DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2023-2024)
Class : IX

SCIENCE

Under the Guidance of

Shri Ashok Kumar
Secretary (Education)

Shri Himanshu Gupta
Director (Education)

Dr. Rita Sharma
Addl. DE (School & Exam.)

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Anil Kumar Sharma

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अशोक कुमार, भा.प्र.से.
सचिव (शिक्षा)
ASHOK KUMAR, IAS
Secretary (Education)

सत्यमेव जयते

राष्ट्रीय राजधानी क्षेत्र
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पुराना सचिवालय, दिल्ली-110054
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D.O. NO. : DE.5/228/Exam/Message/SM/2018/1095
Dated : 24.11.2023

MESSAGE

"Children are like wet cement, whatever falls on them makes an impression."
Haim Ginott

Embracing the essence of this quote, the Directorate of Education, GNCT of Delhi is unwavering in its commitment to its core mission of delivering high-quality education to all its students. With this objective in mind, DoE annually develops support materials meticulously tailored to suit the learning needs of students from classes IX to XII.

Every year, our expert faculty members shoulder the responsibility of consistently reviewing and updating the Support Material to synchronize it with the latest changes introduced by CBSE. This continuous effort is aimed at empowering students with innovative approaches and techniques, fostering their problem-solving skills and critical thinking abilities. I am confident that this year will be no exception, and the Support Material will greatly contribute to our students' academic success.

The support material is the result of unwavering dedication of our team of subject experts. The Support Material has been specially curated for our students, with the belief that its thoughtful and intelligent utilization will undoubtedly elevate the standards of learning and will continue to empower our students to excel in their examinations.

I wish to congratulate the entire team for their invaluable contribution in creating a highly beneficial and practical Support Material for our students.

I extend my best wishes to all our students for a promising and bright future.

24.11.23

(Ashok Kumar)

HIMANSHU GUPTA, IAS
Director, Education & Sports
No. PS/DE/2023/349
Dated: 29/11/2023

सत्यमेव जयते

Directorate of Education
Govt. of NCT of Delhi
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Near Vidhan Sabha,
Delhi-110054
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MESSAGE

It brings me immense pleasure to present the support material for students of classes IX to XII, meticulously crafted by our dedicated subject experts. Directorate of Education is committed to empower educators and students alike by providing these resources free of cost for students of all government and government aided schools of Delhi.

The support material is an appreciable effort to align the content with the latest CBSE patterns. It has been carefully designed as a resource to facilitate the understanding, acquisition and practice of essential skills and competencies outlined in the curriculum.

The core of this support material lies in providing a framework for adopting an analysis-based approach to learning and problem-solving. It aims to prompt educators to reflect on their teaching methodologies and create an interactive pathway between the child and the text.

In the profound words of Dr A.P.J. Abdul Kalam, **"Educationists should build the capacities of the spirit of inquiry, creativity, entrepreneurial and moral leadership among students and become their role model."**

The journey of education is ongoing; it's the process, not just the outcome, which shapes us. This support material endeavours to be that catalyst of change for each student of Directorate of Education.

Let us embark on this transformative journey together, ensuring that every student feels equipped not only with the knowledge but also, with the skills and mindset to thrive in the 21st century.

I wish you all the best for all your future endeavours.

28/11

(HIMANSHU GUPTA)

Dr. RITA SHARMA
Additional Director of Education
(School/Exam)

सत्यमेव जयते

Govt. of NCT of Delhi
Directorate of Education
Old Secretariat, Delhi-110054
Ph. : 23890185

D.O. No. DE.5/228/Exam/Message/SM/2013/1096
Dated: 24.11.2023

MESSAGE

The persistent efforts of the Directorate in making the course material more accessible and student-friendly are evident in the conscientious preparation of the Support Material. Our team consistently adapts to the evolving educational landscape, ensuring that the Support Material for the various subjects of classes 9 to 12 align with the latest CBSE guidelines and syllabi prescribed for the annual examinations.

The Support Material encapsulates crucial subject-specific points and facts, tailored to suit the students, all presented in a lucid language. It is our firm belief that these resources will significantly augment the academic prowess of our students, empowering them to excel in their upcoming examinations.

I extend my heartfelt congratulations to the diligent officials and teachers whose dedication and expertise have played a pivotal role in crafting this invaluable content/resource.

I convey my best wishes to all our students for a future brimming with success. Remember, every page you read is a step towards an enlightened tomorrow.

Rita Sharma

(Dr Rita Sharma)

DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL

(2023-2024)

SCIENCE

Class : IX

(English Medium)

NOT FOR SALE

PUBLISHED BY : DELHI BUREAU OF TEXTBOOKS

भारत का संविधान

भाग 4क

नागरिकों के मूल कर्तव्य

अनुच्छेद 51 क

मूल कर्तव्य – भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह –

(क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;

(ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;

(ग) भारत की संप्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण बनाए रखे;

(घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभावों से परे हो, ऐसी प्रथाओं का त्याग करे जो महिलाओं के सम्मान के विरुद्ध हों;

(च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;

(छ) प्राकृतिक पर्यावरण की, जिसके अंतर्गत वन, झील, नदी और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणिमात्र के प्रति दयाभाव रखे;

(ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत् प्रयास करे, जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई ऊँचाइयों को छू सके; और

(ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य को शिक्षा के अवसर प्रदान करे।

Constitution of India

Part IV A (Article 51 A)

Fundamental Duties

It shall be the duty of every citizen of India —

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

*(k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

Note: The Article 51A containing Fundamental Duties was inserted by the Constitution (42nd Amendment) Act, 1976 (with effect from 3 January 1977).

*(k) was inserted by the Constitution (86th Amendment) Act, 2002 (with effect from 1 April 2010).

भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक [1]**[संपूर्ण प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य]** बनाने के लिए, तथा उसके समस्त नागरिकों को :

सामाजिक, आर्थिक और राजनैतिक **न्याय,**

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की **स्वतंत्रता,**

प्रतिष्ठा और अवसर की **समता**

प्राप्त कराने के लिए,

तथा उन **सब में**

व्यक्ति की गरिमा और [2]**[राष्ट्र की एकता**

और अखंडता] सुनिश्चित करने वाली **बंधुता**

बढ़ाने के लिए

दृढ़संकल्प होकर **अपनी इस संविधान सभा में** आज तारीख 26 नवंबर, 1949 ई. को **एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।**

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1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) ''प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य'' के स्थान पर प्रतिस्थापित।
2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) ''राष्ट्र की एकता'' के स्थान पर प्रतिस्थापित।

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

---

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

SCIENCE SUPPORT MATERIAL CLASS-IX

SESSION-(2023-2024)

CLASS : IX

Group Leader : Dr. Ravinder Kumar (Vice Principal)
RPVV Civil Lines (1207113)

Subject Experts	Designation	School/Branch
Mr. Ajay Kumar	Lecturer	Core Academic Unit DOE
Mr. Sunit Kumar	TGT (N.Sci)	Core Academic Unit DOE
Mr. Amit Kaushik	TGT (N.Sci)	RPVV Surajmal Vihar Delhi
Mr. Sudhakar Jha	TGT (N.Sci)	RPVV Civil Lines, Delhi
Ms. Naseem Bano	TGT (N.Sci)	SOSE, Khichri Pur, Delhi
Mohd. Tariq Iqbal (Urdu Medium)	TGT (N.Sci)	SBV No.1 (UM) Jama Masjid, Delhi

Question Paper Design
Class IX (2023-24)
Subject : Science (086)

Time : 3hrs. **Maximum Marks : 80 Marks**

S.No.	Competencies	Total
1.	Demonstrate Knowledge and Understanding	46%
2.	Application of Knowledge/Concepts	22%
3.	Formulate, Analyze, Evaluate and Create	32%
		100%

Note: • Typology of Questions:

- ❖ VSA including objective type questions, Assertion–Reasoning type questions: SA; LA; Source-based/Case-based/Passage-based/ Integrated assessment questions.
- ❖ An internal choice of approximately 33% would be provided.

Internal Assessment: 20 Marks

- Periodic Assessment – 05 marks + 05 marks
- Subject Enrichment (Practical Work) – 05 marks
- Portfolio – 05 marks.

Suggestive verbs for various competencies

- Demonstrate Knowledge and Understanding
  State, name, list, identify, define, suggest, describe, outline, summarize, etc.
- Application of Knowledge/Concepts
  Calculate, illustrate, show, adapt, explain, distinguish, etc.
- Analyze, Evaluate and Create
  Interpret, analyze, compare, contrast, examine, evaluate, discuss, construct, etc.

(Note : Pl. follow instruction provided by CBSE for Assessment Area, Course Structure and Question Paper Design)

Course Structure
Class – IX
(Annual Examination)

Unit No.	Unit	Marks
I	Matter – Its Nature and Behaviour	25
II	Organisation in the Living World	22
III	Motion, Force and Work	27
IV	Food, Food Production	06
	Total	80
	Internal assessment	20
	Grand Total	100

Annual Syllabus
Session : 2023-2024
Class : IX
Subject : Science (086)

Unit No.	Unit	Marks
I	Matter-Its Nature and Behaviour	25
II	Organization in the Living World	22
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	Total	**80**
	Internal assessment	**20**
	Grand Total	**100**

Contents

UNIT-I Matters- Its Nature and Behaviour

Chapter-1: Matter in our surroundings

Definition of Matter : Solid, Liquid and Gas; Characteristics - Shape, Volume, Density; change of state-melting (Absorption of heat), freezing, evaporation (Cooling by evaporation), Condensation, Sublimation.

Practical : Determine the melting point of ice and boiling point of water.

Chapter-2: Is Matter Around us Pure :

Elements, compound and mixtures, Heterogeneous and homogeneous mixtures, colloids and suspensions. Physical and chemical changes (excluding separating the components of a mixture).

Practical : Preparation of

a) A true solution of common salt, sugar and alum.

b) A suspension of soil, chalk power and fine sand in water.

c) A colloidal solution of starch in water and egg albumin/milk in water and distinction between these on the basis of :

- transparency
- filtration criterion
- stability

Practical : Preparation of a) Mixture b) A compound, using iron filings and sulphur powder and distinction between theses on the basis of-

I) appearance i.e. homogeneity and heterogeneity

ii) behaviour towards a magnet

iii) behaviour towards Carbon di-sulphide as a solvent

iv) effect of heat

Practical : Performing the following reactions and classifying them as physical or chemical changes:

a) Iron with Copper Sulphate solution in water

b) Burning of magnesium ribbon in air

c) Zinc with dilute Sulphuric Acid

d) Sodium Sulphate with Barium Chloride in the form of their Solution in water.

UNIT-II Organization in the Living World:

Chapter -5: The Fundamental Unit of Life

Cell as a basic unit of life; Prokaryotic and Eukaryotic cells, multicellular organisms, cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, golgi apparatus; nucleus, chromosomes- basic structure, number.

Practical : Preparation of stained temporary mounts of

a) Onion peel

b) Human Cheek cells and to record observations and draw their labelled diagrams.

Chapter-6: Tissues

Structure and functions of animal and plant tissues (only four types of tissues in animals, Meristematic and Permanent tissues in plants).

Practical : Identification of Parenchyma, Collenchyma and Sclerenchyma tissues in plants, Striped, Smooth and Cardiac muscle fibres and Nerve cell in animals from prepared slides, Draw their labelled diagram.

UNIT-III - Motion, Force and Work

Chapter-8: Motion

Distance and displacement, velocity, uniform and non-uniform motion along a straight line, acceleration, distance-time and velocity- time graphs for uniform motion and uniformly accelerated motion, elementary idea of uniform circular motion.

Chapter-9: Force and Laws of Motion:

Force and motion, Newton's Laws of Motion, Action and Reaction forces, Inertia of body, Inertia and mass, Momentum, Force and Acceleration.

UNIT V - Food Production

Chapter-15: Improvement in Food Resources

Plant and animal breeding and selection for quality improvement and management; Use of fertilizers and manures; Protection from pests and diseases, Organic farming.

The above mid-term syllabus is to be completed by 15 September 2023.
Revision of Syllabus for Mid-Term Examination 2023
Mid-Term Examination 2023

UNIT III - Motion, Force ans Work

Chapter-10: Gravitation

Gravitation, Universal law of Gravitation, Force of Gravitation of earth (gravity), Acceleration due to gravity; Mass and weight, Free fall.

Floatation : Thrust and pressure, Archimedes' principle, Buoyancy.

Practical : Determination of the density of solid (denser than water) by using a spring balance and measuring cylinder.

Practical : Establishing the relation between the loss in weight of solid when fully immersed in (a) tap water (b) Strongly salty water with the weight of water displaced by it by taking at least two different solids.

UNIT I- Matter - Its Nature and Behaviour

Chapter : 3 : Atoms and Molecules

Particle nature and their basic units: Atoms and molecules, Laws of Chemical

Combination. Atomic and molecular masses.

Practical : Verification of Law of Conservation of mass in a chemical reaction.

Chapter 4 : Structure of The Atom : Electrons, Protons and Neutrons, Valency, Chemical formula of common compounds, Atomic Number and Mass Number, Isotopes and Isobars.

UNIT III - Motion, Force and Work

Chapter-11 : Work and Energy

Work done by a force, Energy, Power, Kinetic and Potential energy; Law of conservation of energy. (excluding commercial unit of Energy)

Chapter 12 : Sound

Nature of sound and its propagation in various media, speed of sound, range of hearing in humans, ultrasound, reflection of sound, Echo.

Practical : Determination of the speed of a pulse propagated through a stretched string / slinky (helical spring).

Practical : Verification of the Laws of reflection of sound.

- **The entire syllabus is to be completed by January 31, 2024**
- **Revision of entire syllabus for Annual Examination 2024**
- **For more information kindly visit to CBSE Academic:**

https://cbseacademic.nic.in/curriculum_2024.html

Common Annual School Examination (CASE) : 2023-24 will be based on the complete syllabus.

Annual Examination (CASE) - 2024

Note for the Teachers :

1. The chapter Natural Resources (NCERT Chapter 14) will not be assessed in the year-end examination. However, learners may be assigned to read this chapter and encouraged to prepare a brief write up on any concept of the chapter in their portfolio. This may be for Internal Assessment and credit may be given for Periodic Assessment/Protfolio.

2. The NCERT text book present information in boxes across the book. These help students to get conceptual clarity. However, the information in these boxes would not be assessed in the Year-end examination.

Question Paper Design
Class IX/X (2023-24)
Subject : Science (086)

Theory

Maximum Marks : 80 **Duration : 3 Hours**

S.No.	Competencies	Marks
1.	Demonstrate Knowledge and Understanding	46%
2.	Application of Knowledge/Concepts	22%
3.	Formulate, Analyze, Evaluate and Create	32%
	Total	**100%**

Note :

- Typology of Questions : VSA including objective type questions, Assertion - Reasoning type questions; SA; LA; Source-based/ Case based / Passage based / integrated assessment questions.

  An internal choice of approximately 33% would be provided.

Internal Assessment : 20 Marks

- Periodic Assessment - 05 Marks + 05 marks
- Subject Enrichment (Practical Work) - 05 Marks
- Portfolio : - 05 Marks

Suggestive verbs for various competencies

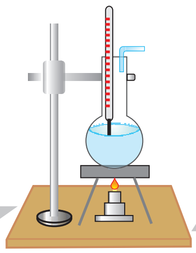
- Demonstrate Knowledge and Understanding:

  State, name, list, identify, define, suggest, describe, outline, summarize, etc.
- Application of Knowledge / Concepts:

  Calculate, illustrate, show, adapt, explain, distinguish, etc.
- Formulate, Analyze, Evaluate and Create:

  Interpret, analyze, compare, contrast, examine, evaluate, discuss, construct, etc.

CONTENT



Chapter - 1

Matter In Our Surrounding

CONCEPT MAPPING

Matter

- **States of Matter**
  - **Solids**
    1. Definite shape.
    2. Definite volume
    3. Do not flow
    4. Particles are closely packed.
    5. Incompressible.

    Ex.: Table, Chair.
  - **Liquids**
    1. No definite shape
    2. Fixed volume
    3. Can flow
    4. Particles are loosely packed
    5. Little compressible

    Ex.: Water, Milk
  - **Gases**
    1. No definite shape
    2. No Fixed volume
    3. Can flow
    4. Particles are Very loosely packed
    5. Highly compressible

    Ex.: Air, Oxygen
- **Matter is made up of Particles**
  - **Physical Nature of Particles**
    1. Particles of matter are continuously moving.
    2. Particles of matter have space between them.
    3. Particles of matter attract each other.
- **Change of State of Matter**
  - **Effect of change in Temperature**
    - **Increase in Temperature**
      - **Fusion or Melting**: Solids melt to form liquid
        - **Melting Point**: The temperature at which solid melts to form liquid
      - **Evaporation**: Liquids changes into vapours
        - **Boiling Point**: The temperature at which a liquid boils to form vapours
          - **Factors affecting Evaporation**
            1. Exposed surface Area
            2. Increase in temperature
            3. Humidity
            4. Wind velocity
      - **Sublimation**: The change of solid directly into gas or vapours
    - **Decrease in Temperature**
      - **Freezing**: Liquid changes into solid
      - **Condensation**: Vapours changes into liquid
  - **Effect of change of Pressure**

Matter

The matter is the material of which everything in this universe, (in and around us) is made up of. It is anything that occupies space and has mass and offers resistance to any applied force.

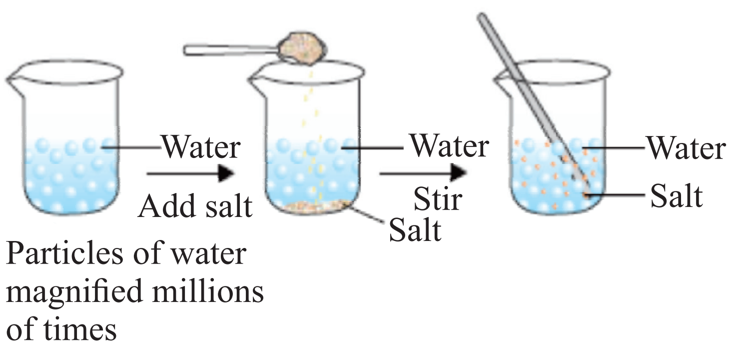
Physical Nature of Particles :

Matter is made up of particles. The particles of matter are very-very small.

Characteristics of Particles :

(i) **Particles of matter are continuously moving** i.e., they possess kinetic energy. As the temperature rises, particles moves faster because kinetic energy of the particles increases.

(ii) **Particles of matter have space between them.** When we make tea, coffee or lemonade (nimbu pani), particles of one type of matter get into the space between particles of the other. This shows that there is enough space between particles of matter.



When we dissolve salt in water, the particles of salt get into the space between particles of water.

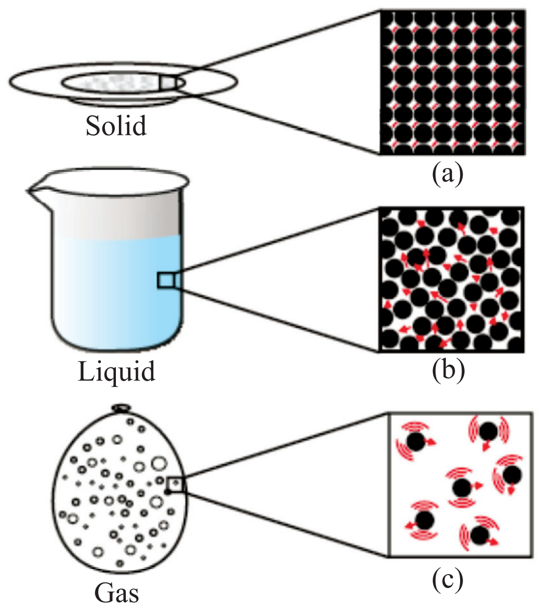
Particles are varying and have spaces between them

(iii) **Particles of matter attract each other.** When we open a water tap, try to break the stream of water with our fingers, can we do this ? No, because the stream of water remains together. Particles of water are held together because of the force of attraction between them.

- *The space between the particles and kinetic energy of particles is minimum in solids, intermediate in liquids and maximum in gases.*

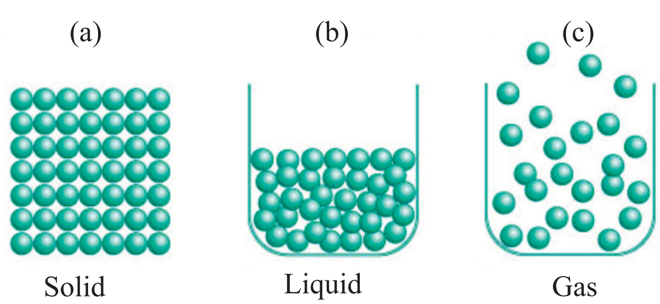
- *The force of attraction between the particles is strongest in solids, intermediate in liquids and weakest in gases.*

• *Movement of particles is minimum in solids, more in liquids and maximum in gases.*



a, b and c show the magnified schematic pictures of the three states of matter.
The motion of the particles can be seen and compared in the three states of matter.

Dig. Three states of matter



Arrangement of particles in three states of matter and their movements

States of Matter

The physical states of a matter are : (i) Solid, (ii) Liquid, (iii) Gas.
We can classify our body into three states of matter i.e.,

(i) Bones and teeth are solids.
(ii) Blood and water present in our body are liquids.
(iii) Air in our lungs is gaseous.

(i) Solid State:

Characteristics of solid states are :

(a) Have definite shape.

(b) Have distinct boundaries.

(c) Have rigidity and incompressibility.

(d) Have definite volume.

Some Exceptional Examples: Rubber band is a solid but it can change its shape under force and regains its shape when force is removed. If excessive force is applied, it breaks.

The solids have fixed and rigid shape. The kinetic energy of the particles in the solid state is very less and therefore, solids have fixed and rigid shape.

- *We can compress sponge as its pores are filled with air but it is solid.*
- *Salt and sugar take the shape of the container in which they are placed but shape of their crystals do not change, so they are solids.*

(ii) Liquid State :

The characteristics of liquid state are :

(a) Have fluidity i.e., they are not rigid.

(b) Low compressibility.

(c) No definite shape and boundaries. They take the shape of the vessels.

(d) Have definite volume.

- *Force of attraction between the particles of liquid keeps its volume same.*
- *Liquids are substances having fixed (definite) volume and no fixed shape. They take the shape of the container in which they are stored.*
- *The gases (oxygen and carbon dioxide) from the atmosphere diffuse and dissolve in water. Due to these gases aquatic plants and animals are able to survive. Diffusion is much more in liquids than in solids due to free movement of particles of liquids.*

(iii) Gaseous State :

The characteristics of gaseous state are :

(a) Have fluidity.

(b) Have high compressibility.

(c) Have no definite boundaries.

(d) Have no definite shape.

(e) Have no definite volume.

- *The particles in a gas are free to move in any direction hence gases can flow.*
- *Gases are substance that do not have fixed volume and occupy all the volume available to them.*

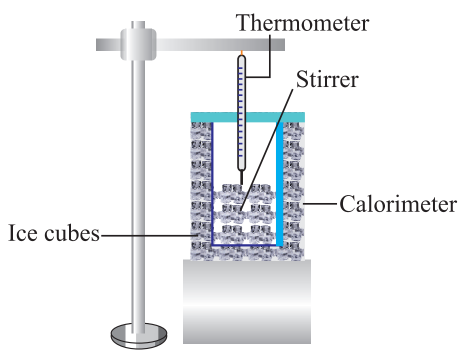
- *Pressure of gas is the force applied on the walls of vessel by the irregular moving gas particles.*

Change of State of Matter

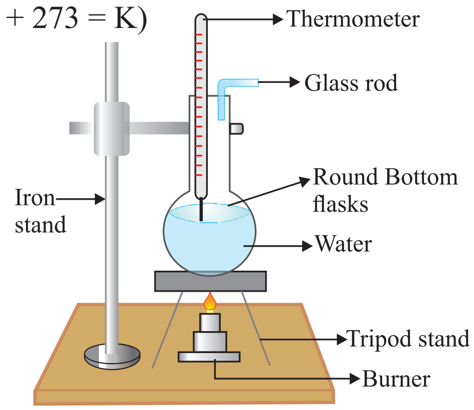
- Water can exist in three states of matter i.e., solid – ice, liquid – water, gas – water vapour.
- On heating ice melts into water and then converts into water vapours.

Change in the physical state of matter can be done in two ways :

(A) **By Changing the Temperature :** (^{0}C + 273.15 = K) or (^{0}C + 273 = K)



(a) Melting of ice to form water



(b) Boiling of water to form water vapour

(i) **Melting Point :** The temperature at which a solid melts to form liquid at atmospheric pressure is called its melting point. Melting point of ice is 273.16 K (0ºC). During melting the temperature of ice does not rise even though heat is being supplied continuously because of latent heat of fusion. This latent heat of fusion is used up to overcome the forces of attraction between ice particles. At 0º C energy of water particles is much more than the energy of particles of ice at 0ºC.

- ***Latent Heat of Fusion :*** *The amount of heat required to change I kg solid to its liquid state (at its melting point) at atmospheric pressure.*

(ii) **Boiling Point :** The temperature at which a liquid boils to form vapours at atmospheric pressure is called its boiling point. Boiling point of water is 373 K (100º C + 273 = 373 K).

- ***Latent Heat of Vapourization :*** *The amount of heat required to change 1 kg liquid to its gaseous state (at its boiling point) at atmospheric pressure.*
- *During boiling the temperature of water does not rise even though heat is being supplied continuously as this heat of vapourization is used up to overcome the forces of attraction between water particles.*

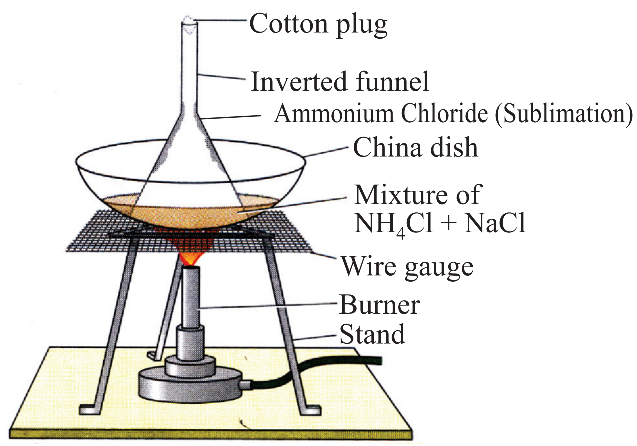
At 100ºC, energy of water vapours is much more than the energy of water at 100ºC. So, we can change one state of matter to another state by changing temperature.

Solid State $\underset{\text{Cooling}}{\overset{\text{Heat}}{\rightleftharpoons}}$ Liquid State $\underset{\text{Cooling}}{\overset{\text{Heat}}{\rightleftharpoons}}$ Gaseous State

- At 25ºC, Water is liquid.
  At 0ºC, Water is solid (ice) as well as liquid.
  At 100ºC, water is gaseous state (steam).

(iii) Sublimation : The change of solid directly into vapours on heating and of vapours into solid on cooling without passing through the intervening liquid state is called sublimation.

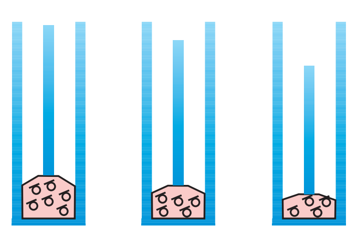
Example : When camphor or ammonium chloride is heated in a China dish covered by a inverted funnel (with cotton plug in its upper open end), the vapours of ammonium chloride are converted into solid ammonium chloride on coming in contact with the cold inner walls of the funnel.



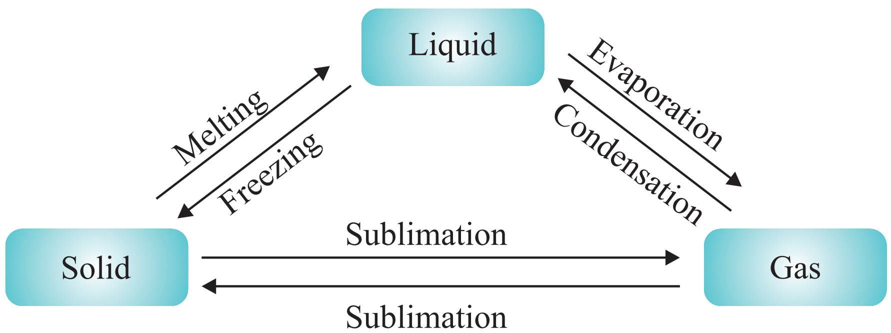
Sublimation of Ammonium Chloride

(B) Effect of Change of Pressure :

If we compress a gas in a cylinder, the distance between the particles of gas is reduced and finally gas is liquefied on lowering temperature.



- *By applying high pressure, the particles of a gas can be brought close together.*
- *Solid carbon dioxide (dry ice) is changed into carbon dioxide gas directly without changing into liquid when pressure is reduced to one atmospheric pressure.*
- *Thus, states of matter i.e., solid, liquid and gas are determined by temperature & pressure.*



<u>**Evaporation**</u> **:** A surface phenomenon in which liquid changes into vapours at any temperature below its boiling point is called evaporation. Particles on the surface of a liquid have higher kinetic energy than others, so they break the forces of attraction between the particles & escape from the surface of liquid in the form of vapours.

Factors affecting evaporation : Rate of evaporation depends on :

(a) **Exposed surface area :** On increasing surface area of liquid, rate of evaporation increases.

(b) **Increase in temperature :** Increases kinetic energy of particles hence rate of evaporation increases.

(c) **Humidity :** When the humidity of air (degree of dampness of air) is low, evaporation rate is increased. More humidity, less evaporation.

(d) **Wind :** When wind speed increases, rate of evaporation also increases.

Evaporation always causes cooling : The cooling caused by evaporation is based on the fact that when a liquid evaporates, it takes latent heat of vaporization from surroundings which on losing heat get cooled.

Examples :

(i) When we put acetone on our hand, it gets vapourized by taking heat from our hand and our hand feels cool.

(ii) We should wear cotton clothes in summer to keep us cool and comfortable as cotton is good absorber of water, so it absorbs the sweat from our body and exposes it to air for evaporation of sweat thus cools our body.

(iii) Often people sprinkle water on ground during summer. This water takes heat from ground and surrounding air to evaporate, thus making the place cool.

QUESTIONS

VERY SHORT QUESTIONS

1. Write different states of matter.
2. Which has more density – liquid or solid ?
3. What is the melting point of ice ?
4. Boiling point of alcohol is 78ºC. Change it into Kelvin scale ?
5. Why do gas exert pressure ?
6. How do we liquefy the gases ?
7. What happens to particles when salt dissolves in water ?
8. What is the physical state of water at:
   (a) 0º C (b) 25ºC
9. What is the chemical name of dry ice ?
10. Why is heat energy needed to melt a solid ?

SHORT QUESTIONS

1. Classify the matter on the basis of physical characteristics ?
2. Why solid carbon dioxide is called 'dry ice' ?
3. Why do we keep ether and acetone at cool places ?
4. Write two factors which will increase rate of evaporation ?
5. Which gas is supplied in the liquefied form at home and in hospitals ?
6. Compare the force of attraction between iron, rubber band and chalk ?
7. Arrange sugar, water and oxygen in the increasing order of force of attraction between their particles ?
8. Define boiling point, melting point and evaporation ?
9. What is sublimation? Name two substances which undergo sublimation.
10. Why does steam causes more severe burns than boiling water?
11. Change the temperature in celsius scale temperature :
    (a) 293 K (b) 470 K.

LONG QUESTIONS

1. Describe the factors affecting evaporation ?
2. (a) Why do we wear cotton clothes in summers ?
   (b) Why do we feel cold, when we keep acetone or ether on our palm ?
3. Write three characteristics of particles of matter. Give one example of each ?
4. Write the characteristic responsible for :
   (a) Smell of perfume spreads in the room.
   (b) Water takes the shape of the container in which it is kept.
5. Name three states of matter. Give one example of each and state three characteristic properties of each.
6. Compare the properties of solids, liquids and gases in tabular form.
7. (a) Write full forms of (i) LPG (ii) CNG
   (b) Draw the 'states of matter triangle' to show the interconversion of states of matter.
8. (a) Why does a desert cooler cool better on a hot, dry day?
   (b) What is evaporation? How can the evaporation of a liquid be made faster?

OBJECTIVE TYPE QUESTION:

1. A few substances are arranged in the increasing order of 'forces of attraction' between their particles. Which one of the following represents a correct arrangement ?

   (a) Water, air, wind (b) Air, sugar, oil
   (c) Oxygen, water, sugar (d) Salt, juice, air

2. Which one of the following sets of phenomena would increase on raising the temperature ?

(a) Diffusion, evaporation, compression of gases.

(b) Evaporation, compression of gases, solubility

(c) Evaporation, diffusion, expansion of gases.

(d) Evaporation, solubility, diffusion, compression of gases.

3. The property to flow is unique to fluids. Which one of the following statements is correct?

(a) Only gases behave like fluids

(b) Gases and solids behave like fluids

(c) Gases and liquids behave like fluids

(d) Only liquids are fluids

4. Choose the correct statement of the following:

(a) conversion of solid into vapours without passing through the liquid state is called sublimation.

(b) conversion of vapours into solid without passing through liquid state is called vaporisation.

(c) conversion of vapours into solid without passing through the liquid state is called freezing.

(d) conversion of solid into liquid is called sublimation.

5. During summer, water kept in an earthen pot becomes cool because of the phenomenon of

(a) diffusion. (b) transpiration

(c) osmosis. (d) evaporation

6. On converting 25ºC, 38ºC and 66ºC to kelvin scale, the correct sequence of temperature will be

(a) 298K 311K and 339K

(b) 298K, 300K and 338K

(c) 273K, 278K and 543K

(d) 298K, 310K, and 338K

[K=273+tºC]

7. Fill in the blanks:

(a) The boiling points of, acetone is 329 K, its temperature in Celsius will be ....ºC.

(b) The arrangement of particles is ordered in the .... state. However there is no order in the .... state.

(c) Evaporation of a liquid at room temperature leads to a .... effect.

(d) Osmosis is a special kind of ....

8. Match the physical quantities given in column A to their S. I. units given in column B :

Column A	**Column B**
Temperature	Pascal
Density	Cubic Metre
Volume	Kelvin
Pressure	Kilogram per cubic meter

9. Choose the correct option given in bracket.

The amount of heat required to change 1 kg solid to its liquid state at atmospheric pressure is known as its ....

(Latent heat of fusion / Latent heat of vaporisatoin)

Assertion and reason type questions:-

Two statements are given one labelled assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation fo A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertions (A) : Steam causes severe burn than boiling water

   Reason (R) : Steam has latent heat.

2. Assertion (A) : A glass filled with ice has water droplets on its outer surface

   Reason (R) : Ice is liquid state of water.

Answers:

1. (a)
2. (c)

Chapter - 2

Is Matter Around Us Pure ?

CONCEPT MAPPING

Matter

- **Pure Substances**
  - **Elements**
    - Represented by Symbols
    - Cannot be broken into Simpler Substances.
    - eg. Copper, Sodium, Silver, Oxygen, Hydrogen etc.
  - **Compounds**
    - Have fixed Composition.
    - Can be broken down into its constituents by chemical reactions or electrochemical reactions
    - eg: Water, Salt, Sugar etc.
- **Impure Substances** (Mixtures)
  - **Homogeneous**
    - True Solutions
    - Uniform Composition
    - eg. Sugar & water, Iodine & alcohol
  - **Heterogeneous**
    - Colloidal Solution & Suspension
    - Non-uniform Composition
    - eg. Sand & Sugar, water & oil, milk.
  - **Solution**
    - (Solute + solvent)
    - Unsaturated
    - Saturated
    - Super Saturated
  - **Methods of Separation***

* not in CBSE

Elements

- **Metals**
  - Malleable
  - Ductile
  - Good Conductor of Heat & Electricity
  - eg. Copper, Silver, Gold, Sodium
- **Metalloids**
  - Show some of the properties of metals and some of non-metals.
  - eg. Silicon, Germanium
- **Non-metals**
  - Non-malleable
  - Non-ductile
  - Bad conductor of Heat & Electricity
  - eg. Oxygen, Hydrogen, Nitrogen, Sulphur etc.

'Pure' word means that there is no mixing in a substance. But according to scientific language all things are mixture of so many substances, not of single one. That's why they are not pure.

E.g. Milk, water, fat, etc.

- *Pure substances means that all elements have same chemical properties.*
- *A pure substance is made up of same kind of elements.*

Substance : A substance is a kind of matter that cannot be separated into other kind of matter by any physical process. A pure substance is made up of same kind of elements.

What is a mixture ?

It is a substance in which two or more substances (element or compound) are simply mixed together in any proportion. Examples : The air is a mixture of oxygen, nitrogen, carbon dioxide and water vapour.

Types of Mixture : Mixture is of two types :

(i) Homogenous mixture

(ii) Heterogenous mixture

Homogenous Mixture : These types of mixtures have no visible boundaries of separation between the various constituents.

Example : Sugar in water. It has a uniform composition throughout its mass.

Heterogenous Mixture : These types of mixtures have visible boundaries of separation between the various constituents.

Example : Mixture of sugar and sand. It does not have a uniform composition throughout its mass.

Solution : A solution is a homogenous mixture of two or more substances. E.g., Nimboo pani, soda water.

Solution : A solution has a solvent and a solute as its components. The component of the solution that dissolves the other component in it is called the solvent. The component of the solution that is dissolved in the solvent is called the solute.

Solution

Solute (Substance dissolved) | **Solvent** (Substance in which dissolved)

e.g., Sugar + Water ⇒ Sugar solution

Types of Mixtures

True Solution	Colloidal	Suspension
1. Size of solute particles is smallest. $< 10^{-9}$m.	1. Size of solute particles bigger than true but smaller than suspension. In between 10^{-9} to 10^{-6} m.	1. Size of particles biggest. $> 10^{-6}$ m.
2. Solute particles can't be seen with naked eye.	2. Solute particles can't be seen with Naked eye.	2. Can be seen with naked eye.
3. Homogenous mixture.	3. Seems homogenous but actually heterogenous mixture.	3. Heterogenous mixture.
4. Particles can't be separated by filteration.	4. Particles can't be separated by filteration.	4. Can be Separated by filteration.
5. Transparent	5. Translucent	5. Opaque
6. Stable solutions - i.e., solute particles do not settle on keeping.	6. Stable solutions.	6. Unstable solution – solute particles settle upon keeping.
7. Do not show tyndall effect.	7. Show tyndall effect.	7. May or may not show tyndall effect.
8. Solution diffuse rapidly through filter paper as well as parchment paper.	8. Colloid particles pass through filter paper but not through parchment paper.	8. Suspension particles do not pass through filter paper as well as parchment paper.
9. e.g., Sugar in water.	9. e.g., Milk, blood.	9. e.g., Sand/mud in water.

Common examples of colloids :

	Dispersal Phase (Solute)	Dispersion Medium (Solvent)	Type	Example
1.	Liquid	Gas	Aerosol	Fog, cloud
2.	Solid	Gas	Aerosol	Smoke

3	Gas	Liquid	Foam	Shaving Cream
4.	Liquid	Liquid	Emulsion	Milk, face cream, emulsion paint
5.	Solid	Liquid	Sol	Mud, digene
6.	Gas	Solid	Foam	Foam, rubber sponge
7.	Liquid	Solid	Gel	Jelly, cheese
8.	Solid	Solid	Solid sol	Coloured gemstones, glass (milky, coloured)

- *Gas in gas is not a colloidal solution – it is called a mixture.*

Saturated Solution : Solution in which no more solute can be dissolved without raising its temperature is called saturated solution.

Unsaturated Solution : Solutions in which more solute can be dissolved without raising its temperature is called Unsaturated solution.

Solubility : It is the amount of solute in a saturated solution at a given temperature.

Concentration of Solution

1. Mass by mass percentage $= \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$

2. Mass by volume percentage $= \frac{\text{mass of solute}}{\text{volume of solution}} \times 100$

Physical Vs Chemical Changes

Chemical	Physical
• Not easily reversible • New Product(s) formed • Reactants used up • Often heat/light/sound/ fizzing occurs • Electricity may be produced • A precipitate may form e.g., Wood burning	• Easily reversible • No new products • Often just a state change • e.g., ice melting

Elements

Made of same type of atoms

S.No.	Metals	Non-metals	Metalloids
1.	Lustrous	Non-lustrous	Metallaoids have intermediate properties between metals and non-metals.
2.	Malleable, ductile	Non-malleable, non-ductile	E.g., Boron, Germanium, Silicon
3.	Sonorous	Non-sonorous	
4.	Good conductors of heat & electricity	Bad conductors	
5.	e.g., Gold, iron etc.	e.g., Oxygen, Phosphorus	

Element	Compound
1. Can not be broken into simpler substance by chemical reaction.	Can be separated into simpler substance by chemical reactions.
2. Consists of similar kind of atoms.	Consist of atoms of different element in fixed mass ratio.
3. It represented by using symbols	Represented by using chemical formula.
4. Ex.: Iron, Copper etc.	Ex.: Water, Sodiumchloride, etc.

Mixture	Compound
1. Elements or compounds are simply mixed so no new substance is formed.	1. Substances are reacted together with each other to make a new substance.
2. Elements do not combine in a fixed ratio.	2. Composition of the components is fixed i.e., they combine together in a fixed ratio according to their masses.
3. A mixture shows the properties of its components.	3. Compound doesn't show the properties of component elements.
4. Components can be easily separated by any mechanical method which is suitable.	4. Components can't be separated from each other by simple mechanical methods.
5. e.g., sugar in water, oil in water	5. e.g., Iron and sulphur react to from iron sulphide.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Classify the following into homogenous and heterogenous mixtures :
   (a) Ice (b) Soil
   (c) Wood (d) Air
2. Name the type of mixture formed by mixing sulphur and carbon disulphide.
3. Justify the statement that: 'Rusting of iron is corrosion and it is a chemical change".
4. Name the processes used for separatoin :
   (a) Miscible liquids
   (b) Immiscible liquids
   (c) Butter from milk
   (d) Sand from water-sand mix
   (e) Separation of colours in dyes.
   (f) Camphor from camphor, sand and salt
   (g) Alcohol from aqueous alcohol.
5. Name the apparatus by which mixture of oil and water can be separated.
6. A hard substance produces a tinkling sound when beaten. Is it metal or a non metal?
7. What type of solution is an alloy?
8. Classify the following as physical change or chemical change.
   (a) Burning of magnesium ribbon in air
   (b) Burning of sulphur in air
   (c) Electrolysis of water.
9. Which component of the mixture (Iron & sulphur) reacts with dil HCl and gives hydrogen gas?
10. Crystallization is a better technique than simple evaporation. Give one reason to justify the statement.

SHORT ANSWER TYPE QUESTIONS

1. What is meant by concentration of a solution?
2. List the two conditions essential for using distillation as a method for separation of the components from a mixture.
3. Smoke and fog both are aerosols. In what ways are they different?
4. Salt can be recovered from its solution by evaporation can you suggest any other method also?
5. " Air is a mixture not a compound." Justify this statement.
6. Define tyndall effect with example.
7. Alloys can not be separated by physical methods, though it is considered mixture. Why?
8. Name two properties of a substance to check its purity?

LONG ANSWER TYPE QUESTIONS

1. Why the interconversion of states of matter is considered as a physical change? Give three reasons to justify your answer.
2. During an experiment the students were asked to prepare a 20% (mass/mass) solution of sugar in water. Ram dissolved 20 gm of sugar in 100 gm of water while Sohan prepared it by dissolving 20 gm of sugar in water to make 100 gm of solution.
   (a) Are the two solutions of the same concentration.
   (b) Compare the mass% of the two solutions.
   (c) Whose solution contain less amount of solute.
3. When a fine beam of light enters a room through a small hole, Tyndall effect is observed, Explain, why does this happen ? Give one more example where this effect can be observed.
4. Differentiate :
   a) Elements and compounds.
   b) Homogeneous and Heterogeneous mixtures.
   c) Compounds and mixtures.
5. How properties of true solutions differ from that of colloids. Explain?

OBJECTIVE TYPE QUESTIONS :

1. Complete the sentence by choosing the correct words given in the bracket:
   a. Pure substances are .... and have the same .... throughout.
   b. Mixture of sulphur and carbon disulphide is. .... and does not show .... (homogenous, heterogeneous, Tyndall effect.
   c. Tincture of iodine has antiseptic properties. This solution is made by dissolving .... in .... (potassium iodide, iodine, water, alcohol)
2. Which of the following are homogeneous in nature ?
   (i) ice. (ii) wood. (iii) soil (iv) air
   (a). (i) and (iii) (b). (ii) and (iv)
   (c). (i) and (iv) (d) (iii) and iv)
3. Which of the following are physical changes ?
   (i) Melting of iron metal. (ii) Rusting of iron
   (iii) Bending of an iron rod. (iv) Drawing a wire of iron metal
   a. (i), (ii) and (iii),
   b. (i), (ii) and (iv)
   c. (i), (ii) and (iv)
   d. (ii), (iii) and (iv)
4. Which of the following are chemical changes ?
   (i) Decaying of wood. (ii) Burning of wood
   (iii) Sawing of wood. (iv) Hammering of a nail into a piece of wood
5. Name the process associated with the following:
   a. Dry ice is kept at room temperature and at one atmospheric pressure.
   b. A drop of ink placed on the surface of water contained in a glass spreads throughout the water.
   c. A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring.

d. An acetone bottle is left open and the bottle becomes empty.

e. Settling of sand when a mixture of sand and water is left undisturbed for some time.

f. Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths.

6. Give an example each for the mixture having the following characterstics. Suggest a suitable method to separate the components of these mixtures

a. A volatile and a non-volatile component ....

b. Two volatile components with appreciable difference in boiling points.....................

c. Two immiscible liquids ....

d. One of the components changes directly from solid to gaseous state ....

e. Two or more coloured constituents soluble in some solvent ....

7. Which of the following are not compounds ?

a. Chlorine gas

b. Potassium chloride

c. Iron.

d. Iron sulphide

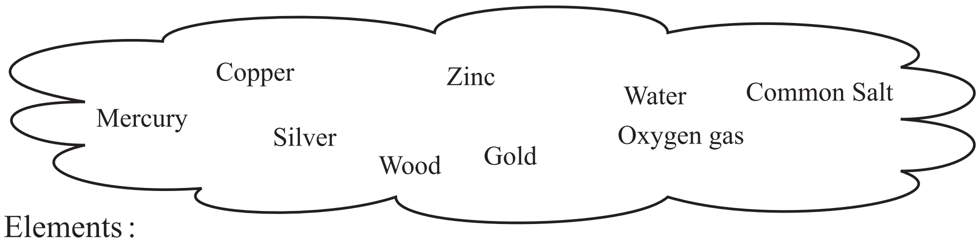
e. Aluminum

f. Iodine

g. Carbon

h. Carbon monoxide

8. Classify the substances given in the cloud into elements and compounds :



Elements :

Compounds :

9. Sugar crystals obtained from sugarcane and beetroot are mixed together. Will it be pure substance or a mixture ? Yes or No

Assertion-Reason Type Questions:-

Two statements are give-one laballed assertion (A) and the other labelled Reason (R). Select the correct answer to the question from the codes (a), (b), (c), (d) as given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation fo A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (A) : A mixture of Ammonium chloride and sodium chloride can be separated by sublimation.

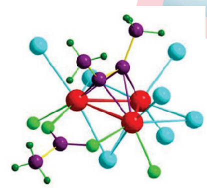
   Reason (R) : Sodium chloride sublimes on heating.

2. Assertion (A) : A mixture of kerosene and water cannot be separated by a separating funnel.

   Reason (R) : Kerosene oil and water have different densities and are insoluble

Answers :

1. (a)
2. (d)



Chapter - 3

Atoms And Molecules

CONCEPT MAPPING

Law of Chemical Combination

Law of conservation of mass
- Mass can neither be created nor be destroyed
- eg. $C + O_2 \rightarrow CO_2$
  12gm + 32gm → 44gm

Law of constant proportions
- Compound consists of the elements combined together in the same ratio
- $H_2O = 2 : 16$
  1 : 8

Dalton's Atomic Theory

(Atoms) are:
tiny particles
- indivisible
  (Can neither be created nor destroyed)
- Identical mass and chemical properties
  (Same element)
- Different mass and chemical properties
  (different elements)
- Combine in the same ratio

Atom
- Smallest particle of an element
- Each atom shows all the properties of element
- Form Ions

Molecule
- Smallest particle of element or compound
- Properties of the substances are the properties of molecules

Atomic mass
- mass of an atom
- equals to $\frac{1}{12}$ of mass of C-12 atom

Existence of Atom
- Reactive Molecule, Ions
- Free
- Molecule can be
  - Monoatomic (free)
  - Polyatomic Molecule (Reactive)

Ions
- Cations (+vely charged)
- Anions (–vely charged)

- Types of molecule
  - Homoatomic
  - Heteroatomic
- Molecular mass: Sum of masses of all atoms
- Formula unit mass: Sum of atomic mass of ions and atoms
- Atomicity: no. of atoms present in one molecule

Laws of Chemical Combination :

The chemical reaction between two or more substances giving rise to products is governed by certain laws. These laws are called Laws of Chemical Combination'.

Laws of Chemical Combination

- Law of Conservation of Mass
- Law of Constant Proportions
- Law of Multiple Proportions
- Law of Reciprocal Proportion
- Gay Lussac's law of combining gaseous volume

(Will study in higher classes)

Law of Conservation of Mass

According to this law, "Mass can neither be created nor destroyed."

In a chemical reaction, this law can be understood in the following way:

" During a chemical reaction total mass of reactants will be equal to total mass of products."

For example, $A + B \rightarrow AB$

Reactant Product

Then, $m_A + m_B = m_{AB}$

where, m_A = Mass of A

m_B = Mass of B

m_{AB} = Mass of AB

$$2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(l)$$

$$2 \times 2 = 4\text{ gm} + 2 \times 16 = 32\text{ gm} \rightarrow 2 \times (2 + 16) = 36\text{ gm}$$

$$4g + 32g = 36gm$$

Example : In a reaction 5.3 gm of sodium carbonate reacted with 6 gm of ethanoic acid. The products were 2.2 gm of CO_2, 0.9 gm of H_2O and 8.2 gm of sodium ethanoate. Show that these observations are all in agreement with law of conservation of mass.

Sodium carbonate + Ethanoic acid $\rightarrow$ Sodium ethanoate + CO_2 + H_2O

Solution :

$$\underbrace{\text{Sodium carbonate} + \text{Ethanoic acid}}_{\text{Reactants}} \rightarrow \underbrace{\text{Sodium ethanoate} + CO_2 + H_2O}_{\text{Products}}$$

Now, according to the law of conservation of mass :

Mass of sodium carbonate + Mass of ethanoic acid = Mass of sodium ethanoate + Mass of CO_2 + Mass of H_2O

Putting values of masses from the equation :

$$5.3 \text{ gm} + 6.0 \text{ gm} = 8.2 \text{ gm} + 2.2 \text{ gm} + 0.9 \text{ gm}$$

Or $$11.3 \text{ gm} = 11.3 \text{ gm}$$

Since, LHS = RHS

Law of conservation of mass is in agreement with the given values in equation.

Law of Constant Proportions

According to this law, "A pure chemical compound always contains the same elements combined together in the same proportion by mass irrespective of the fact from where the sample has been taken or from which procedure has it been produced."

For example :

- 18 gm of $H_2O \Rightarrow$ 16 gm of oxygen + 2 gm of hydrogen,

  i.e., $m_H/m_O = 2/16 = 1/8$
- 36 gm of $H_2O \Rightarrow$ 32 gm of oxygen + 4 gm of hydrogen,

  i.e., $m_H/m_O = 4/32 = 1/8$
- 9 gm pf $H_2O \Rightarrow$ 8 gm of oxygen + 1 gm of hydrogen,

  i.e., $m_H/m_O = 1/8$

From the above three cases, differently weighing H, O samples were taken but the ratio of mass of 'H' to mass of 'O' comes out to be '1/8' is same, proving law of constant proportion.

Likewise, if a sample of 'H_2O' was taken from anywhere *i.e.,* from well, pond, lake or anywhere the ratio of masses of 'H' to 'O' will come out to be same as '1/8'.

Example : Hydrogen and oxygen combine in the ratio 1 : 8 by mass to form water. What mass of oxygen gas would be required to react completely with 3.0 gm of hydrogen gas ?

Solution : $\frac{m_H}{m_O} = \frac{1}{8}$ (Given in equation For H_2O)

But, $m_H = 3.0$ gm (given)

Or $\frac{3}{m_O} = \frac{1}{8}$

Or $m_O = 24$ gm

.: Mass of oxygen will be 24 gm.

Or it will be a sample of 27 gm of H_2O where 3 gm of hydrogen is present with 24 gm of oxygen.

Dalton's Atomic Theory

Based upon laws of chemical combination, Dalton's Atomic Theory provided an explanation for the Law of Conservation of Mass and Law of Constant Composition.

Postulates of Dalton's atomic theory are as follows :

- All matter is made up of very tiny particles called 'Atoms' .
- Atom are indivisible particles, which can't be created or destroyed in a chemical reaction. (Proves 'Law of Conservation of Mass')
- Atoms of an element have identical mass and chemical properties.
- Atoms of different elements have different mass and chemical properties.
- Atom combine in the ratio of small whole numbers to form compounds. (Proves 'Law of Constant Proportion')
- The relative number and kinds of atoms are constant in a given compound.

Atom

- According to modern atomic theory, an atom is the smallest particle of an element which takes part in chemical reaction such that during the chemical reaction, the atom maintains its identity, throughout the chemical or physical change.
- Atoms are very small and hence can't be seen even through a very powerful microscope.
- Atomic radius of smallest atom of Hydrogen is 0.37×10^{-10} m or 0.037 nm.

  Such that, $1 \text{ nm} = 10^{-9}$ m

IUPAC (International Union of Pure and Applied Chemistry)
Symbols of Atoms of Different Elements

Element	Symbol	Element	Symbol
Aluminium	Al	Iodine	I
Argon	Ar	Iron	Fe
Barium	Ba	Lead	Pb
Calcium	Ca	Nitrogen	N
Carbon	C	Oxygen	O
Chlorine	Cl	Potassium	K
Cobalt	Co	Silicon	Si
Copper	Cu	Silver	Ag
Fluorine	F	Sulphur	S
Gold	Au	Zinc	Zn
Hydrogen	H		

Atomic Mass

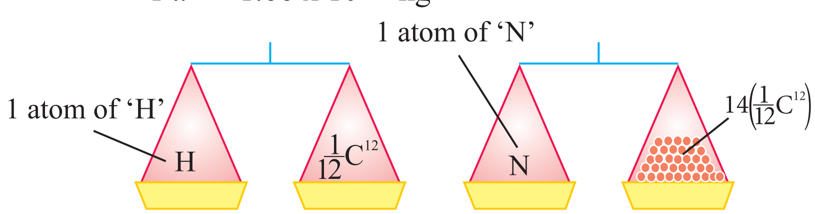
- The mass of an atom of an element is called its atomic mass.
- In 1961, IUPAC have accepted 'atomic mass unit' (u) to express atomic and molecular mass of elements and compounds respectively.

Atomic Mass Unit

The atomic mass unit is defined as the quantity of mass equal to 1/12 of mass of an atom of Carbon-12.

$$1 \text{ amu or } u = \frac{1}{12} \times \text{ Mass of an atom of C–12}$$

$$1\ u = 1.66 \times 10^{-27} \text{ kg}$$

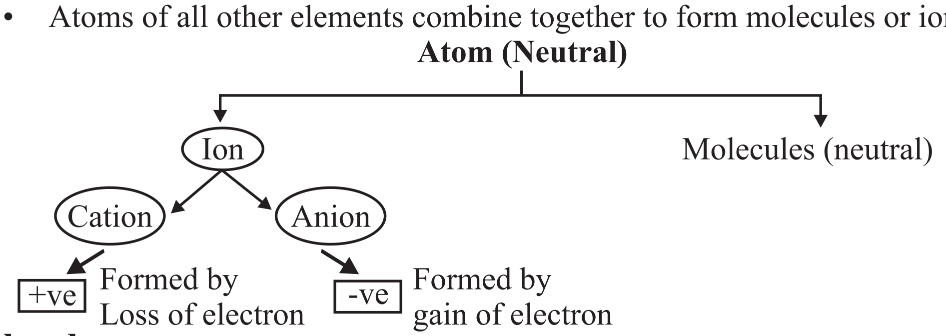


Atomic Mass of H = 1u Atomic Mass of N = 14 u

Atomic Mass of some elements					
Element	**Symbol**	**Atomic Mass**	**Element**	**Symbol**	**Atomic Mass**
Hydrogen	H	1u	Sodium	Na	23u
Helium	He	4u	Magnesium	Mg	24u
Lithium	Li	7u	Aluminium	Al	27u
Beryllium	Be	9u	Silicon	Si	28u
Boron	B	11u	Phosphorous	P	31u
Carbon	C	12u	Sulphur	S	32u
Nitrogen	N	14u	Chlorine	Cl	35u
Oxygen	O	16u	Potassium	K	39u
Fluorine	F	19u	Calcium	Ca	40u
Neon	Ne	20u	Iron	Fe	56u

How do atoms exist ?

- Atoms of most of the elements are very reactive and do not exist in free state.
- Only the atoms of noble gases (such as He, Ne, Ar, Kr, Xe and Rn) are chemically unreactive and can exist in the free state as single atom.
- Atoms of all other elements combine together to form molecules or ions.



Molecule

- A molecule is a group of two or more atoms which are chemically bonded with each other.
- A molecule is the smallest particle of matter (except element) which is capable of an independent existence and show all properties of that substance.

E.g., 'H_2O' is the smallest particle of water which shows all the properties of water.

- A molecule may have atom of same or different elements, depending upon this, molecule can be categorized into two categories :

Homoatomic molecules (containing atoms of same element) and **Heteroatomic molecules** (containing atoms of different elements)

Molecules

Homoatomic molecules of elements

Eg., O_2, N_2, O_3, S_8, P_4 etc.

Heteroatomic molecules compounds

Eg. H_2O, CO_2, NaCl, $CaCO_3$

Molecules of some compounds	
Compound	**Combining Elements**
Water (H_2O)	Hydrogen, Oxygen
Ammonia (NH_3)	Nitrogen, Hydrogen
Carbon Dioxide (CO_2)	Carbon, Oxygen
Hydrogen Chloride (HCl)	Hydrogen, Chlorine
Methane (CH_4)	Carbon, Hydrogen
Ethane (C_2H_6)	Carbon, Hydrogen
Sodium Chloride (NaCl)	Sodium, Chlorine
Copper Oxide (CuO)	Copper and Oxygen

Atomicity

The number of atoms present in one molecule of an element is called its atomicity.

	Name	**Formula**	**Atomicity**	
1.	Argon	Ar	Monoatomic (1)	Noble gases constitute monoatomic molecules
2.	Helium	He	Monoatomic (1)	
3.	Oxygen	O_2	Diatomic (2)	
4.	Hydrogen	H_2	Diatomic (2)	
5.	Phosphorus	P_4	Tetratomic (4)	
6.	Sulphur	S_8	Polyatomic (8)	
7.	Ozone	O_3	Triatomic (3)	

Chemical formulae

It is the symbolic representation of the composition of a compound.

Characteristics of chemical formulae

- The valencies or charges on ion must balance.
- When a compound is formed of metal and non-metal, symbol of metal comes first. *E.g.*, CaO, NaCl, CuO.
- When polyatomic ions are used, the ions are enclosed in brackets before writing the number to show the ratio. E.g., $Ca(OH)_2$, $(NH_4)_2 SO_4$

Molecular Mass

It is the sum of atomic masses of all the atoms in a molecule of that substance. It is also expressed in Atomic mass units.

e.g., Molecular mass of H_2O = 2 x Atomic mass of Hydrogen + 1 x Atomic mass of Oxygen

So, Molecular mass of $H_2O = 2 \times 1 + 1 \times 16 = 18\ u$

Formula Unit Mass

It is the sum of atomic mass of all atoms present in formula for a compound.

e.*g.,* In NaCl, Na = 23u and C1= 35.5u

So, Formula unit mass = $1 \times 23 + 1 \times 35.5 = 58.5\ u$

Rules of writing chemical formulae :

Rule 01:

- Write symbols of atoms of element.
- Then write their valencies / charges below the symbols.
- Now crossover the valencies of constituent atoms.
- As a result, the first atom gets valency of second atom and the second atom gets the valency of the first atoms.
- By crossover chemical formula is formed.

Rule 02 :

- If valency is 1, it is not written below.

Rule 03 :

- In case we have two or more same poly atomic ions, we use brackets and then write subscript.

Examples:

(i) Symbol : H S

valency : 1 2 H_2S_1 or H_2S (Hydrogen sulphide)

(ii) Symbol : C O eg. $(NH_4)_2SO_4$, $Al_2(SO_4)_3$

valency : 4 2 C_2O_4 or CO_2 (Carbon dioxide)

[Take 2 common and dividethe formula by2]

(iii)For Hydrochloric acid (Hydrogen chloride)

Symbol H Cl

valency 1 1 H_1Cl or HCl

(iv)For Carbon tetrachloride

Symbol C Cl

valency 4+ 1- C_1Cl_4 or CCl_4

(v) For Magnesium chloride

Symbol Mg Cl

valency 2+ 1- Mg_1Cl_2 or $MgCl_2$

(vi)For aluminium oxide

Symbol Al O

valency 3+ 2- Al_2O_3

(vii) For Calcium oxide

Symbol Ca O

valency 2+ 2- Ca_2O_2 or CaO

[Take 2 common and divide the formula by 2]

(viii)For Sodium nitrate

Symbol Na NO_3 $NaNO_3$

valency 1+ 1-

Ions

An ion may be defined as an atom or group of atoms having positive or negative charge.

Some positively charged ions : Na^+, K^+, Ca^{2+}, Al^{3+} etc.

Some negatively charged ions : Cl^- (chloride ion), S^{2-} (sulphide ion), OH^- (hydroxide ion), SO_4^{2-} (sulphate ion) NO_3^- (Nitrate ion)

Ions

Monoatomic Ions	**Polyatomic Ions**
↓	↓
Charged single atom	**Charged group of atoms**
↓	↓
Mg^{2+} (Magnesium ion)	NH_4^+ (Ammonium ion)
Na^+ (Sodium ion)	CO_3^{2-} (Carbonate ion)
Cl^- (Chloride ion)	SO_4^{2-} (Sulphate ion)
Al^{3+} (Aluminium ion)	OH^- (Hydroxide ion)

Chemical Formulae of Ionic Compounds (Polyatomic ions)

(i) Sodium carbonate

Na CO_3

1+ 2- Na_2CO_3

(ii) Aluminium sulphate

Al SO_4

3+ 2- $Al_2\ (SO_4)_3$

(iii) Calcium hydroxide

Ca OH

2+ -1 $Ca(OH)_2$

(iv) Ammonium sulphate

NH_4 SO_4

1+ 2- $(NH_4)_2SO_4$

(v) Magnesium hydroxide

Mg OH

2+ 1- $Mg(OH)_2$

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. What do you understand by valence electrons?
2. Name the anion and cation that constitute the molecule of calcium oxide.
3. An element 'X' has atomic number 13. Write the formula of its oxide.
4. Write the names of elements present in common salt.
5. If 'K' and 'L' shells of an atom are completely filled with electrons then what will be the total number of elections in that atom ?
6. Name any two elements that exist as independent atoms.
7. Identify polyatomic ion in $MgCO_3$.
8. State the law of constant proportion.

SHORT ANSWER TYPE QUESTIONS

1. Write the chemical formulae of-

(a) Calcium chloride	(e) Lead Nitrate
(b) Magnesium bicarbonate	(f) Calcium Phosphate
(c) Aluminum sulphate	(g) Iron (II) sulphide
(d) Sodium carbonate	(h) Mercury (I) chloride.

2. Write the molecular formulae of all the compounds that can be formed by the combination of following ions.

Cu^{2+}, Na^{+}, Fe^{3+}, Cl^{-}, SO_4^{2-}, PO_4^{3-}

3. Write the cations (Positively charged ions) and anions (negatively charged ions) Present (if any) in the following compounds.

(a) NaCl	(c) NH_4NO_3
(b) H_2	(d) $Ca\,(HCO_3)_2$

4. Give the formulae of the compounds formed from the following sets of elements

(a) Calcium and fluorine
(b) Nitrogen and Hydrogen
(c) Nitrogen and Oxygen
(d) Sulphur and Oxygen
(e) Carbon and Oxygen
(f) Carbon and Chlorine

5. Classify each of the following elements or compounds on the basis of their atomicity.

(a) F_2 (b) NO_2 (c) CH_4 (d) P_4 (e) H_2O_2

(f) P_4O_{10} (g) O_3 (h) HCl (i) He (j) Ag

6. Write postulates of Dalton's atomic theory (at least three).

7. What is the difference between the molecule of an element and molecule of a compound? Give one example of each.

8. What is the difference between 2H and H_2? (at least two differences)

LONG ANSWER TYPE QUESTIONS

1. a) Atoms are very tiny particles, but it is important to know about them, why?
   b) What is the full form of IUPAC?
   c) State the rules given by IUPACfor writing symbols of elements.

2. An element X has multiple valency of 2 and 3 both. It is a metal. What will be the chemical formula of :
   a) Oxide
   b) Chloride
   c) Sulphate formed by X.

3. Find the mass ratio of elements present in the given compounds.
   a) Calcium Oxide
   b) Magnesium Sulphide
   c) Sodium Chloride
   d) Carbon Dioxide
   c) Ammonia

OBJECTIVE TYPE QUESTIONS

1. Which of the following statements is not true about an atom?

a. Atoms are not able to exist independently

b. Atoms are the basic units from which molecules and ions are formed

c. Atoms are always neutral in nature

d. Atoms aggregate in large numbers to form the matter that we can see, feel or touch

2. The chemical symbol for nitrogen gas is

a, Ni

b. N_2

c. N^+

d. N

3. The chemical symbol for sodium is

a. So

b. Sd

c. NA

d. Na

4. Give the chemical formulae of the compounds formed from the following sets of elements.

a. Calcium and fluorine

b. Hydrogen and sulphur

c. Nitrogen and hydrogen

d. Carbon and chlorine

e. Sodium and oxygen

f. Carbon and oxygen

5. Write the molecular formulae for the following compounds

a. Copper (II) Bromide. ....

b. Aluminium (III) nitrate. ....

c. Calcium (II) phosphate ....

d. Iron (III) sulphide ....

e. Mercury (II) chloride ....

f. Magnesium (II) chloride ....

6. An element 'X' forms an oxide X_2O_3

a. State the valency of X

b. Write the chemical formula for chloride of X.

7. Write the molecular formulae of the compounds that can be formed by the combination of following ions

a. Cu^{2+} and Cl^- ....

b. Na^+ and NO_3- ....

c. Fe^{3+} and SO_4^{2-} ....

d. Fe^{2+} and Cl^- ....

8. Classify each of the following on the basis of their atomicity.

Elements	**Atomicity**
F_2	
NO_3	
NO_2	
P_4	
H_2O_2	
He	
Ag	
CH_4	
P_4O_{10}	
C_4H_{10}	

9. Fill in the blanks

a. In a chemical reaction, the sum of the masses of the reactants and products remains unchanged. This is called ....

b. A group of atoms carrying a fixed charge on them is called ....

c. The formula unit mass of $Ca_3(PO_4)_2$ is ....

d. Formula of sodium carbonate is .... and that of ammonium sulphate is ....

Assertion and reason type questions:-

Two statements are given one labelled assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation fo A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (A) : Sulphates are polyatomic ions.

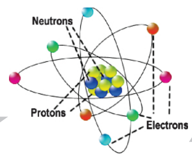
   Reason (R) : The sulphate ion consists of one sulphur atom and four oxygen atom and carries an overall charge of 2-

Answer: (a) The Sulphate ion is SO_4^{2-}. The atoms of a polyatomic ion are tightly bonded together and so the entire ion behaves as a single unit.

2. Assertion (A) : Magnesium and chlorine ions are represented by Mg^{2+} and Cl^- respectively.

   Reason (R) : The chemical formula of Magnesium Chloride is Mg_2Cl.

Answer : (c)



Chapter - 4

Stracture of Atom

CONCEPT MAPPING

STRUCTURE OF ATOM

ATOM

Electron
- Thomson (discovery)
- From cathode rays
- -1.6×10^{-19} C (charge)
- 9.1×10^{-31} kg (mass)

Proton
- Goldstein (discovery)
- Anode rays or canal rays
- $+1.6 \times 10^{-19}$ C (charge)
- 1.673×10^{-27} kg (mass)

Neutron
- Chadwick (discovery)
- α particles on lighter elements
- Neutral
- 1.673×10^{-27} kg (mass)

ATOMIC MODELS

Thomson's Atomic model
- Watermelon model
- Electrons embedded in positive sphere

Rutherford's Atomic Model
- Atom has maximum empty space
- Positive charge occupies less space
- Nucleus is very small

Bohr's Atomic Model
- Distribution of electrons in shells
- Rule of $2n^2$
- Valence Shells have Valence electrons
- K, L, M, N shells

ATOM

Atomic Number
⇩
No. of protons
or
No. of electron

Isotopes:
- Same At No.
- Diff Mass No.

Atomic Mass
⇩
No. of protons
+
No. of Neutrons

Isobars:
- Same Mass No.
- Diff. Atomic No.

John Dalton considered atom to be an indivisible entity, but his concept had to be discarded at the end of nineteenth century, when scientists through experiments were able to find existence of charged (electrons and protons) and neutral particles (neutrons) in the atom. These particles were called the 'Sub-atomic particles'.

Discovery of Electrons - Cathode Rays (By J.J. Thomson)

Thomson explained presence of electrons by cathode rays experiment.

Facts about Electrons

- Charge on electron = - 1.6×10^{-19} C (C = Coloumb)
  (As calculated by Robert E. Millikan)
- Mass of electron = 9.1×10^{-31} kg

Discovery of Protons - Anode Rays/Canal Rays (By E. Goldstein)

E. Goldstein by his famous anode rays/canal rays experiment was able to detect presence of positively charged particles called protons in the atom.

Facts about Protons

- Charge on proton = + 1.6×10^{-19} C
- Mass of proton = 1.673×10^{-27} kg
  i.e., Mass of proton = 1840 x Mass of electron

Discovery of Neutrons (By J. Chadwick)

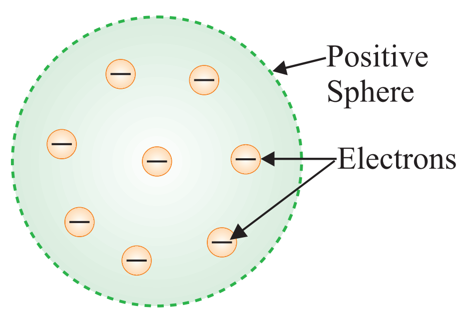
- J. Chadwick bombarded lighter elements (like lithium, boron etc.) with a-particles and observed emission of new particles having zero charge but having mass equal to that of proton.
- These particles were called 'Neutron' *i.e.,* neutral particle of the atom.
- Neutron are absent in Protium isotope of hydrogen atom. ($_1H^1$)
- Since, mass of electron is negligible as compared to that of proton and neutron, sum of masses of protons and neutrons in an atom will compose its atomic mass.

Atomic Models

- From the knowledge of existence of subatomic particles viz., electron, proton and neutron in an atom, various atomic models were proposed by different scientists.
- Following are some of the atomic models :
  - (a) Thomson's Model of Atom
  - (b) Rutherford's Model of Atom
  - (c) Bohr's Model of Atom
- The most trusted and scientifically established model of atom which is adopted these days is 'Quantum Mechanical Model of Atom'. It will be dealt in higher classes.

Thomson's Atomic Model

- This model is often called the 'Watermelon Model'.
- In this model, Thomson predicted the presence of electrons inside positive sphere (made up of protons), just same as seeds of watermelon are embedded in red edible part of watermelon.



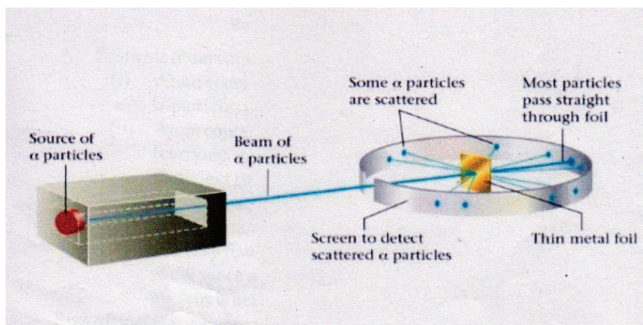
J. J. Thomson's Model of Atom

- Although this model explained neutrality of atom, it was not able to explain other scientific experiments conducted on atom. Hence it was discarded.

Rutherford's Atomic Model

- In his famous 'a- particle Scattering Experiment', Rutherford bombarded a- particle (Helium nucleus $_2He^4$) upon thin gold foil.

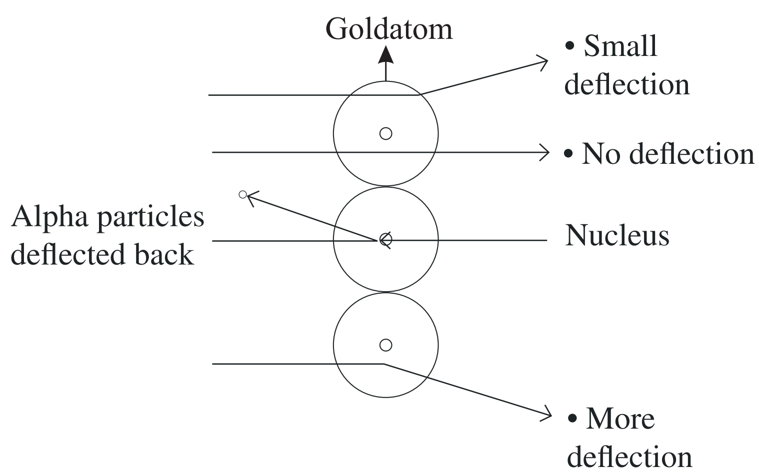
Rutherford made following observations from this experiment:



(i) Most of a-particles passed through gold foil undeflected.

(ii) Some of the a-particles deflected by foil by small angles.

(iii) One out of every 12000 particles appeared to rebound.



Rutherford's α-ray Scattering Experiment

- **From his observation, Rutherford had drawn following conclusions:**

(i) Atom consists of predominantly empty space as most of a-particles passed through gold foil undeflected.

(ii) Atom contains centrally placed positively charged nucleus (carrying positively charged particles), because few alpha particles were deflected and very few *i.e.,* one in 12000 bounced back.

(iii) Since a minute fraction of α-particles suffered deflections and very few bounced back, this led to conclusion that most of the space an atom is empty and the space occupied by nucleus is negligible compared to this empty space.

Size of nucleus was about 10^{-5} times that of size of atom.

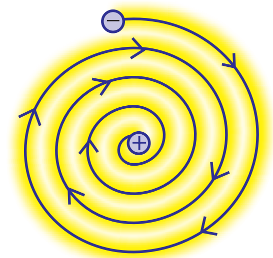
Volume of nucleus = 10^{-5} x volume of atom

(iv) Whole of the atomic mass is concentrated in the nucleus.

- **On the basis of his experiment, Rutherford proposed model of an atom having following features :**
  - (i) There is positively charged centre in nucleus of an atom called nucleus. Nearly all the mass resides in nucleus (Proton + Neutron).
  - (ii) Electrons revolve round the nucleus in well defined orbits.
  - (iii) Size of nucleus is very small compared to the size of atom.

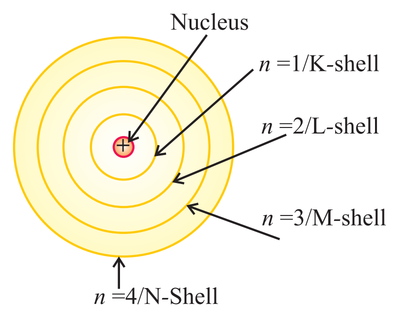
Drawbacks of Rutherford's Model (Unstability of Atom)

- According to Rutherford, electrons revolve round the nucleus in well-defined orbits, but electrons being charged particles will lose their energy and finally fall into the nucleus. This will make atom highly unstable.
- This was the major drawback of Rutherford which was unexplained by him.

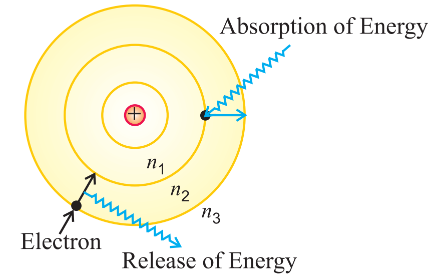


Bohr's Atomic Model

- To overcome drawbacks of Rutherford's Model, Neil Bohr in 1912 proposed modified model of structure of atom. He made following assumptions :
  - (i) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.
  - (ii) While revolving in discrete orbits, the electrons do not radiate energy.
  - (iii) Energy is emitted or absorbed by an atom only when an electron moves from one orbit to another.



Energy levels in Atom



"Electron's Energy Change"
Bohr's Model

Atomic Number

The total number of protons lying in the nucleus of any atom is called the atomic number.

- An atomic number is the identity of an atom, changing atomic number means changing the atom.
- Atomic number is denoted by 'Z'. (Z=no. of Proton)
- For a neutral atom, no. of protons and electrons are equal.

Mass Number

It is the sum of total number of protons and neutrons lying in the nucleus of an atom.

Mass Number = **Number of Protons + Number of Neutron**

It is denoted by 'A'. ($A = n_p + n_N$)

Representation of Atom : Mass no. → A, Atomic no. → Z $\;{}^{A}_{Z}E$ (E = Symbol of element)

E.g., ${}^{27}_{13}Al$ (z) Atomic No. of Aluminium (A*l*) = 13 ($Z = n_p$)

(A) Mass No. of Aluminium (A*l*) = 27 ($A = n_p + n_N$)

$$(A = 13 + 14)$$

Example. *Calculate number of protons, electrons and neutrons for :*

(a) ${}^{35}_{17}Cl$ (b) ${}^{23}_{11}Na$

Solution : (a) $^{35}_{17}$ Cl

$_zCl = 17\ (n_p)$

Here, since Cl is neutral, so $n_e = n_p = 17$.

Now, $^ACl = 35$

Or $35 = n_p + n_N$

Or $35 = 17 + n_N$

Or $n_N = 35 - 17 = 18$

(b) $^{23}_{11}$ Na

$_ZNa=11$

$n_p=n_e=11$

$^ANa=23$

$23=n_p+n_N$

$23=11+n_N$

$n_N=23-11=12$

Distribution Of Electrons In Various Shells

The distribution of electrons in various shells is done in accordance to 'Bohr-Bury Scheme'.

Bohr-Bury Scheme

This scheme can be summarized as follows :

(i) The filling of electrons in an atom is done in accordance to '$2n^2$', where '*n*' is the number of shell and '$2n^2$' represents the total number of electrons that can be accommodated in that particular shell.

If $n = 1$, *i.e.,* K= shell, $2n^2 = 2 \times (2)^1 = 2$ electrons

If $n = 2$, *i.e.,* L = shell, $2n^2 = 2 \times (2)^2 = 8$ electrons

If $n = 3$, *i.e.,* M = shell, $2n^2 = 2 \times (3)^2 = 18$ electrons

If $n = 4$, *i.e.,* N = shell, $2n^2 = 2 \times (4)^2 = 32$ electrons

Maximum number of electrons that can be filled in particular shell.

(ii) The outermost shell can't hold more than 8 electrons, while second last shell can't have more than 18 electrons, even though they may have capacity to hold more electrons.

For example, in '$_{20}Ca$', the electron distribution will be :

	K	L	M	N
$_{20}Ca =$	2	8	8	2

But $_{20}Ca = 2, 8, 10$ is wrong although 'M' shell can contain upto 18 electrons.

(iii) Electrons are not filled in a given shell, unless the inner shells are filled. This means, shells are filled in a step wise manner.

Some examples :

(a) $_{19}K = 2, 8, 8, 1$

(b) $_{13}Al = 2, 8, 3$

(c) $_{9}F = 2, 7$

(d) $_{10}Ne = 2, 8$

(e) $_{11}Na = 2, 8, 1$

"Fundamental Particles in Atom"

Name of Elements	Symbol	Atomic Number	Number of Electrons	Number of Protons	No. of Neutrons	Atomic Mass	Electronic Configuration				Valency
							K	L	M	N	
Hydrogen	H	1	1	1	-	1	1	-	-	-	1+, -
Helium	He	2	2	2	2	4	2	-	-	-	0
Lithium	Li	3	3	3	4	7	2	1	-	-	1+
Beryllium	Be	4	4	4	5	9	2	2	-	-	2+
Boron	B	5	5	5	6	11	2	3	-	-	3+
Carbon	C	6	6	6	6	12	2	4	-	-	4+
Nitrogen	N	7	7	7	7	14	2	5	-	-	3-
Oxygen	O	8	8	8	8	16	2	6	-	-	2-
Fluorine	F	9	9	9	10	19	2	7	-	-	1-
Neon	Ne	10	10	10	10	20	2	8	-	-	0
Sodium	Na	11	11	11	12	23	2	8	1	-	1+
Magnesium	Mg	12	12	12	12	24	2	8	2	-	2+
Aluminium	Al	13	13	13	14	27	2	8	3	-	3+
Silicon	Si	14	14	14	14	28	2	8	4	-	4
Phosphorus	P	15	15	15	16	31	2	8	5	-	3-
Sulphur	S	16	16	16	16	32	2	8	6	-	2-
Chlorine	Cl	17	17	17	18	35.5	2	8	7	-	1-
Argon	Ar	18	18	18	22	40	2	8	8	-	0
Potassium	K	19	19	19	20	39	2	8	8	1	1+
Calcium	Ca	20	20	20	20	40	2	8	8	2	2+

Valence shell and valence Electrons

- From Bohr-Bury scheme, we know that maximum number of electrons which can be accommodated in outermost shell is 8.
- Every element tends to have 8 electrons in its outermost shell, in achieving 8 electrons, i.e. octet an atom can either gain electrons or loose electrons.
- The number of electrons lost or gained by an element in achieving determines its valency.
- Electrons in the outermost shell will be called its Valence electrons.

For example,

S. No.	Element	Electron distribution	Valency	Valence electron
1.	$_{6}C$	2, 4	4	4
2.	$_{7}N$	2, 5	3	5
3.	$_{8}O$	2, 6	2	6
4.	$_{9}F$	2, 7	1	7
5.	$_{10}Ne$	2, 8	0	8
6.	$_{11}Na$	2, 8, 1	1	1
7.	$_{12}Mg$	2, 8, 2	2	2
8.	$_{20}Ca$	2, 8, 8, 2	2	2

- lighter elements like H and He can fill 2 elements in their outermost shell.

S. No.	Element	Electron distribution	Valency
1.	$_{1}H$	1	1
2.	$_{2}He$	2	0

- For elements like Li, Be and B, these elements lose their outermost electrons to achieve 2 electrons in their outermost shell. These elements will have valency in accordance to this act.

S. No.	Element	Electron distribution	Valency
1.	$_{3}Li$	2, 1	1
2.	$_{4}Be$	2, 2	2
3.	$_{5}B$	2, 3	3

Isotopes :

Isotopes are atoms of the same elements having same atomic number and different mass numbers e.g. Isotope of Hydrogen are: ${}^{1}_{1}H$, ${}^{2}_{1}H$, ${}^{3}_{1}H$

E.g., Chlorine has two isotopes of mass number 35 and 37 respectively. ${}^{35}_{17}Cl$ and ${}^{37}_{17}Cl$.

Uses of isotopes

(i) Uranium isotope is used as fuel in nuclear reactor.

(ii) Isotope of cobalt is useful in treatment of cancer.

(iii) An isotope of iodine is used in the treatment of goitre.

(iv) Carbon -14 is used in carbon dating.

Relative atomic mass is an average of the masses of all the isotopes of the element.

In any mixture of pure chlorine, 75% of Cl^{35} and 25% of Cl^{37} is present.

.: Relative atomic mass = 75% of Cl^{35} + 25% Cl^{37}

Relative atomic mass of chlorine

$$= \frac{75}{100} X\ 35 + \frac{25}{100} X\ 37$$

$$= \frac{3X35}{4} + \frac{1X37}{4} = \frac{105}{4} + \frac{37}{4}$$

$$= \frac{1}{4}(105+37)$$

$$= \frac{1}{4} X142 = 35.5u$$

Isobars

The atoms of those elements which have the same mass number but different atomic numbers are called isobars. Eg. ${}^{40}_{20}Ca$ and ${}^{40}_{18}Ar$ have same mass number and different atomic numbers. ${}^{24}_{11}Na$ and ${}^{24}_{12}Mg$ is another examples of isobars.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. What will happen to an element 'X' if its atoms gain three electrons ?
2. If the electronic configuration of an atom is 2, 8, 2. calculate the total number of electrons in it. Write the name of the atom also.
3. Write any two observation which support the fact that atoms are divisible.
4. Name the particles which determine the mass of an atom.
5. What is the charge on canal rays?
6. What is the difference between Na and Na^+ in terms of electron ?
7. An atom of an element is represented as $^{32}_{16}X$. How many electrons and neutrons are present in this atom ?
8. An atom of an element has 7 electron in its L shell. What is its atomic number and valency ?
9. Which of the following are isotopes and which are isobars?
   Argon, Calcium, Deuterium, Protium.
10. Which subatomic particle has no charge on it ?

SHORT ANSWER TYPE QUESTIONS

1. Why is an atom neutral in spite of the presence of charged particles in it?
2. How does a proton differ from an electron?
3. Why do isotopes show similar chemical properties ?
4. Differentiate between isotopes and isobars. (any two differences).
5. Write the electronic configuration of Mg^{++}. [at- no. = 12]
6. Describe Thomson's model of atom. Which subatomic particle was not present in Thomson's model of atom?
7. Draw the electron distribution of following elements - (dot structure)
   (a) Na (at no. = 11) (c) Cl (at no. = 17)
   (b) Al (at no. = 13) (d) O (at no. = 8)
8. Is it possible for the atom of an element to have one electron, one proton and no neutron. If so, name the element.
9. Write down the electron distribution of Chlorine atom. How many electrons are there in L-shell? (At no. of chlorine = 17)
10. In the atom of an element 6 electrons are present in the outermost shell. If this atom acquires nobel gas configuration by accepting required number of electrons, then what would be the charge on the ion so formed?

LONG ANSWER TYPE QUESTIOS

1. On the basis of Thomson's atomic model of an atom, explain how the atom is neutral as a whole.
2. What do you think would be the observation, if the *a* particle scattering experiement is carried out using a foil of metal other than gold?
3. (a) Helium atom has an atomic mass of u. It has two protons in its nucleus. How many neutrons does it have?
4. Compare electron, proton and neutron considering their charge, mass and position in an atom.
5. (a) What were the limitations of Thomson's model of atoms?

   (b) What are the limitations of Rutherford's model of an atom.
6. Define valency by taking examples of sodium and chlorine.
7. Mg^{+2} has completely filled K and L shells. Explain what do you understand by this statement.
8. Why do Helium, Neon and Argon have zero valency?
9. Enlist the conclusion drawn by Rutherford from his *a*-Particle scattering experiment.
10. What are the postulates of Bohr's model of an atom?
11. What are isotopes? Give 3 applications of such isotopes.

OBJECTIVE TYPE QUESTIONS:

1. Which of the following correctly represent the electronic distribution in the Mg atom ?

   a) 3, 8, 1 b) 2, 8, 2 c) 1, 8, 3 d) 8, 2, 2
2. Rutherford's 'alpha (*a*) particles scattering experiment' resulted in discovery of

   a) Electron (b) Proton c) Nucleus d) Atomic mass
3. The number of electrons in an element X is 15 and the number of neutrons is 16. Which of the following is the correct representation of the element?

   a. ${}^{31}_{15}X$

   b. ${}^{31}_{16}X$

   c. ${}^{15}_{16}X$

   d. ${}^{16}_{15}X$
4. Dalton's atomic theory succesfully explained

   i. Law of conservation of mass

   ii. Law of constant proportions

   iii. Law of radioactivity

   iv. Law of multiple proportion

   a. i, ii and iii b. i, iii and iv

   c. ii, iii and iv d. i, ii and iv

5. Which of the following statements about Rutherford's model of atom are correct?
   i. considered the nucleus as positively charged
   ii. established that the α-particles are four times as heavy as a hydrogen atom
   iii. can be compared to solar system
   iv. was in agreement with Thomson's model
      a. i and iii. b. ii and iv
      c. i and iv. d. only i
6. Which of the following are true for an element?
   i. Atomic number = number of protons + number of electrons
   ii. Mass number = number of protons + number of neutrons
   iii. Atomic mass = number of protons = number of neutrons
   iv. Atomic number = number of protons = number of electrons
      a. i and ii
      b. i and iii
      c. ii and iii
      d. ii and iv
7. The ion of an element has 3 positive charges. Mass number of the atom is 27 and the number of neutrons is 14. What is the number of electrons in the ion?
      a. 13
      b. 10
      c. 14
      d. 16
8. An atom with 3 protons and 4 neutrons will have a valency of
      a. 3 b. 7 c. 1 d. 4
9. The electron distribution in an aluminium atom is
      a. 2, 8, 3. b. 2, 8, 2 c. 8, 2, 3 d. 2, 3, 8
10. Fill in the blanks in the following statements
      a. Rutherford's α-particle scattering experiment led to the discovery of the ....
      b. Istopes have same..........................but different..........................
      c. Neon and chlorine have atomic numbers 10 and 17 respectively. Their valencies will be...................and...................respectively.
      d. The electronic configuration of silicon is.....................and that of sulphur is ....
11. Read the following passage and answer the following questions:
In order to overcome the objections raised against Rutherford's model of an atom, Neils Bohr put forward the following postulates about the model of an atom.
(i) Only certain special orbits known as discrete orbits have electrons
(ii) While revolving in discrete orbits the electrons do not radiate energy.

Now complete the following statement

(a) Atoms are made up of ________________, ___________and_________

(b) ________ amended Rutherford's shortcomings

(c) Electrons do not radiate energy while revolving in _______ orbits.

(d) Discrete orbits are also known as ________________

(e) K Shell can accomodate ______ electrons.

Assertion and Reason type Questions :

Directions : In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true but reason (R) is the correct explanation of assertion (A).

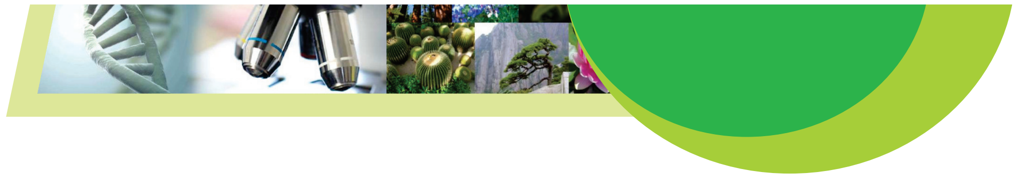
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation assertion (A).

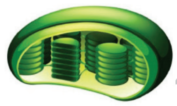
(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1. Assertion : For noble gases, valency is zero.
Reason : Noble gases have 2or8 valence electrons.
Answer : (a) Noble gases have valency zero because their outer most shells are filled completely.

Q2. Assertion : A few positively charged α – particles are deflected in Rutherfords experiment.
Reason : Most of the Space in the atom is empty.
Answer : (b) The positive charge has to be concentrated in a very small volume (nucleus) that repelled and deflected the positively charged α – particles.





Chapter - 5

Fundamental Unit Of Life : Cell

CONCEPT MAPPING

Cell

- Type of Cell →
  - Prokaryotic Cell e.g. Bacteria
  - Eukaryotic Cell
    - Plant Eukaryotic Cell
    - Animal Eukaryotic cell
- Components of Cell
  - Cell wall *(In plants)*
  - Cell membrane/ Plasma Mambrane *(Both plants & animals)*
  - Nucleoid *(in Prokaryotes)* Or Nucleus *(inEukaryotes)*
  - Cell Organelle
    - Endoplasmic Reticulum (ER)
      - Rough ER (Protein Synthesis)
      - Smooth ER (Lipid Synthesis)
    - Golgi apparatus
    - Lysosomes (Suicidal Bags)
    - Mitochondria Power house of the cell
    - Vacuoles (storage sac)
    - Plastids (Only In plants)
      - Chromoplast
      - Leucoplast
      - Chloroplast
    - Centrioles (in Animal Cell)
  - Cytoplasm
    - Protoplasm (Cytoplasm + Cell Organelle + Nucleus)

Type of Organism

- Unicellular: One celled, e.g. amoeba, paramecium, bacteria
- Multicellular: Many celled, e.g. man, cow, dog, insects, plant, fungi

Cell

- A cell is the basic structural and functional unit of all life forms.
- All living forms are composed of microscopic units called as 'Cells'.
- Study of structure and composition of cell is called Cytology'.
- Cell was first discovered and observed by Robert Hooke in a thin dead slice of cork in the year 1665.
- First free living cell was discovered by A. V. Leeuwenhoek. in 1674.
- Protoplasm is an aggregate of various chemicals such as water, ions, salts and other organic molecules like proteins, carbohydrates, fats, nucleic acids, vitamins etc. Present in cytoplasm along with cell organelles & nucleus that constitute a cell.
- It exists in sol-gel states.

Cell Theory :

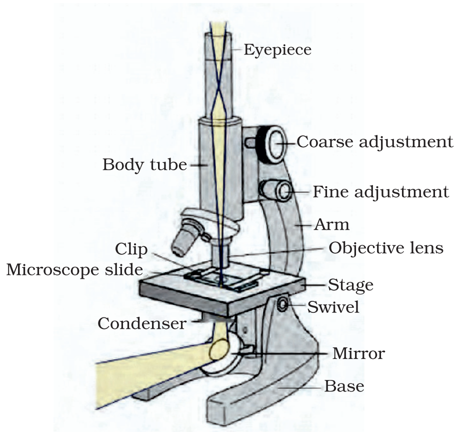
Two biologists, Schleiden and Schwann (1838) gave the Cell theory which states that :

(i) All plants and animals are composed of cells.

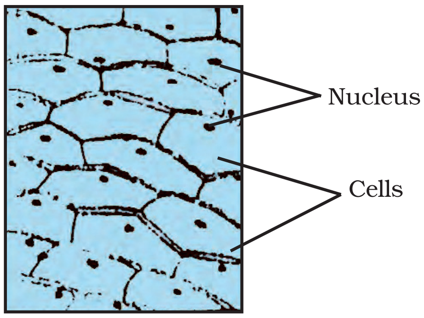
(ii) Cell is the basic unit of life.

(iii) All cell arise from pre-existing cells.

- Viruses are the exceptions of cell theory.

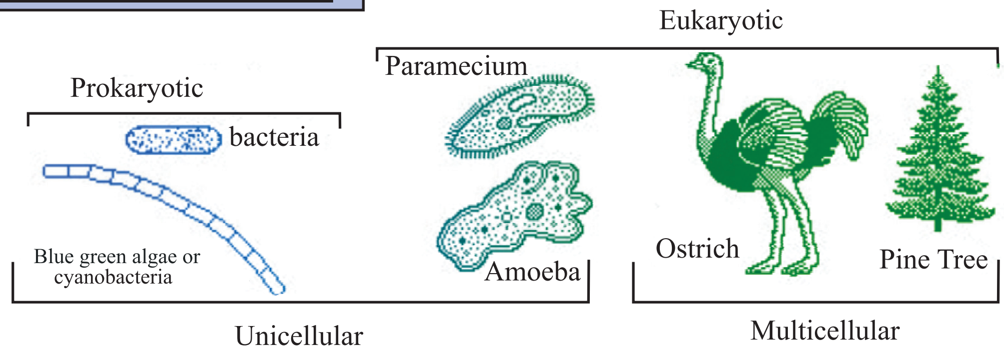


Compound microscope



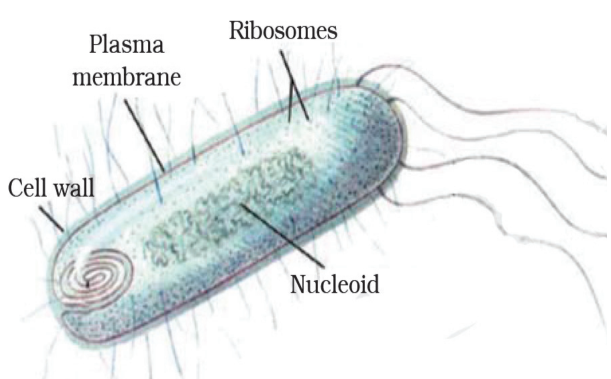
Onion Peel Cells

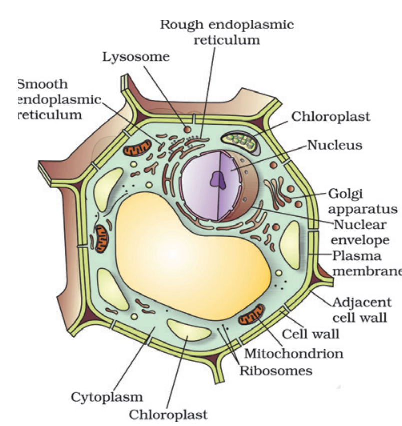
Types of Cell & Organism :



On the Basis of Type of Organization Cells are of two kind

Prokaryotic Cells	**Eukaryotic Cells**
• Very minute in size. (1 to 10^{-6}m)	• Fairly large in size. (5-100µm)
• Nuclear region (nucleoid) not surrounded by a nuclear membreane.	• Nuclear material surrounded by a nuclear membrance.
• Always Unicellular	• May be unicellular or multicellular
• Single Chromosome present.	• More than one chromosome present.
• Nucleolus absent.	• Nucleolus present.
• Cell division by fission or budding	• Cell division by mitosis or meiosis.
• Membrane bound cell organelles are absent.	• Membrane bound cell organelles are present.
Ex. Bacteria	Ex. All Plants, Animals, Amoeba etc.





Organism are of Two Type :

Characteristics	Unicellular organism	Multicellular organism
Cell number	Single cell, Simple	Large number of cells, Complex
Function	All functions are performed by single cell	Different cells perform different specific functions.
Division of labour	Not performed / Required	Cells specified to perform different functions.
Reproduction	Involves the same single cell	Specialised cells, (germ cells) take part in reproduction.
Life span	Short	Long
Examples :	Amoeba, Paramecium bacteria etc.	Plant, Fungi & Animals

Cell Shape : Cells are of variable shapes and sizes. That varies is according to their function position. Generally cells are spherical but they may be elongated (nerve cell). branched (pigmented), discoidal (RBC). Spindle- shaped (muscle cell) etc.

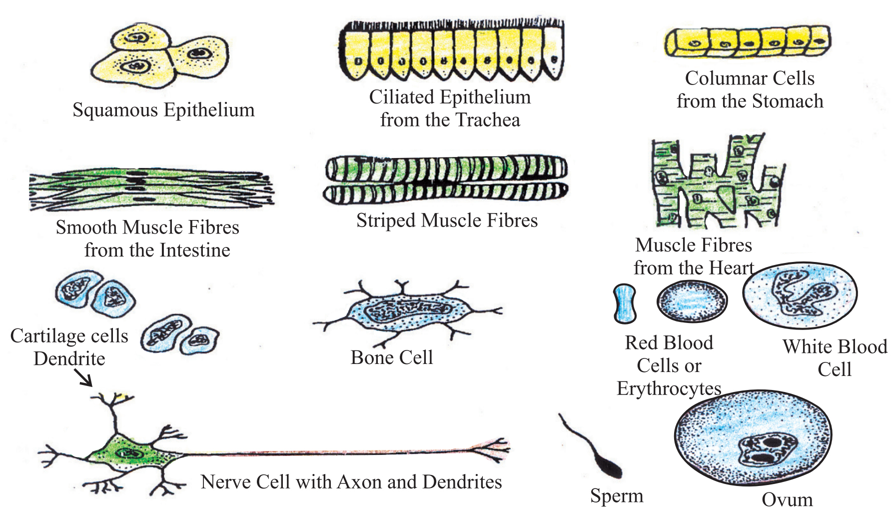


Fig: Different kinds of cell found in the human body

Cell Size : Size of cell is variable depending upon its position & function
Some are microscopic while some are visible with naked eyes. Their size may vary from 0.2 um to 18 cm.

- Size of typical cell in a multicellular organism ranges from 2-120 micron.
- The largest cell is ostrich egg (15 cm long 13cm wide & weight 1.4 kg)
- The longest cell is nerve cell (upto 1m).
- Smallest cells so far known are PPLOs e.g., mycoplasma

Components of Cell

There is an occurrence of division of labour within a Eukaryotic cell as they all got certain specific components called 'Cell organelles'. Each of them perform a specific function.

The three basic components of all the cells are :

(i) Plasma membrane (ii) Nucleus (iii) Cytoplasm

Cell Membrane/Plasma Membrance :

(a) Plasma membrane is selectively permeable in nature, means it allows or permits the entry and exit of some materials in and out of the cell.

(b) Cell membrane is also called plasma membrane or plasma lemma.

(c) It is the limiting boundary of each cell which separates cytoplasm from its surroundings. It is found in both plant as well as animal cells.

(d) It is the outermost covering of a cell in case of animals and lies below the cell wall in case of plants.

(e) As per the lipid model of plasma membrane, it is made up of proteins and lipids where proteins are sandwiched between bilayer of lipids.

(f) Singer and Nicholson gave the fluid mosaic model or lipid - bilayer model of plasma membrane.

(g) It is flexible and can be folded, broken and reunited.

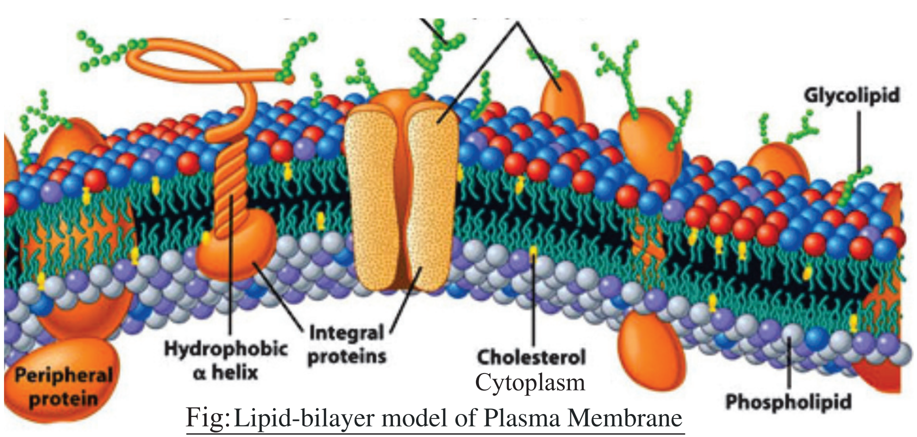


Fig: Lipid-bilayer model of Plasma Membrane

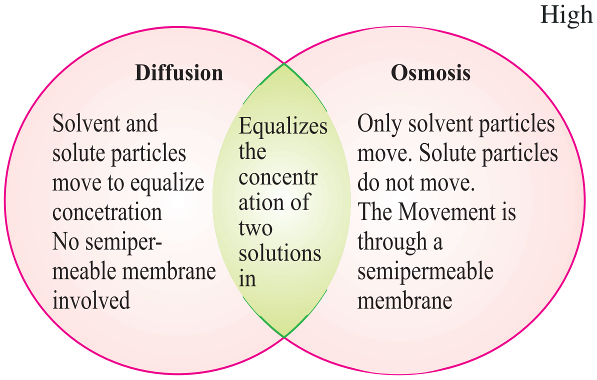
(i) Functions of Plasma Membrane :

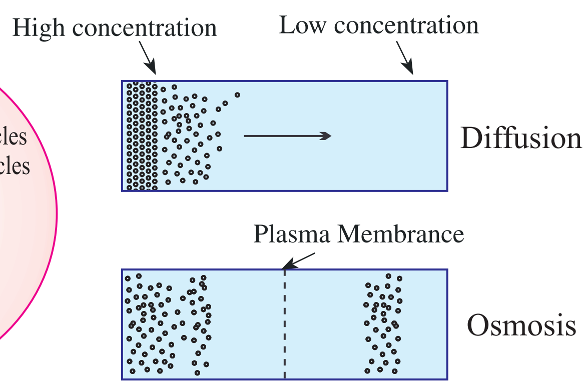
(a) It regulates the movement of molecules inside and outside the cell.

(b) It helps in maintaining the distinct composition of the cell.

(ii) Transportation of molecules across the Plasma Membrane :

This can be done by following ways :





- **Diffusion :** Movement of solutes or ions from a region of higher concentration to a region of lower concentration is called as diffusion. It does not require energy therefore, it is called as passive transport.
- **Osmosis :** The movement of solvent or water from its higher concentration (solvent) to lower concentration (solvent) through a semipermeable membrane is called as osmosis.

Or

The movement of water across semipermeable membrane is called as osmosis.

- **Osmosis can also be called as 'Diffusion of solvents'.**
- **<u>Endosmosis :</u>** Movement of solvent into the cell is called Endosmosis.
- **<u>Exosmosis :</u>** Movement of solvent outside the cell is called Exosmosis.

Types of Solutions on the Basis of Concentration and its effect on cell :

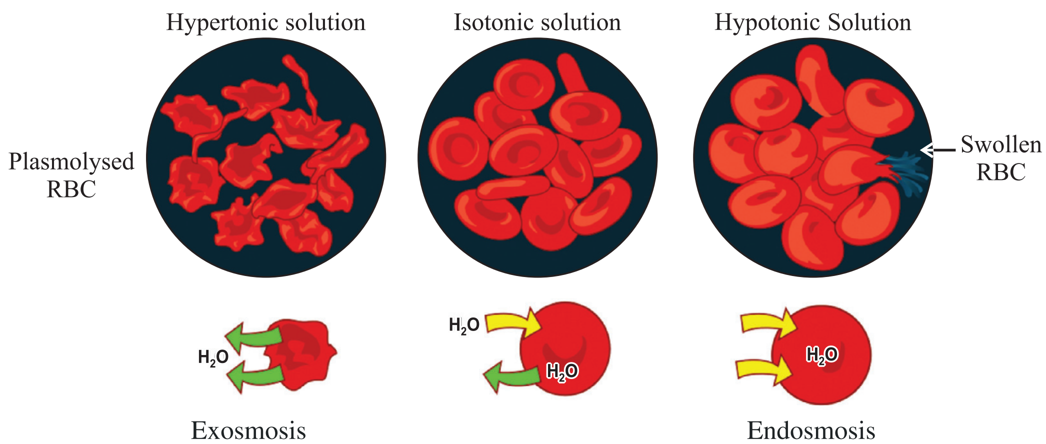


Fig. : Effect of different types of solution on RBC's placed in them.

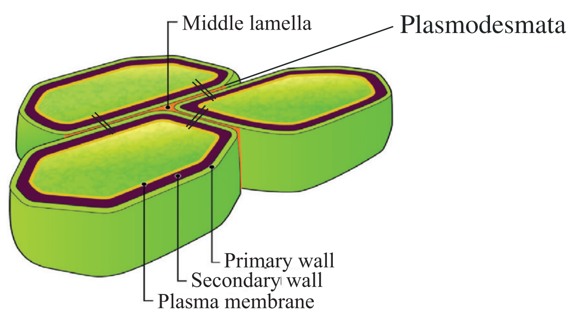
(a) ***Isotonic Solution :*** When concentration of a solution outside the cell is equal to the concentration of cytoplasm of the cell, it is called as isotonic solution.

(b) ***Hypertonic Solution :*** When concentration of a solution outside the cell is more than inside of the cell. Due to this, cell loses water and becomes plasmolysed. ***Plasmolysis:–*** Shrinking of the protoplasm away from the cell wall due to Excessive loss of water (Exosmosis) is called Plasmolysis

(c) ***Hypotonic Solutions :*** When the concentration of the solutions outside the cell is lesser than that of cytoplasm of cell, due to excessive endosmosis cell swells up and animal cell may bursts.

Cell Wall

- It is the outermost covering of the plant cells and cells of fungi.
- It is absent in animal cells.
- Cell wall is rigid, strong, thick porous and non-living structure. In plant it is made up of cellulose and hemicelluloses. In fungi it is primarily made up of Chitin. Cell walls of two adjacent cells are joined by a layer called middle lamellae and microscopic channels called plasmodesmata for transport.



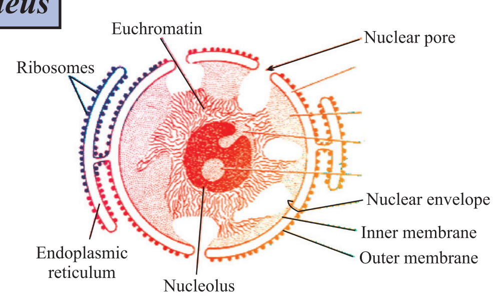
Functions of Cell Wall :

(a) It provides definite shape, structure, support and protection to the cell.

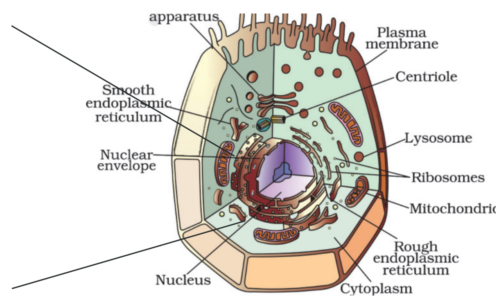
(b) It provides strength to the cell.

(c) It is permeable and allows entry of molecules of different sizes & thus control intercellular Transport.

Nucleus



Enlarged view of Nucleus



Eukaryotic Cell

- Nucleus is the most important cell organelle which directs and controls all its cellular activities.
- It is called as 'Headquarter of the cell'/controller of cell.
- Nucleus was discovered by Robert Brown in 1831.
- In Eukaryotes, a well-defined nucleus is present while in Prokaryotes, a well-defined nucleus is absent.
- Prokaryotes contain a primitive nucleus called Nucleoid.
- It has double layered covering called as nuclear membrane.
- Besides nuclear membrane, nucleus also contains nucleolus and chromatin material. Chromatin is made up of DNA (Deoxy ribonucleic acid) and Protein, that ultimatly condense and forms chromosome.
- Chromosomes or chromatin material consists of DNA which stores and transmits hereditary information for the cell to function, grow and reproduce.
- The functional segment of DNA is called Gene.

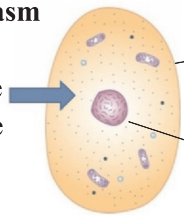
Functions of Nucleus :

(a) It directs and controls all the metabolic activities of the cell and regulates the cell cycle.

(b) It helps in transmission of hereditary characters from parents to their offsprings.

Cytoplasm

Cytoplasm

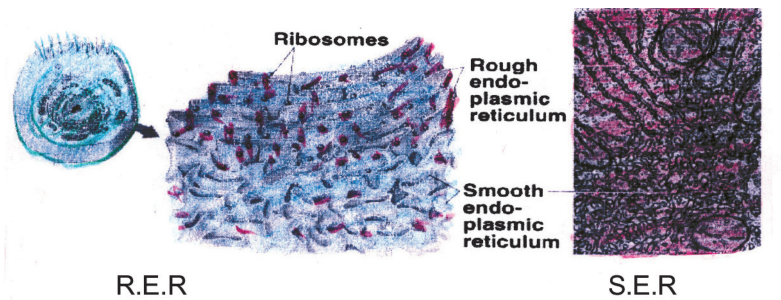


- Cytoplasm is the fluid content enclosed by the plasma membrane.
- Cytoplasm was discovered by Kolliker in 1862.
- It is the site of both biosynthetic and catabolic pathways (Metabolic activities)
- It can be divided into two parts :
  - *(i)* ***Cytosol :*** Aqueous soluble part contain various fibrous proteins forming cytoskeleton. It contain about 90% water, 7% Protein 2% carbohydrates & 1% etc.
  - *(ii)* ***Cell organelles :*** Living part of the cells having definite shape, structure and function bounded by plasma membrane.
- **There are single membrane bound, double membrane bound and non membrane bound Cell organelles.**

Single Membrane bound cell organelles	Double Membrane bound cell organelles	Non Membrane bound cell organelles
eg. ER, Lysosomes, Golgibodies & Vacuoles Peroxisomes	eg. Mitochondria, Plastids These 2 also have their own DNA material	eg. Ribosome, Centrosomes, Microtubules

Endoplasmic Reticulum

- It is the network of membrane bound tubules and sheet present in the cytoplasm.
- It was discovered by Garnier and structure given by Porter, Claude and fullum.
- These are present in all cells except prokaryotes and mammaliam erythrocytes.



Endoplasmic reticulum is of two types :

Smooth ER	Rough ER
• Made of tubules mainly.	• Made of Cisternae and vesicles.
• Helps in steroid, lipids and Polysaccharide synthesis.	• Helps in protein synthesis.
• Ribosomes are absent.	• Contains ribosome on its surface.

Function of ER :

(a) It is the only organelle which serves as a channel for the transport of materials between various regions of cytoplasm and between cytoplasm and nucleus.

(b) It also functions as a cytoplasmic framework to provide surface for some of the biochemical activities. It forms endoskeleton of cell.

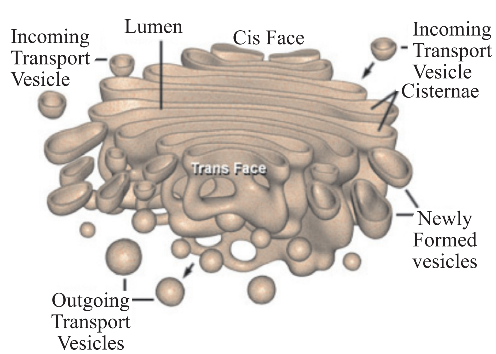
(c) It helps in synthesis of fats, protien, steroids, cholesterol etc.

(d) SER plays a crucial role in detoxification of drugs and poisonous by products.

(e) Membrane biogenesis: Protein & Lipids produced by ER are used to produce cell membrane.

Golgi apparatus consists of a system of membrane bounded fluid filled vesicles arranged parallel to each other in stacks called Cisternae along with some large and spherical vesicles. It was discovered by Camillo Golgi. It is absent in prokaryotes, mammalian RBC's & sieve cells.

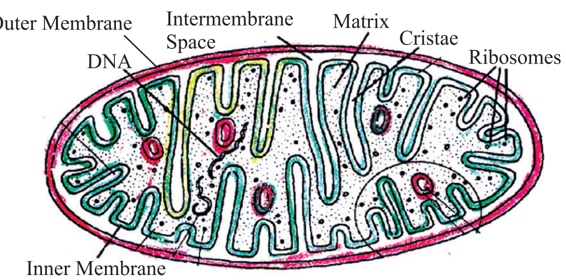
The Golgi Apparatus



Functions of Golgi apparatus :

(a) Its function include the storage, modification, Packaging & secretion of products in vesicles.
(b) It involves in the formation of lysosomes.
(c) It is secretary in nature. It helps in melanin synthesis.
(d) It also involves in the synthesis of cell wall & plasma membrane.

Mitochondria



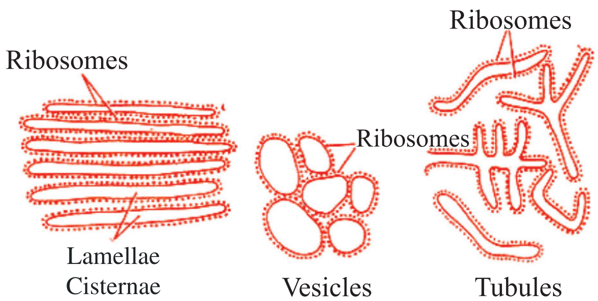
It is a rod shaped structure found in cytoplasm of all eukaryotic cells except mammalian RBC's.

- These are also absent in prokaryotes.
- It was first seen by Kolliker in insect cells in 1880.
- It is also called as 'Power House of the Cell' or the 'Storage Battery'.
- It is double membranous structure where outer membrane has specific proteins while inner membrane is folded inside to form chambers called Cristae.
- Mitochondria has its own DNA & Ribosomes

Functions of Mitochondria :

(a) Its main function is to produce, store and release the energy in the form of ATP (Adenosine Triphosphate) The energy currency of the cell.
(b) It is the site for cellular respiration (Kreb cycle) in which ATP are produced.

Ribosomes



(Ribosomes located on different cell organelles and their parts)

- Ribosomes are the sites of protein synthesis.
- All structural and functional proteins (enzymes) coded by the nuclear DNA are synthesized upon cytoplasmic ribosomes. The DNA codes are transcripted into messenger RNA (mRNA) (Ribonucleic Acid) molecules, Which comes out of the Nucleolus and translated (Protein synthesis) by ribosomes attached to RER in the form of proteins.

Functions of Ribosomes :

Ribosomes are the main site of protein synthesis. Synthesized proteins is transported by endoplasmic reticulum.

Plastids

- It is double membranous, discoidal structure, found mainly in algae and plant cells.
- Besides being discoidal or rhombic in plant cells, they occur in variable shapes like in (algae.) They can be 'U' - shaped, spiral, coiled, ribbon- shaped etc.
- They also have their own DNA and ribosomes.

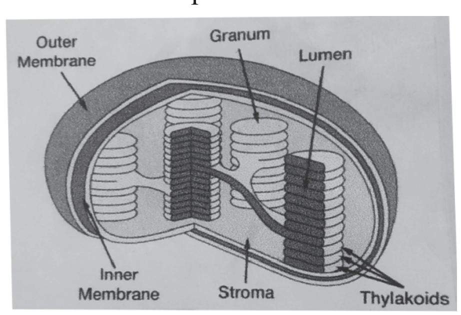
Depending upon the type of pigment present in them, they are of following three types :

(i) Leucoplast – These are white or colourless and found in non- photosynthesis tissue of plant such as Root, bulb, seeds, etc. They can change into other type of plastids. The primary functions is storage of starch, oil, proteins.

(ii) Chromoplast – These are coloured plastids except green, these impart colour to fruits & flowers.

(iii) Chloroplast – It contains chlorophyll which impart green colour to leaves and, found in aerial parts of plants. It helps in the process of photosynthesis so it is called the 'Kitchen of cell in plant.

Chloroplast :



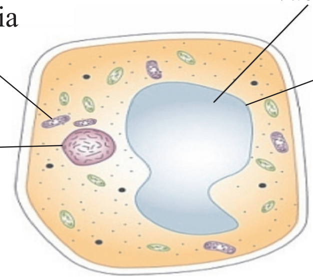
Chloroplast have following two parts:

(i) Grana : It constitutes the lamellar system. These are found layered on top of each other. These stacks are called Grana. Each granum of the chloroplast is formed by superimposed closed compartments called Thylakoids.

Function : They are the sites of light reaction of photosynthesis as they contain photosynthetic pigment chlorophyll, photosynthetic units.

(ii) Stroma : It is a granular transparent substance also called as matrix. Grana are embedded in it. Besides Grana they also contain lipid droplets, starch grains, ribosomes etc.

Vacuoles

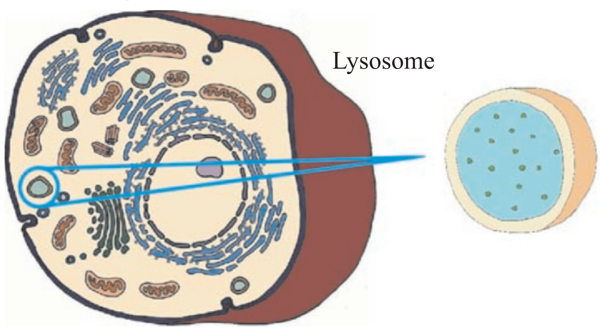


- These are membrane bounded regions in the cytoplasm containing water and other substances. They are bounded by a single membrane called Tonoplast.
- In animal cells vacuoles are absent or smaller in size. In plant cells a single large vacuole is found which occupies about 90% of the volume of cell.

Functions :

It helps in maintaining osmotic pressure in a cell & stores toxic metabolic products (Waste product) water, sugar, protein etc.

Lysosome (Suicidal Bag)



- They are tiny single membrane bound cell organelle containing powerful digestive enzymes for intracellular digestion.
- Lysosome absent in RBC's
- Lysosomes are synthesised by golgi body & enzymes present in it are synthesised by RER.

Functions :-

(a) Their main function is phagy (digestion). Means they breakdown worn out cell parts.

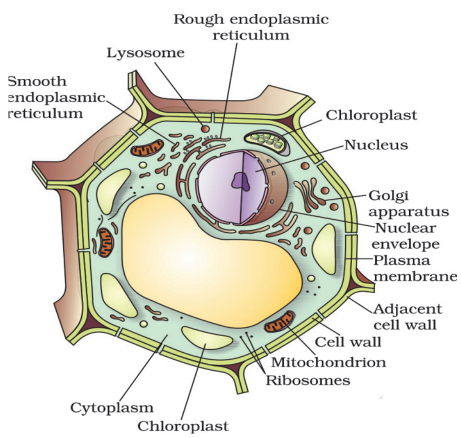
(b) They are kind of waste disposal system of the cell.

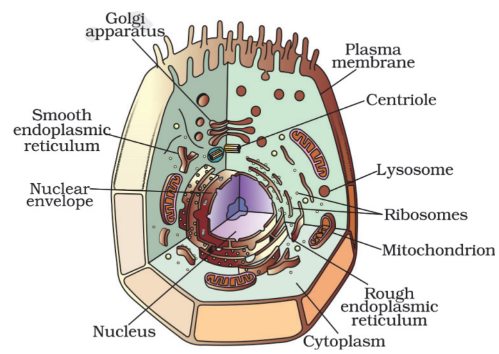
(c) They help in digesting foreign materials like invading viruses and bacteria in the cell.

Suicidal Bag : During disturbances in cellular metabolism (i.e., in case of cell damage), lysosomes burst and their enzymes are released into the cytoplasm which digest their own cell. Therefore they are also called 'Suicidal Bags'.

Difference between Plant cell and Animal cell

Plant Cell	Animal Cell
• Contain chloroplasts for Photosynthesis • Have a cell wall to maintain structure and rigidity. • Usually do not contain lysosomes and Peroxisomes. • Cells are square and rigid or geometric shaped. • Have one large central vacuole.	• No chloroplasts (plastids) • No cell wall • May Contain cilia and/or flagella • Cells are fluidic and flexible, many shapes. • Has small or no vacuoles. • Have lysosome



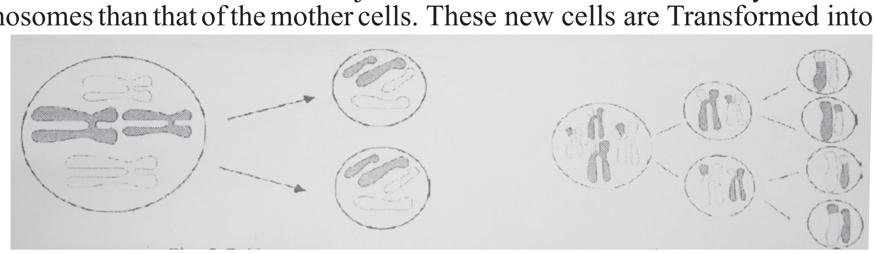


Cell Division : New cells are formed in organisms in order to grow, to replace old, dead and injured cells, and to form gametes required for reproduction. The process by which new cells are made is called cell division.

The two main types of cell division are :

i) Mitosis : The process of cell division by which most of the cells divide for growth is called mitosis. In this process, each cell called mother cell divides to form two identical daughter cells. The daughter cells have the same number of chromosomes as mother cell. It helps in growth and repair of tissues in organisms.

ii) Meiosis : Specific cells of reproductive organs or tissues in animals and plants divide to form gametes, which after fertilisation give rise to offspring. They divide by a different process called meiosis which involves two consecutive divisions. When a cell divides by meiosis it produces four new cells instead of just two. The new cells have only half the number of chromosomes than that of the mother cells. These new cells are Transformed into gametes.



Mitosis Meiosis

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Which organelle controls osmotic pressure in a plant cell?
2. Who gave the fluid mosaic model of plasma membrane?
3. Which cell organelle is called as 'Digestive bag'?
4. Where are chromosoms present and what are their functions?
5. Which cell organelle contains enzymes for ATP production?
6. Which cell organelle is called as the 'Head quarter of cell'?
7. Name the largest cell and the longest cell.

SHORT ANSWER TYPE QUESTIONS

1. What is the composition of protoplasm ?
2. Define (i) cell (ii) Unicellular organism (iii) multicellular organism.
3. What is the difference between diffusion and osmosis ?
4. Why plasma membrane is called as selectively permeable membrane ?
5. What happen if we remove mitochondria from a animal cell justify ?
6. State any two function of Golgi Apparatus?
7. Name various type of plastids present in a plant cell. Also write their roles.
8. State the main function of lysosome ?
9. Which cell organelle in known as powerhouse of cell and why Also write their role?
10. What is the function of SER ?
11. How Mitosis is different from meiosis.

LONG ANSWER TYPE QUESTIONS

1. Draw a neat and labelled diagram of mitochondria.
2. Differentiate between plant and animals cell with suitable diagram.
3. Write a short note on nucleus and chromosomes.
4. Explain the effect of concentration of solution on the cell ?
5. Who proposed cell theory. What are its postulates ?
6. Draw a neat labelled diagram of plant cell ?
7. What are chloroplast ? Explain its structure and Function?
8. What are the functions of vacuoles ?
9. Expand the following : ATP, DNA, RNA alongwith their function.
10. What happens if we give too much fertilizer to the root of a plant.

OBJECTIVE TYPE QUESTIONS

I Fill in the Blanks:

1. .... and .... proposed the cell theory.
2. Nucleus in the cell is discovered by ....
3. A Human cell have .... pairs of chromosome.
4. A .... can be made into crystal. (bacterium, virus, amoeba)
5. The main constituent of cell-wall in plant is ....
6. Chromosomes are made up of nucleic acid and ....

II MCQ

1. **Which of the following is an example of a single cell that does not function as a full fledged organism ?**
   (a) White blood cells (WBC) (b) Amoeba
   (c) Euglena (d) Paramecium
2. **Who discovered the first living cell ?**
   (a) Robert Hooke (b) Leeuwenhoek
   (c) Purkinje (d) Robert Brown
3. **Who used the word 'protoplasm first time for living cells ?**
   (a) Robert Hooke (b) Leeuwenhoek
   (c) WBC and Amoeba (d) Robert Brown
4. **Which organelle is considered as a suicide bag ?**
   (a) Centrosome (b) Mesosomes
   (c) Lysosomes (d) Chromosome
5. **Which of the following organelle is present in onion cells but not in human cheek cells ?**
   (a) Cell wall (b) cytoplasm
   (c) nucleus (d) plasma membrane
6. **Which cell organelle plays a crucial role in detoxifying many poisons and drugs ?**
   (a) Golgi Apparatus (b) Lysosomes
   (c) Smooth Endoplasmic Reticulum (SER) (d) Vacuoles
7. **Function of centriole is**
   (a) formation of spindle fibre (b) nucleolus formation
   (c) cell wall formation (d) cell division initiation
8. **viruses are**
   (a) Uni cellular micro-organisms (b) Bi-Cellular micro-organisms
   (c) Multi-cellular micro-organisms (d) Non-cellular micro-organisms

III Case based Question:

Specific cells of reproductive organs or tissue in Animals and plants divide to form gametes, which after fertilisation give rise to offspring.

Q1. Name the cell division by which gemete cells are formed.

Q2. How many chromosomes are presents in gemetes?

Q3. Meiosis is also known as reduction division. explain.

9. Which of the following often distinguishes plant cells from animal cells ?

(a) centrioles (b) nucleus

(c) Chromatin (d) rough ER

III Match the Following:

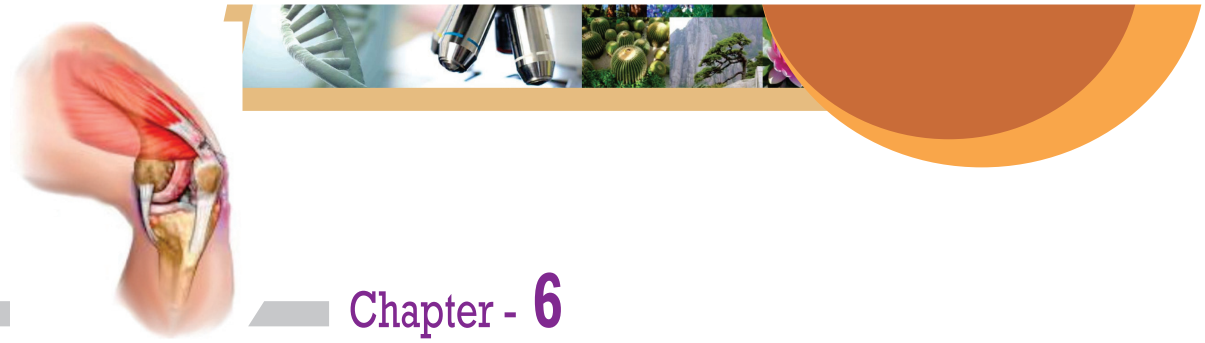
C1	C2
A. Smooth Endoplamic reticulum	1. Amoeba
B. Nucleoid	2. ATP
C. Food Vacuole	3. Bacteria
E. Mitochondira	4. Detoxification
D. Plastids	5. Leucoplast
	6. Suicidal Bags.

Assertion & Reasoning Questions :

- Assertion A :Meiosis is also called reduction division.
  Reason (R) : The number of chromosomes in the resulting cells are reduced to half.
- Assertion (A) : Mitosis cell division is responsible for the growth of the organisms.
  Reasoning (R) : The cell divided into two daughter cell.
- Assertion (A) : Mitochondria is known as the power house of the cell.
  Reasoning (R) : Mitochondria contain powerful hydrolysing exzymes.
- Assertion : Cell is the functional and structural unit of life.
  Reason : Cell perform all the life process and form the structure of the living beings.

True and False :

1. Plant cell will plasmolyse when placed in a hypotonic solution.
2. Animal cell will shrink in a hypotonic solution.
3. Mitrochondria is known as suicidal bag of a cell of all.
4. Cell wall is present in plant cell.



Chapter - 6

Tissue

CONCEPT MAPPING

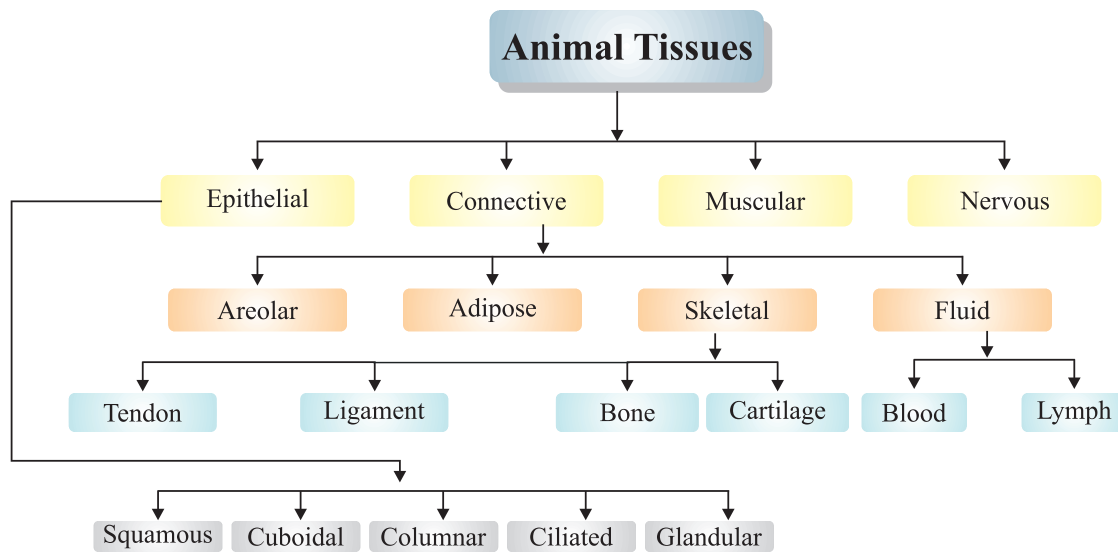
Tissue (Group of similar cells performing common specialised function)

- Plant Tissue
  - Meristematic Tissue
    - Primary Meristem
      - Apical Meristem (Tips of root and stem)
      - Intercalary (Base of leaves and internodes)
    - Secondary Meristem
      - Lateral Meristem
        - Vascular Cambium (for secondry growth)
        - Cork Cambium
  - Permanent Tissue
    - Simple Permanent (ground tissue) (Made up of one type of cell)
    - Complex Permanent (Vascular Tissue) (Made up of more than one type of cell)
      - 2 Types
        - Xylem (Conduction of water & minerals)
          - (Components of Xylem): Tracheids, Vessels, Xylem Parenchyma, Xylem Fibres
        - Phloem (Conduction of food)
          - (Components of Phloem): Sieve tubes, Companion cells, Phloem fibres, Phloem parenchyma
    - Dermal tissue (Epidermal tissue)
- Animal Tissue (Next page)

Parenchyma: Aerenchyma, Chlorenchyma

Parenchyma	Collenchyma	Sclerenchyma
Oval, elongated	Elongated	Long, narrow
Polygonal	Thickened, irregular	Lignified
Living	Living	Dead

ANIMAL TISSUE



Tissue : A group of cell that are similar in structure and work together to achieve a particular function is called Tissue.

Histology : The microscopic study of tissue is called Histology.

Cell differentiation : The process by which a cell changed its shape and size to perform a specific function.

PLANT TISSUE- Meristematic & Permanent Tissues

MERISTEMATIC TISSUE *(growth tissue or dividing tissue)*

These are simple living tissues having thin walled,compactly arranged immature cells which are capable of division and formation of new cells.

Main features of Meristematic tissues are :

- Thin primary cell wall (cellulosic).
- Intercellular spaces are absent (compact tissue).
- Generally vacuoles are absent, dense cytoplasm & prominent nuclei are present.
- Actively dividing cells are present in growing regions of plants e.g., root & shoot tips.

Classification on the Basis of Location

(A) *Apical Meristem*
- It is present at the growing tips of stems and roots.
- Cell division in this tissue leads to the elongation of stem & root, thus it is involved in primary growth of the plant. (increase the length)

(B) *Intercalary Meristem*
- It is present behind the apex. It helps in longitudinal growth.
- It is the part of apical meristem which is left behind during growth period.
- These are present at the base of leaf and near the node region.
- These lead to the increase in the length of leaf (Primary) eg., in grass stem, bamboo stem, mint stem etc.

(c) *Lateral Meristem (Cambium)*
- It is also called as secondary meristem.
- It occurs along the side of longitudinal axis of the plant.
- It gives rise to the vascular tissues.
- Responsible for growth in girth of stem and root.
- They are responsible for secondary growth by increasing the girth.

PERMANENT TISSUE
- The permanent tissues are formed from those meristematic cells which are left behind and have lose the ability to divide and take up a specific role.
- The division and differentiation of the cells of meristematic tissues give rise to permanent tissues.
- They have definite shape, size and function . The permanent tissue may be dead or living.

- As a result of cell differentiation the meristematic tissues tend to form different type of permanent tissues.
- In cell differentiation, developing tissues changes from simple to more complex forms to perform various specialized functions.

Depending upon the stucture and composition the permanent tissue are classfied into two types :

(A) Simple Permanent Tissues (Supporting tissue and protective tissue)

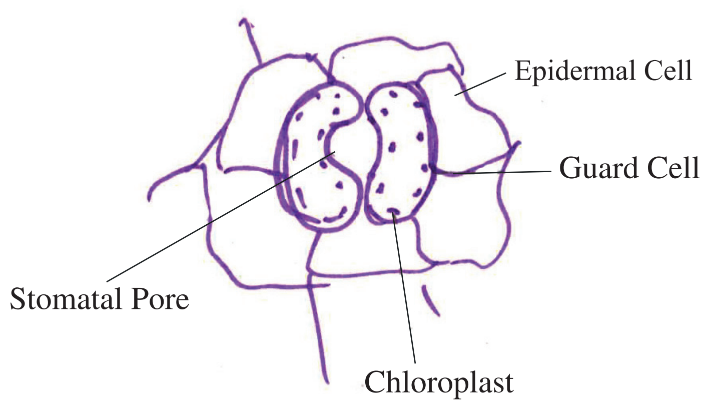
(B) Complex Permanent Tissue

(A) Simple Permanent Tissues : (a) Protective / (b) Supportive

(a) *Protective Tissues:* These dermal tissues are primarily protective in function. They Consist of:

(i) Epidermis

- Epidermis forms one cell thick outermost layer which covers the entire surface of plants such as leaves, flowers, stems and roots.
- Epidermis is covered outside by cuticle. Cuticle is a water resistant layer of waxy substance called as cutin which is secreted by the epidermal cells and provide protection against loss of water and also invasion by microbes.
- Cells of epidermis of leaves are not continuous at some places due to the presence of small pores called as stomata.
- Each stomata is guarded by a pair of bean-shaped cells called as guard cells. These are the only epidermal cells which possess chloroplasts, the rest being colourless.



STOMATA

Functions of Epidermis

- The main function of epidermis is to protect the plant from desiccation and infection.
- Cuticle of epidermis cuts the rate of transpiration and evaporation of water and prevents wilting.
- Function of Stomata : It allows gaseous exchange to occur during photosynthesis, respiration and also helps in transpiration.

(ii) **Cork or Phellem**

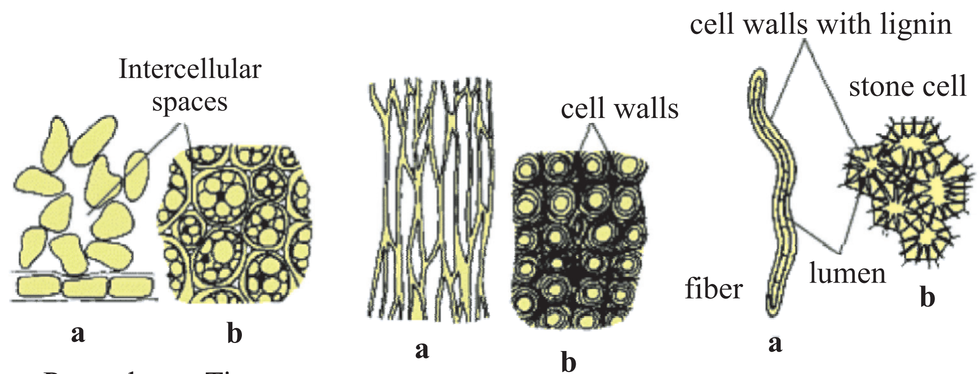
- In older roots and stems, tissues at the periphery become cork cells or phellem cells.
- Cork is made up of dead cells with thick walls and without any intercellular spaces. (Completely arrange).
- The cell wall in cork deposit waxy substance called as suberin.
- The cells of cork become impermeable to water and gases due to the deposition of suberin.
- The cork cells are without any protoplasm but are filled with resins or tannins.

Functions of Cork :

- Cork is protective in function. Cork cells prevent plants from desiccation, infection and mechanical injury.
- Imperviousness, lightness, toughness, compressibility and elasticity make the cork commercially valuable.

(A) Supportive tissues: These are supportive in function and are of three types :

The Three Basic Types of Plant Tissue (Supporting Tissue)

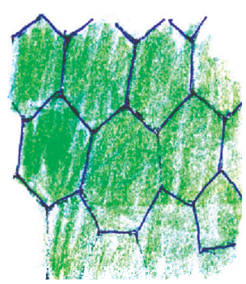


Parenchyma Tissue Collenchyma Tissue Sclerenchyma Tissue

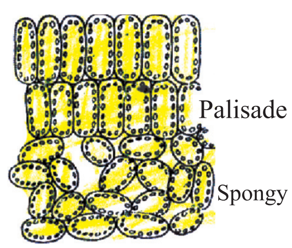
[a. longitudinal section (LS) b. Transverse Section (TS)]

(i) Parenchyma : It is the fundamental packing tissue.

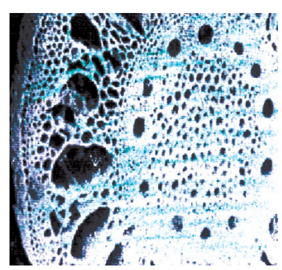
- Loosely packed thin walled cells, oval or spherical in structure with large space between them and most common simple permanent tissue.
- Cell wall mainly composed of cellulose & pectin. They are living cells.
- Large central vacuole for food & water storage.
- Primary function is food storage and packing.



Parenchyma



Chlorenchyma



Arenchyma

Parenchyma and its type :

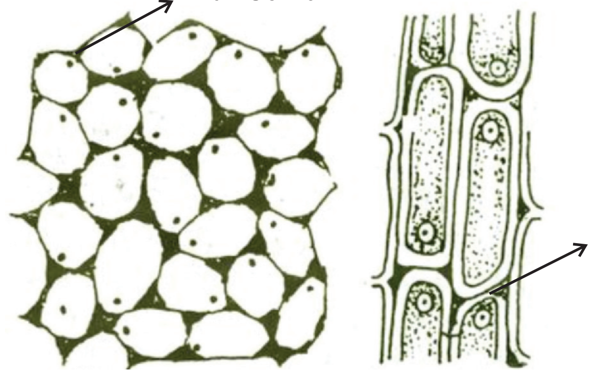
Idioblast : Some parenchyma involved in storage of excretory substances such as resin, tannin, gum and oils called as idioblast.

- In typical parenchyma chlorophyll is absent.

Chlorenchyma : Chloroplast containing parenchyma tissues are called as chlorenchyma which perform photosynthesis e.g., mesophyll cells of leaves.

Aerenchyma : In hydrophytic plants aerenchyma (a type of parenchyma containing air spaces) provides buoyancy.

(ii) Collenchyma : It is the living mechanical tissue.



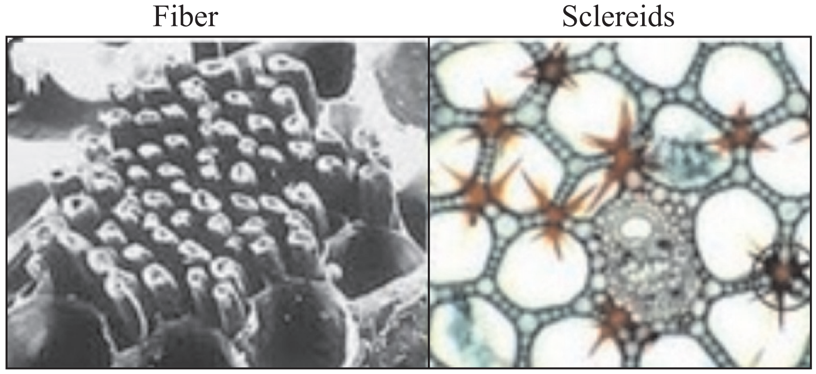
Collenchyma

- Elongated cells with thick corners.
- Localized cellulose and pectin thickening.
- Provides flexibility & easy bending of various parts of plant.
- Few chloroplasts may be present.
- Give mechanical strength and elasticity to te growing stems.
- They have no or very little intercellular spaces.

(iii) Selerenchyma :

Cells of sclerenchyma are of two types :

Fiber Sclereids

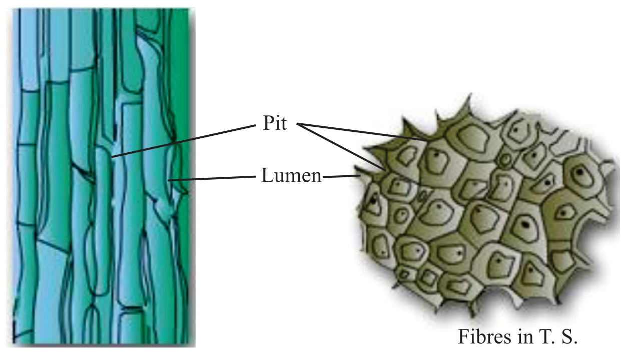


Sclereids :

- These are also called grit cells or stone cells.
- These are small cells, where lumen is so small due to higher thickening of cell wall, sclereids are present in fruit wall of nuts, the grit of guava & pear, seed coates of legumes.

Fibres :

- They are very long, narrow, thick, lignified cells. Lumen is large as compared to sclereids. Generally 1-3 mm long.
- In the thick walls of both the fibres and sclereids thin areas called as pits, are present.



Fibres in L. S.

Fibres in T. S.

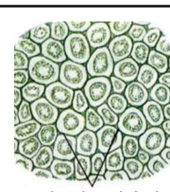
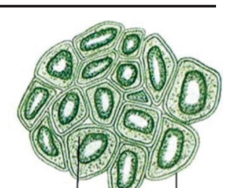
Fibres in L.S.

- Composed of extremely thick walled cells with little or no protoplasm.
- Cells are dead & possess very thick lignified walls.
- Lignin is water-proof material.
- Intercellular spaces are absent.

Uses of Sclerenchyma Fibres

- These are used in the manufacture of ropes, mats & certain textile fibres.
- Jute and coir are obtained from the thick bundle of fibres.

Difference between Parenchyma, Collenchyma and Sclerenchyma

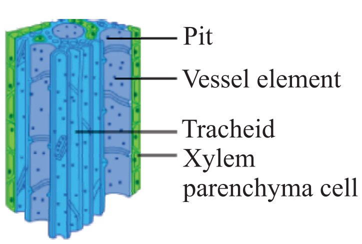
Features	Parenchyma	Collenchyma	Sclerenchyma
	 thin primary cell wall	 irregularly thickened primary cell wall	 thick secondary primary cell wall

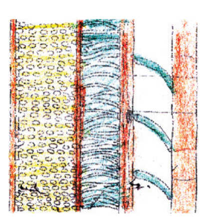
1. Cell shape	Isodiametric cells which are oval, spherical or polygonal in shape.	Circular, oval or polyhedral.	Variable in shape. Fibres and sclereids.
2. Cell Wall	Thin cellulosic cell wall.	Uneven thickening on their cell wall.	Lignified secondary cell wall present.
3. Cytoplasm	Abundant	Present	Absent
4. Nucleus	Present (Living tissue)	Present (Living tissue)	Absent (Dead tissue)
5. Vacuoles	Large vacuole	Vacuolated	Absent
6. Intercellular spaces	Present	Absent	Absent
7. Occurrence	Basically packing tissue, all soft part of plant-pith, cortex, medullary rays.	Dicot stems, petiole and beneath the epidermis. Absent in monocot and roots.	Dicot hypodermis, bundle sheath, pericycle, seed, pulp of fruits.
8. Functions	Food storage, photosynthesis, provide buoyancy to hydrophytes	Provide tensile strength, mechanical support, phtosynthesis	Protection from stress and strain, mechanical strength.

(B) Complex permanent Tissues

- It consists of more than one type of cells which work together as a unit.
- It helps in transportation of organic materials, water and minerals.
- It is also known as conducting or vascular tissue.
- Xylem and phloem together form vascular bundles.
- It is two kinds. (a) Xylem and (b) Phloem.

(a) ***Xylem:*** Also known as wood and is a vascular and mechanical tissue. Xylem help in Transportation of water and minerals from soil to plant parts.





Xylem consists of four types of cells called as its components or elements :

(i) Tracheids :

- They are elongated dead cells (primitive elements) mainly involved in conduction of water and minerals in gymnosperms.

(ii) Vessles :

They are advance element (generally found in angiosperms).

- Vessels are cylindrical tube like structures placed one above the other end to end which form a continuous channel for efficient conduction of water.

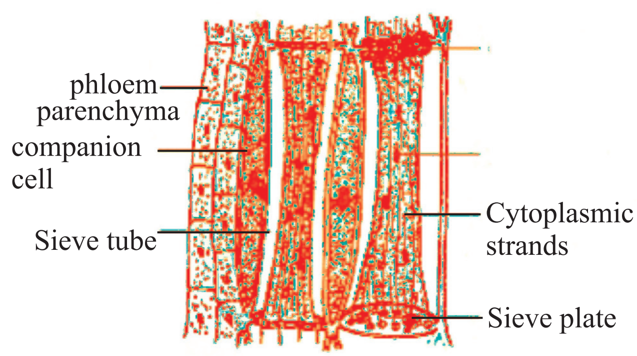
(iii) Xylem parenchyma :

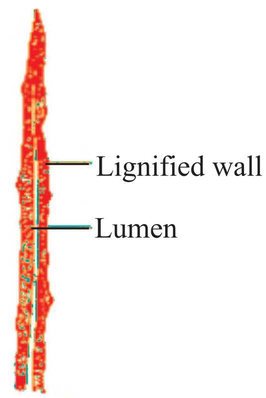
- They are small and thick walled parenchymatous cells designed for storage of starch (food).

(iv) Xylem sclerenchyma (fibres)

- They are non-living fibers with thick walls and narrow cavities which provide mechanical support.
- Except xylem parenchyma all other xylem elements are dead.
- The annual rings present in the trunk of a tree are xylem rings.
- By counting the number of annual rings, we can determine the age of a tree.

(a) ***Phloem :*** It transport (translocation) food from leaves to other parts of the plant. All phloem cells are living except phloem fibres.





Phloem fibre (bast fibre)

Phloem consist of four types of components/elements :

(i) Sieve tubes :

- Sieve tubes are tubular structures made up of elongated, thin walled cells placed end to end.
- The end walls of sieve tube cells are perforated by numerous pores, called as sieve plates.

- Nucleus of sieve cell degenerates at maturity. However, cytoplasm persists, because of protoplasmic continuation of sieve tube with companion cell through plasmodesmata.

(ii) **Companion cells :**

- Companion cells have dense cytoplasm and prominent nuclei.
- Sieve tubes & companion cells are also called sister cells because they originate from single mother cell.

(iii) **Phloem fibre/Phloem Sclerenchyma :**

- They give mechanical support to sieve tubes and are dead.

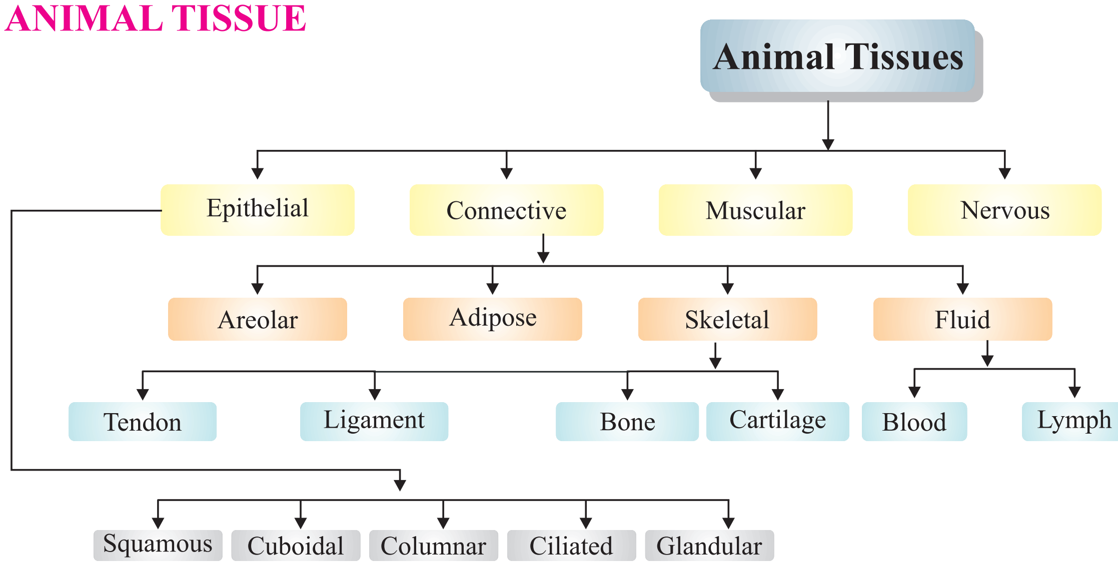
(iv) **Phloem parenchyma :**

- They store food and help in radial conduction of food.

Difference Between Xylem and Phloem

Features	Xylem	Phloem
Cells : Living/dead	Dead (Except-xylem parenchyma)	Living (Except phloem fibre)
Cells : Thickness Material Permeability	 Thick Lignin Impermeable	 Thin Cellulose Permeable
Cross walls	None	Sieve plates
Cytoplasm	None	Yes
Function	Carries water and minerals	Carries sugars (Food)
Direction of flow	Upwards (Unidirectional)	Down and up (bidirectional)
Special features	Tracheids Vessels	Companion cells

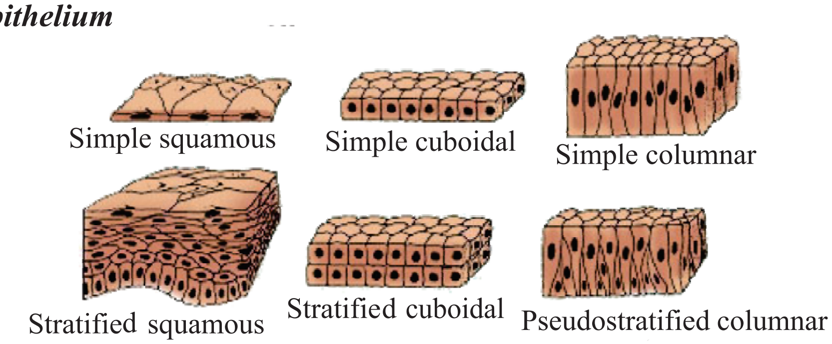
ANIMAL TISSUE



EPITHELIAL TISSUE

- It is the covering or protective tissue in animal body.
- Cells of epithelium are set very close to each other tightly packed and the tissue rests on a non-cellular basement membrane & consists of single layer of cells. That forms a continuous sheet.
- It covers all the organs and line the cavities of hollow organs like stomach.
- It is primarily protective in function.

Type of Epithelium



Epithelium tissues are classified as :

(a) SimpleSquamous epithelium : Also called pavement epithelium.

- Cells arranged end to end like tiles on a floor.
- Cells are polygonal in surface view.
- It forms the delicate lining of cavities (mouth, oesophagus, nose, pericardium, alveoli etc.) blood vessels and covering of the tongue and skin.

Skin :

- Epithelial cells are arranged in many layers (stratum) to prevent wear and tear in skin. This pattern is called stratified squamous epithelium.

(b) Cuboidal epithelium :

- They are cube like cells that fit closely, cells look like squares in section, but free surfarce appears hexagonal.
- It is found in kidney tubules, thyroid vesicles and in glands (salivary glands, sweat glands).
- It forms germinal epithelium of gonads (testes and ovaries).
- It is involved in absorption, excretion and secretion. It also provides mechanical support.

(c) Colummar epithelium :

- Columnar means 'pillar-like' epithelium. It forms lining of stomach.
- Small intestine and colon, forming mucous membranes.
- Border of micro villi is present at the free surface end of each cell which increases absorption efficiency in small intestine.

(d) Ciliated epithelium :

- Cells may be cuboidal or columnar.
- Found in respiratory tract, lining of spermduct, oviduct & kidney tubules etc.
- On its free surface are present protoplasmic outgrowths called cilia.
- It helps in the movement of ova in the fallopian tube.

(e) Glandular epithelium :

- Gland cells secretes substances at the epithelial surface.
- Sometimes position of epithelial tissue folds inward and form multicellular gland so called Glandular epithelial.

CONNECTIVE TISSUE

- The cells of the connective tissue are loosely spaced and embedded in an intercelluar matrix.
- Their basic function is to provide support to different organs and keeping them in place.
- Connective tissue have two components : matrix and cellular components.

(A) *Fluid or vascular tissue :*

- Blood
  - Cellular Component
    - RBC (Erythrocyte) Have haemoglobin)
    - Platelets
    - WBC
      - Lymphocyte Monocyte
      - Eosinophil, Basophil, Neutrophil
  - Matrix Component
    - Plasma

Blood and lymph

- Blood is a type of connective tissues, fluid matrix of blood is called plasma, having wandering or floating cells, called corpuscles. Blood helps in the transportation of various materials such as nutritive substances, gases, excretory products, hormones etc. and provide immunity.

(a) Plasma

- Form 55% part of blood. Constitution : water 90-92%, Protein 7% (Albumin, fibrinogen, globulin), inorganic salt 0.9% etc.

(b) Corpuscles

- Forms 45% part of blood.

(i) RBCs (Red Blood Corpuscles)

- They are also called as erthyrocytes, containing red coloured respiratory pigment called haemoglobin that helps in transportation of oxygen and CO_2.

(ii) WBCs (White Blood Corpucles) (Leucocytes: They are also called as 'Soldiers of the body'.) Provide immunity.

- They are irregular, amoeboid, phagocyte cells that protect our body by engulfing bacterial & other foreign particles.They are of five types : Monocytes, Lymphocytes, Basophils, Neutrophils, Eosinophils.

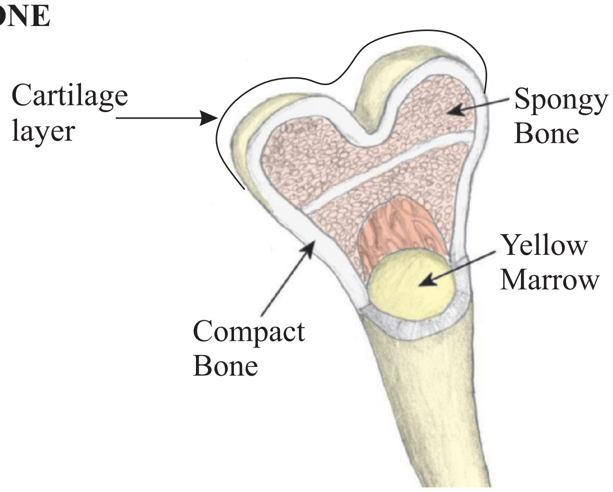
(iii) Blood platelets or thrombocytes

- They are spindle shaped cells which are involved in clotting of blood.

(B) *Skeletal Tissue*

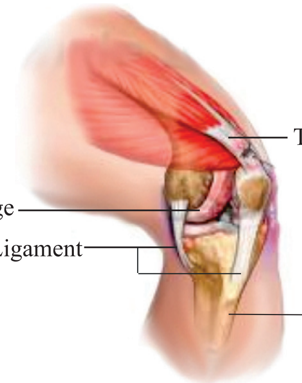
It is hard connective tissue that forms supportive framework i.e. skeleton of the body. It is of two types : (i) Bone and (ii) Cartilage.

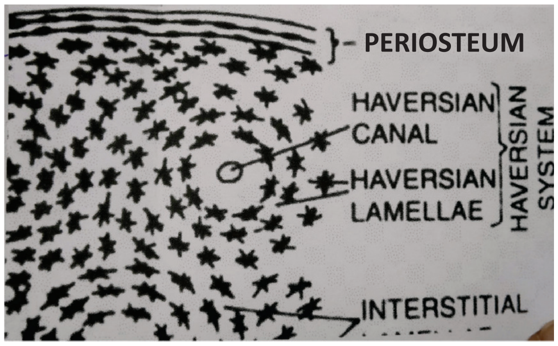
(i) BONE



Structure of bone

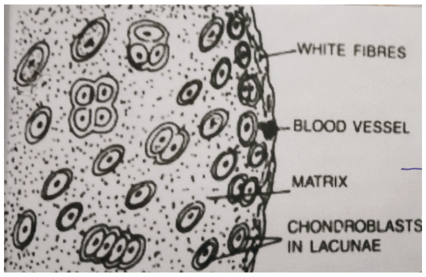
(i) Bone
- It is a nonflexible and strong tissue.
- Matrix of bone is very hard because of salts such as calcium phosphate, $CaCO_3$ (60-70%) etc. and a protein ossein.
- Bone cells (osteoblasts) are embedded in this hard matrix.
- Matrix is deposited in the form of concentric layers of lamellae formed around a central canal, the bone cells occupy small spaces between the concentric layers of matrix.





T.S. of Bone

(ii) Cartilage
- This tissue is elastic, less harder as compared to bones.
- Elasticity is due to presence of chondrin (protein). Cells are called as chondrocytes which are widely spaced and matrix is reinforced by fibres.
- It is found at joint of bones, in the nose, ear, trachea and larynx.
- It provides flexibility and great tensile strength.



T.S. of Cartilage

Bone	Cartilage
1. Hard and inflexible 2. Porous. 3. Blood vessels present. 4. Matrix made up of protein and mineral sells (e.g., calcium phosphate)	1. Flexible 2. Non-porous 3. Blood vessels absent. 4. Matrix made up of protein.

(c) ***Dense regular connective Tissue (Fibrous Tissue)***

(i) Ligament *(ii) Tendon*

It is most abundant type of connective tissue. It is further divided into following types :

(i) Yellow fibrous connective tissue (Ligament)

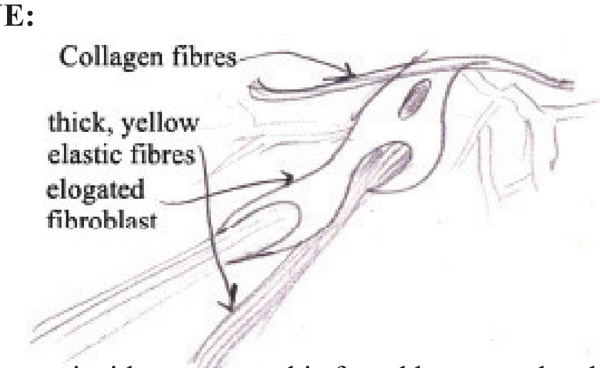
- They are very elastic due to the presence of a network of yellow fibres in its matrix called as ligament which connect bone to bone.

(ii) White fibrous connective tissue (Tendon)

- They have very little matrix containing abundant white fibres forming layers and non-elastic in nature with great strength.
- Bundles of this tissue are called as tendons, which connects muscles to the bones.

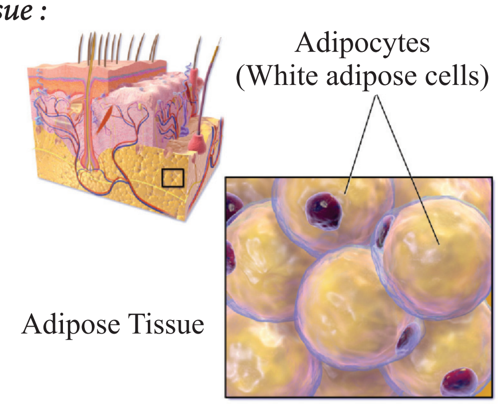
Tendons	Ligaments
1. Inelastic (Limited flexibility) 2. Join muscles to bone. 3. Made up of white collagen fibres.	1. Elastic 2. Connect bones to bones. 3. Made up of white collagen as well as yellow elastin fibres

(D) AREOLAR TISSUE:



- This tissue fills spaces inside organs and is found between the skin & muscles, around blood vessels, nerves and in the bone marrow.
- It is a supporting and packing tissue.
- It also helps in repair of tissues after injury.

(e) *Adipose tissue :*



- These are oval and round cells, filled with fat globules called adipocytes.
- It is found in subcutaneous layer below the skin, around the heart, brain and below the eyeballs. It acts as an insulator and prevents loss of heat from the body.
- It serves as a fat reservoir and keeps visceral organs in position.

MUSCULAR TISSUE

- Movements are brought about in our body with the help of muscular tissue.
- They are long fibre-like cells called muscle fibres.
- They are capable of contraction or relaxation because they are made up of contractile proteins. (actin and myosin)

Types of Muscular Tissue

Skeletal Muscle

Cardiac Muscle

Smooth Muscle

(a) *Skeletal muscles*

- These muscles shows alternate light and dark bands hence the name is striped or striated muscles.
- They are also called as voluntary muscles because these are under the control of one's will.
- Muscle fibers or cells are long multinucleated and unbranched.
- Each fibre is enclosed by thin membrance which is called as sarcolemma.
- Its Cytoplasm is called as sarcoplasm.
- These muscles get tired and need rest.

(b) *Cardiac muscle*

- They are involuntary muscles.
- Only found in the walls of heart.
- They are uninucleated and branched. Branches are united by intercalated disc.
- In these muscles rhythmic contraction and relaxation occurs throughout the life and never get tired.

(c) ***Smooth muscle :***

They do not show any alternate light & lark bands, so also called non-striated muscles

- They are involuntary muscles also called as smooth muscles.
- These muscle fibres are uninucleated and spindle shaped.
- They are not enclosed by membrane but many fibres are joined together in bundles. They constitute internal organs.
- Such muscles are found in the walls of stomach, intestine, urinary bladder, bronchi, iris of eye etc.
- Peristaltic movements in alimentary canal are brought about by smooth muscles.

Striated Muscle	Smooth or Non-striated Muscle	Cardiac Muscle
1. They are present in the limbs, body walls, tongue, pharynx and beginning of oesophagus.	1. They are present in the oesophagus (posterior part only). urino-gential tract, urinary bladder, vessels, iris of eye, dermis of skin, and arrector pili muscles of hair.	1. They are present in the wall of the heart, pulmonary veins and superior vena cava.
2. Cylindrical	2. Spindle shaped.	2. Cylindrical.
3. Unbranched.	3. Unbranched	3. Branched.
4. Multinuclecate.	4. Uninucleate	4. Uninucleate.
5. Bounded by sarocolemma.	5. Bounded by plasmalemma.	5. Bounded by sarcolemma
6. Light and dark bands present	6. Light and dark bands absent	6. Faint light and dark bands present.
7. No oblique bridges and intercoalated discs	7. No oblique bridges and intercalated discs.	7. Oblique bridges and intercalated discs present.
8.Nerve supply from central nervous system.	8. Nerve supply from autonomic nervous system.	8. Nerve supply from the brain and autonomic nervous system.
9. Blood supply is abundant.	9. Blood supply is scanty.	9. Blood supply is abundant.
10. Very rapid contraction.	10. Slow contraction.	10. Rapid contraction.
11. They soon get fatigued.	11. They donot get fatigued.	11. They never get fatigued.
12. Voluntary	12. Involuntary	12. Involuntary

NERVOUS TISSUS

- They are highly specialized tissues due to which the animals are able to perceive and respond to the stimuli.
- Their functional unit is called as nerve cell or neuron.

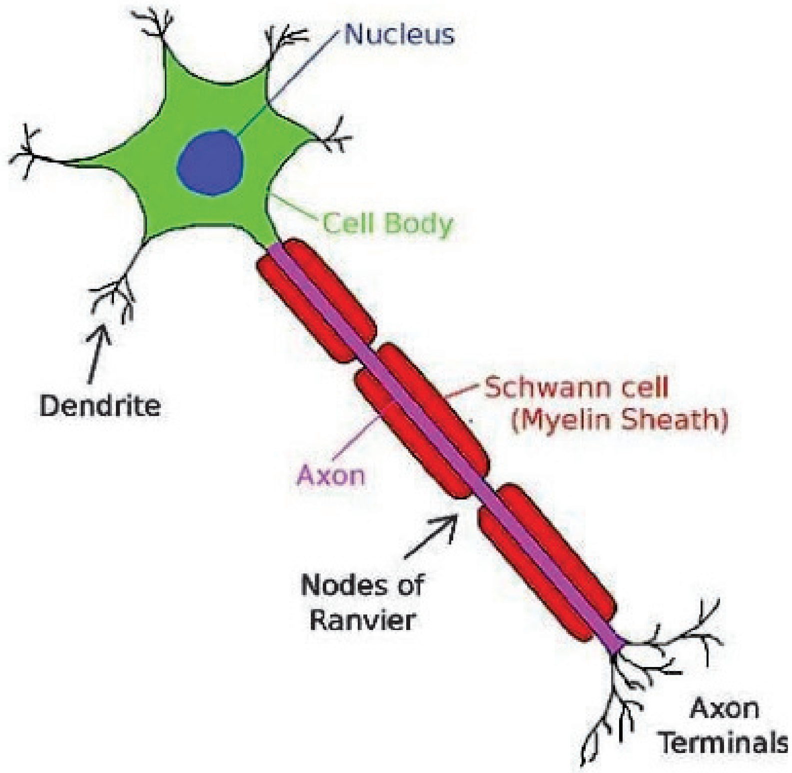
Parts of Neuron

(a) Cell body is cyton covered by plasma membrane.

(b) Short hair like extensions rising from cyton are dendrons which are further subdivided into dendrities.

(c) Axon is long, tail like cylindrical structure with fine branches at the end and is covered by a sheath, which is known as myelin sheath.

- The signal that passes along the nerve fibre is called nerve impulse.
- Nerve ending of one neuron is very closely placed to the dendrons of another neuron to carry impulses from one neuron to another neuron in the form of electrochemical waves. This close proximity is called as synapse.



Structure of Neuron

OBJECTIVE TYPE QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. The tissue derived directly form the meristem of embryo is called as ....
2. A group of cells with similar structure organized to do a common function is called as ....
3. Which plant tissue remains in active metabolic state always ?
4. Sieve tubes and companion cells are found in .... tissue.
5. Long, narrow, dead cells having a thick deposition of lignin in the cell wall are called .... cells.
6. Which tissue is responsible for transport of water in plants ?
7. The special property of muscle fibres to contract forcefully and return to relaxed state is called .... (excitability / contractibility / flexibility)
8. A branch of science dealing with the study of bones is called............ . (Ornithology/ physiology/ osteology)
9. The fluid matrix of blood is called ....
10. Spindle-shaped, non-striated, involuntary muscle fibres present in hollow internal organs like urinary bladder are called .... (smooth muscle fibres/ striated muscle fibres/ cardiac muscle fibres.)

Multiple choice question (MCQ)

1. In plants which of the following have the capability of cell division ?
   (a) Parenchyma (b) Sclerenchyma
   (c) Xylem (d) Apical Meistem
2. The growth in plants is
   (a) limited to certain regions (b) uniform in all parts
   (c) limited to top region (d) limited to roots only.
3. Intercalary meristems are found
   (a) at nodes and base of leaves (b) at growing tips of roots
   (c) beneath the bark (d) at the tips of stem

4. Cells of the tissue have dense cytoplasm, thin cellulose walls and prominent nuclei. Identify the tissue.
   (a) Collenchyma (b) Sclerenchyma
   (c) Meristem (d) Parenchyma
5. Dead long and narrow cells in a plant belong to which tissue ?
   (a) Parenchyma (b) Sclerenchyma
   (c) Collenchyma (d) Meristem
6. Bone is an example of ____________
   (a) Muscular tissue (b) Connective tissue
   (c) Epithelial tissue (d) Nervous tissue
7. Which animal tissue is usually separated from the underlying tissue by an extracellular fibrous basement membrane ?
   (a) Muscular tissue (b) Connective tissue
   (c) Epithelial tissue (d) Nervous tissue
8. Oesophagus and the lining of the mouth are also covered with which tissue ?
   (a) Squamous epithelium (b) Ciliated epithelium
   (c) Areolar connective (d) Striated muscle tissues
9. Husk of a coconut is made of which tissue ?
   (a) Parenchyma tissue (b) Sclerenchymatous tissue
   (c) Collenchyma (d) Xylem
10. Muscles contain special proteins called ________ that help in muscle movement.
   (a) receptor proteins (b) enzymes
   (c) nucleo proteins (DNA, RNA) (d) contractile proteins (actin and myosin)

VERY SHORT ANSWER TYPE QUESTIONS

1. Which meristem increases the girth of the plant ?
2. Name the epidermal tissue which helps in movement of ova in the oviduct.
3. Suggest a term for " The signal which passes along the nerve fibre :-
4. Which tissue helps in buoyancy in aquatic plants ?
5. "I am an animal tissue which fills the space inside the body organs and also supports them". Identify me and write my name.
6. Blood has a fluid matrix. Name this matrix.
7. Name the tissues which enables animals to move rapidly in response to stimuli.

SHORT ANSWER TYPE QUESTION

1. Name the outermost layer of cells in plants. State any two functions of this layer.
2. What is cutin ? Where is it found ?
3. What is the speciality of ciliated columnar epitheium tissue ?
4. Which animal tissue is responsible for transportation of various materials in body ? Name various components / cells of this tissue.
5. Where is suberin found in plants ? What is its function ?

SHORT ANSWER TYPE QUESTION

1. Draw a well labelled diagram of small pores present in epidermis of a leaf. State any two functions of these pores.
2. Broadly classify animal tissues.
3. Write the composition of mammalian blood. State any two main functions of blood.
4. Write down the identifying features of connective tissue. State any one major difference between ligament and tendon.
5. With the help of diagram explain the structure of neuron.
6. Name the cells of adipose tissue. Where is adipose tissue found in an animal body ? State its function also.

LONG ANSWER TYPE QUESTION

1. What is meristematic plant tissue ? Categorise and explain various meristematic tissues. Also show the location of these meristermatic tissues with help of a well labelled diagram.
2. (i) Write characteristic features of complex permanent tissues.
   (ii) Name two complex permanent tissues found in plants.
   (iii) What do these two complex permanent tissues constitute together ?
   (iv) Write the composition and function of these complex permanent tissues.
3. Differentiate between three types of muscles on the basis of their structure and function. Draw a neat well labelled diagram of these three types of muscles.
4. What are different kind of connective tissues ? State their functions.
5. Differentiate between parenchyma, collenchyma and sclerenchyma tissue on the basis of following :-
   (i) Cell Well (ii) Cytoplasm (iii) Nucleus
   (iv) occurrence (v) Function

ASSERTION AND REASON BASED QUESTION

Directions – In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Mark the collect choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the collect explanation of assertion (A)

(b) Both assertion (A) and reason (R) are true but season (R) is not the collect explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1. Assertion - Water Hyacinth floats on water surface.

Reason - Inter-cellular spaces are absent in between the cells of sclerenchyma.

Ans. (b) Water Hyacinth floats on water surface because it has spongy petioles that enclose a lot of air in its aerenchyma. This air makes the plant lighter than water so that it is able to float on the water surface.

Q2. Assertion – Blood is considered to be 'connective tissue'.

Reason – During circulation, blood passes through all the organs of the body.

Ans. (a) Blood is circulated through all the organs of the body and therefore connects different tissues and organs of the body.

Q3. Assertion - Neurons are the functional unit of Nervous Tissue.

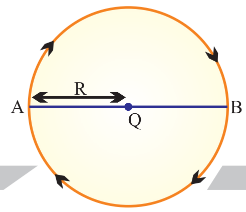
Reason - The signal that passes along the nerve fibre is called impulse.

Q4. Assertion - Sclerenchyma tissue is also call dead tissue of plant.

Reason - Cells of sclerenchyma tissue have extremely thick wall due to the deposition of lignum in it.

Q5. Assertion - Adipose tissue act as an insulator.

Reason - The cell of adipose tissue are filled with fat globules.



Chapter - 7

Motion

CONCEPT MAPPING

Physical State

- **Rest** (No change in position)
- **Motion** (change in position)
  - **Uniform Motion**: Equal distance travelled in equal time intervals.
  - **Non-uniform Motion**: Unequal distance travelled in equal time intervals.
    - **Accelerated Motion**: Increase in motion with time
      - Uniformly Accelerated Motion
      - Non Uniformly Accelerated Motion
    - **Deaccelerated Motion**: Decrease in motion with time
      - Uniformly Deaccelerated Motion
      - Non Uniformly Deaccelerated Motion
  - **Linear**: Straight line path
    - **Distance**: Actual path travelled by a body
      - **Speed**: Distance traveled in a unit time. Unit m/s. It is **Scalar** (only Magnitude) quantity
    - **Displacement**: Shortest distance between Initial and final position
      - **Velocity**: Displacement traveled in a unit time. Unit - m/s. It is **vector** (both magnitude and direction) quantity.
  - **Circulatory Motion**: Circulatory path
  - **Oscillatory Motion** (To and fro motion)

Equations of Motion

- $v = u + at$ → First Equation
- $S = ut + \frac{1}{2}at^2$ → Second Equation
- $v^2 = u^2 + 2as$ → Third Equation

Where :
v = Final velocity
u = Initial velocity
a = Acceleration
t = Time taken
s = Distance covered

Rest : A body is said to be in a state of rest when its position does not change with respect to a reference point.

Motion : A body is said to be in a state of motion when its position changes continuously with respect to a reference point.

Motion can be of different types depending upon the type of path by which the object is going through.

(i) Circulatory motion/Circular motion – In a circular path.
(ii) Linear motion – In a straight line path.
(iii) Oscillatory/Vibratory motion – To and fro path with respect to origin.

Physical quantity:– There are seven basic physical quantity. Every quantity is written in two parts : first write the magnitude of the physical quantity and then write the unit of the quantity, i.e., magnitude per Unit

Physical Quantities :

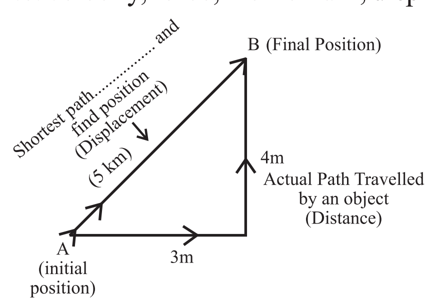
Quantity Name	SI Unit	
	Name	Symbol
Length	Metre	m
Time	Second	s
Mass	Kilogram	Kg
Absolute Temperature	Kelvin	K
Amount of Substance	Mole	mol
Electric Current	Ampere	A
Luminous Intensity	Candela	cd

Physical Quantities can be grouped into two :

i) Scalar quantities ii) Vector quantities

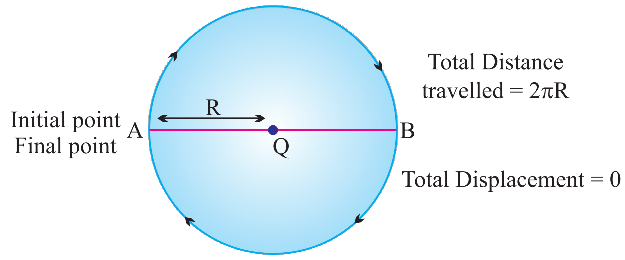
i) **Scalar quantities :** Those Physical quantities that has only magnitude but no direction. i.e. speed, distance, mass, volume, time, temperature, work, electric current.

ii) **Vector quantities :** Those physical quantities that has both magnitude as well as direction. i.e. velocity, force, momentum, displacement, acceleration etc.



- The actual path or length travelled by an object during its journey from its initial position to its final position is called the distance. It is denoted by 'd'
- Distance is a scalar quantity which requires only magnitude but no direction to explain it.
  Example, Ramesh travelled 65 km. (Distance is measured by odometer in vehicles.)
- The actual distance (covered by an object) in between its initial and final position is called displacement. It is denoted by S.
- Displacement is a vector quantity requiring both magnitude and direction for its explanation.
  Example, Ramesh travelled 65 km south-west from Clock Tower.

- Displacement can be zero (when initial point and final point of motion are same) ***Example,*** circular motion.



- Distance and displacement are denoted by 'S'.

Difference between Distance and Displacement

Distance	Displacement
1. Length of actual path travelled by an object.	1. Shortest length between initial point and far point of a distance travelled by an object.
2. It is scalar quantity. - It includes only magnitude 3. It remains positive, can't be '0' or negative.	2. It is vector quantity.- It includes both magnitude and direction. 3. It can be positive (+ve), negative (-ve) or zero.
4. Distance can be equal to displacement (in linear path).	4. Displacement can be equal to distance in linear path or it is lesser than distance.

Example 1. *A body travels in a semicircular path of radius 10 m starting its motion from point 'A' to point 'B'. Calculate the distance and displacement.*

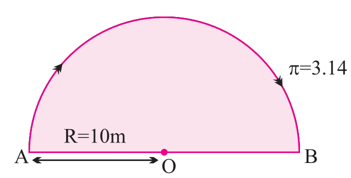
Solution : Total distance travelled by body, S = ?

Given, $\pi = 3.14, R = 10\,m$

$S = \pi R$

$S = 3.141 x 10m$

$= 31.4m$



Total displacement of body, S = ?

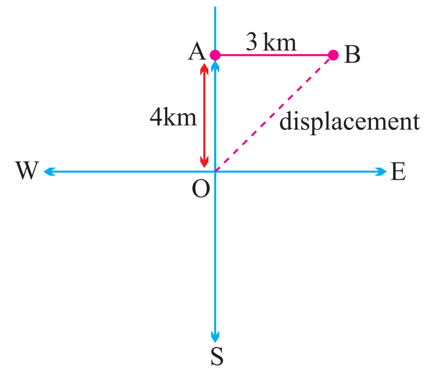
Given, $R = 10\,m$

$S = 2 \times R$

$= 2 \times 10\,m = 20\,m$

Example 2. *A body travels 4 km towards North. There it turn to its right and travels another 3 km before coming to rest. Calculate (i) total distance travelled, (ii) total displacement.*

Solution :



Total distance travelled $= OA + AB$

$= 4\text{ km} + 3\text{ km}$

$= 7\text{ km}$ **Ans.**

Total displacement $= OB$

$$OB = \sqrt{OA^2 + AB^2}$$

$$= \sqrt{(4)^2 + (3)^2}$$

$$= \sqrt{16+9}$$

$$= \sqrt{25}$$

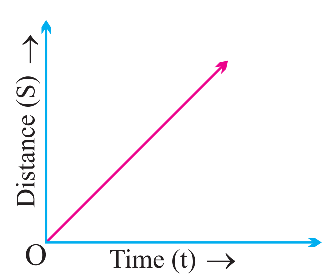
$= 5\text{ km}$ **Ans**

Uniform and Non-uniform Motions :

- ***Uniform Motion :***

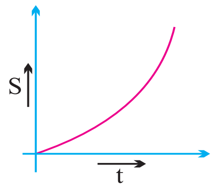
  When a body travels equal distance in equal interval of time, then the motion is said to be uniform motion.

eg. movements of hands of a clock, rotation and revolution of the earth.

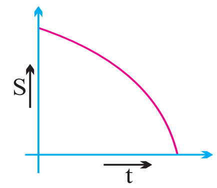


- **Non-uniform Motion :**

  In this type of motion, the body will travel unequal distances in equal intervals of time. eg. motion of a car on a busy road.



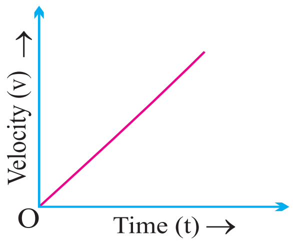
Continuous increase in slope of curve indicates accelerated non-uniform motion.



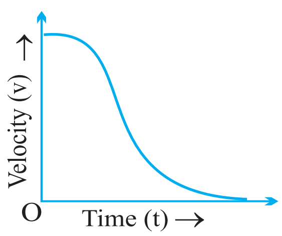
Continuous decrease in slope of curve indicates decelerate non-uniform motion.

Non-uniform motion is of two types :

(i) ***Accelerated Motion :*** When motion of a body increases with unequal *interval of time.*



(ii) ***De-accelerated Motion or Non uniform Retardation :*** When motion of a body decreases with unequal interval of time.



Continuous decrease in slope of curve indicates deaccelerated non-uniform motion.

Speed : The measurement of distance travelled by a body per unit time is called speed. It is denoted by ν.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$\nu = \frac{s}{t}$$

- SI unit = m/s (meter/second)
- If a body is travelling with uniform motion, then there will be a constant speed throughout the motion.
- Average speed will describe one single value of speed throughout the motion of the body.

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

- If a body is travelling with non-uniform motion, then the speed will not be constant and have different values throughout the motion.
- It is necessary to write the unit of every quantity in the answer of numerical questions :

Example : *What will be the speed of body in m/s and km/hr if it travels 40 kms in 5 hrs ?*

Solution :

Distance (s) = 40 km

Time (t) = 5 hrs.

$$\text{Speed (in km / hr)} = \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{40 \text{ km}}{5 \text{ hrs}}$$

= 8 km/hr **Ans.**

Speed (in m/s) = ?

40 km = 40 × 1000 m = 40,000 m

5 hrs = 5 × 60 × 60 sec.

$$= \frac{40 \times 1000 \text{ m}}{5 \times 60 \times 60 \text{ s}}$$

$$= \frac{80 \text{ m}}{36 \text{ s}}$$

= 2.22 m/s **Ans.**

Velocity : It is the speed of a body in given direction.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

- Velocity is a vector quantity. Its value changes when either its magnitude or direction changes. It is also denoted by v

- For a non-uniform motion in a given line, average velocity will be calculated in the same way as done in average speed.

$$\text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time}}$$

- For uniformly changing velocity, the average velocity can be calculated as follows :

$$\text{Avg velocity} = \frac{\text{Initial velocity} + \text{Final velocity}}{2}$$

$$V_{(avg)} = \frac{u+v}{2}$$

where, u = initial velocity, v = final velocity

SI unit of velocity = ms^{-1}

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

$\because$

- It can be positive (+ve), negative (-ve) or zero.

Example 1 : *During first half of a journey by a body it travel with a speed of 40 km/hr and in the next half it travels with a speed of 20 km/hr. Calculate the average speed of the whole journey.*

Solution : Speed during first half (v_1) = 40 km/hr

Speed during second half (v_2) = 20 km/hr

$$\text{Average speed} = \frac{v_1 + v_2}{2}$$

$$= \frac{40+20}{2} = \frac{60}{2}$$

$$= 30 \text{ km/hr}$$

Average speed by an object (body) = 30 km/hr. **Ans.**

Example 2 : *A car travels 20 km in first hour, 40 km in second hour and 30 km in third hour. Calculate the average speed of the train.*

Solution : Speed in Ist hour = 20 km/hr, *Distance travelled during 1st hr = 1×20= 20 km*

Speed in IInd hour = 40 km/hr, *Distance travelled during 2nd hr = 1×40= 40 km*

Speed in IIIrd hour = 30 km/hr, *Distance travelled during 3rd hr = 1×30= 30 km*

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

$$= \frac{20+40+30}{1+1+1} = \frac{90}{3}$$

$$= 30 \text{ km/hr}$$

Ans.

Acceleration : Acceleration is seen in uniform motion and it can be defined as the rate of change of velocity with time.

$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time}}$$

$$\Rightarrow \text{Acceleration} = \frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Time}} \qquad a = \frac{v-u}{t}$$

where, v = final velocity, u = initial velocity

If $v > u$, then 'a' will be positive (+ve).

Retardation/Deacceleration : Deacceleration is seen in uniform motion during decrease in velocity with time. It has same definition as acceleration.

$$= \frac{\text{Change in velocity}}{\text{time}}$$

$$a = \frac{v-u}{t}$$

Here $v < u$, 'a' = negative (-ve).

Unit of Acceleration and deacceleration is m/s^2 or ms^{-2}

Example 1 : *A car speed increases from 40 km/hr to 60 km/hr in 5 sec. Calculate the acceleration of car.*

Solution : $u = \frac{40\text{ km}}{\text{hr}} = \frac{40 \text{ x } 1000}{60 \text{ x } 60} = \frac{40 \text{ x } 5}{18} = \frac{200}{18} = 11.11\text{ms}^{-1}$

$$v = \frac{60\text{ km}}{\text{hr}} = \frac{60 \times 5}{18} = \frac{150}{9} = 16.66\text{ ms}^{-1}$$

$a = ?$ $t = 5$ sec.

$$a = \frac{v-u}{t}$$

$$= \frac{16.66 - 11.11}{5}$$

$$= \frac{5.55}{5}$$

$$= 1.11\text{ ms}^{-2}$$

Ans.

Example 2. *A car travelling with a speed of 20 km/hr comes into rest in 0.5 hrs. What will be the value of its retardation ?*

Solution : $v = 0$ km/hr

$u = 20$ km/hr

$t = 0.5$ hrs

Retardation, $a' = ?$

$$a' = \frac{v-u}{t}$$

$$= \frac{0-20}{0.5}$$

$$= -\frac{200}{5}$$

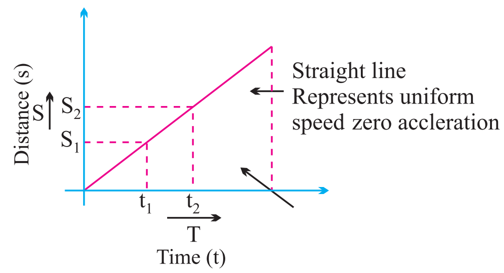
$$= -40\text{ km/hr}$$

Ans.

Graphical Representation of Equation :–

(i) Distance-Time Graph : (s-t graph)

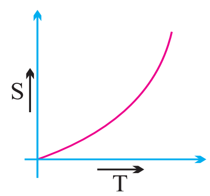
(a) *s-t* graph for uniform motion :



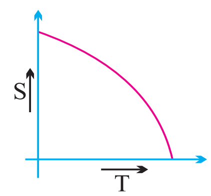
The slope of a distance - time graph represent speed of an object speed of an object moving with uniform speed can be determined by :

$$v = \frac{s_2 - s_1}{t_2 - t_1}$$

(b) *s-t* graph for non-uniform motion :

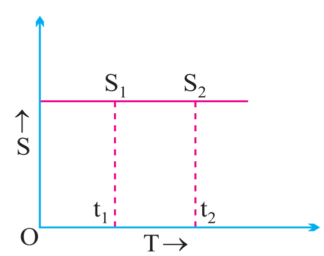


Continuous increase in slope of curve indicates accelerated non-uniform motion.



Continuous decrease in slope of curve indicates decelerated non-uniform motion.

(c) *s-t* graph for a body at rest :



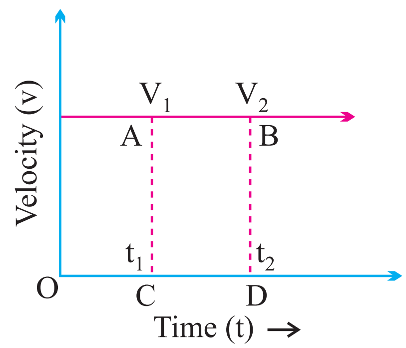
$$v = \frac{s_2 - s_1}{t_2 - t_1}$$

But, $s_2 = s_1$

$$\therefore \quad v = \frac{0}{t_2 - t_1} \quad \text{Or} \quad v = 0$$

(ii) Velocity-Time Graph : (v-t graph)

(a) v-t graph for uniform motion :



$$a = \frac{v_2 - v_1}{t_2 - t_1}$$

But, $v_2 = v_1$

$$\therefore \qquad a = \frac{0}{t_2 - t_1} \qquad \text{Or} \qquad a = 0$$

Distance covered by the object in time t_1 or t_2 is :-

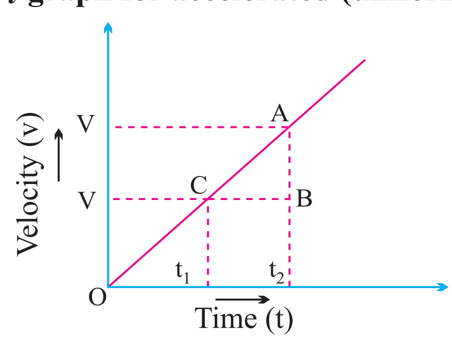
distance (s) = AC x CD

= area of rectangle

ABCD

(b) v-t graph for non-uniform motion :

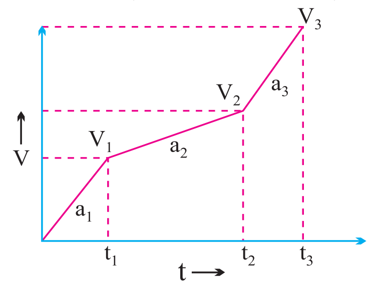
(A) v-t graph for accelerated (uniform) motion :



$$a - \frac{\text{change in velocity}}{\text{time taken}} \Rightarrow a = \frac{v - u}{t_2 - t_1} \quad \frac{\text{Final velocity (v) - Initial Velocity (u)}}{t_2 - t_1}$$

In uniformly accelerated motion, there will be equal increase in velocity in equal interval of time throughout the motion of body.

(B) *v-t* graph for accelerated (non-uniform) motion :



Here if, $$t_2 - t_1 = t_2 - t_3$$

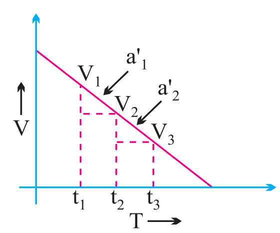
Then, $$v_2 - v_1 \neq v_3 - v_2$$

$$\frac{v_2 - v_1}{t_2 - t_1} \neq \frac{v_3 - v_2}{t_3 - t_2}$$

Or

Or $$a_2 \neq a_3$$

(C) *v-t* graph for deaccelerated (uniform) motion :



Here, $$v_2 - v_1 = v_3 - v_2$$

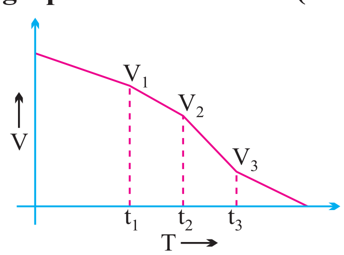
If $$t_2 - t_1 = t_3 - t_2$$

$$\frac{v_2 - v_1}{t_2 - t_1} = \frac{v_3 - v_2}{t_3 - t_2}$$

Then,

Or $$a'_1 = a'_2$$

(D) *v-t* graph for deaccelerated (non-uniform) motion :



Here, $$v_2 - v_1 \neq v_3 - v_2$$

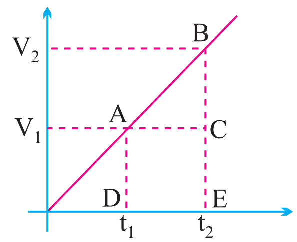
If $$t_2 - t_1 = t_3 - t_2$$

$$\frac{v_2 - v_1}{t_2 - t_1} \neq \frac{v_3 - v_2}{t_3 - t_2}$$

Then,

Or $$a'_1 \neq a'_2$$

Note : *The area enclosed between any two time intervals is '$t_2 - t_1$' in v/t graph will represent the total displacement by that body.*



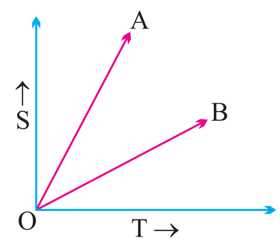
Total distance covered/travelled by body between t_2 and t_1, time intervals

$= \frac{1}{2} \times$ (CE-BE) x (OE-OD) + AD X (DE)

= Area of ΔABC + Area of rectangle ACED

$= \frac{1}{2} \times (v_2 - v_1) \times (t_2 - t_1) + v_1 \times (t_2 - t_1)$

Example : *From the information given in s/t graph, which of the following body 'A' or 'B' will be more faster ?*



Solution : $V_A > V_B$ **(Steeper The slope of line in distance-Time graph the greater the speed)**

Equation of Motion (For Uniformly Accelerated Motion) By graphical method:

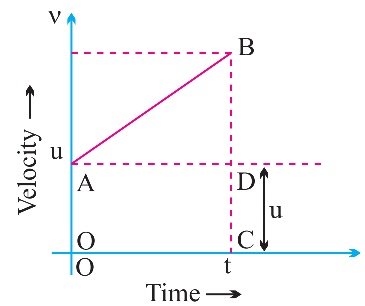
(i) First Equation of motion:

$$v = u + at$$

Or Final velocity = Initial velocity + Acceleration × Time

Graphical Derivation :

Suppose a body has initial velocity 'u' (*i.e.,* velocity at time $t = 0$ sec.) at point 'A' and this velocity changes to 'v' at point 'B' in 't' *i.e.,* final velocity will be 'v'.



For such a body there will be an acceleration.

$$a = \frac{\text{Change in velocity}}{\text{Change in time}}$$

$$a = \frac{\text{OB} - \text{OA}}{\text{OC} - 0} = \frac{v - u}{t - 0}$$

$$a = \frac{v - u}{t} \Rightarrow \text{at} = \text{v - u}$$

Or

Or $\quad v = u + at$

(ii) Second Equation of motion :-

$$\boxed{s \quad = ut + \tfrac{1}{2}at^2}$$

Distance travelled by The object = Area of OABC (trapezium)

= Area of OADC (rectangle) + Area of ΔABD

= OA × AD + ½ × AD × BD

$= u \times t + ½ \times t \times (v - u)$

$\left(\because \frac{v - u}{t} = a\right)$ so [v-u = at]

$= \boxed{ut + ½ \times t \times at}$

(iii) Third Equation of motion :-

$$\boxed{v^2 = u^2 + 2as}$$

s = Area of trapezium OABC

$$s = \frac{(\text{OA} + \text{BC}) \times \text{OC}}{2}$$

$$s = \frac{(u+v)\times t}{2}$$

Or $$s = \left(\frac{u+v}{2}\right)\times\left(\frac{v-u}{a}\right) \qquad \left(\because \frac{v-u}{t} = a\right)$$

$$s = \frac{v^2 - u^2}{2a}$$

$\therefore$

Or $$v^2 = u^2 + 2as$$

Example 1. *A car starting from rest moves with uniform acceleration of 0.1 ms^{-2} for 4 mins. Find the speed and distance travelled.*

Solution : $u = 0$ ms^{-1} $\quad\because$ car is at rest.

$a = 0.1$ ms^{-2}

$t = 4 \times 60 = 240$ sec.

$v = ?$

From, $v = u + at$

$v = 0 + 0.1 \times 240$

Or $v = 24$ ms^{-1} **Ans.**

Distance travelled

$s = ut + \frac{1}{2}at^2$

$= 0 \text{ x } 240 + \frac{1}{2} \text{ x } 0.1 \text{ x } (240)^2$

$= 2880$ m or

$s = 2.88$km

Example 2. *The brakes applied to a car produces deaceleration of 6 ms^{-2} in opposite direction to the motion. If car requires 2 sec. to stop after application of brakes, calculate distance travelled by the car during this time.*

Solution : Deceleration, $a = -6$ ms^{-2}

Time, $t = 2$ sec.

Distance, $s = ?$

Final velocity, $v = 0$ ms^{-1} $\quad\because$ car comes to rest.

Now, $v = u + at$

Or $u = v - at$

Or $u = 0 - (-6) \times 2 = 12$ ms^{-1}

And, $s = ut + \frac{1}{2}at^2$

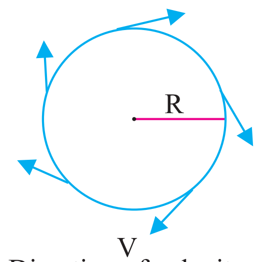
$= 12 \times 2 + \frac{1}{2} \times (-6) \times (2)^2$

$= 24 - 12 = 12$ m **Ans.**

Uniform Circular Motion

If a body is moving in a circular path with uniform speed, It is motion is called uniform circular motion.

In such a motion the speed may be same throughout the motion but its velocity (which is tangential) is different at each and every point of its motion due to continuous change in direction. Thus, uniform circular motion is an accelerated motion.



Direction of velocity (Tangential)

so, velocity of an object in a circular motion is :

$$v = \frac{2\pi r}{t}$$

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Change the speed 6 m/s into km/hr.
2. Why do speedometer and odometer provided in a motor vehicle ?
3. What is the other name of negative acceleration ?
4. What does the slope of distance-time graph indicate ?
5. What can you say about the motion of a body if its speed-time graph is a) straight line parallel to the time axis b) straight line
6. Define Motion and speed
7. Is distance is a scalar or vector quantity? Why?
8. Is displacement a scalar quantity? Why?
9. Define average speed. How do we calculate it ?
10. What is difference between speed and velocity?

SHORT ANSWER TYPE QUESTIONS

1. A tortoise moves a distance of 100 m in 15 minutes. What is its speed in km/hr ?
2. If a bus travelling at 20 m/s is subjected to a steady deceleration of 5 m/s^2, how long will it take to come to rest ?
3. What is the difference between uniform linear motion and uniform circular motion ?
4. Explain why the motion of a body which is moving with constant speed in a circular path is said to be accelerated.
5. Define velocity. What is SI unit of velocity?
6. What is meant by the term acceleration? Write its SI unit.
7. Write difference between 'distance' and 'displacement'.
8. Under what conditions can a body travel a certain distance and yet its resultant displacement be zero.
9. Is a uniform circular motion accelerated? Explain.
10. What type of motion is exhibited by a free falling body & why?

LONG ANSWER TYPE QUESTIONS

1. Derive the equations $v = u + at$, $s = ut + \frac{1}{2}at^2$ and $v^2 = u^2 + 2as$ graphically.
2. A car travels 30 kilometers at a uniform speed of 40 km/hr and next 30 km at a uniform speed of 20 km/hr. Find its average speed.
3. (a) Convert a speed of 54 km/hr into m/s.

   (b) Change the speed of 6 m/s into km/hr.

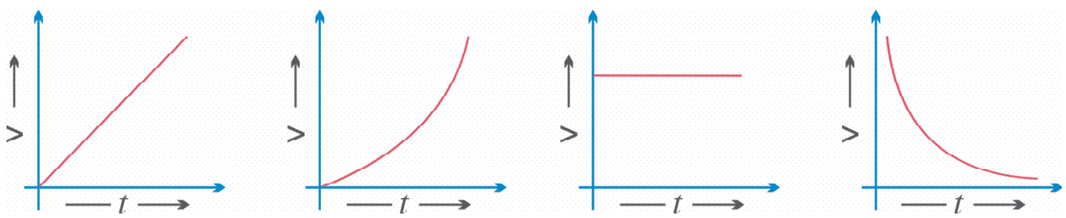
   (c) A driver decreases the speed of a car from 25 m/s to 10 m/s in 5 seconds. Find the acceleration of car.
4. A scooter acquires a velocity of 36 km/hr in 10 seconds just after the start. Calculate the acceleration of the scooter. Also calculate the distance covered upto this time.

[Hint : change speed in m/s, v = u + at].

6. A car increase its speed from 20 km/hr to 50 km/min 10 seconds. Find its acceleration. [Hint : convert km/hr to m/s. v = u + at].

7. A cyclist goes around a circular path once every 2 minutes. If the radius of the track is 105 metres. Calculate his speed. $\left[v=\frac{2\pi r}{t},\ \pi\frac{22}{7}\right]$.

8. Which type of motion is represented by each one of the following graphs?



(a) (b) (c) (d)

Answer of Long Questions :

3. 26.6 km/hr.

4. (a) 15 m/s (b) 21.6 km/hr (c) a = -3 m/s^2

5. a = 1 m/s^2

6. a = 0.83 m/s^2

7. v = 5.5 m/s

OBJECTIVE TYPES QUESTIONS

MCQ

1. The numerical ratio of displacement to distance for a moving object is

(a) equal to or less than 1
(b) always equals to 1
(c) always less than 1
(d) always more than 1

2. Retardation of a body is expressed in

(a) m
(b) ms^{-1}
(c) -ms^{-2}
(d) ms^{-2}

3. If the displacement time graph of a particle is parallel to the time axis, the velocity of the particle is

(a) Unity
(b) Infinity
(c) Zero
(d) None of these

OBJECTIVE TYPES QUESTIONS

4. The slope of velocity-time graph gives

(a) the displacement (b) the distance

(c) the acceleration (d) the speed

5. The distance covered by a bus moving with a speed of 36Km/hr in 15 min. is

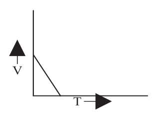
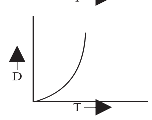
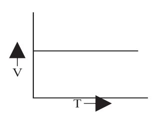
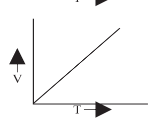
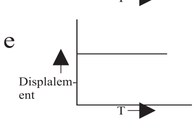
(a) 0.9Km (b) 9 Km

(c) 90Km (d) 900Km

6. A body is thrown vertically upward with velocity 'u' the greatest height 'h' to which it will rise is,

(a) $\frac{u}{g}$ (b) $\frac{u^2}{2g}$ (c) $\frac{u^2}{g}$ (d) $\frac{u}{2g}$

7. Match the following :

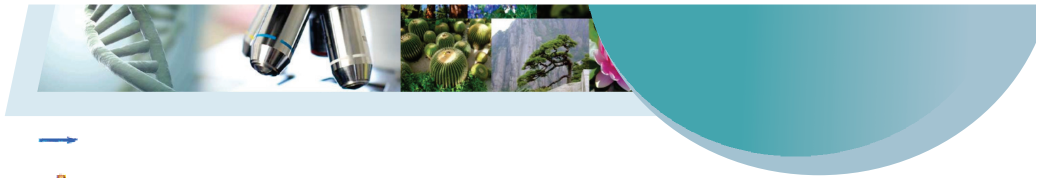
Column I	**Column II**
a 	p. Constant velocity
b 	q. Non-uniform speed
C 	
d 	r. Body at rest
e 	t. uniform retardation

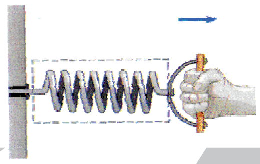
Q. Assertion Reasoning based questions :–

A) Displacement of an object may be zero but distance covered by it is not zero Displacement is the shortest distance between initial and final position of the object.

B) Assertion (A) – Motion with uniform velocity is always along a straight line path.
Reason (R) – Uniform velocity means that speed and direction remain unchanged.

C) Assertion (A) – Slope of Distance time graph represent the speed.
Reason (R) – Sleeper the slope of the line greater will be the speed of an object.





Chapter - 8

Force And Laws Of Motion

CONCEPT MAPPING

Force And Laws Of Motion

- **Force**
  - Force (F) = Mass (m) × Acceleration (a)
  - Unit = Newton (N)
  - Balanced force → Resultant force is zero
  - Unbalanced force → Resultant force is greater than zero
- **Newton's Laws of Motion**
  - Newton's first law of motion
    - Inertia → Tendency to resist the change
    - Mass → Measurement of Inertia
  - Newton's second law of motion
    - $\boxed{\text{Force} = m \times a}$
    - Momentum $\boxed{p = mv}$
    - Unit of momentum $\boxed{p = \text{kgm/s}}$
  - Newton's third law of motion
    - Law of Conservation of momentum → Total momentum of the system remains constant.
    - Action – Reaction → For every action there is an equal and opposite reaction

Force :

Force : It is the force that enables us to do any work. To do anything, either we pull or push the object. Therefore, pull or push is called force.

Example, to open a door, either we push or pull it. A drawer is pulled to open and pushed to close.

Effects of Force

(i) Force can move a stationary body or object. For example, a football can be set to move by kicking it, *i.e.,* by applying a force.

(ii) Force can stop a moving body. For example, by applying brakes, a running cycle or a running vehicle can be stopped.

(iii) Force can change the direction of a moving object. For example, by applying force, *i.e.,* by moving handle, the direction of a running bicycle can be changed. Similarly by moving steering, the direction of a running vehicle is changed.

(iv) Force can change the speed of a moving body. By accelerating, the speed of a running vehicle can be increased or by applying brakes the speed of a running vehicle can be decreased.

(v) Force can change the shape and size of an object. For example, by hammering, a block of metal can be turned into a thin sheet. By hammering, a stone can be broken into pieces.

Forces are mainly of two types :

(A) Balanced forces

(B) Unbalanced forces

(A) Balanced Forces

- If the resultant of applied forces is equal to zero, these are called balanced forces.

  Example, In a tug of war if both the teams apply similar magnitude of forces in opposite directions, rope does not move in either side. This happens because of balanced forces in which resultant of applied forces become zero.

- Balanced forces do not cause any change of state of an object. Balanced forces are equal in magnitude and opposite in direction.

- Balanced forces can change the shape and size of an object. For example, when forces are applied from both sides over a balloon, the size and shape of balloon are changed.

(B) Unbalanced Forces

- If the resultant of applied forces are greater than zero, the forces are called unbalanced forces. An object in rest can be moved because of applying Unbalanced forces.
- Unbalanced forces can do the following :
  * Move a stationary object
  * Increase the speed of a moving object
  * Decrease the speed of a moving object
  * Stop a moving object
  * Change the shape and size of an object

Laws of Motion :

Galileo Galilei : Galileo was the first to say that objects move with a constant speed when no force acts on them. This means if an object is moving on a frictionless path and no other force is acting upon it, the object would be moving in uniform motion forever. That is, there is no unbalanced force working on the object.

- But practically it is not possible for any object. Force of friction, force of air and many other forces are always acting upon an object.

Newton's Laws of Motion :

Newton studied the ideas of Galileo and gave the three laws of motion. These laws are known as Newton's laws of motion.

Newton's First Law of Motion (Law of Inertia) :

Any object remains in the state of rest or in uniform motion along a straight line, until it is compelled to change the state by applying external unbalanced force.

Explanation : If any object is in the state of rest, then it will remain in rest until an external force is applied to change its state. Similarly, an object will remain in uniform motion in a straight line until any external force is applied over it to change its state. This means all objects resist a change in their state. The state of any object can be changed by applying external forces only.

Newton's First Law of Motion in Everyday Life :

(a) A person standing in a bus falls backward when bus starts moving suddenly. This happens because the person and bus both are at rest while bus is not moving, but as the bus starts moving, the legs of the person start moving along with bus but upper portion of his/her body has the tendency to remain at rest. Because of this, the person falls backwards if he is not alert.

(b) A person standing in a moving bus falls forward if driver applies brakes suddenly. This happens because when bus is moving, the person standing in it is also in motion along with bus. But when driver applies brakes the speed of bus decreases suddenly or bus comes to the state of rest suddenly.In this condition the legs of the person which are in contact with the bus come to rest while the upper part of his/her body has the tendency to remain in motion. Because of this person falls forwards if he / She is not alert.

(c) Before hanging the wet clothes over laundry line, usually many jerks are given to the clothes to get them dried quickly. Because of jerks, droplets of water from the pores of the cloth fall on the ground and reduced amount of water in clothes dries them quickly. This happens because when suddenly clothes are in motion by giving jerks, the water droplets in it have the tendency to remain at rest and they are separated from clothes and fall on the ground.

(d) When a pile of coins on the carom-board is hit by a striker, only the coin at the bottom moves away leaving rest of the pile of coins at the same place. This happens because when the pile is struck with a striker, the coin at the bottom comes in motion while remaining coins in the pile have the tendency to remain at rest and they vertically fall on the carom-board and remain at same place.

(e) Seat belt in cars saves the passengers when sudden brake is applied, by stopping them from moving forwards.

Mass and Inertia

- The property of an object because of which it resists a change in its state is called inertia. Inertia of an object is measured by its mass. Inertia is directly proportional to the mass. This means inertia increases with increase in mass and decreases with decrease in mass. A heavy object will have more inertia than the lighter one.
- In other words, the natural tendency of an object that resists the change in state of uniform motion or rest of the object is called inertia.

- Since a heavy object has more inertia, thus it is difficult to push or pull a heavy box over the ground than the lighter one. Similarly, a greater opposing force is needed to stop a heavy body than a light body in the same time, if they are moving with the same speed.

Momentum

- Momentum is the quantity of motion an object has.
- The product of mass and velocity is called the momentum. Momentum is denoted by 'p'.

  Therefore, Momentum of the object = Mass × Velocity

  Or, $p = m \times v$

Where, p = momentum, m = mass of the object and v = velocity of the object.

Momentum, Mass and Velocity

- Since momentum is the product of mass and velocity ($p = m \times v$) of an object. It means momentum is directly proportional to both mass and velocity. Momentum increases with increase of either mass or velocity of an object.
- This means if a lighter and a heavier object are moving with same velocity, the heavier object will have more momentum than the lighter one.
- If a small object is moving with great velocity, it has tremendous momentum. And because of momentum, it can harm an object more severely. For example, a small bullet having a little mass even kills a person when it is fired from a gun.
- Usually, road accidents prove more fatal because of high speed. This happens because vehicle running with high speed has high momentum.

Momentum of an object which is in the state of rest :

Let an object with mass 'm' be in the state of rest.

Since, object is at rest, its velocity, $v = 0$

Now, we know that

$$\text{Momentum} = \text{mass} \times \text{velocity}$$

Or $$p = m \times 0 = 0$$

Thus, the momentum of an object at rest *i.e.,* non-moving, is equal to zero.

Unit of momentum :

SI unit of mass = Kilogram i.e. kg

SI unit of velocity = meter per second *i.e.,* m/s

We know that $$\text{Momentum } (p) = m \times v$$

Therefore, $$p = \text{kg} \times \text{m/s}$$

Or $$p = \text{kg m/s}$$

Therefore, SI unit of momentum = kg m/s

Numerical Problems Based on Momentum

Type I. Calculation of Momentum

Example 1. *What will be the momentum of a stone having mass of 10 kg when it is thrown with a velocity of 2 m/s ?*

Solution : Mass (m) = 10 kg

Velocity (v) = 2 m/s

Momentum (p) = ?

We know that, $$\text{Momentum } (p) = \text{Mass } (m) \times \text{Velocity } (v)$$

Therefore, $$p = 10 \text{ kg} \times 2 \text{ m/s} = 20 \text{ kg m/s}$$

Thus, the momentum of the stone = 20 kg m/s. **Ans.**

Example 2. *The mass of a goods lorry is 4000 kg and the mass of goods loaded on it is 20000 kg. If the lorry is moving with a velocity of 2 m/s, what will be its momentum ?*

Solution : Given, Velocity (v) = 2 m/s

Mass of lorry = 4000 kg, Mass of goods on the lorry = 20000 kg

Therefore, Total mass (m) on the lorry = 4000 kg + 20000 kg = 24000 kg

Momentum (p) = ?

We know that, Momentum (p) = Mass (m) × Velocity (v)

Therefore, p = 24000 kg × 2 m/s

Or p = 48000 kg m/s

Thus, the momentum of the lorry = 48000 kg m/s. **Ans.**

Example 3. *A car having mass of 1000 kg is moving with a velocity of 0.5 m/s. What will be its momentum ?*

Solution : Given, Velocity of the car (v) = 0.5 m/s

Mass of the car (m) = 1000 kg

Momentum (p) = ?

We know that, Momentum (p) = Mass (m) × Velocity (v)

Therefore, p = 1000 kg × 0.5 m/s = 500 kg m/s

Thus, momentum of the car = 500 kg m/s. **Ans.**

Statement of Newton's Second Law of Motion

Rate of change of momentum of an object is proportional to applied unbalanced force in the direction of force.

Mathematical expression (Derivation)

Suppose, Mass of an object = m kg

Initial velocity of an object = u m/s

Final velocity of an object = v m/s

So, Initial momentum, $p_1 = mu$, Final momentum, $p_2 = mv$

$\therefore$ Change in momentum = Final momentum – Initial momentum

$$p = p_2 - p_1$$

$$p = mv - mu$$

$$p = m(v - u)$$

$$\therefore \text{Rate of change of momentum} = \frac{\text{Change in momentum}}{\text{Time taken}}$$

$$= \frac{m(v-u)}{t}$$

- According to IInd law, this rate of change is momentum is directly proportional to force.

$$\therefore \quad F \propto \frac{m(v-u)}{t}$$

We know that, $\frac{v-u}{t} = a$ (From Ist equation of motion)

$$F \propto ma$$

So, $F = kma$

Where k is a constant. Its value = 1.

$\therefore$ Taking K = 1, we get F = ma

Hence, the product of mass and acceleration gives force applied.

SI unit of force = kg m/s^2 or Newton (N)

Q. Define 1 Newton.

Ans. When an acceleration of 1 m/s^2 is seen in a body of mass 1 kg, then the force applied on the body is said to be 1 Newton.

Proof of Newton's First Law of Motion from Second Law

First law states that if external force F = 0, then a moving body keeps moving with the same velocity, or a body at rest continues to be at rest.

So, $F = 0$

We know $F = \frac{m(v-u)}{t}$

(a) A body is moving with initial velocity u, then

$$0 = \frac{m(v-u)}{t} = m(v-u) = 0 \quad t = 0$$

$$v - u = \frac{0}{m} = 0 \qquad \Rightarrow \qquad v - u = 0$$

So, $v = u$

Thus, final velocity is also same.

(b) A body is at rest *i.e.,* $u = 0$.

Therefore, from above $u = v = 0$

So, the body will continue to be at rest

Newton's Third Law of Motion

To every action there is an equal and opposite reaction.

Note : Action and reaction act on two different objects.

Applications :

(i) Walking on a road.

(ii) A boat moves back when we deboard it.

(iii) A gun recoils.

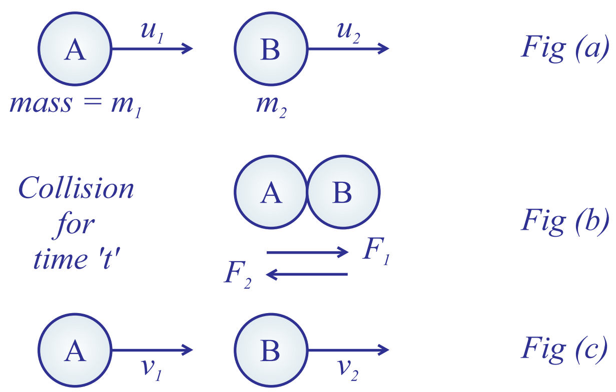
(iv) Rowing of a boat.

Law of Conservation of Momentum

When two (or more) bodies act upon one another, their total momentum remains constant (or conserved) provided no external forces are acting.

Initial momentum before collision = Final momentum after collision

Suppose, two objects A and B each of mass m_1 and mass m_2 moving initially with velocities u_1 and u_2, strike each other for time t and start moving with velocities v_1 and v_2 respectively.



Now, Initial momentum of object A = m_1u_1

Initial momentum of object B = m_2u_2

Final momentum of object A = m_1v_1

Final momentum of object B = m_2v_2

So, Rate of change of momentum in A, $F_1 = \dfrac{m_1v_1 - m_1u_1}{t}$

$$= \frac{m_1(v_1 - u_1)}{t} \qquad \text{...(i)}$$

And Rate of change of momentum in B, $F_2 = \dfrac{m_2v_2 - m_2u_2}{t}$

$$= \frac{m_2(v_2 - u_2)}{t} \qquad \text{...(ii)}$$

We know from the third law of motion,

$$F_1 = -F_2$$

So, $\dfrac{m_1(v_1 - u_1)}{t} = -\dfrac{m_2(v_2 - u_2)}{t}$ [From equations (i) & (ii)]

Or $m_1v_1 - m_1u_1 = -m_2v_2 + m_2u_2$

So $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Thus, Initial momentum = Final momentum

Hence, total momentum is conserved.

Example 1. *A bullet of mass 20 g is fired horizontally with a velocity of 150 m/s from a pistol of mass 2 kg. Find the recoil velocity of the pistol.*

Solution : Given, Mass (m_1) of bullet = 20 g = 0.02 kg

Mass (m_2) of pistol = 2 kg

Initially bullet is inside the gun and it is not moving.

So, Mass $= m_1 + m_2 = (0.02 + 2)$ kg = 2.02 kg

And $u_1 = 0$

So, Initial momentum = $2.02 \times 0 = 0$ ...(i)

Finally let the velocity of pistol be v_2 and v_1 for bullet = 150 m/s

So, Final momentum $= m_1v_1 + m_2v_2$

$= 0.02 \times 150 + 2v_2$ ...(ii)

We know that Initial momentum = Final momentum

So, $0 = 0.02 \times 150 + 2v_2$ [From equations (i)

$0 = \frac{2}{100} \times 150 + 2v_2$ and (ii)]

$\Rightarrow$ $3 + 2v_2 = 0$

Or $2v_2 = -3$

$v_2 = \frac{-3}{2}$

Or $v_2 = -1.5$ m/s **Ans.**

(–)ve sign indicates that gun recoils in direction opposite to that of the bullet.

$\therefore$ recoil velocity of rifle = 1.5m/s backwards.

Example 2. *Two hockey players A of mass 50 kg is moving with a velocity of 4 m/s and another one B belonging to opposite team with mass 60 kg is moving with 3 m/s, get entangled while chasing ball and fall down. Find the velocity with which they fall down and in which direction ?*

Solution : Given, $m_A = 50$ kg, $u_A = 4$ m/s

$m_B = 60$ kg, $u_B = 3$ m/s

Initial momentum$_A$ $= m_A u_A$

$= 50 \times 4 = 200$ kg m/s

Initial momentum$_B$ $= m_B u_B$

$= 60 \times 3 = 180$ kg m/s

So, Total initial momentum $= 200 + 180 = 380$ kg m/s ...(i)

Final momentum $= (m_A + m_B)v = (50 + 60)v$

$= 110v$ ...(ii)

According to the law of conservation of momentum,

Initial momentum = Final momentum

$$380 = 110v$$

Or $v = \dfrac{380}{110} = 3.45$ m/s in the direction they were running. **Ans.**

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Can force be negative? If yes, is it possible?
2. What is the tendency of a body to resist its change of state called ?
3. Inertia is also measured by................of an object.
4. Higher the mass of an object, higher is its................ .
5. Force/Acceleration is determined by................
6. Why does the load from the cage above the seats in a bus falls down when suddenly brakes are applied ?
7. When a tree is shaken, its fruits and leaves fall down. Why?
8. Define momentum of a body.
9. On what factors does the momentum of a body depend?
10. Why is it difficult to walk on a slippery road?

SHORT ANSWER TYPE QUESTIONS

1. Quantity of motion contained in a body is................ .
2. Unit of momentum is................ .
3. Define 1 Newton.
4. Although we know that a moving body keeps moving indefinitely until an external force is applied on it, then why does a ball stop when we slide it on ground (without stopping it) ?
5. Why is it difficult to stop a truck suddenly than a motorbike ?
6. When a metro suddenly stops all the passengers fall forward on its floor. Why does this happen ?

7. We have atmosphere above us that exerts a huge pressure on our shoulders, head and whole body. Why don't we get crushed under it ?

8. A coin of mass 1 kg and a stone of mass 5 kg are thrown down the Eiffel Tower with an acceleration of 10 m/s^2. Which one would reach ground early and why ?

9. Give applications of the First law of motion. (Law of inertia)

10. (a) Friction is measured in.................. .
    (b) Distinguish between balanced and unbalanced forces.

LONG ANSWER TYPE QUESTIONS

1. (a) Derive the first law of Newton from the second law.
   (b) Find the force required to stop a car of mass 1000 kg with two passengers each of 50 kg sitting inside, if it is moving at 60 km/hr speed and takes 5 s to stop.

2. Two balls A and B of masses 40 g and 50 g are moving at speeds of 40 m/s and 30 m/s respectively. If after colliding, B statrs moving with a velocity of 25 m/s, what is the velocity of A ?

3. A girl of mass 30 kg jumps on a cart of mass 5 kg with a velocity of 10 m/s. Find the velocity with which both together start moving after she jumps on it.

4. (a) Why does a gunman get a jerk on firing a bullet?
   (b) Calculate the momentum of a toy car of mass 200 gm moving with a speed of 5 m/s. [Hint - convert mass into kg].
   (c) State the law of conservation of momentum.

5. For how long should a force of 100 N act on a body of 20 kg so that it acquires a velocity of 100 m/s? [Hint - using formula $F = ma$. $v = u + at$]

6. (a) Find the acceleration produced by a force of 5 N acting on a mass of 10 kg.

(b) Which would require a greater force : (a) accelerating a 10 gm mass by 5 m/s^2 or (b) a 20 gm mass by 2 m/s^2?
[Hint:convert mass into kg].

7. The velocity of a body of mass 10 kg increases from 4 m/s to 8 m/s when a force acts on it for 2s.

   (a) What is the momentum before the force acts on the body ?

   (b) What is the momentum after the force acts?

   (c) What is the gain in momentum per second?

   (d) What is the value of force?

   $$\left[\text{Hint: } a = \frac{v-u}{t} \text{ and } F = ma\right]$$

Answers to Long Answer Type Questions

1. (b) -11000/3 N
2. 46.25 m/s
3. 8.57 m/s
4. (b) 1 kg ms
5. 20 secs.
6. (a) 0.5 m/s^2
   (b) A greater force of 0.05 N is required for accelerating a 10 gm mass.
7. (a) 40 kg.m/s
   (b) 80 kg.m/s
   (c) 20 kg.m/s^2
   (d) 20 N.

OBJECTIVE TYPE QUESTIONS :

I MCQ.

(i) A truck and a car are moving with equal velocity, on applying brakes, both will stop after certain distance and then :

(a) Truck will cover less distance before stopping.

(b) Car will cover less distance before stopping.

(c) Both will cover equal distance.

(d) None of the above.

(ii) In which of the following cases, the net force is not zero ?

(a) An object floating in air

(b) A ball freely falling from a certain height.

(c) A cork floating on the surface of water

(d) All the cases.

(iii) A force acts on a body of mass 3kg such that its velocity changes from $4ms^{-1}$ to $10\ ms^{-1}$. The change in momentum of the body is :

(a) $42Kgms^{-1}$ (b) $2Kgms^{-1}$ (c) $18Kgms^{-1}$ (d) $14Kgms^{-1}$

(iv) While opening a tap with two fingers, the forces applied are:

(a) equal in magnitude (b) Parallel to each other

(c) opposite in direction (d) All of the above

(v) **The engine of a car produces an acceleration of $4ms^{-2}$ in a car. If this car pulls another car of same mass, what is the acceleration produced?**

(a) $8ms^{-2}$ (b) $2ms^{-2}$ (c) $4ms^{-2}$ (d) $0.5ms^{-2}$

(vi) A force of 100N acts on a body of mass 2kg for 10 sec. The change in the velocity of the body is

(a) $100ms^{-1}$ (b) $250ms^{-1}$ (c) $500ms^{-1}$ (d) $1000ms^{-1}$

II Assertion and Reason type questions :

Choose the appropriate answer from the following choices :

- **Assertion Reasoning Questions :-**

Read the Assertion (A) and Reason (R) statements carefully and mark the correct option out of the following :

a) Both Assertion (A) and Reason (R) are true, and (R) is correct explanation of the assertion (A)

b) Both (A) and (R) are true, but (R) is not current explanation of (A).

c) (A) is True but (R) is false.

d) (A) is False but (R) is true.

(i) **Assestion (A) :** If the external force on the body is zero, then its acceleration is zero.

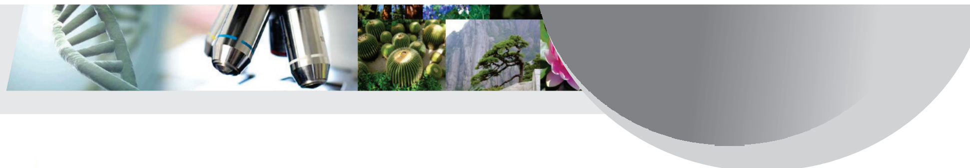
Reason (R) : Acceleration does not depend on force.

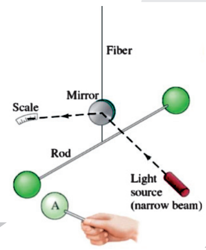
(ii) **Assertion (A) :** If two objects of different masses have same momentum, the lighter body possess greater velocity.

Reason (R) : For all bodies momentum always remains same.

(iii) **Assertion (A) :** Newton's third law of motion is applicable only when bodies are in motion.

Reason (B) : Newton's third law applies to all types of forces eg., gravitaional, electric or magnetic force etc.





Chapter - 9

Gravitation

CONCEPT MAPPING

Gravitation

Newton's Universal law of gravitation

Force (F) = $\frac{GM_1M_2}{R^2}$

G = Gravitational Constant

M_1 = Mass of object 1

M_2 = Mass of object 2

R = distance between object

W = m × g

Weight = Mass × Acceleration due to gravity
Gravity

Buoyant force 'f'

Thrust → Pressure

P = F/A

P = Pressure

F = Force

A = Area

Acceleration due to gravity (g) = 9.8 m/s^2

$g = \frac{GM}{R^2}$

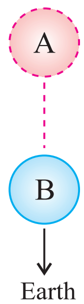
R = Radius of Earth

M = Mass of Earth

G = Gravitational constant

Value of G = 6.67×10^{-11} Nm^2/kg^2

Gravitational Force of Earth



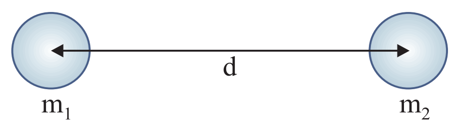
If we release a small stone without pushing it from a height, it accelerates towards earth. The stone is accelerated towards earth, means some force is acting on it or gravity of earth.

The force which pulls the objects towards the centre of the earth is known as gravitational force of the earth or gravity of earth.

Here, stone also attracts earth. It means every object in universe attracts every other object, by a force called gravitational force.

Newton's Universal Law of Gravitation *(Imp.)*

Sir Isaac Newton in 1687 proposed a law about the force of attraction between two objects in the universe which is known as Newton's law of gravitation.



According to this law :

Every mass in this universe attracts every other mass with a force which is directly proportional to the product of two masses and inversely proportional to the square of the distance between them.

Let masses (m_1) and (m_2) of two objects are distance (d) apart, then force of attraction (F) between them

$$F \propto m_1 \times m_2$$

$$F \propto \frac{1}{d^2}$$

$$F \propto \frac{m_1 \times m_2}{d^2}$$

$$F = \frac{Gm_1 \times m_2}{d^2}$$

where G is a proportionality constant and is known as Gravitational constant.

Value of G = 6.67×10^{-11} Nm^2/kg^2

G is called universal gravitational constant.

If unit of F is in Newton, m is in kg, d is in metre, then unit of G can be calculated as :

$$G = \frac{F \times d^2}{m_1 \times m_2} \text{ so unit be } \frac{Nm^2}{kg^2} \text{ or } Nm^2/kg^2$$

Relation between Newton's third law of motion and Newton's law of gravitation

According to Newton's third law of motion, **"Every object exerts equal and opposite force on other object but in opposite direction."**

According to Newton's law of gravitation, "Every mass in the universe attracts the every other mass."

In case of freely falling stone and earth, stone is attracted towards earth means earth attracts the stone but according to Newton's third law of motion, the stone should also attract the earth and really it is true that stone also attracts the earth with the same force $F = m \times a$ but due to very less mass of the stone, the acceleration (a) in its velocity is 9.8 m/s^2 and acceleration (a) of earth towards stone is 1.65×10^{-24} m/s^2 which is negligible and we cannot feel it.

Importance of universal law of gravitation

(i) The force that binds us to the earth.

(ii) The motion of moon around the earth.

(iii) The motion of earth around the sun.

(iv) The tides due to moon in the sea.

Free fall of an object and acceleration during free fall

When an object is thrown upward, it reaches certain height, then it starts falling down towards earth. It is because the earth's gravitational force is exerted on it.

This fall under the influence of earth is called 'free fall of an object'.

During this free fall direction do not change but velocity continuously changes the rate of which is called acceleration due to gravity.

It is denoted by 'g'.

Its unit is same as acceleration i.e. m/s^2.

Gravitational Acceleration and its value at the surface of earth

The uniform acceleration produced in a freely falling object due to the gravitational force of earth, is called acceleration due to gravity. It is represented by 'g' and it always acts towards the centre of the earth.

Value of 'g' on the surface of earth

The force acting on an object is

$$F = \frac{GM_e m}{R^2} \qquad \text{...(i)}$$

Where M_e = Mass of earth

m = Mass of an object

R = Radius of earth

and if acceleration due to gravity is 'g' due to force F then,

$$F = m \times g \qquad \text{...(ii)}$$

Equating (i) and (ii), we get
$$m \times g = \frac{GM_e m}{R^2}$$

Or
$$g = \frac{GM_e}{R^2}$$

If $G = 6.673 \times 10^{-11}$ Nm^2/kg^2, $M_e = 6 \times 10^{24}$ kg, $R^2 = (6.37 \times 10^6)^2$ m^2

Then,
$$g = \frac{6.6734 \times 10^{-11} \times 6 \times 10^{24}}{(6.37 \times 10^6)^2}$$

$$g = 9.8 \text{ m/s}^2$$

Relationship and difference between 'G' and 'g'

G = Gravitational constant

g = Acceleration due to gravity

$$g = \frac{GM}{R^2}$$

Difference between G (Gravitational constant) and *g* (Acceleration due to gravity)

Gravitation Constant (G)	Gravitational acceleration (g)
1. Its value is 6.6734×10^{-11} Nm^2/kg^2.	1. Its value is 9.8 m/s^2.
2. Its value remains constant always and everywhere.	2. Its value varies at various places.
3. Its unit is Nm^2/kg^2.	3. Its unit is m/s^2.
4. It is a scalar quantity.	4. It is a vector quantity.

Example. *If two stones of 150 gm and 500 gm are dropped from a height, which stone will reach the surface of earth first and why ? Explain your answer. (Imp.)*

Ans. It was Galileo, who first time demonstrated and depicted that the acceleration of an object falling freely towards earth does not depend on the mass of the object.

It can be verified by universal law of gravitation. Let an object of mass m, is allowed to fall from a distance of R, from the centre of the earth.

Then, the gravitational force, $$F = \frac{GM_e m}{R^2} \quad (M_e = \text{Mass of the earth})$$

The force acting on the stone is $$F = m \times a$$

So, $$m \times a = \frac{GM_e m}{R^2}$$

Or $$a = \frac{GM_e}{R^2}$$

So, acceleration in an object falling freely towards earth depends on the mass of earth and height of the object from the centre of the earth. So stones of mass 150 gm and 500 gm will reach the earth surface together.

Equation of motion when an object is falling freely towards earth or thrown vertically upwards :

Case 1. When an object is falling towards earth with initial velocity (u), then

Velocity (v) after t seconds, $v = u + gt$

Height covered in t seconds, $h = ut + \frac{1}{2}gt^2$

Relation between v and u when t is not mentioned :

$$\boxed{v^2 = u^2 + 2gh}$$

Case 2. When object is falling from rest position means initial velocity $u = 0$ (zero), then

Velocity (v) after t seconds, $v = gt$

Height covered in t seconds, $h = \frac{1}{2}gt^2$

Relation between v and u when t is not mentioned :

$$\boxed{v^2 = 2gh}$$

Case 3. When an object is thrown vertically upwards with initial velocity u, the gravitational acceleration will be negative ($-g$), then

Velocity (v) after t seconds, $v = u - gt$

Height covered in t seconds, $h = ut - \frac{1}{2}gt^2$

Relation between v and u when t is not mentioned :

$$\boxed{v^2 = u^2 - 2gh}$$

Mass

The mass of a body is the quantity of matter contained in it. Mass is a scalar quantity which has only magnitude but no direction.

SI unit of mass is kilogram which is written in short form as kg.

- Mass of a body is constant and does not change from place to place.
- Mass of a body is usually denoted by the small 'm'.
- Mass of a body cannot be zero.

Weight

The force with which an object is attracted towards the centre of the earth, is called the weight of the object.

$$\text{Force} = m \times a$$

In case of earth, $a = g$

So, $F = m \times g$

But the force of attraction of earth on an object is called its weight (W). So,

$$W = m \times g$$

So, weight is the force and its SI unit is Newton (N). It depends on 'g' and is a vector quantity.

Relation between 1 kg wt and express it into Newton :

We know that $W = m \times g$

If mass (m) = 1 kg, $g = 9.8$ m/s^2, then

$$W = 1\ \text{kg} \times 9.8\ \text{m/s}^2$$

Or $1\ \text{kg wt} = 9.8\text{N}$

So, the gravitational force of earth that acts on an object of mass 1 kg is called as 1 kg wt.

Distinguish between Mass and Weight

Mass	Weight
1. We can measure mass of an object by its inertia.	1. Weight = mass × acceleration or $m \times g$.
2. The total quantity of matter contained in an object is called mass of an object.	2. The gravitational force by which earth attracts an object is called weight of the object.
3. Mass of the object remains constant at all the places.	3. Weight of the object is different at different places.
4. Measurement of mass is done by using a pan or beam balance.	4. Measurement of weight is done by using a spring balance.
5. Mass does not change even when value of g is zero at any place.	5. Weight of the object becomes zero if g is zero.

Factors affecting value of *g*

Earth is not a perfect sphere. The radius of earth increases when we go from pole to equator. Therefore, in most of the calculation, we can take g as constant at the surface of earth or closer to it. But, as we move away from earth, we can use equation $g = \frac{GM}{d^2}$ for solving problems.

Example. *Calculate the value of 'g' at a height of 12800 km from the centre of the earth (radius of earth is 6400 km). Draw its interpretation.*

Solution : We know that $g_1 = \frac{GM_e}{(Re)^2}$, $R_e = 6400$ km

Height of the object from the centre of earth = 12800 km = $2R_e$

$$\therefore \qquad g_2 = \frac{GM_e}{(2R_e)^2}$$

Or
$$\frac{g_1}{g_2} = \frac{G \cdot M_e}{(R_e)^2} \times \frac{(2R_e)^2}{G \cdot M_e}$$

$$\frac{g_1}{g_2} = \frac{4}{1} \qquad \text{Or} \qquad 4g_2 = g_1$$

So, the value of gravitational acceleration 'g' at a distance of 12800 km from the centre of the earth is ¼.

The value of gravitational acceleration 'g' decreases with increasing height.

The weight of an object on moon is one-sixth of the weight on earth.

Let mass of an object be m, its weight on earth means the force by which earth attracts it towards the centre.

Now, $$F_e = \frac{GM_e m}{R_e^2} \qquad ...(i)$$

where G = Gravitational constant, M_e = Mass of the earth, m = Mass of object, R_e = Radius of the earth

Weight of an object on moon,

$$F_m = \frac{GM_m m}{R_m^2} \qquad ...(ii)$$

where M_m = Mass of the moon, R_m = Radius of the moon

Dividing equation (i) by equation (ii), we get

$$\frac{F_e}{F_m} = \frac{GM_e \cdot m}{R_e^{\ 2}} \times \frac{R_m^{\ 2}}{GM_m \cdot m}$$

$$\frac{F_e}{F_m} = \frac{M_e}{M_m} \times \left(\frac{R_m}{R_e}\right)^2$$

We know that mass of earth is 100 times the mass of the moon.

So, $M_e = 100M_m$

And radius of earth is 4 times the radius of moon.

So, $R_e = 4R_m$

Then,

$$\frac{F_e}{F_m} = \frac{100M_m}{M_m} \times \left(\frac{R_m}{4R_m}\right)^2$$

$$\frac{F_e}{F_m} = \frac{100}{1} \times \frac{1}{16}$$

$$\frac{F_e}{F_m} = 6 \text{ times (approx.)}$$

Hence, $F_e = 6F_m$

Thrust and Pressure

Thrust : The force acting on an object prependicular to the surface is called thrust.

Pressure : The effect of thrust per unit area is called pressure.

$$\text{Pressure (P)} = \frac{\text{Force (F)}}{\text{Area (A)}} = \frac{\text{Newton}}{\text{meter}^2} = \text{N/m}^2$$

SI unit of pressure is Nm^{-2}

which is called pascal (Pa)

Factors on which pressure depends

Pressure depends on two factors :

(i) Force applied

(ii) Area of surface over which force acts

Examples : *(Imp.)*

- The base of high buildings is made wider so that weight of walls act over a large surface area and pressure is less.
- School bags are having broad strap so that the weight of school bags fall over a larger area of the shoulder and produce less pressure and becomes less painful.
- The blades of knives are made sharp so very small surface area and on applying force, it produces large pressure and cuts the object easily.
- All liquids and gases are fluids and they exert pressure in all directions.

Buoyancy

The upward force experienced by an object when it is immersed into a fluid is called force of buoyancy. It acts in upward direction and it depends on the density of the fluid volume of object immersed in liquid.

- Force of gravitational attraction of the earth on the surface of the object $\leq$ buoyant force exerted by fluid on the surface of the object.

Result : The object floats.

- Force of gravitational attraction of the earth on the surface of the object > buoyant force exerted by fluid on the surface of the object.

Result : The object sinks.

That is why, allpin sinks and boat/ship floats on the surface of water. (Archimedes' principle)

Density

The mass per unit volume is called density of an object. If M is the mass and V is the volume, then density (d) is

$$\text{Density } (d) = \frac{\text{Mass}\left(\text{M}\right)}{\text{Volume}\left(\text{V}\right)}$$

SI unit = kg/m^3

Archimedes' Principle *(Imp.)*

It states, when a body is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.

Applications of Archimedes' Principle :

(i) It is used in determining relative density of substances.

(ii) It is used in designing ships and submarines.

(iii) Hydrometers and lactometers are made on this principle.

It is because of this ship made of iron and steel floats in water whereas a small piece of iron sinks in it.

Relative density

The ratio of the density of a substance to that of the density of water is called relative density.

$$\text{Relative density} = \frac{\text{Density of a substance}}{\text{Density of water}}$$

It has no unit.

Solved Numericals *(Imp.)*

Example 1. *Relative density of gold is 19.3. The density of water is 10^3 kg/m^3. What is the density of gold in kg/m^3 ?*

Solution : Given, Relative density of gold = 19.3

Density of water = 10^3 kg/m^3

So, Density of gold = Relative density of gold × Density of water

$= 19.3 \times 10^3$

Hence, density of gold $= 19.3 \times 10^3$ kg/m^3. **Ans.**

Example 2. *Mass of 0.025 m^3 of aluminium is 67 kg. Calculate the density of aluminium.*

Solution : Given, Mass of aluminium = 67 kg

Volume of aluminium = 0.025 m^3

So, $\text{Density} = \frac{M}{V} = \frac{67}{0.025}$

$= 2680$ kg/m^3 **Ans.**

Example 3. *The mass of brick is 2.5 kg and its dimensions are 20 cm × 10 cm × 5 cm. Find the pressure exerted on the ground when it is placed on the ground with different faces.*

Solution : Given, Mass of the brick = 2.5 kg

Dimensions of the brick = 20 cm × 10 cm × 5 cm

So, Weight of the brick (Thrust/Force)

$= F = mg = 2.5 \times 9.8 = 24.5$ N

(i) When the surface area 10 cm × 5 cm is in contact with the ground, then

$$\text{Area} = 10 \times 5 = 50 \text{ cm}^2$$

$$= \frac{50}{10000} = 0.005 \text{ m}^2$$

So, $$P = \frac{F}{A} = \frac{24.5}{0.0050}$$

$$= 4900 \text{ N/m}^2$$ **Ans.**

(ii) When the surface area 20 cm × 5 cm is in contact with the ground, then

$$\text{Area} = 20 \times 5 = 100 \text{ cm}^2$$

$$= \frac{100}{10000} = 0.01 \text{ m}^2$$

So, $$P = \frac{F}{A} = \frac{24.5}{0.01}$$

$$= 2450 \text{ N/m}^2$$ **Ans.**

(iii) When the surface area 20 cm × 10 cm is in contact with the ground, then

$$\text{Area} = 20 \times 10 = 200 \text{ cm}^2$$

$$= \frac{200}{10000} = 0.02 \text{ m}^2$$

So, $$P = \frac{F}{A} = \frac{24.5}{0.02}$$

$$= 1225 \text{ N/m}^2$$ **Ans.**

Example 4. *A force of 20N acts upon a body whose weight is 9.8N. What is the mass of the body and how much is its acceleration ?*

Solution : Given, Force = 20N, Weight W = 9.8N

We know, $W = mg$

So, $9.8 = m \times 9.8$

Or $m = 1$ kg **Ans.**

And, $F = ma$

So, $20 = 1 \times a$

Or $a = 20 \text{ m/s}^2$ **Ans.**

Example 5. *A man weighs 1200N on the earth. What is his mass (take g = 10 m/s²) ? If he was taken to the moon, his weight would be 200N. What is his mass on moon ? What is his acceleration due to gravity on moon ?*

Solution : Given, Weight of man on earth $W_1 = 1200$ N

Weight of man on moon $W_2 = 200$ N

Gravitational acceleration of earth = 10 m/s^2

Now, $W = mg$

Or $m = W/g$

$= 120$ kg

So, mass on moon will be 120 kg as it is constant everywhere so mass of man on moon = 120 kg. **Ans.**

Now, $W_2 = mg_2$

Or $200 = 120 \times g$

Or $$g = \frac{200}{120} = \frac{10}{6} = \frac{5}{3}$$

$= 1.66$ m/s^2 **Ans.**

Example 6. *An object is thrown vertically upwards and reaches a height of 78.4 m. Calculate the velocity at which the object was thrown ? (g = 9.8 m/s^2)*

Solution : Given, $h = 78.4$ m, $v = 0$, $g = 9.8$ m/s^2, $u = ?$

$v^2 = u^2 - 2gh$

Or $0 = u^2 - 2 \times 9.8 \times 78.4$

Or $$u^2 = \frac{2 \times 98 \times 784}{10 \times 10}$$

Or $$u = \sqrt{\frac{2 \times 2 \times 49 \times 784}{10 \times 10}}$$

$$u = \frac{2 \times 7}{10}\sqrt{784}$$

Or $u = 39.2$ m/s^2 **Ans.**

Example 7. *What is the mass of an object whose weight is 49 Newton ?*

Solution : Given, Weight of object W = 49N

$g = 9.8$ m/s^2

Now, $W = mg$

Or $$m = \frac{W}{g} = \frac{49}{9.8}$$

$= 5$ kg **Ans.**

QUESTIONS

VERY SHORT ANSWERS QUESTION

1. State the universal law of gravitation.
2. Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth.
3. Is value of G constant at all the places ?
4. What is the weight of an object of mass 1 kg ? **Ans : 9.8N**
5. A body has weight of 10 kg on the surface of earth. What will be its weight when taken to the centre of the earth ? **Ans : 0**
6. What is the value of gravitational acceleration acting on a free falling object ?

SHORT ANSWERS QUESTION

1. What is the value of universal constant G and its unit ?
2. Why do pins sink in water ?
3. Name a factor on which g depends.
4. Name the balance used to measure weight of an object.
5. Mass of an object is 1600 gm on the earth. What is its mass on the moon? Why ? **Ans : 1600 gm**
6. Two objects placed in a room, are not pulling each other. Why ?
7. Name the force responsible for the motion of moon around the earth. How can some objects move around the earth ?

LONG ANSWERS QUESTION

14. State Archimedes' Principle and explain it with example.
15. State two factors on which buoyant force depends.
16. Density of aluminium is 2700 kg m-3. What is its relative density ? Denisty of water is 1000 kg m-3. Define relative density. **Ans : 2.7**
17. A ball is released from a height of 1 metre. What time it will take to reach the surface of the earth ? Ans : 0.45 s
18. A ball thrown up, vertically returns to the thrower after 6 s. Find :
    (a) the velocity with which it was thrown up. **Ans : 29.4 m/s**
    (b) the maximum height it reaches and **Ans : 4.9 m**
    (c) its position after 4 s. **Ans : 39.2 m**

OBJECTIVE TYPE QUESTIONS

MCQ.

1. A weightless balloon contains 200g of water. Its weight in water will be.

(a) 100g. (b) 200g. (c) 400g. (d) Zero.

2. Archimedes Principle holds for

(a) liquids only (b) Gases only
(c) liquids and gases both (d) may go anywhere.

3. The unit of relative density is

(a) Kgm^{-3} (b) gcm^{-3} (c) gl^{-1} (d) no unit

4. The relative density of a solid is 0.6. It floats in water with.

(a) 40% of its volume inside water (b) 60% of its volume
(c) whole of its volume inside water (d) any fraction of its volume inside a water

5. The Pressure exerted by man on earth is minimum when he

(a) Sits (b) Stands on one foot
(c) Stands M both feet (d) lies on ground.

6. If mass of a body is M on the earth surface, then the mass of the same body on the moon's surface is:

(a) M/6 (b) Zero (c) M (d) None

7. If a planet existed whose mass and radius were both half to those of the earth, the acceleration due to gravity at its surface would be.

(a) $19.6ms^{-2}$ (b) $4.9ms^{-1}$ (c) $2.45ms^{-2}$ (d) $9.8ms^{-2}$

8. The gravitational force between two bodies does not depend on

(a) Their Separation (b) Their masses
(c) The product of their masses. (d) The medium between the two bodies.

9. Match the coloumn

	Column I		Column II
(a)	Gravitational Const.)	(i)	$F = \frac{mg}{2}$
(b)	Acceleration due to gravity at earth's surgace (g).	(ii)	$F = \frac{mg}{4}$
(c)	Acceleration due to gravity at depth Centre	(iii)	$6.67x10^{-11}Nm^2kg^{-2}$
(d)	Force on a particle of mass 'm' placed at depth r/2 inside the earth	(iv)	Zero
(e)	Force on a particle of mass 'm' placed at height equal to radius of earth.	(v)	$9.8ms^{-2}$

- **Assertion Reasoning Questions :-**

  Read the Assertion (A) and Reason (R) statements carefully and mark the correct option out of the following :

  a) Both Assertion (A) and Reason (R) are true, and (R) is correct explanation of the assertion (A)

  b) Both (A) and (R) are true, but (R) is not current explanation of (A).

  c) (A) is True but (R) is false.

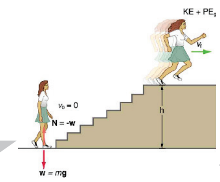
  d) (A) is False but (R) is true.

Q1 Assertion (A) : The value of acceleration due to gravity is maximum at the poles and minimum at the equator.

Reason (R) : Radius of earth is least along poles and maximum along the equatorial plane.

Q2. Assertion (A) : Although mass of an object has a constant value but its weight changes from place to place

Reason (R) : Weight = Mass x Acceleration due to gravity



Chapter - 10

Work And Energy

CONCEPT MAPPING

WORK = F x S
Unit = Joule (J)
1 Joule = 1 Newton × 1 Meter

Formula of work done
= force × displacement
or w = F × s
or w = F x s x Cos Θ

Work done may be
Positive +ive
Negative –ive
Zero (0)

ENERGY
capacity of doing work
Unit = Joule (J)

Rate of energy consumption

POWER
Rate of doing work
Power (P) = Work/Time (w/t)
Unit = Watt (W)
1 Watt = 1 Joule/1Second

Forms of energy —
1. Heat energy
2. Chemical energy
3. Electrical energy
4. Solar energy
5. Sound energy
6. Mechanical energy

Transformation of energy
Electrical energy → Heat energy
Battery → Bulb

Conservation of energy

Kinetic energy
$K_E = \frac{1}{2} mv^2$
Unit = Joule (J)

Potential energy
$P_E = mgh$
Unit = Joule (J)

Commercial unit of energy
kilowatt hour (kwh)
1 kwh = 3.6×10^6 Joules

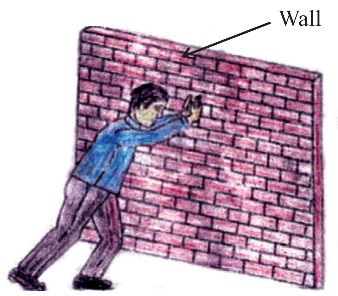
Work done :

For doing work, energy is required.

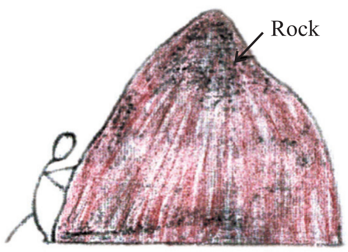
- In animals, energy is supplied by the food they eat.
- In machine, energy is supplied by fuel.

Not much work inspite of working hard : Reading, writing, drawing, thinking, and analysing are all energy consuming. But in scientific manner, no work is done in above cases.

- *Example :* A man is completely exhausted in trying to push a rock (wall), but work done is zero as the wall is remain stationary.
- A man standing still with heavy suitcase may be tired soon but he does no work in this situation as he is stationary.



When a force is applied on the wall, the wall does not move. So work is not done



When a force is applied on the rock, the rock does not move. So work is not done

Work is said to be done when :

(i) a moving object bring to rest.

(ii) an object at rest starts moving.

(iii) velocity of an object changes.

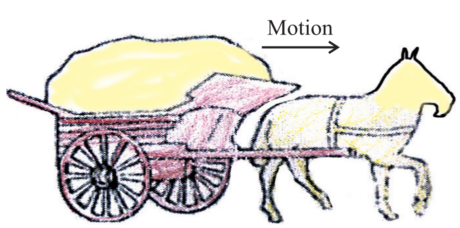
(iv) shape of an object changes.

Scientific Conception of Work is done when force is applied on a body and when that force produces motion under its influence.

Condition of Work done

(i) Force should be applied on the body.

(ii) Body should be displaced.



Force is applied by the horse and cart start moving.

Examples : Work is done when :

(i) A cyclist is pedalling the cycle.

(ii) A man is lifting load in upward or downward direction.

Work is not done when :

(i) A coolie carrying some load on his head stands stationary.

(ii) A man is applying force on a big rock, that does not move at all.

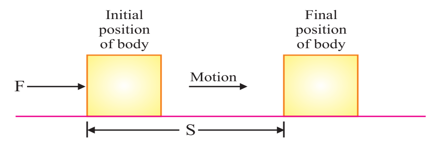
Work Done by a Fixed Force

Work done in moving a body is equal to the product of force and displacement of body in the direction of force.

$$\text{Work} = \text{Force} \times \text{Displacement}$$

$$W = F \times S$$

Work is a scalar quantity.



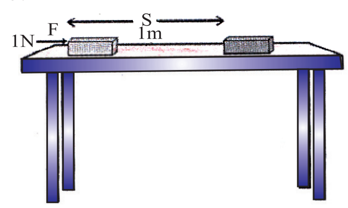
Unit of Work

Unit of work is **Newton metre or Joule.**

When a force of 1 Newton moves a body through a distance of 1 metre in its own direction, then the work done is known as 1 Joule.

$$1 \text{ Joule} = 1 \text{ Newton} \times 1 \text{ metre}$$

$$1 \text{ J} = 1 \text{ Nm}$$



$1J = 1N \times 1\ m$

Whenever work is done against gravity, the amount of work done is equal to the product of weight of the body and the vertical distance through which the body is lifted.

W = Weight of body x vertical distance.

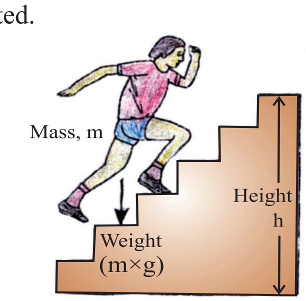
W = m x g x h

m - mass of the body

g - acceleration due to gravity

h - height through which the body is lifted.

Note : Here, force required to lift the body is equal to its weight.



During climbing work is done against gravity

The amount of work done depends on the following factors :

(i) **Magnitude of force :** Greater the force, greater is the amount of work & vice-versa.

(ii) **Displacement :** Greater the displacement, greater is the amount of work & vice-versa.

Negative, Positive and Zero Work

Work done by a force can be positive, negative or zero.

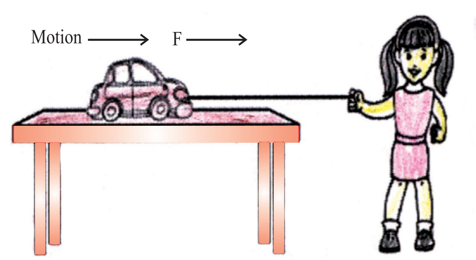
(i) Work done is **positive** when a force acts in the direction of motion of the body. ($\theta = 0^o$) (θ is the angle between the applied force and direction of object)

θ = angle between direction of force applied & the motion of body.

Example : A child pulls a toy car with a string horizontally on the ground. Here work done is positive.

Case I

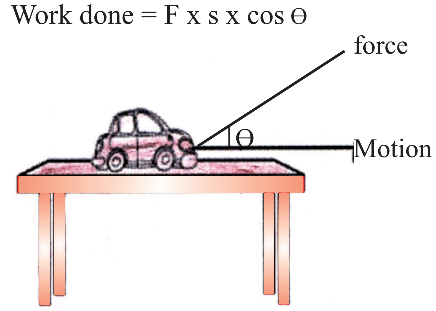
$W = F \times S$



Positive work done

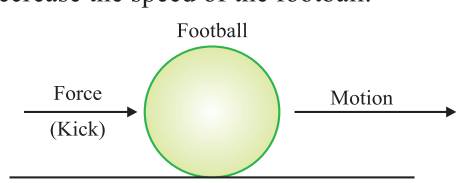
Case II

Work done = F x s x cos θ

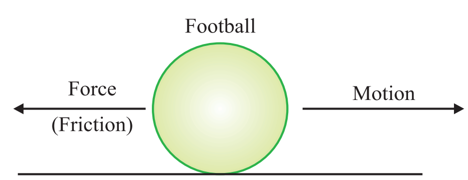


(ii) Work done is **negative** when a force acts opposite to the direction of motion of the body. (θ= 180^o)

Example : When we kick a football lying on the ground, the force of our kick moves the football. Here direction of force applied & motion of football is same so work done is positive. But the football moving on the ground slows down gradually and ultimately stops. This is because a force due to friction (of ground) acts on the football. This force of friction acts in a direction opposite to the direction of motion of football. So, in this case, the work done by the force of friction on the football is negative (and) it decrease the speed of the football.



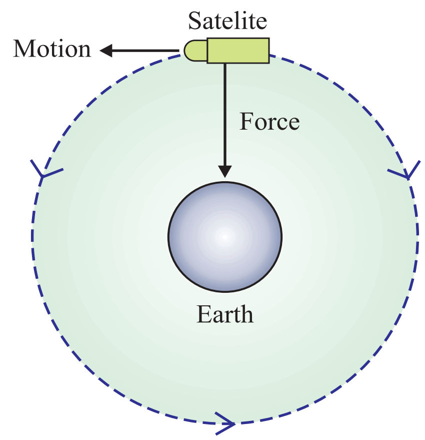
Positive work



Negative work

(iii) Work done is **zero** when a force acts at right angles to the direction of motion. (θ= 90^o)

Example : The moon moves around the earth in circular path. Here force of gravitation acts on the moon at right angles to the direction of motion of the moon. So work done is zero.



Zero work

- -ve (negative) sign indicates that work is done against gravity.

Note that if work is done against the direction of motion (gravity), then it is taken –ve.

Example. *A coolie lifts a luggage of 15 kg from the ground and put it on his head 1.5 m above the ground. Calculate the work done by him on the luggage.*

Solution : Mass of luggage (m) = 15 kg

Displacement (S) = 1.5 m

So, Work done, W = F × S

$= mg \times S$ [F= mg]

$= 15 \times 10 \times 1.5$ [$g = 10$ m/s^2]

[g = force of gravity]

$= 225.0$ kg m/s^2

= 225 Nm = 225 J

Hence, work done = 225 J.

Energy

(i) The sun is the biggest source of energy.

(ii) Most of the energy sources are derived from the Sun.

(iii) Some energy is received from nucleus of atoms, interior of the earth and the tides.

Definition : The capacity of doing work is known as energy.

The amount of energy possessed by a body is equal to the amount of work it can do. Working body loses energy, body on which work is done gains energy.

Energy is a scalar quantity.

Unit : The SI unit of energy is Joule (J) and its bigger unit is kilo joule (kJ).

$$1 \text{ kJ} = 1000 \text{ J}$$

The energy required to do 1 Joule of work is called 1 Joule energy.

Forms of Energy

Main forms of energy are :

(i) Kinetic energy
(ii) Potential energy
(iii) Heat energy
(iv) Chemical energy
(v) Electrical energy
(vi) Light energy
(vii) Sound energy
(viii) Nuclear energy

- Sum of kinetic energy & potential energy of a body is called mechanical energy.

Mechanical energy

The energy possessed by a body on account of its motion or position is called mechanical energy.

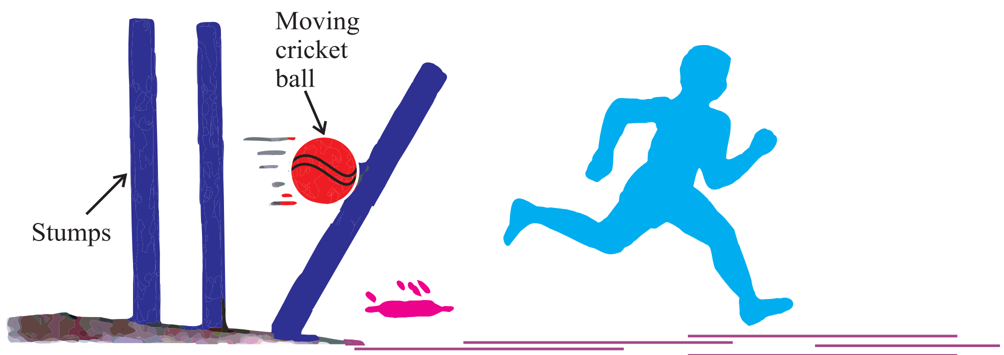
Kinetic Energy

The energy possess by an object due to its motion is called kinetic energy.

Examples of kinetic energy :

- A moving cricket ball
- Running water
- A moving bullet, stone
- Flowing wind
- A moving car, arrow
- A running athelete
- A rolling stone

- Flying aircraft



Kinetic energy

Kinetic energy is directly proportional to mass and the square of velocity.

Formula for Kinetic Energy

The kinetic energy of a moving body is measured by the amount of work it can do before coming to rest. If an object of mass 'm' moving with uniform velocity 'u', it is displaced through a distance 's', Constant force 'F' acts on it in the direction of displacement velocity changes from 'u' to 'v'. Then acceleration is 'a'.

$$\text{Work done, W} = F \times s \qquad ...(i)$$

and

$$F = ma \qquad ...(ii)$$

According to third equation of motion, relationship between u, v, s and a is as follows :

$$v^2 - u^2 = 2as$$

So,

$$s = \frac{v^2 - u^2}{2a} \qquad ...(iii)$$

Now putting the value of F and s from (ii) and (iii) in equation (i),

$$W = ma \times \frac{v^2 - u^2}{2a}$$

$$= \frac{m}{2} \times v^2 - u^2 = \frac{1}{2} m\left(v^2 - u^2\right)$$

If $u = 0$ (when body starts moving from rest)

$$W = \tfrac{1}{2}mv^2$$

Or

$$E_K = \tfrac{1}{2}mv^2$$

Example. *An object of mass 15 kg is moving with uniform velocity of 4 m/sec. What is the kinetic energy possessed by it ?*

Solution : Mass of the object, m = 15 kg

Velocity of the object, v = 4 m/s

$E_K = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 15 \text{ kg} \times 4 \text{ ms}^{-1} \times 4 \text{ ms}^{-1}$

$= 120$ J

The kinetic energy of the object is 120 J.

Potential Energy

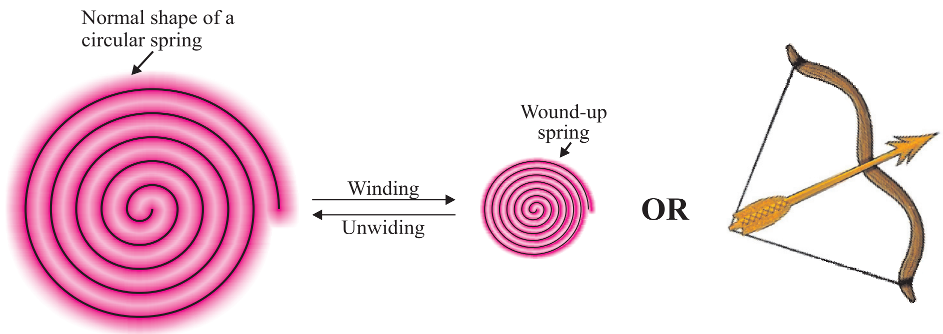
The energy of a body due to its position or change in shape is known as potential energy.

Examples :

(i) Water kept in dam : It can rotate turbine to generate electricity due to its position above the ground.

(ii) Wound up spring of a toy car : It possess potential energy which is released during unwinding of spring. So toy car moves.

(iii) Bent string of bow : Potential energy due to change of its shape (deformation) released in the form of kinetic energy while shooting an arrow.



Factors affecting Potential Energy

(i) Mass : P. E. $\propto m$

More the mass of body, greater is the potential energy and vice-versa.

(ii) Height above the ground :

P. E. $\propto h$ (does not depend on the path it follows)

Greater the height above the ground, greater is the P.E. and vice-versa.

(iii) Change in shape : Greater the stretching, twisting or bending, more is the potential energy.

Potential Energy of an Object on a Height

If a body of mass 'm' is raised to a height 'h' above the surface of the earth, the gravitational pull of the earth ($m \times g$) acts in downward direction. To lift the body, we have to do work against the force of gravity.

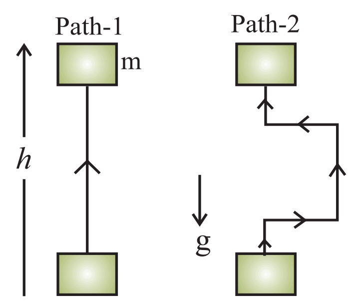
Thus, Work done, W = Force × Displacement

Or W $= m \times g \times h = mgh$

This work is stored in the body as potential energy (gravitational potential energy).

Thus, Potential energy, $E_P = m \times g \times h$

where g = acceleration due to gravity.



Ep = M×g×h = Ep = mgh

Example. *If a body of mass 10 kg is raised to a height of 6 m above the earth, calculate its potential energy.*

Solution : Potential energy of the body = mgh

Mass of body = 10 kg

Height above the earth = 6 m

Acceleration due to gravity = 10 m/s^2

So, $E_P = 10 \times 10 \times 6$

$= 600$ J

Thus, potential energy of the body is 600 Joules.

Transformation of Energy

The change of one form of energy to another form of energy is known as transformation of energy.

Example :

(i) A stone on a certain height has entire potential energy. But when it starts moving downward, potential energy of stone goes on decreasing as height goes on decreasing but its kinetic energy goes on increasing as velocity of stone goes on increasing. At the time stone reaches the ground, potential energy becomes zero and kinetic energy is maximum.

Thus, its entire potential energy is transformed into kinetic energy.

(ii) At hydroelectric power house, the potential energy of water is transformed into kinetic energy and then into electrical energy by dynamo.

(iii) At thermal power house, chemical energy of coal is changed into heat energy, which is futher converted into kinetic energy and electrical energy.

(iv) Plants use solar energy to make chemical energy in food by the process of photosynthesis.

Law of Conservation of Energy

- Whenever energy changes from one form to another form, the total amount of energy remains constant.
- "Energy can neither be created nor be destroyed."
- Although some energy may be wasted during conversion, but the total energy of the system remains the same.

Conservation of Energy during Free Fall of a Body

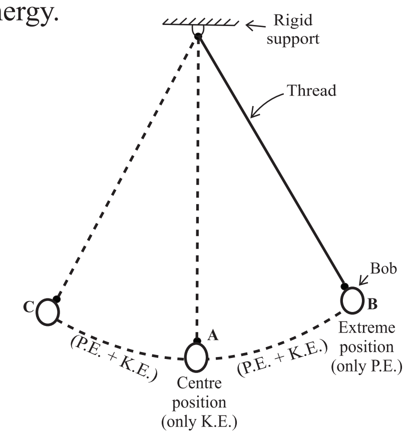
- A ball of mass 'm' at a height 'h' has potential energy = mgh.
- As ball falls downwards, height 'h' decreases, so the potential energy also decreases.
- Kinetic energy at 'h' is zero but it is increasing during falling of ball.
- The sum of potential energy & kinetic energy of the ball remains the same at every point during its fall.

$$\tfrac{1}{2}mv^2 + mgh = \text{Constant}$$

Kinetic energy + Potential energy = Constant

	Ball		P.E. of Ball	K.E. of Ball	Total Energy of Ball (P.E. + K.E.)
Ball at rest		A	20J	0J	20 + 0 = 20J
Falling ball		B	15J	5J	15 + 5 = 20J
Falling ball		C	10J	10J	10 + 10 = 20J
Falling ball		D	5J	15J	5 + 15 = 20J
Just before hitting the ground		E	0J	20J	0 + 20 = 20J

Conservation of energy in a simple Pendulum A swinging pendulum shows an example of conservation of energy.



A swinging (or oscillating) simple pendulum

A simple pendulum consists of small metal ball (called bob) suspended by a long thread from a rigid support, such that the bob is free to swing back and forth when displaced.
Its energy is continuously transformed (or converted) from potential energy to kinetic energy and vice-versa.
The total energy of the swinging pendulum at any instant remains the same (or conserved).
The body which does work loses energy and the body on which work is done gains energy.

Rate of Doing Work = Power

"Power is defined as the rate of energy consumption." or Rate of doing work.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}} \quad \text{Or} \quad P = \frac{W}{t}$$

where P = Power

W = Work done

t = Time taken

Unit of Power

SI unit of Power is Watt (W) = 1 Joule/second.

$$1 \text{ Watt} = \frac{1 \text{ Joule}}{1 \text{ second}} \quad \text{Or} \quad 1 \text{ W} = \frac{1 \text{ J}}{1 \text{ s}}$$

Power is one Watt when one Joule work is done in one second.

$$\text{Average Power} = \frac{\text{Total work done or total energy used}}{\text{Total time taken}}$$

Power of Electrical Gadget

The power of an electrical appliance tells us the rate at which electrical energy is consumed by it. Here, when work is done, an equal amount of energy in consumed.

Bigger unit of Power : Bigger unit of power is called Kilowatt or KW.

1 Kilowatt (KW) = 1000 Watt = 1000 W or 1000 J/s

Example. *A body does 20 Joules of work in 5 seconds. What is its power ?*

Solution :

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Work done = 20 Joules

Time taken = 5 sec.

$$P = \frac{20 \text{ J}}{5 \text{ s}}$$

So, Power = 4 J/s = 4 W

Thus, power of the body is 4 Watts.

QUESTIONS
OBJECTIVE TYPE QUESTIONS

I. Objective Type Questions.

(i) If Ramesh has done the same amount of work in less time as compared to Rohan then

(a) Ramesh has more power (b) Rohan has more power

(c) both have equal power (d) None of these

(ii) A flying kite possesses

(a) only potential energy (b) Only kinetic energy

(c) both P.E. and K.E. (d) neither P.E. nor K.E.

(iii) The workdone on an object does not depend upon the

(a) Displacement (b) force applied

(c) angle between force (d) initial velocity of the object

(iv) If a force F applied on a body gives its velocity V, its power will be.

(a) Fv (b) F/v

(c) Fv^2 (d) F/v^2

(v) Two particles of masses 1g and 4g have equal kinetic energies. what is the ratio between their velocity?

(a) 1:4 (b) 1:8

(c) 1:2 (d) 1:16

(vi) Moon revolves around the earth due to gravitational force (F) of earth on moon. The work done by the gravitational force is (r=radius of circular orbit of moon).

(a) $F.2\pi r$ (b) $F.\pi r$

(c) Zero (d) negative work

II. Fill in the blanks :

(i) A 20 Kg. mass object is being lifted through a height of __________m when 784 J of work is done on it.

(ii) In a heat engine, heat energy is converted into ___________

(iii) If the velocity of a body is tripled, then the K.E. of the body becomes _________ times that its initial values.

(iv) If a proton and an electron are brought towards each other, the _________ will decrease.

VERY SHORT ANSWERS QUESTIONS

1. When we say the work is done?
2. Define 1 Joule of work.
3. Give an example in which a force does positive work.
4. Give an example in which a force does negative work.
5. Define the term energy of a body.
6. Write the units of : (a) Work, (b) Energy. (c) Power
7. Define power
8. Define 1 Watt energy
9. Define 1 Kilo Watt hour.
10. What are various energy transformations, that occurs when you hit a cricket ball?

SHORT ANSWERS QUESTIONS

1. What is conservation of energy ? Explain with an example.
2. What do you understand by kinetic energy ? Write its formula.
3. On what factors does the kinetic energy of a body depends ?
4. What happens to potential energy of a body when its height is doubled ?
5. How many joules are there in 1 Kilowatt hour ?

LONG ANSWERS QUESTIONS

1. What are the quantities on which the amount of work done depend ? How are they related to work ?
2. A load of 100 kg is pulled up to 5 m. Calculate the work done. (g = 10 m/s2) (Ans. 5000 J)
3. A body of mass m is moving with a velocity 5 ms^{-1}. Its kinetic energy is 25 J. If its velocity is doubled, what is its kinetic energy ? (Ans. 100 J)
4. A boy weighing 50 kg climbs up a vertical height of 100 m. Calculate the amount of work done by him. How much potential energy he gains ? (Given $g = 9.8\ m/s^2$) (Ans. 4.9×10^4 J)
5. Five electric fans of 120 watts each are used for 4 hours. Calculate the electrical energy consumed in kilowatt hours. (Ans. 2.4 KWh)
6. The power of an electric heater is 1500 Watt. How much energy it consumes in 10 hours ? [Ans. 15 KWh (units)]
7. a) Justify law of conservation of energy with the help of a suitable activity or example.

   b) Give 3 examples where kinetic energy changed to potential energy?

III Assertion and reasoning Questions

Directions : In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1. Assertion - As a ball falls downwards, potential energy keeps decreasing but kinetic energy keeps increasing.

Reason - Energy can neither be created nor be destroyed.

Ans. option (a)Law of conservation of energy implies that the sum of potential energy and kinetic energy of the ball remains same at every point during its fall.

Q2. Assertion - Work done by the gravitational force of a revolving satellite, around the Earth, in a circular motion is zero.

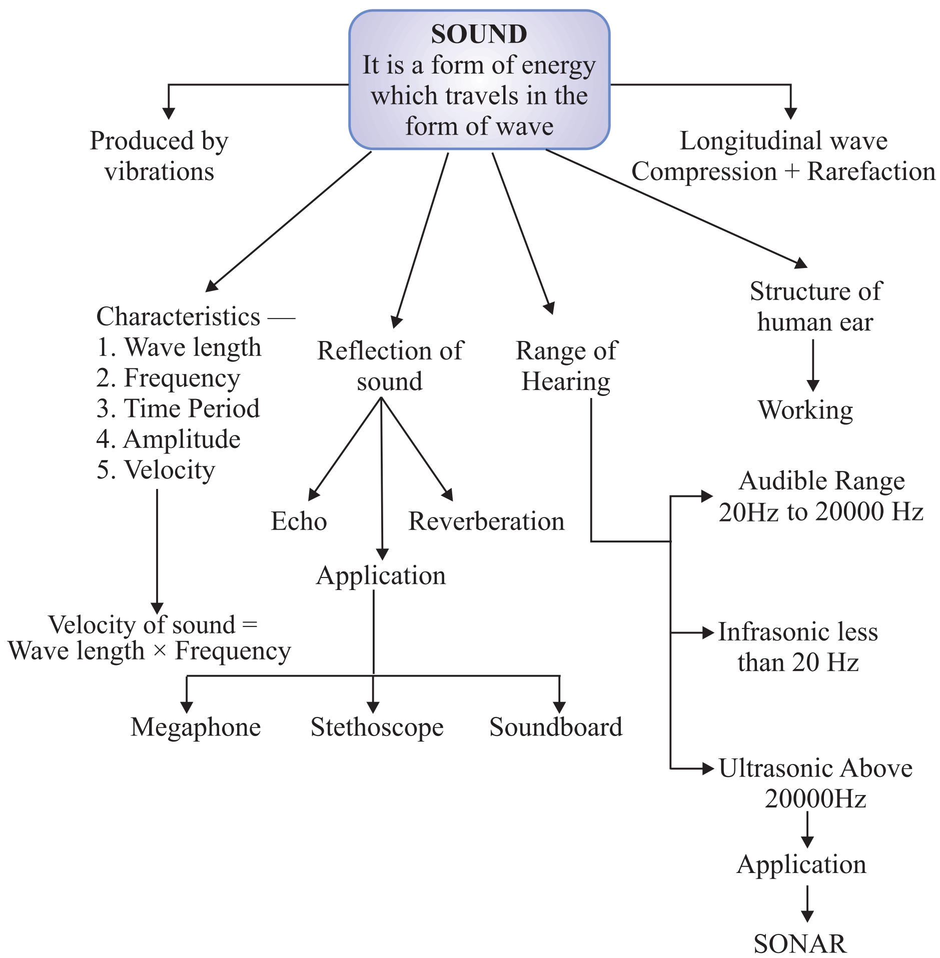
Reason - Force of gravitation acts on the satellite, opposite to the direction of motion of the satellite.

Ans . option (c) Force of gravitation acts on the satellite at right angles to the direction of motion of the satellite, therefore work done is zero therefore Assertion (A) is true but Reason (R) is false.

Chapter - 11

Sound

CONCEPT MAPPING



Sound

(i) The sensation felt by our ears is called sound.

(ii) Sound is a form of energy which makes us hear.

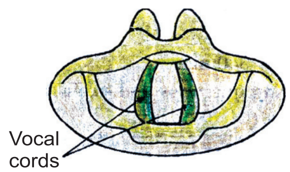
(iii) Law of conservation of energy is also applicable to sound.

(iv) Sound travels in form of wave.

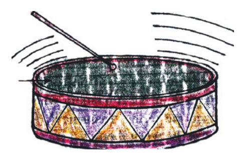
Production of Sound

Sound is produced when object vibrates or sound is produced by vibrating objects.

- The energy required to make an object vibrate and produce sound is provided by some outside source (like our hand, wind etc.).
- *Example :* Sound of our voice is produced by vibration of two vocal cords in our throat [Fig. (a)].
- Sound of a drum or tabla is produced by vibration of its membrane when struck [Fig. (b)].

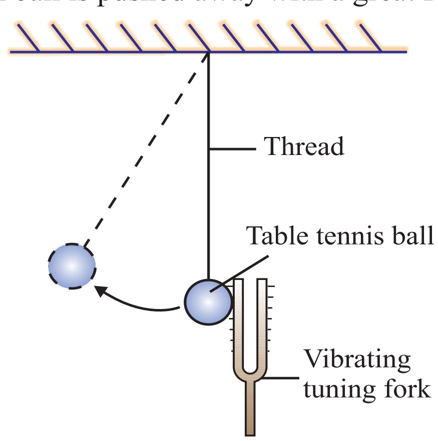


(a) Sound is produced when our vocal cords vibrate



(b) Sound is produced when the skin of a drum vibrates

- In laboratory experiments, sound is produced by vibrating tuning fork. The vibrations of tuning fork can be shown by touching a small suspended pith ball (cork ball) with a prong of the sounding tuning fork. The pith ball is pushed away with a great force.



Sound can be produced by following methods :

(i) By vibrating string (sitar)

(ii) By vibrating air (flute)

(iii) By vibrating membrane (table, drum)

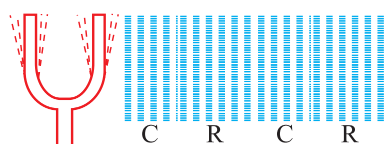
(iv) By vibrating plates (bicycle bell)

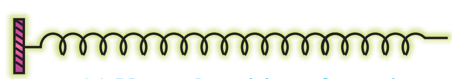
(v) By friction in objects

(vi) By scratching or scrubbing the objects etc.

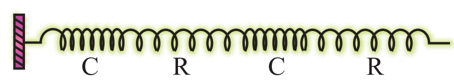
Propogation of Sound

- The substance through which sound travels is called a **medium**.
- The **medium** may be **solid**, **liquid** or **gas**.
- When an object vibrates, then the air particles around it also start vibrating in exactly the same way and displaced from their stable position.
- These vibrating air particles exert a force on nearby air particles so they are also displaced from their rest position and start to vibrate.
- This process is continued in the medium till sound reaches our ears.
- The disturbance produced by sound travels through the medium (not the particles of the medium).
- Wave is a disturbance which travels through a medium and carries energy.
- So sound travels in wave form known as mechanical waves.





(a) Normal position of a spring

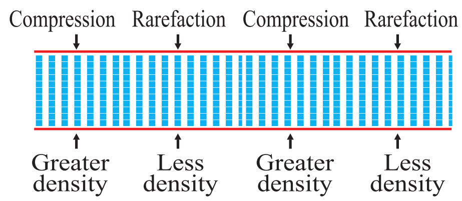


(b) Longitudinal wave in a spring

Sound Waves are Longitudinal Waves

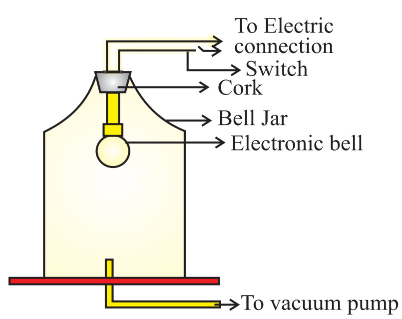
- When a body vibrates then it compresses the air surrounding it and forms an area of high density called compression (C).
- Compression is the part of wave in which particles of the medium are closer to one another forming high pressure.
- This compression moves away from the vibrating body.
- When vibrating body vibrates back an area of low pressure is formed called rarefaction (R).
- Rarefaction is the area of wave in which particles of the medium are further apart from one another forming a low pressure or low density area.

- When body vibrates back and forth, a series of compression and rarefaction is formed in air resulting in sound wave.
- Propogation of sound wave is propogation of density change.



Sound needs Medium for Propogation

- Sound waves are mechanical waves.
- It needs material medium for propogation like air, water, steel etc.
- It cannot travel in vaccum.
- An electric bell is suspended in airtight bell jar connected with vacuum pump.
- When bell jar is full of air, we hear the sound but when air is pumped out from the bell jar by vacuum pump and we ring the bell, no sound is heard.
- So medium is necessary for propagation of sound.
- So, sound can not be heard directly on the surface of moon/in outer space as there is no air/atmosphere at moon or in outer space. The astronauts who land on moon (or walk in outer space) talk to one another through wireless sets using radio waves.



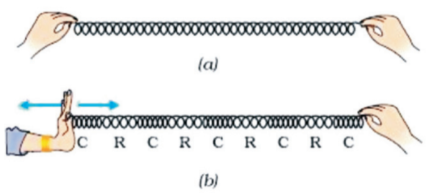
Experiment to show that sound cannot travel through vacuum *(Imp.)*

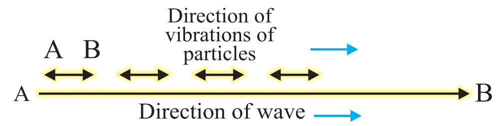
Sound Waves are Longitudinal Waves

(i) A wave in which the particles of the medium vibrate back and forth in the same direction in which the wave is moving, is called a **longitudinal wave**.

- When we push and pull the slinky compression (number of turns are more or closer) and rarefaction (number of turns are less or farther) are formed.

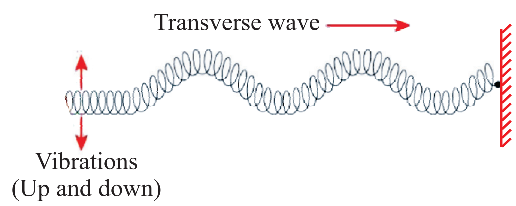
- When a wave travels along with slinky, its each turn moves back and forth by only a small distance in the direction of wave. So the wave is longitudinal.
- The direction of vibrations of the particles is parallel to the direction of wave.

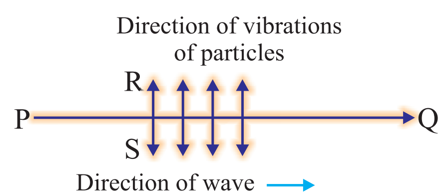




(ii) When one end of a slinky is moved up and down rapidly whose other end is fixed, it produces **transverse wave.**

- This wave moves along the slinky in horizontal direction, while turns of slinky (particles) vibrate up and down at right angle to the direction of wave.
- Thus in transverse wave particles of the medium vibrate up and down at right angles to the direction of wave.
- Light waves are transverse waves but they don't need a material medium for propagation.

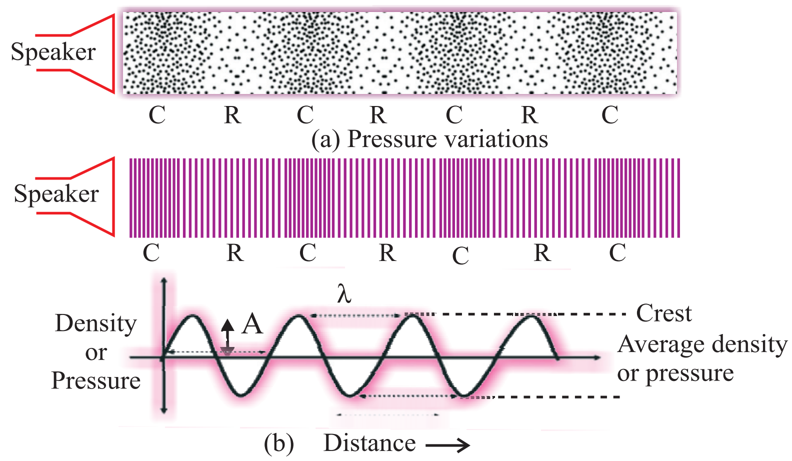




Characteristics of Sound Wave

The characteristics of sound waves are : wavelength, frequency, amplitude, time period and velocity.

- When a wave travel in air the density and pressure of air changes from their mean position.
- Compression is shown by crest while rarefaction is shown by trough.
- Compression is the region of maximum density or pressure.
- Rarefaction is the region of minimum density or pressure.



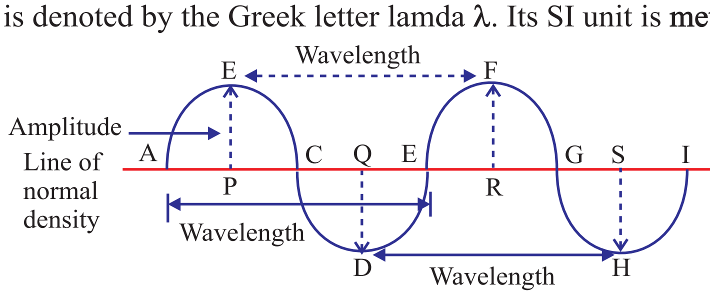
(i) Wavelength :

(a) In sound waves the combined length of a compression and an adjacent rarefaction is called its wavelength.

(b) The distance between the centres of two consecutive compressions or two consecutive rarefactions is also called its wavelength.

(c) So, we can say that the minimum distance in which a sound wave repeats itself is called its wave lenght.

(d) It is denoted by the Greek letter lamda λ. Its SI unit is **metre.**



(ii) Frequency :

(a) No. of complete waves produced in one second or number of vibrations per second is called frequency.

(b) Number of compressions or rarefactions passed in one second is also called frequency.

- Frequency of wave is same as the frequency of the vibrating body which produces the wave.
- The SI unit of frequency is **hertz (Hz)**. The symbol of frequency is ν **(nu).**
- **1 Hertz :** One Hz is equal to 1 vibration per second.
- Bigger unit of frequency is **kilohertz kHz = 1000 Hz.**

(iii) Time Period :

(a) Time taken to complete one vibration is called **time period.**

(b) Time required to pass two consecutive compressions or rarefactions through a point is called time period.

- SI unit of time period is **second (s)**. Time period is denoted by **T.**
- The frequency of a wave is the reciprocal of the time period.

$$v = \frac{1}{T}$$

(iv) Amplitude :

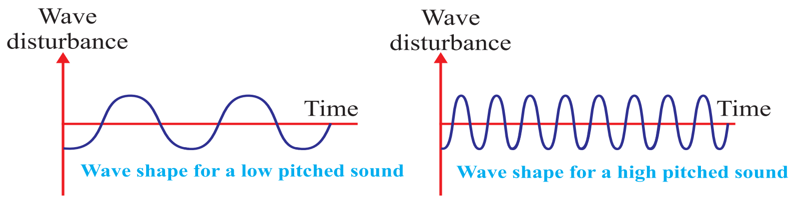
The maximum displacement of the particle of the medium from their original undisturbed position is called amplitude of the wave.

- Amplitude is denoted by **A and its SI unit is metre (m).**

Sound have characteristics like pitch and loudness and timbre.

Pitch : The pitch of sound depends on the frequency of sound (vibration). It is directly proportional to its frequency. Greater the frequency, higher is the pitch and lesser the frequency, lower is the pitch.

- A woman's voice is shrill having a high pitch while a man's voice is flat having low pitch. This is because women have shorter vocal cords, which vibrate more quickly and produce a higher pitch. On the other hand, men have longer vocal cords that vibrate with low frequencies giving then a flat deep voice.
- High pitch sound has large number of compressions and rarefactions passing a fixed point per unit time.



Loudness : The loudness depends on the amplitude of the sound wave.

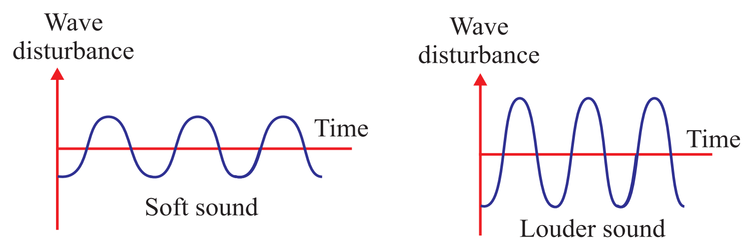
- Loudness is the measure of the sound energy reaching the ear per sec.
- Greater the amplitude of sound wave, greater is the energy, louder the sound; short is the amplitude, less is the energy, soft is the sound.
- Loudness is measured in decibel **'dB'**.

- Mathematically, Loudness of sound is proportional to the square of the amplitude of the vibration producing the sound.

$$\textbf{Loudness} \ \alpha \ \textbf{Amplitude}^2$$

eg.:- if amplitude becomes twice, the loudness increases by a factor of 4

- Anything above 80dB, the sound is considered as **'NOISE'.**



Quality or Timbre : The timbre of a sound depends on the shape of sound wave produced by it. It is the characteristic of musical sound.

- It helps us to distinguish between two sounds of same pitch & loudness.
- Sound of single (same) frequency is called **tone** while a mixture of different frequencies is called **note**. Noise is unpleasant to hear while music is pleasant to hear and it is of good quality.
- **Tone**- sound of single frequency is called tone
- **Note** - A sound that is produced when several frequencies are mixed, is called a note
- **Music**- An art of sound that has elements of rhythm, melody and harmony and is pleasant to hear.

(v) Velocity :

The distance travelled by a wave in one second is called velocity of the wave. Its SI unit is metre per second (ms^{-1}).

$$\text{Velocity} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$V = \frac{\lambda}{T}$$

(λ is the wavelength of the waves travelled in one time timeperiod T)

$$V = \lambda v \quad \left(\frac{1}{T} = v\right)$$

So, Velocity = Wavelength × Frequency

This is the wave equation.

Example. *What is the frequency of sound wave whose time period is 0.05 second ?*

Solution : Frequency, $v = \frac{1}{T}$

Given $T = 0.05$ s

So,

$$v = \frac{1}{0.05} = \frac{100}{5} = 20 \text{ Hz}$$

Hence frequency = 20 Hz.

Speed of Sound in Various Mediums

(i) Speed of sound depends on the nature of material through which it travels. It is slowest in gases, faster in liquids and fastest in solids.

(ii) Speed of sound increases with the rise in temperature.

(iii) Speed of sound increases as humidity of air increases.

(iv) Speed of light is faster than speed of sound flash of light is seen first, followed by sound of thunder.

(v) In air, speed of sound is $344\ ms^{-1}$ at 22ºC.

Sonic Boom

Some aircrafts, bullets, rockets etc. have 'supersonic speed'.

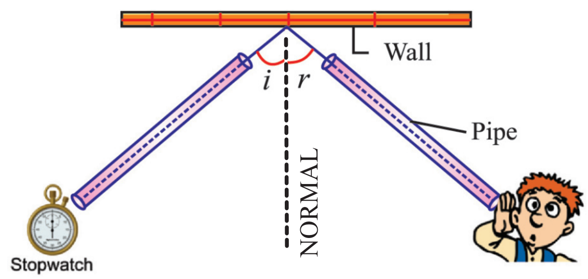
- Supersonic refers to the speed of an object which is greater than the speed of sound and it produces extremely loud sound waves called 'shock waves' in air.
- Sonic boom is an explosive noise caused by shock waves.
- It emits tremendous sound energy which can shatter the glass panes of windows.

Reflection of Sound

Like light, sound also bounces back when it falls on a hard surface. It is called reflection of sound. The laws of reflection of light are obeyed during reflection of sound.

(i) The incident sound wave, the reflected sound wave and normal at the point of incidence lie in the same plane.

(ii) Angle of reflection of sound is always equal to the angle of incidence of sound.



Reflection of Sound

Echo

The repetition of sound caused by the reflection of sound waves is called an echo.

- We can hear echo when there is a time **gap of 0.1 second** in original sound and echo (reflected sound).
- Echo is produced when sound reflected from a hard surface (*i.e.,* brick wall, mountain etc.) as soft surface tends to absorb sound.

To calculate the minimum distance to hear an echo :

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Here Speed of sound in air = 344 ms^{-1} at 22ºC

Time = 0.1 second

So, $$344 = \frac{\text{Distance}}{0.1 \text{ sec}}$$

Or Distance = $344 \times 0.1 = 34.4$ m

So, distance between reflecting surface and audience = $\frac{34.4}{2}$ = 17.2 m (at 22ºC).

- So, the minimum distance **the source of sound and the reflecting surface should be 17.2m to be able to hear an echo.**
- **Rolling of thunder** is due to multiple reflection of sound of thunder from a number of reflecting surfaces such as clouds and the earth.

Reverberation

(i) The persistence of sound in a big hall due to repeated or multiple reflections of sound from the walls, ceiling and floor of the hall is called reverberation.

(ii) If it is too long, sound becomes blurred, distorted and confusing.

Methods to reduce reverberation in big halls or auditoriums

(i) Panels made of felt or compressed fibre board are put on walls and ceiling to absorb sound.

(ii) Heavy curtains are put on doors and windows.

(iii) Carpets are put on the floor.

(iv) Seats are made of material having sound absorbing properties.

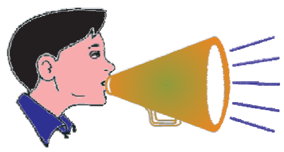
Difference between Echo and Reverberation

Echo	Reverberation
1. The repetition of sound caused by reflection of sound wave is called echo.	1. The persistence of sound in a big hall due to repeated or multiple reflections of sound from the walls, ceiling and floor of the hall is called reverberation.
2. Echo is produced in a big empty hall. Here is no multiple reflections of sound. Sound is not persistant.	2. If reverberation is too long, sound becomes blurred, distorted and confusing due to overlapping of different sound.

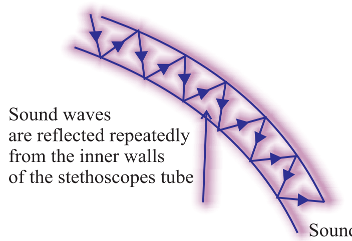
Uses of Multiple Reflection of Sound

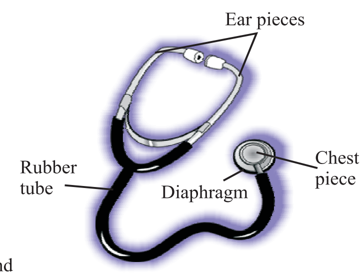
(i) Megaphone, loudspeakers, bulb horns and trumpets, shehnai etc. are designed to send sound in a particular direction without spreading all around. All these instruments have funnel tube which reflects sound waves repeatedly towards audience. In this amplitude of sound waves adds up to increase loudness of sound.

(ii) **Stethoscope :** It is a medical instrument used for listening the sounds produced in human body mainly in heart and lungs. The sound of the heartbeats reaches the doctor's ears by the multiple reflection of the sound waves in the rubber tube of stethoscope.



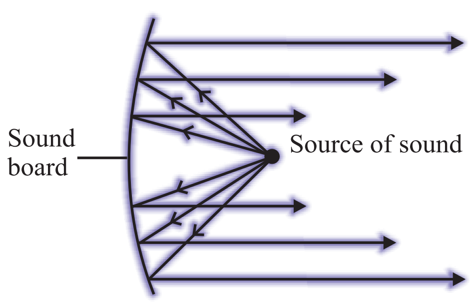
Megaphone

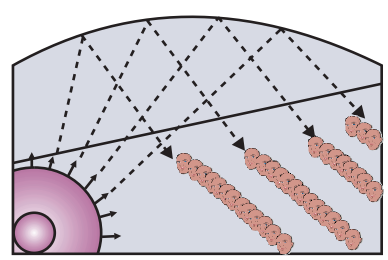




(iii) **Sound Board :** In big halls or auditoriums sound is absorbed by walls, ceiling, seats etc. So a curved board (sound board) is placed behind the speakers so that his speech can be heard easily by audiences. The soundboard works on the multiple reflection of sound.

(iv) The ceiling of concert halls are made curved, so that sound after reflection from ceiling reaches all the parts of the hall .





Concert hall

Range of Hearing

(i) Range of hearing in human is 20 Hz to 20000 Hz.

- Children younger than 5 years and dogs can hear upto 25 KHz.

(ii) The sounds of frequencies lower than 20 Hz are known as 'infrasonic sounds'.

- A vibrating simple pendulum produces infrasonic sounds.
- Rhinoceroses communicate with each other using frequencies as low as 5 Hz.

- Elephants and whales produces infrasonic waves.
- Earthquakes produce infrasonic waves (before shock waves) which some animals can hear and get disturbed.

(iii) The sounds of frequencies higher than 20 KHz are known as **'ultrasonic waves'**.

- Dogs, porpoises, dolphins, bats and rats can hear ultrasonic sounds.
- Bats and rats can produce ultrasonic sounds.

QUESTIONS

VERY SHORT ANSWER QUESTIONS

1. Why sound waves are called mechanical waves ?
2. Which characteristic of sound determine : (a) Pitch, (b) Loudness ?
3. Which property of sound leads to the formation of echo?
4. Write the hearing range of human being.

SHORT ANSWER QUESTIONS

1. Name the two types of waves which can be generated in a slinky.
2. What is SI unit of frequency ? Write its bigger unit also.
3. How is sound produced ?
4. In which medium sound travels fastest : air, water or steel ?
5. Name two devices which work on the reflection of sound.
6. State two laws of reflection of sound.
7. Define the terms wavelength & frequency.
8. Define the term time period and amplitude.
9. Can astronauts talk to each other in outer space?
10. What is sound ?

LONG ANSWER QUESTIONS

1. Explain why, the flash of lightning reaches us first and the sound of thunder is heard a little later ?
2. What is meant by supersonic speed ?
3. Why are the ceiling of concert halls made curved ?
4. What is reverberation ? How can reverberation in a big hall be reduced ?
5. What is echo ? How is echo formed ? How thunder of clouds is formed ?

6. Write any three applications of ultrasound.
7. Explain how bats use ultrasound to catch the prey.
8. A wave is moving in air with a velocity of 340 m/s. Calculate the wavelength if its frequency is :
   (a) 512 vibrations per second (b) 100 Hz.
   [Ans: (a) 0.66 m (b) 3.4 m]
10. A stone is dropped from the top of a tower 500 m high into a pond of water at the base of tower. When is the splash heard at the top ? Given g = 10 ms-2 and speed of sound = 340 ms-1. [Ans: 11.475]
    [Hint : Time taken by stone to reach at pond, t = ?, Use s = ut + ½gt2, 500 = 0 + ½ × 10t2; so, t2 = 100 or t = 10 sec.]
11. What is vaccum ? Why sound can not travel through vaccum ?

OBJECTIVE TYPE QUESTIONS

1. A sound wave has a frequency of 1KHz and wavelength 25cm, to travel 2.2km it takes.

(a) $2\frac{3}{7}$ sec $= \frac{17}{7}$ sec (c) $80\frac{2}{5}$ min. $= \frac{402}{5}$ min.

(c) 5/4 min. (d) $\frac{44}{5}$

2. A body produces sound only if it is

(a) made of steel (b) made of glass

c) made of iron (d) vibrating

3. Sound travels fastest in

(a) air (b) vacuum

(c) steel (d) water

4. A sound produces 50 crests and 50 troughs in 0.5 seconds. What is the frequency of the wave?

(a) 50 Hz (b) 100 Hz

(c) 150 Hz (d) 200 Hz

5. **The voice of a friend is recognised by its**
   (a) Pitch (b) Quality
   (c) Velocity (d) Intensity

6. **A 440 Hz sound wave travels with a speed of 340 ms^{-1}. The wavelength of the wave is**
   (a) 1.5×10^5 m (b) 0.77 m
   (c) 1.3 m (d) 1.1 m

7. **Earthquake produces which kind of sound before the main shock begins?**
   (a) Ultrasound (b) Infra sound
   (c) Audible Sound (d) None of these

8. **A mechanical wave will be transverse or longitudinal depending on :**
   (a) the nature of medium (b) the whole of excitation
   (c) frequency (d) amplitude

9. **Which of the following can travel through vacuum?**
   (a) Light waves (b) Heat waves
   (c) X-rays (d) Sound waves

10. **The velocity of sound is affected by change in**
   (a) Temperature (b) Medium
   (c) Pressure (d) Wavelength

Chapter -12

Improvement In Food Resources

CONCEPT MAPPING

Improvement in food resources

- Crop
  - Crop variety improvement
    - Factors :
      1. Higher yield
      2. Biotic & Abiotic resistance
      3. Improved variety
      4. Wider adaptability
  - Crop production improvement
    - Factors :
      1. Nutrient management → Manure, Fertilizer
      2. Irrigation → Wells, Rivers, Life system
      3. Cropping patterns → Mixed Cropping, Inter Cropping, Crop Rotation
  - Crop protection improvement
    - Factors :
      1. Protection in field → Weed, Insect, Disease
      2. Protection during storage
         - Biotic
           - Insect
           - Birds
           - Mites
           - Bacteria
           - Fungi
         - Abiotic
           - Moisture
           - Temperature
  - Animal Husbandary
    1. Management of farms: dairy and poultry
    2. Bee Keeping
    3. Fisheries
    4. Animal breeding
       - Inbreeding
       - Out breeding
         - Out crossing
         - Interspecific hybridisahon
         - Cross breeding

Green Revolution

Green revolution is a programme introduced in many countries to **increase food** production by use of modern technology, proper irrigation, improved seeds etc.

White Revolution

White revolution is a programme in India to **increase production of milk** in India. This programme made India self-sufficient in production of milk.

Improvement in Crop Yields

Types of Crops :

- **(a) Cereals :** They include crops like wheat, rice, maize, barley etc. They provide us carbohydrates.
- **(b) Seeds :** Not all seeds of plants are edible like seeds of apple or cherries. Edible seeds include cereals, pulses, oil seeds and nuts. They provide us fats.
- **(c) Pulses :** They include legumes such as gram, pea, black gram, green gram, lentil. They provide us proteins.
- **(d) Vegetables, spices and fruits :** They provide us vitamins & minerals.

They include apple, mango, cherry, banana, water-melon etc.
Vegetables like spinach, leafy vegetables, carrot etc.
Spices like chilly, black pepper, cinnamon, fennel etc.

(e) **Fodder crops-** They provide green fodder to the cattle eg - oats, sorghum etc.

Crop Season :

Different cops require different conditions (temperature, moisture, etc.), different photo-periods (duration of sunlight) for their growth and completing life cycle.

The two types of crops seasons are :

(a) Kharif Season : These crops grow during rainy season (June to October). They are also called summer season crops E.g. of Kharif crops are black gram, green gram, pigeon pea, rice, paddy, soyabean.

(b) Rabi Season : These crops are grown during November to April. Rabi crops are known as winter crops. E.g., wheat, gram, peas, mustard, linseed etc.

Approaches which enhance the crop yield are as following :

(i) Crop variety improvement

(ii) Crop production improvement

(iii) Crop protection improvement

(A) Crop Variety Improvement : Factors by which variety improvement can be done are :

- Good and healthy seeds
- Hybridization : It is the process of crossing between two or more genetically dissimilar plants to produce a new variety with good properties of both the crops.

Properties to be possessed by improved seeds
Or
Factors for which variety improvement in crops is done

(a) Higher yield : To increase the productivity of the crop per acre.

(b) Improved quality : Quality of crop products vary from crop to crop.

(c) Biotic & Abiotic resistances : Crop production reduces due to biotic and abiotic factors. Varieties resistant to these factors can improve crop production.

(d) Wider adaptability : Crops which can grow in different conditions, will help in setting high production.

(e) Desired agronomic traits : Crops which contain desired agronomic traits (height, branching, leafs), sets high production.

(B) Crop Production Improvement : It involves different practices carried out by farmers to achieve higher standards of crop production. They are :

(a) Nutrient management
(b) Irrigation
(c) Cropping patterns
(a) Nutrient Management : Like other organisms, plants also require some elements for their growth. These elements are called nutrients.

Sources	Nutrients
Air	Carbon, oxygen
Water	Hydrogen, oxygen
Soil	(i) Macro nutrients : Nitrogen – required by plants in large amount, phosphorus, potassium, calcium, magnesium, sulphure.

(ii) **Micro nutrients :** Iron, Mn – required in small amount, boron, Zn, copper, molybdenum, chlorine.

Manure and Fertilizers

To increase the yield, the soil can be enriched by supplying nutrients in the form of manure and fertilizers.

Manure :

- It is a source of organic matter.
- It supplies small quantities of nutrients to the soil.
- It is prepared by the decomposition of animal excreta and plant waste.

Various forms of Manures :

(A) **Compost :** The process in which animal excreta (like cow dung), kitchen waste, plant remains, waste food, sewage waste etc. are decomposed in pits is known as composting.

(B) **Vermicompost :** Compost prepared by using earthworms to hasten the process of decomposition of plants and animals refuse is called vermicompost. Here, an earthworm is physically aerator, crusher and mixer, chemically a degrader and biologically a stimulator of decomposition.

(C) **Green manure :** Some plants like sunn hemp, guar etc. are grown and after sometime mulched by ploughing in the field. These green plants turn into green manures. They are rich in nitrogen and phosphorus.

Fertilizers :

Fertilizers are prepared in factories. They are made up of chemical substances. They have large amount of nutrients like **Nitrogen, Phosphorus and Potassium. (NPK)**

Fertilizers are easily absorbed by the plants since they are soluble in water. It is costly.

Difference between Manures and Fertilizers

Manures	Fertilizers
1. These are organic substances.	1. These are inorganic substances.
2. These are made up of natural substances (decomposition of plant and animal waste).	2. These are made of chemical substances.
3. These have less amount of nutrient.	3. These have large amount of nutrients.

4. These are cheap and are prepared in rural homes or fields.	4. These are costly and are prepared in factories.
5. Manures are slowly absorbed by the plants since they are insoluble in water.	5. Fertilizers are easily absorbed by the plants since they are soluble in water.
6. It is difficult to store and transport.	6. Their storage and transportation is easy.

(b) Irrigation : The process of supplying water to the crop plants is called irrigation.

Methods of Irrigation :

(i) Wells : These are of two types :

Dug wells : In dug wells, water is collected by bullock-operated devices or by pumps.

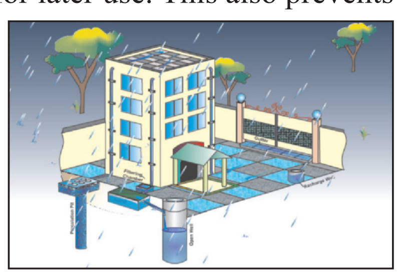
Tube wells : It makes very deep underground water available for irrigation. Motor pump is used to lift water.

(ii) Canals : These get water from large rivers.

(iii) River lift system : In this system, water is directly taken from rivers through pumps. This system is useful for irrigation in areas close to river.

(iv) Tanks : These are small storage reservoirs.

(v) Rain water harvesting : Rain water harvesting is a accumulation of water in tanks for later use. This also prevents soil erosion.



(c) Crop Patterns : Different patterns are used to maximize the production from crop field. They are :

(i) Mixed cropping

(ii) Inter cropping

(iii) Crop rotation

(i) Mixed cropping : Growing two or more than two crops together on the same piece of land is called mixed cropping. *E.g.,* wheat and gram, wheat and mustard, groundnut and sunflower. This is generally done to minimize the risk of total crop faliure due to abnormal weather conditions. Fertility is also seen to be increased.

(ii) Inter cropping : Two or more crops are grown on the same field in a definite pattern. Few rows of one followed by few rows of the other. *E.g.,* Soyabean + maize, pearl millet (Bajra) + Cow pea (lobia). It makes better use of natural resources of sunlight, land and water end also arrest soil erosion effectively

(iii) Crop rotation : Crop rotation is policy of growing different crops one after another on the same field.

- If some crop is grown again and again on the same field, same nutrients are extracted from soil again and again. So we should choose different crops so that all nutrients of soil are used.
- **Advantages :**

  (1) Soil fertility is maintained.

  (2) It controls pests and weeds.

  (3) Several crops can be grown in succession with only one soil preparation.

(C) Crop Protection Improvement

To protect crops against diseases causing organisms and other harming factors is called crop protection. Following methods are used to control these problems :

(a) Pest control during growth

(b) Storage of grains

(a) Pest control during growth : Pest is any destructive organism which can destroy or harm crops or products obtained from them. Pests are of many types :

(i) Weeds : Unwanted plants in the cultivated field *e.g.,* xanthium.

(ii) Insects : Insects can harm plants in following ways :

- They cut the root, stem and leaf.
- They suck the cell sap from various parts of the plant.

(iii) **Pathogens :** Organisms such as bacteria, fungi and viruses which cause diseases in plants are called pathogens. They are transmitted through air, water, soil.

(b) **Storage of grains :** For getting seasonal foods throughout the year, they are stored in safe storage. But during storage of grains, they can be destroyed and wasted by various means.

(i) **Biotic Factors :** Due to living organisms like insects, birds, mites, bacteria, fungi.

(ii) **Abiotic Factors :** Due to non-living factors such as moisture, inappropriate temperature etc.

These factors affect quality in form of degradation, loss in weight, change in colour, poor germinability.

Organic Farming

Using fertilizers and pesticides has its own disadvantages. They cause pollution, damage soil fertility in long run. Grains, fruits, vegetables obtained may contain harmful chemical in small amount.

Organic farming is a farming system with no or very little use of chemicals like fertilizers and pesticides.

Different ways to protect food grains before they are stored for future use :

(a) **Drying :** The food grains should be properly dried in the sun.

(b) **Maintenance of hygiene :** The grains must not contain insects. The godowns should be cleaned well. The cracks in the roof and on the walls and floor should be sealed completely.

(c) **Fumigation :** Godowns and stores should be properly sprayed with fumigants. Specially, the seeds should be treated with insecticides and fungicides.

(d) **Storage devices :** Cleaned and dried grains should be stored in gunny bags or other proper bags. Airtight, moisture-resistant and temperature-resistant storage devices have been developed by various organizations. These should be used.

ANIMAL HUSBANDRY

Animal husbandry is a scientific management of domestic animals in an efficient manner to obtain food and other useful products from them.

Cattle farming : Purpose of cattle farming is :

(a) For getting milk

(b) Ploughing fields

(c) Bull cart for transportation

Types of cattle :

- Cow (Bos indicus)
- Buffalo (Bubalus)

Milch animals : These includes milk producing animals (female cattle).

Draught animals : Those animals which do not produce milk and are used for agricultural work.

Lactation period : The period of milk production between birth of a young one and the next pregnancy is called lactation period.

Care of Cattle

(1) Cleanliness

- Roofed shelter with good ventilation for protection from rain, heat and cold.
- Regular brushing of skin of cattle.
- Sloping floor for shelter for avoiding water-logging.

(2) Food

- Roughage mainly containing fibre
- Concentrates containing proteins
- Food containing micronutrients (vitamins and minerals) for enhanced milk production

Diseases : Diseases can cause death and reduce milk production.

- Parasites are small organisms living inside or outside the body of another organism (host). They derive food from the body of host.
- External parasites on skin of cattle cause skin diseases.
- Internal parasites like worms cause stomach and intestine problems and

flukes cause liver problems.

- Bacteria, virus cause infectious diseases (diseases that can be easily transmitted from one to another).

Poultry Farming : Poultry farming is done for eggs and meat. They both provide protein to our diet.

Broilers : Birds grown for obtaining meat are called broilers. They can be used after 6-8 weeks from their birth.

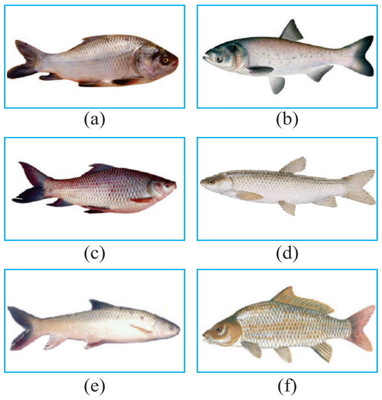
Layers : Birds grown for obtaining eggs are called layers. They can be used after 20 weeks when sexual maturity has been attempted to lay eggs.

Most of the broilers and layers are cross-bred.

Breeding is done to enhance following properties in hens :

- More and better quality chicks.
- Low maintenance.
- Breeding is done to produce dwarf broilers (meat-giving birds). Feeding cost is the biggest expense in poultry farms. Dwarf broilers need less food and can reduce cost by 30%. Also, they can tolerate more heat.

Fish Production :



(a) Catla (b) Silver carp (c) Rohu (d) Grass carp
(e) Mrigal (f) Common carp

Fish production is a great source of protein to our diet.

Fish production is of two types :

(1) Fin fish production/True fish production : Production and management of cartilaginous and bony fishes such as pomphret, tuna, cod, catla, prawns, rohu etc.

(2) Shell fish production : Production of shell-fish such as prawns, mollusks.

Depending on the mode of obtaining fishes, fishing are of two types :

(1) Capture fishing : Naturally living fishes in various water bodies are captured.

(2) Culture fishing : Fishes of desired variety are cultivated in confined areas with utmost care to get maximum yield. This is also called aquaculture. Aquaculture can be done in oceans, rivers, lakes, ponds etc. When it is done in oceans, it is called mariculture.

Marine fishing : Marine fishing includes fish production in ponds, rivers, reservoirs.

- Popular marine fishes includes Pomphret,Tuna,Sardines, Bombay duck. Some costly fishes found in sea like nullets, prawns, seaweed, oysters.
- Using satellites, regions of high fish population in sea can be found. Echo-sounders are also used.

Inland fishing : It includes fish production in fresh water (for example ponds, rivers, lakes, reservoirs) and brackish water (for example estuaries).

Composite Fish Culture : A fish culture system where 5 to 6 varieties of fish are reared in a single fish pond.

- They are selected so that they do not compete for food. They should have different food requirements.

Example :

Catla : Feeds in the upper part of water.

Rohu : Feeds in middle part of water.

Mrigals, common carps : Feeds at bottom.

- **Advantage :** More yield.

  Problems : Many fishes lay eggs during monsoons only, due to which number of fishes will not grow fast. So hormonal stimulation is used. Using this fishes can be made to reproduce any time.

Apliculture Bee-keeping : It is the practice of keeping, caring & management of honeybees on a large scale for obtaining honey and wax.

Many farmers use bee-keeping for additional small income. Also, there are big farms called apiaries/bee farms.

Apiary : The setting up of a number of bee hives in desirable location in a systematic manner that allows maximum pollen and nectar collection.

- Some common Indian varieties of bees include *apis carana indica* (Indian bee), *dorsata* (rock bee), *floral* (little bee).
- One Italian variety *mellifera* is also used in India for commercial large scale production because of its following advantage :

  (a) High honey collection capacity.

  (b) They reproduce fast.

  (c) They sting less.

  (d) They stay in a bee hive for long.

Honey : It is a dense sweet liquid.

- It is used in medicines. It is used as sugar.
- It is used as a source of energy.

Pasturage : Pasturage is the availability of flowers to the bees for nectar and pollen collection.

Or, Pasturage of flora is the type of crop, flower or other plants from which bee collects nectar and pollens to produce honey.

It affects the quality and quantity of honey because different flora produce nectar and pollen of different types *e.g.,* almond honey of Kashmir is very tasty.

QUESTIONS

VERY SHORT ANSWER

1. Why do we need food ?
2. Name some cereals which provide us carbohydrate.
3. What is kharif season? Name a few kharif crops.
4. What is manure? How is it prepared?
5. What is hybridization?
6. What is the main sources of irrigation in India?
7. What do you mean by mixed cropping.

SHORT ANSWER

1. What are pathogens? How are they transmitted?
2. Write the differences between manures and fertilizers.
3. What are the differences between broilers and layers.
4. Write the advantages of inter-cropping and crop-rotation.
5. What are the benefits of cattle farming.

LONG ANSWER

11. (*a*) What are the ways to protect food grains before they are stored for future use?

    (*b*) Write advantages of bee keeping.
12. What is composite fish culture? What is the main problem associated with this practice? What is the criteria of choosing fish for this type of culture.
13. What factors may be responsible for losses of grains during storage?
14. What are macro nutrients? From were the plants get it.

    Or

    Draw the diagram of Inter cropping.
15. Why should our food contain cereals, pulses, fruits and vegetables?

OBJECTIVE TYPE QUESTIONS.

I Match the following :

	Column I		Column II
a.	Micronutrient	p.	Soyabean
b.	Kharif crop.	q.	Bee
c.	Rabi crop.	r.	Wheat
d.	Apis mellifera	s.	Molybedinum

2. Manure and fertilisers are the main source of __________ supply to plants.
3. Growing two or more crops in definite row pattern is known as ____________

II MCQ.

(i) The best way to increase the yield of wheat in India is

a. To sow seeds of improved varities.

b. To use tractors

c. To reduce the quantity of ration consumers.

d. To remone weeds from the wheat fields.

(ii) Birds specially grown for meat only is known as ____________

a. Hybrid. b. Broiler. c. bird management.

d. Bird culture

(iii) The drones in honey bee are

a. Sterile male. b. fertile males.

c. Sterile female. d. fertile female.

(iv) Potato tuber wash and Iodine solution placed together change their colour to ___________

a. Blue-Black. b. Blue.

c. Brick-red. d. Magenta.

(iv) Metanil yellow causes _________

a. Stomach ulcer. b. Diarrhoea.

c. Cancer. d. Paralysis.

Assertion and Reasoning Type Questions

Direction : In the following questions, a statement of assertion (A) in followed by a statement of Reason (R). Mark the correct choice as

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of Assertion (A)

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1. Assertion (A) Vermicomposting is an important method of preparing compost,

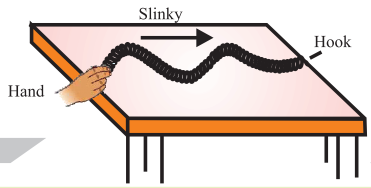
Reason (R) : An earthworn is physically an aerator, crusher and mixer, chemically a degrader and biologically a stimulator of decomposition.

Ans. (a) The degradation of organic waste through the consumption by the earthworms is called vermi composting.

Q2. Assertion (A) - The basic objective in mixed cropping is to minimise the risk and insurance against the total crop failure.

Reason (R) - Wheat and chicken pea are examples of inter cropping.

Ans. (b) Both the assertion and season are true but here, the reason is not the correct explanation of assertion, the mixed cropping is done to minimise the risk and insurance against the crop failure due to abnormal weather conditions and wheat and chick-pea in an example for the same.



Experiment

List of Practical

Experiment No. 1 : Preparation of

(a) A true solution of common salt, sugar and alum.

(b) A suspension of soil, chalk powder and fine sand in water.

(c) A colloidal solution of starch in water and egg albumin/milk in water and distinction between these on the basis of

- Transparency
- Filtration criterion
- Stability

Experiment No. 2 : Preparation of

(a) Mixture

(b) A compound

Using Iron filing and Sulphur powder and distinction between these on the basis of :

(i) Appearance, *i.e.,* homegeneity and heterogeneity

(ii) Behaviour towards a magnet

(iii) Behaviour towards carbon disulphide as a solvent

(iv) Effect of heat

Experiment No. 3 : Performing the following reactions and classifying them as physical or chemical changes :

(a) Iron with Copper Sulphate solution in water

(b) Burning of magnesium ribbon in air

(c) Zinc with dilute Sulphuric Acid

(d) Heating of Copper Sulphate Crystals

(e) Sodium Sulphate with Barium chloride in the form of their solutions in water

Experiment No. 4 : Preparation of stained temporary mounts of

(a) onion peel,

(b) Human Cheek Cells & to record observations and draw their labeled diagrams.

Experiment No. 5 : Identification of Parenchyma, Collenchyma and Sclerenchyma tissues in plants striped, smooth and cardiac muscle fibers and nerve cells in animals from prepared slides. Drawing of their labeled diagrams.

Experiment No. 6 : Determination of the melting point of ice and the boiling point of water.

Experiment No.7 : Verification of Law of reflection of sound.

Experiment No. 8: Determine the density of solid (denser than water) by using a spring balance and measuring cylinder.

Experiment No. 9 : Establishing the relation between the loss in weight of a solid when fully immersed in

(a) tap water

(b) Strongly salty water, with the weight of water displaced by it by taking at least two different solids.

Experiment No.10 : Determination of the speed of a pulse propagated through a stretched string/slinky.

Experiment No. 11 : Verification of Law of Conservation of mass in a chemical reaction.

EXPERIMENT NO. 1

Aim : To prepare :

(a) a true solution of common salt, sugar and alum

(b) a suspension of soil, chalk powder and fine sand in water

(c) a colloidal solution of starch in water and egg albumin water and to distinguish between these on the basis of

(i) filtration (ii) transparency (iii) stability

Apparatus required : Take hard glass test tubes, test tube stand, a China dish, a glass rod, a tripod stand, funnels, filter paper, torch or flash light.

Materials (Chemicals) required : Common salt, sugar, alum, chalk powder, garden soil, egg albumin, fine sand and distilled water.

Procedure :

(*a*) To prepare true solutions of dry common salt, sugar and alum

Take three test tubes (A, B, C). Pour 10 cc of distilled water in each test tube. Take a pinch of salt and put it in 'A' test tube and shake it vigorously after closing the mouth of test tube. The common salt dissolves completely to form true solution. Do the same procedure with sugar and alum powder and put them in test tubes labelled 'B' and 'C'. The result is also same. They all (salt, sugar and alum) form true solutions with water.

(b) To prepare suspensions of soil, chalk powder and fine sand in water

Take three test tubes (D, E, F). Pour 10 cc of distilled water in each test tube and pour a pinch of chalk powder in 'D' test tube. Shake it vigorously after closing the mouth of test tube. The chalk powder does not dissolve completely and forms a suspension. Do the same procedure with garden soil and sand (fine sand) in test tubes labelled 'E' and 'F' respectively. The result is also same. All three materials form suspension.

(c) To prepare colloidal solutions of starch in water and egg albumin in water

(i) To prepare a colloidal solution of starch in water Take about 1 gm of starch in a China dish. Pour about 20 cc of distilled water in a China dish. Stir the contents with a glass tube till a milky suspension is formed. Heat the 50 cc of water to the boiling point on a Bunsen flame, by placing it on the tripod stand. Stir the contents of the China dish continuously and pour it in boiling water. Allow the contents to cool. The product so formed is colloidal solution of starch in water in test tube 'G'.

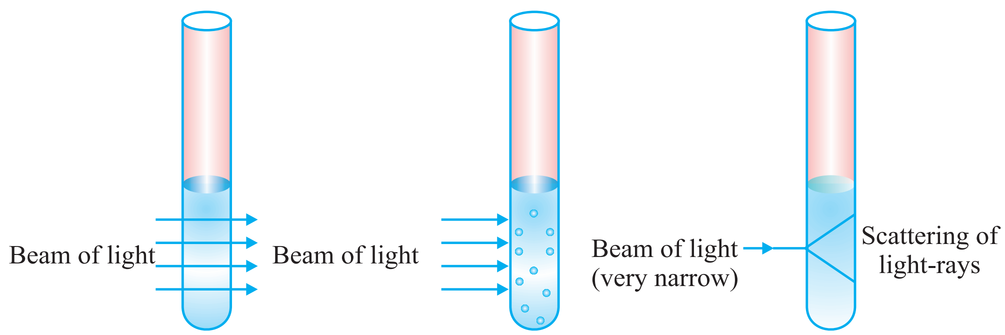
(ii) To prepare a colloidal solution of egg albumin in water

Take about ½ cc of egg albumin in a test tube. Pour about 10 cc of distilled water in the test tube. Shake the contents of the test tube vigorously for 1 minute and the albumin gets suspended to form turbid (light milky) product. The product so formed is the colloidal solution of egg albumin in water.

To distinguish a true solution, a suspension and a colloid on the basis of (a) transparency, (b) filtration (c) stability.

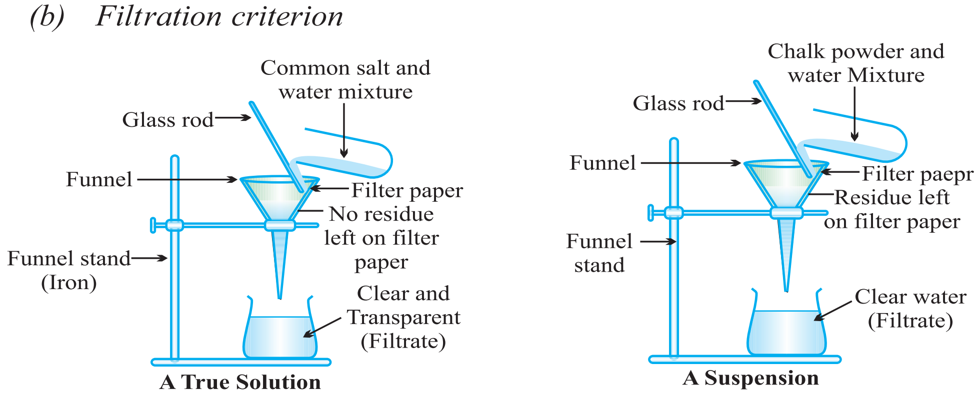
Again take test tube 'A', test tube 'D' and test tube 'G' which are true solution of salt suspension of chalk powder and colloidal solution of starch respectively. Now pass laser light through it to see the transparency. Now filter them all through filter paper and also check their stability in test tubes by allowing its contents to stand for 5 minutes.

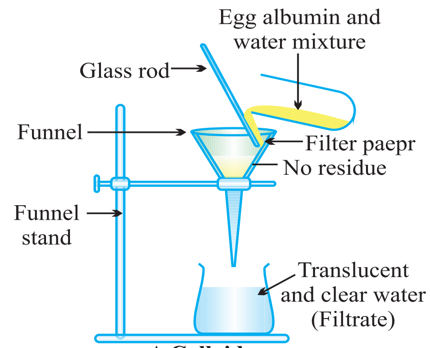
(a) Transparency



To distinguish a true solution, a suspension and a colloid on the basis of transperancy

(b) Filtration criterion





A Colloid

(c) *Stability :* Let the three tubes A, D and G be allowed to stand for 5 minutes.

Observations

	Transparency	**Filtration**	**Stability**
Test tube 'A' : True solution of common salt, sugar, alum	The light rays passes through it.	The contents passes through filter paper leaving no residue. The filtrate is clear and transparent.	No sediments settle down and the solution remains clear.
Test tube 'D' : Suspension of chalk powder	Light rays scatter through contents.	The contents leave residue of chalk powder on the filter paper. The filtrate is clear.	The sediments settle down and clear water collects above it.
Test tube 'G' : Colloidal solution of starch	Light rays scatter in contents of the test tube 'C'.	The content passes through filter paper leaving no residue on the filter paper and filtrate is translucent.	No sediment settles down and there is no change in its consistency.

Result :

(a) True solutions are transparent, stable, homogenous and they can pass through filter paper leaving no residue on the filter paper. They do not scatter light

(b) Suspensions are opaque, leave residue on the filter paper. They are unstable. They scatter light.

(c) Colloids are translucent, leaves no residue on the filter paper and the filtrate is translucent. They are stable and scatter light.

Precautions :

(a) The test tubes should be neat and clean.

(b) Wastage of chemicals should be avoided.

(c) Mix the contents carefully and stir it thoroughly while preparing various types of mixtures.

(d) Do not taste any material.

EXPERIMENT NO. 2

Aim : To prepare (a) a mixture, (b) a compound

Using iron filings and sulphur powder and distinguish between these on the basis of :

(a) appearance i.e., homogeneity and heterogeneity

(b) behaviour towards a magnet

(c) behavior towards carbon disulphide

(d) effect of heat

Theory :

Compound : A pure substance which is composed of two or more elements, combined chemically in a fixed ratio, such that they can be broken into elements only by chemical means is called a compound.

Mixture : When two or more substances (elements, compounds or both) are mixed together in any proportion do not undergo any change but retain their individual properties, the resulting mass is called a mixture.

Material required : A hard glass test tube, a test tube holder, mortar and pestle, two watch glasses, a hand lens, a magnet, a rack full of clean test tubes, Bunsen burner or spirit lamp.

Procedure :

(*a*) Preparation of a mixture of iron and sulphur

Take 7 g of iron filings and 4 g of sulphur and put them in a mortar. Grind the constituents with pestle thoroughly. The product so obtained is a mixture of iron and sulphur. Divide the mixture into two halves and place them in two watch glasses.

(*b*) Preparation of the compound of iron and sulphur (Iron sulphide)

Transfer the mixture of one of the watch glasses to a hard glass test tube. Now hold the test tube in the test tube holder. Heat the mixture strongly on a burner till its contents start glowing with a reddish glow. Stop heating now. Iron reacts with sulphur to form its compound iron sulphide with the release of heat energy. Again transfer the iron sulphide in watch glass.

Observation :

Experiment	Observation	Inference/Result
1. Action with magnet :		
Roll a bar magnet in the mixture as well as in the compound.	Iron particles cling to the magnet in case of the mixture, but not in case of the compound.	Constituents of a mixture can be separated by physical means, but not that of a compound.
2. Observation under magnifying glass :		
Observe the mixture as well as the compound under a magnifying glass by spreading them thinly on a paper.	In case of the mixture, grey particles of iron and yellow particles of sulphur can be seen clearly and they are not uniform throughout. Black mass of homogeneous substance can be seen in case of the compound.	Mixtures are heterogenous in nature, but compounds are homogenous in nature.
3. Action with carbon disulphide :		
Place a small amount of the mixture and compound in separate test tubes and add 5 cc of carbon di-sulphide. Shake well.	In case of the mixture, yellow particles of sulphur dissolve and grey particles of iron settle down. In case of the compound, nothing dissolves.	Constituents of a mixture can be separated by physical means, but not that of a compound.
4. Effect of heat :		
Heat the small amount of mixture and compound separately in two test tubes.	In mixture, sulphur & iron melts to form compound iron sulphide. In compound, no change.	Mixture shows chemical reactions. Compound do not show chemical reaction.

Precautions :

(a) Heat the mixture of iron and sulphur in the hard glass test tube only.

(b) While performing various experiments use minimum amount of the mixture or compound.

(c) Carbon disulphide is inflammable, keep it away from flame.

Practical Based Questions

1. What happens when iron filing and sulphur powder are mixed together in a china dish. Write your observation, what do you find in the mixture (Physical nature)

2. If you rotate a magnet into the mixture of iron filings and sulphur powder, which substance would stick to magnet and why?

3. If the mixture of iron filings and sulphur powder are heated for sometime and then magnet is rolled over the compound, write your observation with reason.

4. If you put some amount of the mixture of iron filings and sulphur into carbon disulphide solution, do you find anything dissolving into carbon disulphide. Name the substance.

5. You are given two test tubes 'A' and 'B' with carbon disulphide solution into them. In test tube 'A' you put a mixture of iron filings and sulphur while in test tube 'B' you put iron sulphide compound. What do you observe in both the test tubes respectively. Write your answer with reason.

6. A student used a test tube for heating a mixture of iron filings and sulphur powder. What suggestion do we give to the student to perform this experiment correctly ?

EXPERIMENT NO. 3

Aim : To carry out the following chemical reactions and classify them as physical or chemical changes :

(a) Iron nail and copper sulphate solution in water

(b) Burning of magnesium ribbon in air

(c) Zinc with dilute sulphuric acid

(d) Heating of copper sulphate

(e) Sodium sulphate with barium chloride in the form of their solutions in water

Materials required : Test tube stand, tongs, spirit lamp, iron nail, copper sulphate solution, 10 cm long magnesium ribbon, small piece of granulated zinc, dilute sulphuric acid, sodium sulphate solution, barium chloride solution.

Theory :

Physical change : When there is no change in the composition of a substance and no change in chemical nature of the substance.

Chemical change : It is a change which brings change in the chemical properties of matter and a new substance is obtained.

Procedure :

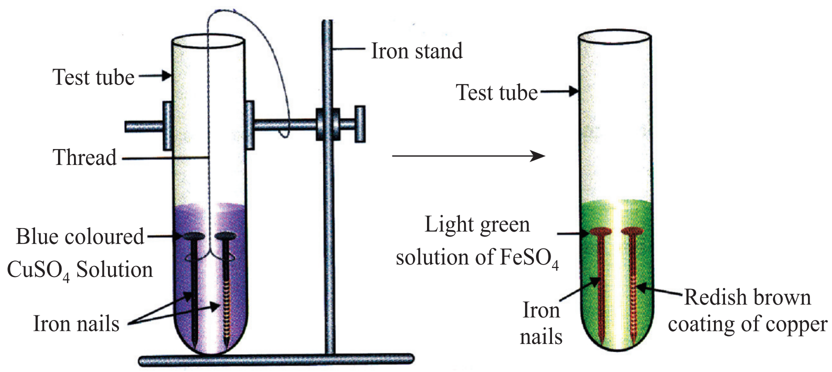
(a) Experiment with iron nail and copper sulphate solution

Pour about 10 ml of copper sulphate solution in the test tube. Place/Put a clear iron nail in the solution and observe after 15 to 30 minutes Observations recorded are given below :

(i) Copper sulphate is blue in colour. On placing nail (iron) in it for 15 minutes or more the colour changes from blue to light blue after 30 minutes finely slightly greenish after 24 hr.

(ii) Iron nail gets coated with reddish/brownish deposit of copper metal.

$$Fe\ (s) + Cu^{2+}SO_4^{2-}\ (aq) \rightarrow Fe^{2+}SO_4^{2-}\ (aq) + Cu\ (s)$$



When iron nails are kept in $CuSO_4$ solution

Inferencce : (i) Chemical change

(ii) Iron displaces copper from $CuSO_4$ because Iron is more reactive than copper.

(b) Experiment with burning magnesium ribbon in air

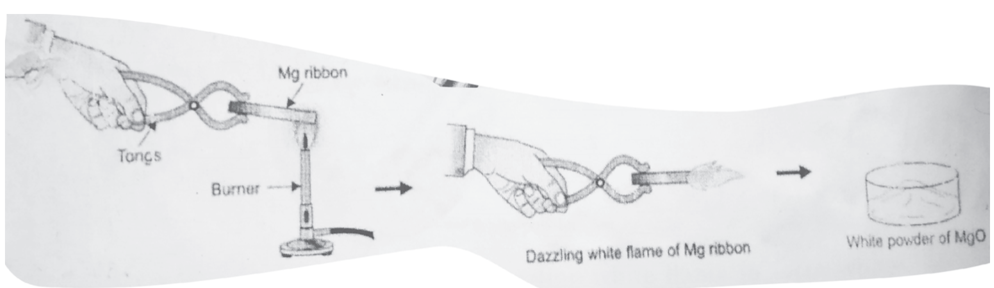
Hold one end of a 10 cm long magnesium ribbon with tong and burn it in air on spirit lamp.

Observation : The magnesium ribbon burns with a dazzling white flame to form a white powdery mass. This white powdery mass continues dropping from the magnesium ribbon.

$2Mg + O_2 \xrightarrow{\Delta} 2MgO + heat$

$MgO + H_2O \quad Mg(OH)_2$

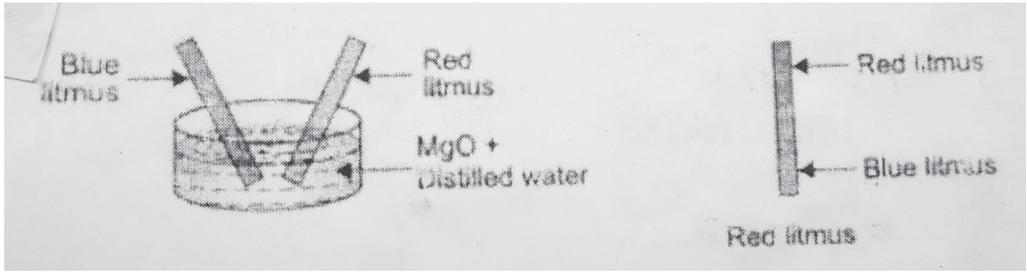
[It turns red litmus to blue being basic in nature]



Inference : (i) Chemical change (ii) MgO is basic in nature

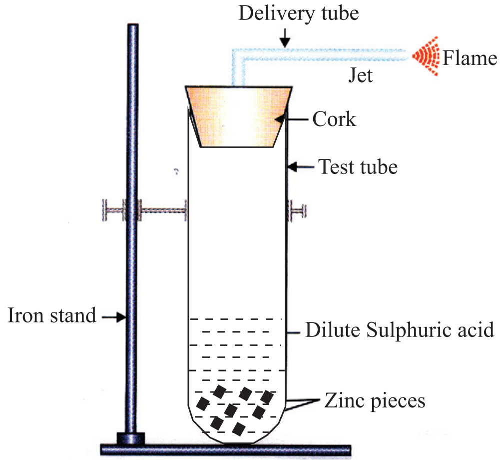
(c) Experiment with zinc and dilute sulphuric acid

Introduce a small piece of granulated zinc in a clean test tube. Pour about 5 ml of dilute sulphuric acid in the test tube.



Observation : The zinc metal briskly reacts with dilute sulphuric acid. From the surface of zinc, a large number of tiny bubbles of a gas rise. The contents of the test tube get hot. The colourless gas evolved is hydrogen, which explodes with a pop sound when burning matchstick brings to the mouth of test tube.

$$Zn + H_2SO_4\ (dil.) \rightarrow ZnSO_4 + H_2\ (g)$$



H_2 gas is produced, when zinc reacts with dil. H_2SO_4 which burns with a pop sound

Inferencce : (i) Chemical change
(ii) H_2 gas is released which burns with pop sound.

(d) Experiment with copper sulphate on heating

Heat 2 g of blue coloured copper sulphate in a tube on Bunsen flame for about 2 to 5 minutes. After 5 minutes cool the test tube now add 2 to 3 drop of water in the test tube.

Observations :

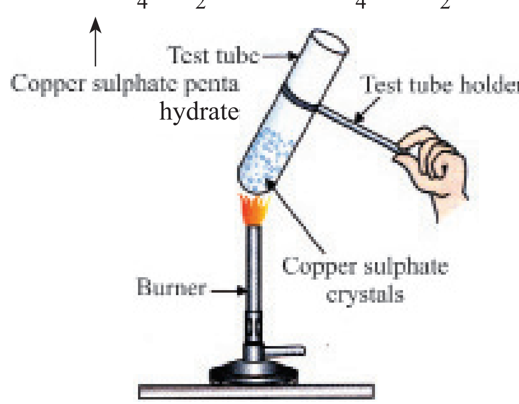
(i) Blue coloured copper sulphate crystals crumbled to form white powdery mass.

(ii) Large amount of steamy fumes are given out.

(iii) These fumes condense on the cooler part of the test tube.

(iv) If few drops of water are added again to white powdery mass, it regains its blue colour.

$$CuSO_4.5H_2O \rightarrow CuSO_4 + 5H_2O$$



Heating of copper sulphate crystals

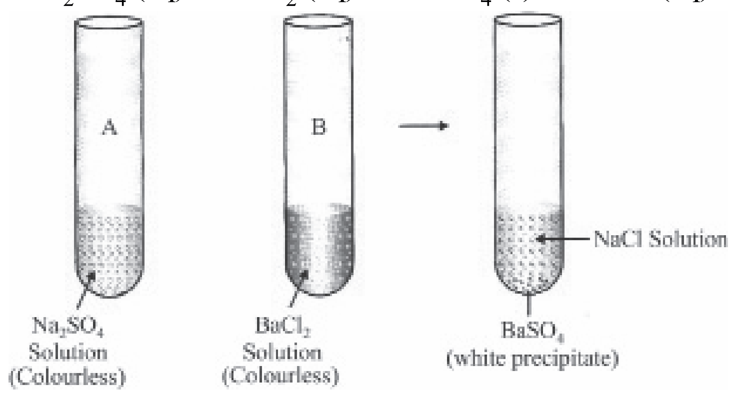
Inferencce : (i) Physical change.
(ii) $CuSO_4.5H_2O$ looses water and becomes anhydrous and on adding water, it again becomes blue in colour.

(e) Experiment with sodium sulphate and barium chloride solutions

Pour about 5 ml of sodium sulphate in a clean test tube and into this add 5 ml of barium chloride solution. Shake the contents of the test tube.

Observations : A white precipitate is formed, which gradually settles at the base of the test tube because insoluble barium sulphate is formed.

$$Na_2SO_4\,(aq) + BaCl_2\,(aq) \rightarrow BaSO_4\,(s) + 2NaCl\,(aq)$$



White precipitate of $BaSO_4$ gets formed when Na_2SO_4 solution and $BaCl_2$ solution react with each other

Precautions:

(a) Test tubes should be clean and dry.
(b) Use minimum amount of chemicals.
(c) Always hold the test tube with a test tube holder before heating.
(d) Use fire tongs for holding magnesium ribbon.

Practical Based Questions

1. What is the colour of copper sulphate penta hydrate and copper sulphate (Anhydrous)

2. What happens if you mix/react sodium sulphate and barium chloride solution.

3. Why copper sulphate changes its colour on heating.

4. Ram has placed iron nail in a test tube containing copper sulphate. After 30 minutes he observed that colour of copper sulphate faded and a material got deposited on the iron–

(a) What will be the colour of the solution if Ram forgets the nail in the test tube.

(b) Name the material which get deposited on nail.

5. Why is it needed to clean the Magnesium ribbon with sand paper before burning?

6. (a) What happens when Zinc granules are added to dil Sulphuric acid?

(b) Which gas will be released and how will you check it?

EXPERIMENT NO. 4 (a)

Aim : To prepare stained temporary mount of onion peel and to record observations and draw a labelled diagram.

Materials required : microscope, onion, knife, needles, forceps, slide, cover slip, brush, methylene blue stain, Safranin stain, glycerine, glass slide, blotting paper, water etc.

Theory : Onion peel is made up of many rectangular cells. These are plant cells. Each cell has a rigid cell wall made of cellulose. Plant cell has plastids and a large central vacuole.

Procedure :

(a) Take a thin onion scale from an onion.

(b) Break it from the concave side to get a transparent and thin piece of membranous onion peel.

(c) Now keep this piece of onion peel in a watch glass containing water.

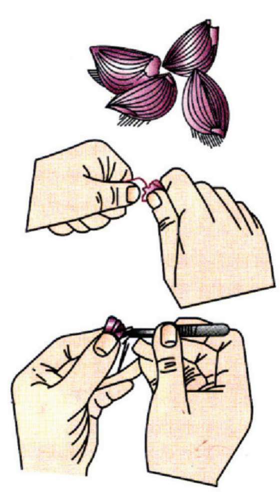
(d) Cut out a small portion of this peel and place it on a glass slide and add a drop of methylene blue solution for a few seconds.

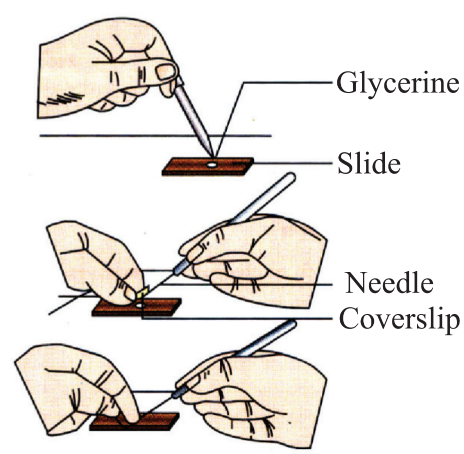
(e) Drain out the stain and mount the onion peel on a drop of glycerine.

(f) Cover the peel gently with cover slip with the help of Needle to avoid the entry of air bubbles.

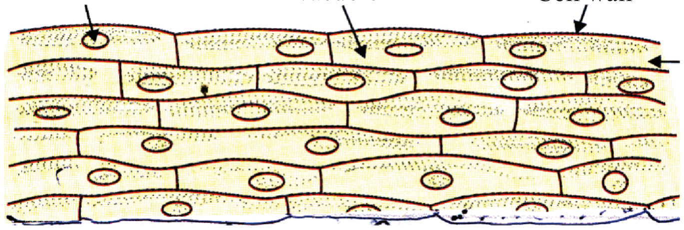
(g) Gently press the cover slip with a needle so as to spread the glycerine evenly.

(h) Remove excess glycerine from the edges of the cover slip using a blotting paper.





Under low powerof the Microscope (slide of onion peel)



Observations :

(a) There are large number of brick shaped (rectangular) cells lying side by side in a membrane.

(b) A distinct darkly stained nucleus is present in each cell.

(c) A prominent vacuole is seen in the centre and cytoplasm is present on inner surface of cell wall.

Precautions :

(a) Always hold the slide from its edges.

(b) Do not put excessive stain on slide.

(c) Put the cover slip at 45º angle to avoid the entry of air bubble.

(d) Soak excessive water or glycerine on slide with blotting paper.

EXPERIMENT NO. 4 (b)

Aim : To prepare stained temporary mount of human cheek cells and to record observations and draw their labelled diagrams.

Materials required : Watch glass, clean glass slide, cover slip, needles, brush, toothpick, methylene blue solution, blotting paper, high powered microscope.

Theory : Human cheek cells are animal cells. They are without cell wall and have denser cytoplasm. Animal cells do not have large vacuoles. They don't have plastids.

Procedure :

(a) Take a clear glass slide and in the middle of it pour a drop of distilled water with the help of a dropper.

(b) Take a clean toothpick and use it to scrap the inner wall of cheek gently, so as to scrap the epithelial tissue.

(c) Mix the scrap on the toothpick in the drop of water placed on the glass slide.

(d) Pour a drop of methylene blue solution on the mixture on the slide and mix it thoroughly.

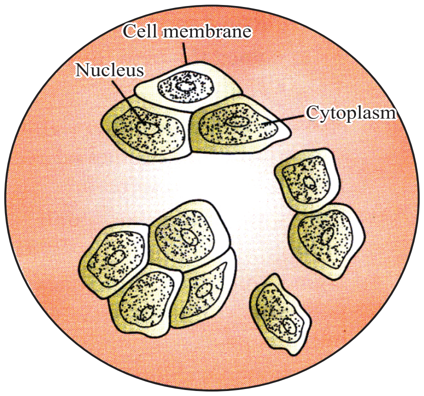
(e) After 2-3 minutes remove the excess water and methylene blue solution evenly on the slide by using tip of a blotting paper.

(f) Put a drop of glycerine on the contents of slide and spread it.

(g) Take a dry and clean cover slip and hold it from its edges with left hand. Place the cover slip on the slide in such a way that one of its edges comes in contact with the mounting material *i.e.,* glycerine. Now put the cover slip without air bubble.

(h) Remove the extra material surrounding the covership with the help of blotting (filter) paper.

(i) Examine the slide under high power microscope.



Slide of cheek cells under microscope

Observations :

(a) Large number of flat cells with irregular boundaries are seen.

(b) Each cell has a thin cell membrane (or plasma membrane).

(c) A distinct deeply stained nucleus is seen in each cell.

(d) There are no intercellular spaces between the cells.

(e) No cell wall is visible.

(f) Space between the plasma membrane and the nucleus is filled with granular material called cytoplasm

Inference : The examination of material on the slide suggests that it is an animal cell, because cell wall and prominent vacuoles are not seen.

Precautions :

(a) Scrapping of the cheek cells should be done very carefully so that no damage is done.

(b) The toothpick should be washed thoroughly so that it does not infect the cheek with any foreign bodies.

(c) The slide should be neatly made with no air bubbles and in just the right amount of glycerine used.

(d) Overstaining and understaining should be avoided.

(e) Mounting should be done in the middle of slide.

Practical Based Questions

1. Why do we use glycerine while preparing the temporary slide?

2. Which stains are used to stain cheek cell and onion peel?

3. What precautions must be taken while preparing the temporary slide?

4. Write the steps to prepare a temporary slide of onion peel.

5. Draw a diagram of onion peel that you observed under microscope.

6. What precautions must be taken while preparing the temporary slide of cheek cell?

7. Draw the diagram of cheek cell that you observed under microsocope.

EXPERIMENT NO. 5

Aim : To identify parenchyma and sclerenchyma tissues in plants striped muscle fibres and nerve cells in animals from prepared slides and to draw their labelled diagrams.

Materials required : Prepared slides of parenchyma tissues, sclerenchymatous tissues, striped muscle fibres, nerve cells and compound microscope.

Theory :

Tissue : A tissue is a group of similar cells having a common origin and held together by intercellular substances to perform a particular function.

Permanent tissues : Some tissues loose their capacity to divide, so they are called permanent tissues. For example, parenchyma, sclerenchyma in plants and striped muscle fibres and nerve cells in animals.

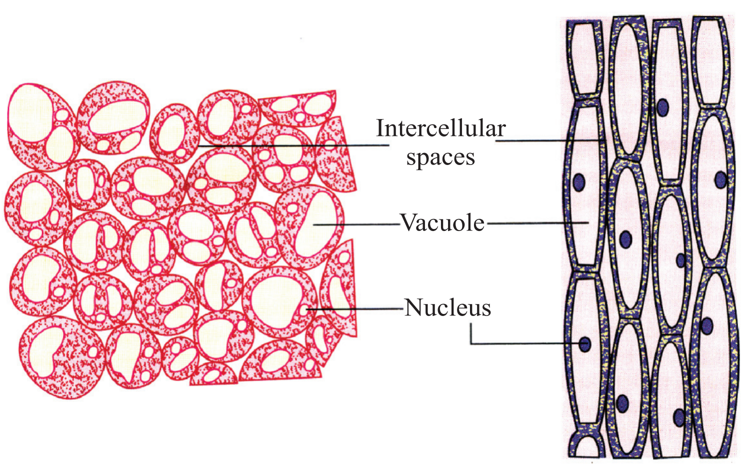
Procedure :

(a) Take a prepared slide and observe it under microscope.

(b) Study the slide and write its identifying features. Also, draw diagrams in your notebook what you see under observation.

Observation :

(a) Parenchyma



Features :

(a) The cells are isodiametric *i.e.,* almost equal in length and width.

(b) There are intercellular spaces at the corners for the exchange of gases.

(c) The cells have thin walls.

(d) There is a large central vacuole in each cell.

(e) A distinct nucleus is present in peripheral cytoplasm.

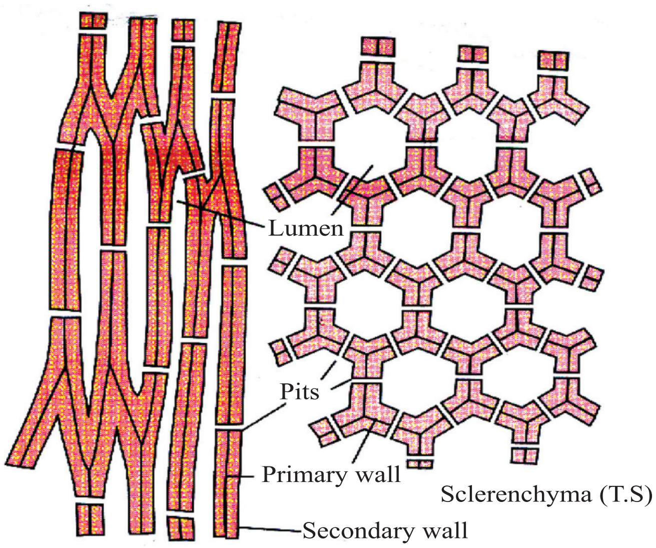
Inference :

(a) Parenchyma tissue is located in soft parts of the stem, leaves, roots, fruits, flowers.

(b) They act as packaging material, sometimes photosynthesis also occurs.

Observation :

(b) Sclerenchyma



Features :

(a) Sclerenchymatous cells are dead cells.

(b) They have evenly thickened hard cell walls.

(c) They have very little or no protoplasm.

(d) They have hard lignified secondary walls.

(e) They can be divided into two types :

(i) Fibres : They are elongated cells with tapering ends.

(ii) Sclereids : These are irregular isodiametric cells.

Inference :

This tissue is very widely distributed tissue and occurs in form of distinct or patches and forms the chief constituents of hard parts of the plant. These cells, being thick walled and having deposition of lignin give mechanical strength to the plant.

Observation :

(c) Striated muscles or voluntary muscles or striped muscle fibres

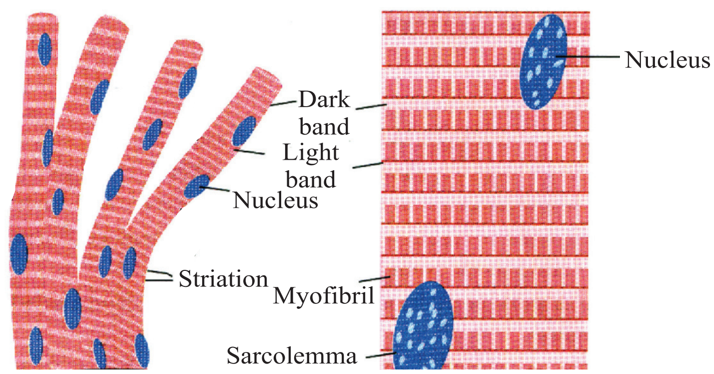


Diagram showing striated muscle fibres or striped muscle fibres

Features :

(a) The fibres are long, cylindrical and unbranched.

(b) The cells are surrounded by connective tissue.

(c) The muscle fibres are multinucleated.

(d) The nuclei lie towards the periphery of the fibres.

(e) The cells of this muscle are non-tapering.

(f) Dark and light band appear alternately giving the characteristic striped or striated appearance.

Inference :

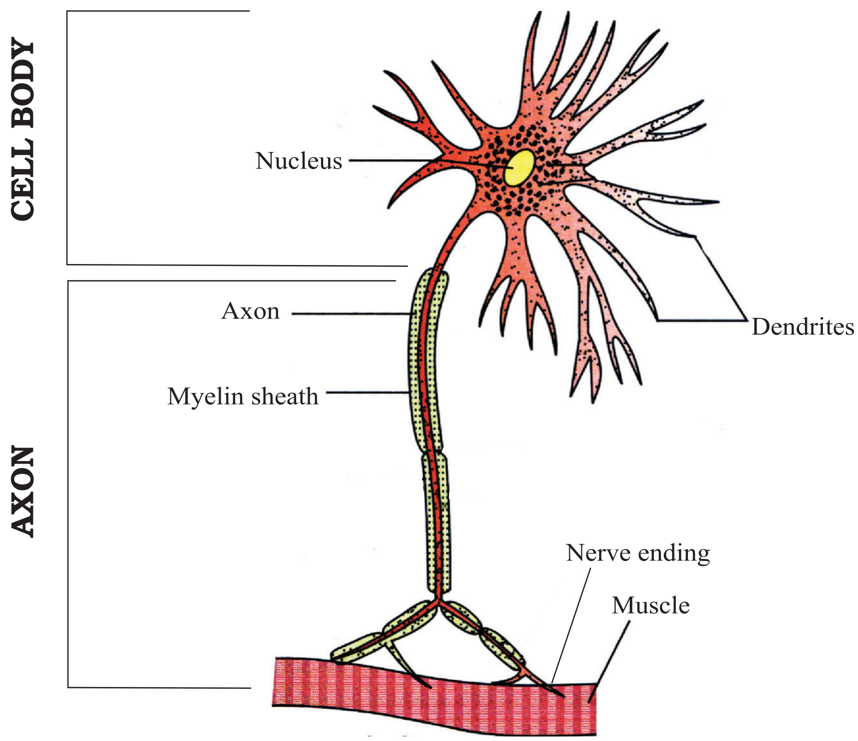
(a) Striped muscle fibres are found attached to the bones in different parts of the body.

(b) These bring about skeletal movements.

(c) They help in locomotion and maintaining the posture of the body.

Observation :

(d) Nerve tissues :



Features :

(a) The nerve cell has a larger body called cyton.

(b) The cell body (cyton) has a prominent nucleus.

(c) Cyton has cytoplasmic projections called dendrites.

(d) A group of axons held together by a connective tissue is called a nerve.

(e) The axons are covered with medulary sheath or myelin sheath.

(f) The nerve endings are attached to muscles.

Inference :

Nerve cell has a large cell body with prominent nucleus such that cyton has cytoplasmic projections called dendrites and one a long one, called axon.

Practical Based Questions

1. What are identifying features of

(a) Parenchyma (b) Collenchyma

(c) Sclerenchyma

2. Draw diagram of striated muscle that you observed in the slide.

3. Draw a neat labelled diagram of a neuron.

4. What is the difference between striated and smooth muscle ?

5. Differentiate between Parenchyma, Collenchyma and Sclerenchyma.

6. Draw a neat labelled diagram of Parenchyma Tissue.

7. Which tissue has cells that are having lignified thickened walls?

EXPERIMENT NO. 6

Aim : To determine the melting point of ice and the boiling point of water.

Materials required : A glass beaker (200 cc), a wire gauze, a tripod stand, a Celsius thermometer, a glass rod, an iron stand, a Bunsen burner or a spirit lamp, a magnifying glass, distilled water, ice cubes prepared from distilled water.

Theory : When a solid is heated then kinetic energy of the molecules is large enough to overcome the binding forces and the substance changes its state.

Melting point of the solid : The constant temperature, at which a solid changes completely to its liquid state at a constant pressure of 1 atmosphere, is called the melting point of the solid.

Boiling point of the liquid (water) : The constant temperature, at which a liquid changes completely to its vapour (gaseous) state at a constant pressure is called boiling point of the liquid.

Procedure :

(a) Melting point of the solid

(i) Take a beaker and put the small ice pieces (crushed ice) into it (about 100 g- 150 g).

(ii) Insert a stirrer into the ice kept in the beaker.

(iii) Place the beaker containing ice on the tripod stand with a wire gauze.

(iv) Suspend a thermometer vertically in the ice by using an iron stand.

(v) Note the temperature of ice before lighting the burner.

(vi) Heat the ice pieces. Stir well while heating.

(vii) Record the temperature when the ice melts completely.

(b) Boiling point of the water

(i) Take about 50 ml of distilled water in a hard glass test tube.

(ii) Put 2-3 small pieces of pumice stone to avoid bumping.

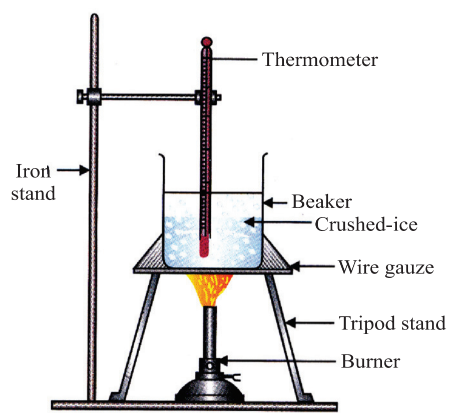
(iii) Fix a cork with bores in the mouth of the test tube and fix it in an iron stand.

(iv) Fix a thermometer in one of the bores and a delivery tube in the other bore.

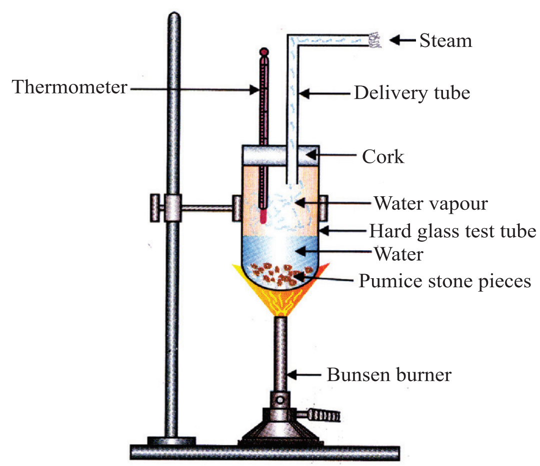
(v) Heat the boiling tube gently. Keep on moving the flame as otherwise the tube is likely to break.

(vi) Note the temperature when the boiling of water starts. Continue heating of water till the temperature becomes constant and the water starts boiling.

(vii) Note the constant temperature also.



To determine the boiling point of water



To determine the boiling point of water

Observation :

Boiling Point of water			**Melting point of ice**		
S. No.	**Time in minutes**	**Boiling point of Water in °C**	**S. No.**	**Time in minutes**	**Melting point of ice in °C**
1.	0	....	**1.**	0	....
2.	1	....	**2.**	1	....
3.	2	....	**3.**	2	....
4.	3	....	**4.**	3	....
5.	4	....	**5.**	4	....

Result :

(a) Boiling point of water is ....°C.

(b) The boiling point does not change with time as long as any water is left for boiling.

(c) Melting point of ice is ....ºC.

(d) The melting point of ice does not change with time as long as ice is present in the mixture of ice and water formed from it.

Precautions :

(a) Use a good quality thermometer.

(b) Do not record the temperature in half or quarter degrees as the accuracy of the thermometer is 1 ºC.

(c) Record the boiling point or the freezing point only when the mercury thread is stable at one place for 2 minutes or more.

(d) Do not immerse the stem of the thermometer in water or ice. This leads to expansion or contraction of the stem which results in recording of wrong temperature.

Practical Based Questions

1. List the steps to determine the melting point of ice.

2. List the steps to determine the boiling point of water.

3. Why do we use distilled water to determine the boiling point of water?

4. A student put 2-3 pieces of pumice stone in water to determine the boiling point of water. Why does he do so?

5. When on heating, water starts converting itself into vapours (steam), the temperature remains constant. Why?

EXPERIMENT NO. 7

Aim : *To verify laws of reflection of sound.*

Material required : Chart paper, glass sheet/cardboard sheet, watch, gum, table, chalk pieces.

Theory : Sound follows laws of reflection like light. These laws are :

(a) Incident angle formed by sound wave, reflection angle are equal to each other.

$$\angle i = \angle r$$

(b) Incident sound ray, reflected sound ray and normal at the point of incidence, all lie in the same plane.

Procedure :

(i) Make 2 pipes of 30 cm each and equal diameters from chart paper.

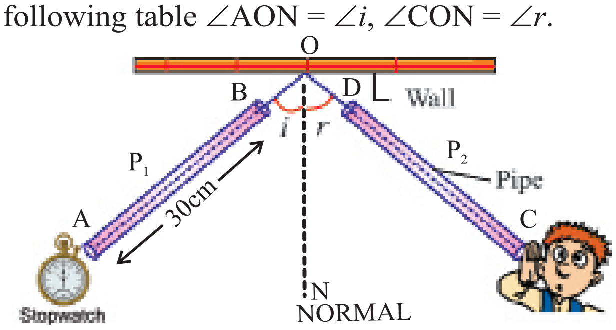
(ii) Put a cardboard/glass sheet between 2 chart pipes or rollers as shown in picture 1.

(iii) Put a clock in front of pipe P_1.

(iv) Now adjust pipe P_2 at different angles and find when do you hear the maximum sound.

(v) Now mark 2 points each at both the pipes A, B and C, D to mark their positions.

(vi) Remove the pipes and make lines making angle of incidence (between AO and ON) and reflection angle (CO and ON) and make their values in the following table $\angle AON = \angle i$, $\angle CON = \angle r$.



Observations :

S. No.	Angle of incidence, $\angle i$	Angle of reflection, $\angle r$	$\angle i - \angle r$
1.			
2.			
3.			
4.			

Result/Conclusion :

(a) Angle of incidence is equal to angle of reflection of sound.

(b) Incident ray, reflected ray, normal at the point of incidence, all lie in the same plane.

Precautions & sources of error :

(i) Don't change the position of pipe P_1 until you are able to hear the maximum sound from P_2.

(ii) Keep watch very close to P_1.

(iii) Glass or cardboard should be of such size that you don't hear the direct sound from watch.

(iv) Table should not move at all.

(v) Both pipes should be of equal lengths and diameters.

Practical Based Questions

1. Write the steps of verification of reflection of sound.

2. Draw a diagram showing reflection of sound and find relationship between $\angle \boldsymbol{i}$ and $\angle \boldsymbol{r}$.

3. A student is performing experiment to verify the laws of reflection of sound with two pipes which are not equal in diameter. Can he get correct result and why?

4. State two laws on which reflection of sound occurs.

5. List the precautions used in experiment to verify the laws of reflection of sound.

EXPERIMENT NO. 8

Aim : *To find density of a solid with the help of a spring balance and measuring cylinder.*

Materials required : Spring balance, a piece of metal, measuring cylinder, thread, water.

Theory : Density is mass per unit volume of a substance. Its unit is kg/m^3 or g/cm^3.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Procedure :

(i) Tie the piece of the metal (or anything else) with a thread and hang it on a spring balance.

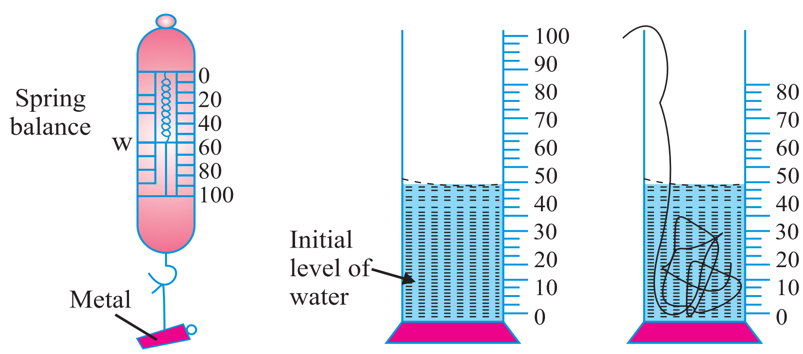
(ii) Find its mass in air.

(iii) Fill a measuring cylinder upto half.

(iv) Immerse this piece of metal fully in water.

(v) Find the volume of displaced water.

(vi) Find the volume with different levels of water.



Observations : Mass of the object (x) = ...grams

S. No.	Initial level of water, V_1	Final level of water, V_2	Displaced water	Volume $V_2 - V_1 = V$
1				V_a =
2				V_b=
3				V_c=

$$\boxed{\text{Average volume of solid (v)} = \frac{V_a + V_b + V_c}{3}\text{ ml}}$$

Calculations : Density $= \dfrac{x}{V}$ g/cm^3

Result : Density of the solid is found to be............ $\boxed{\text{gm/cm}^3}$.

Precautions :

(i) Metal piece used should be dry.

(ii) Calculate the zero error of spring balance before handling.

(iii) There should be no bubble in water.

(iv) Water should not flow out when we put metal piece in it.

(v) Read only Lower meniscus of water.

Practical Based Questions

1. List four steps to find density of a solid with the help of a spring balance and measuring cylinder.

2. Two students A and B are determining the density of water with the help of spring balance and measuring cylinder. Student A took a solid that is denser than water while student B took a solid that is lighter than water. Which student completed experiment successfully and why?

3. List the precautions used in finding the density of a solid.

4. Weight of a solid in air is 50 gm. It displaces 10 ml water when immersed in water. Find it's density and write unit of density.

EXPERIMENT NO. 9

Aim : *To establish relationship between loss in weight of a solid when fully immersed in (i) tap water, (ii) strongly salty water, with the weight of water displaced by it by taking at least 2 different solids.*

Materials required : Spring balance, measuring cylinder, piece of iron, thread, tap water, brine, piece of wood, overflow jar.

Theory : According to Archimedes principle :

"When an object is completely or partially immersed in water, it experiences a decrease in its weight which is equal to the weight of liquid displaced by the immersed part of solid."

Procedure :

(i) Find weight of an object (glass stopper) in air with the help of spring balance.

(ii) Keep the overflow jar on a wooden block.

(iii) Keep filling the overflow jar till water starts flowing.

(iv) Keep a measuring cylinder at the nozzle of the jar.

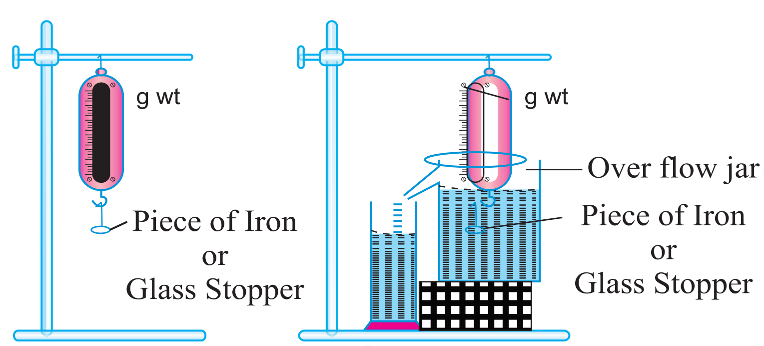
(v) Now, put this spring balance hung with glass stopper, fully immersed in water. Some water will overflow in the measuring cylinder. Find the amount of water collected in the measuring cylinder.

(vi) Note the weight of this glass stopper in water.

(vii) Repeat the steps with piece of iron.

(viii) Repeat the steps with both the objects in brine (saturated solution of salt in water).

Observations :



Object	Weight in air, W_1	Weight in tap water, W_2	Decrease in weight $W_2 - W_1$	Weight in brine, W_3	Decrease in weight, $W_3 - W_1$
1. Glass stopper					
2. Piece of iron					

S. No.	Object	Weight of displaced water (tap water)	Weight of displaced brine
1.	Glass stopper		
2.	Piece of iron		

Conclusion : Weight of displaced water is equal to the weight of object in tap water or brine.

Precautions :

(i) Spring balance should be accurate.

(ii) Measuring cylinder taken should be dry.

(iii) When the object is immersed in water, the water collected in measuring cylinder should not overflow (not even a single drop).

(iv) Object immersed in water should not touch the walls of the container.

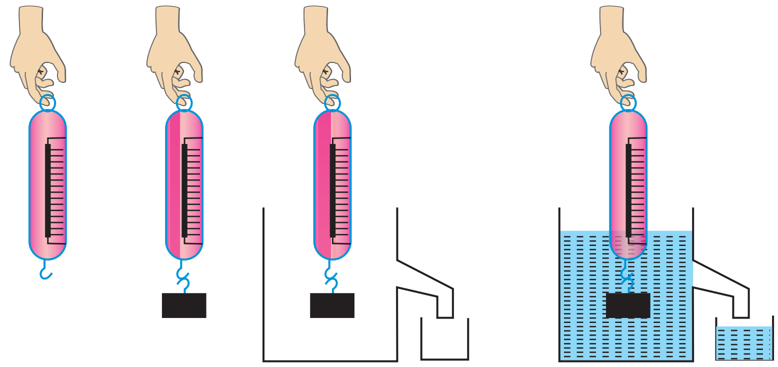
(v) Weight decreased in water should be measured from spring balance only once the object is stable.

(vi) Lower meniscus of colourless solution (Water/Brine) should be read.

Practical Based Questions

1. In an experiment weight of a solid was measured. Also, weight of displaced water was also measured in the same experiment. Which law is verified by it ? Write law and its definition.

2. Out of the following sketches, which shows measurement of weight of displaced water ?



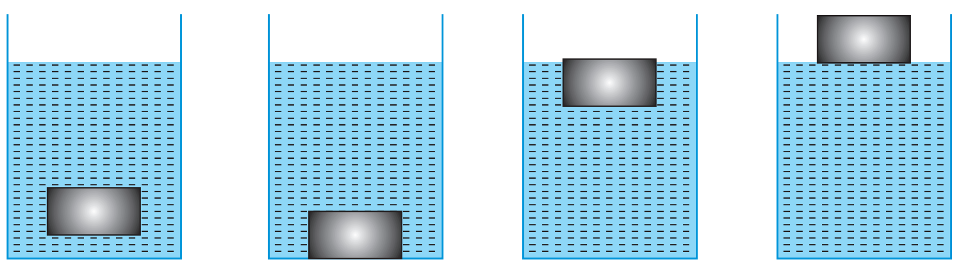
3. An iron nail sinks in sea water but a ship, which is much heavier keeps floating. Write the details why it happen.

4. To find the density of powdered salt, what was taken in a eureka flask? How can we find the density of any thing?

5. A boat A floats on water, a ship B's lower part is immersed in water and a submarine C is completely immersed in water. Explain in your own words.

6. An experiment shows decrease in the weight of an object when it is immersed in water. Write its principle.

7. In which of the following, the decrease in the weight of an object (when immersed in water) is equal to the weight of the water displaced.



8. If an object is immersed in water in a eureka vessel and then in extremely salty water in the same eureka vessel, what will happen? Describe in your words.

EXPERIMENT NO. 10

Aim : *To find the velocity of pulse propagated through a stretched slinky.*

Materials required : A slinky, stop watch, meter scale.

Procedure :

(i) Take a slinky and spread it on a table or smooth floor as shown in the figure.

(ii) Fix its one end at a fixed point on wall.

(iii) Take the slinky in right hand.

(iv) Jerk your hand from right to left.

(v) A pulse is generated. Calculate the time taken for 50 pulses.

(vi) Let this time taken be T seconds.

(vii) Find the distance between two ends of slinky. Let this be D meters.

(viii) Speed of pulse = $\frac{D}{T/50}$ m/s

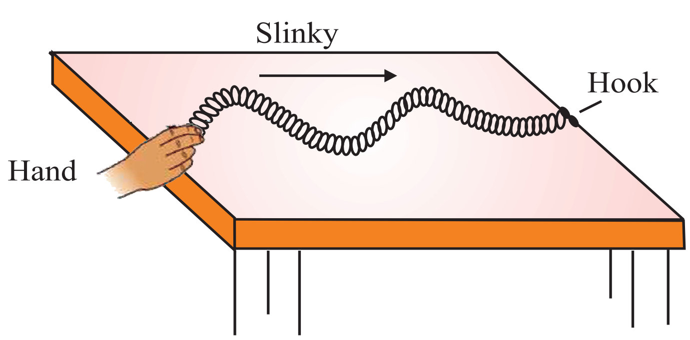
(ix) Repeat the same for 5 times and find the average.

Observations :

Length of slinky = ... m

S. No.	Time for 50 pulses T(s)	Speed
1.		
2.		
3.		
4.		
5.		

Average = ...m/s



Precautions :

(i) Choose a slinky of proper length and ductility.

(ii) Tie one end of slinky properly.

(iii) Start the stop watch as you jerk.

(iv) Give a jerk to slinky horizontally.

Practical Based Questions

1. What kind of waves can be produced in a slinky ? Give definition of these waves.

2. Each particle in a wave propagates within a slinky or a thread. Describe?

3. A wave is produced for a small interval of time. What do you call it?

4. What precautions should be taken during the experiment done with a slinky?

5. What is a pulse? Describe.

6. When the string of a sitar is stretched and left then which types of waves are produced in sitar and in the air?

7. A wave travels in the form of compression and rarefaction. Tell the name of wave. Also define this wave in your words.

8. Which type of wave is produced in water?

EXPERIMENT NO. 11

Aim : To verify the law of conservation of mass in a chemical reaction.

Materials required : Physical balance, conical flask, ignition tube, thread, cork (rubber), barium chloride and sodium sulphate.

Principle : Law of Conservation of Mass : Matter is neither created nor destroyed. Therefore in a chemical reaction the total mass of the substance remains conserved.

Procedure :

(i) Make aqueous solution of barium chloride and sodium sulphate.

(ii) Barium chloride solution should be taken in an ignition tube and sodium sulphate solution is taken in a conical flask.

(iii) The ignition tube containing barium chloride is hanged with the help of a thread inside the conical flask having sodium sulphate in it and a cork is applied on the mouth of the conical flask.

(iv) The whole apparatus is now weighed carefully.

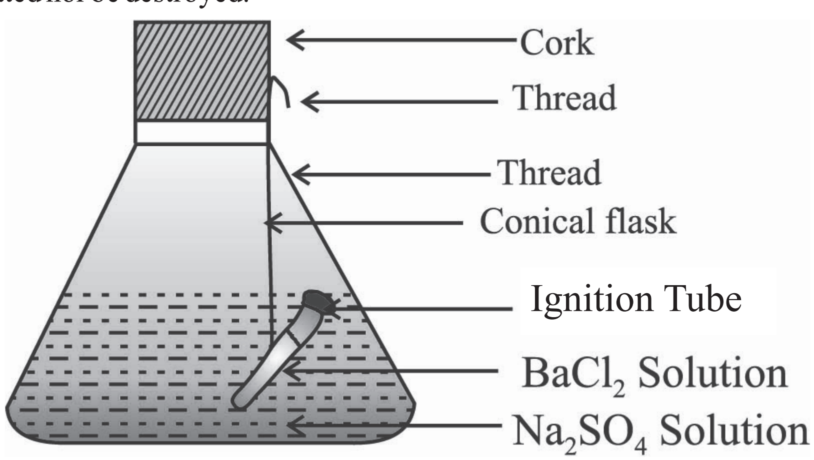
(v) Now tilt the conical flask in such a way that the two solutions get mixed well into each other.

(vi) After the chemical reaction, a white coloured precipitate of Barium sulphate is formed in the conical flask.

(vii) Now again weigh the apparatus in the physical balance.

Inference : The total mass inside the conical flask remains same even after the chemical reaction.

Result : The mass of the substances don't change and it remains conserved. Therefore, it can neither be created nor be destroyed.



Questions

1. What colour changes take place on mixing aqueous solution of barium chloride and sodium sulphate? Why?
2. Write any two characteristics of a solution formed by mixing common salt or Alum in water.
3. You are provided with a mixture of sand and Iodine. How will you proceed to separate the mixture? Name this method. Also draw a labelled diagram of this set up.
4. Why should carbon disulphide be kept away from the flame?
5. 170 g silver nitrate reacts with sodium chloride to give 143.5 g silver chloride and 85 g sodium nitrate. What is the mass of sodium chloride.
6. 12 g Magnesium combine with 16 g Oxygen to give 28 g of Magnesium Oxide. Which law is proved from it?

Practice Question Paper
Annual Examination 2022-23
Class IX
Science-086

Duration : 3 hr M. Marks-80

General Instructions

i. This question paper consists of 39 questions in 5 sections.
ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
iii. Section A consists of 20 objective-type questions carrying 1 mark each.
iv. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.
v. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
vi. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
vii. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION-A

1. On Converting 25°C, 38°C, and 66°C to Kelvin Scale, the Correct sequence of temperature will be
   a. 298K, 311 K, 339K b. 298K, 300K, 338K
   c. 273 K, 278 K, 543 K d. 298K, 310 K, 338K

2. During Summer, water kept in an earthen pot becomes cool because of the phenomenon of
   a. Diffusion b. Transpiration
   c. Osmosis d. Evaporation.

3. Which of the following is not a compound:
   a. glucose solution b. copper sulphate
   c. salt d. oxygen gas

4. The ion of an element has 3 positive charges. If mass number of the atom is 27 and the number of neutrons is 14, what is the number of electrons in the ion?
   a.13 b. 10
   c.14 d. 16

5. The numerical ratio of displacement to distance for a moving object is
a. Equal to or less than 1 b. always equals to 1
c. always less than 1 d. always more than 1

6. Area covered in velocity – time graph depicts
a. Velocity of an object only b. Distance travelled by an object
c. height of an object d. none of these

7. Which of the following properties does not describe a compound :
a. It is composed of two or more elements
b. It is mixed in any proportion by mass
c. It cannot be separated into constituent by physical means
d. None of the above

8. A force of 100 N acts on body of mass 2kg for 10 sec. The change in the Velocity of the body is
a. 500m/s b. 250m/s
c .1000m/s d. 100 m/s

9. An example of metal and non-metal that exists in the liquid state are:
a. Gallium, Mercury b. Mercury, Chlorine
c. Mercury, Bromine d. Bromine, Sulphur

10. What is the formula of Sodium Carbonate:
a. Na_2CO_3 b. $NaHCO_3$
c. $NaCO_3$ d. Na_2HCO_3

11. The ratio by mass of constituent element in sodium chloride is :
a. 23:36 b. 22:35
c. 11:17 d. 23:35.5

12. How many electrons are occupied in the 'M' Shell?
a. 8 b. 16
c. 18 d. 32

13. Name the phenomenon takes place when cytoplasm of a plant cell shrink in a hypertonic solution:
a. Phagocytosis b. Plasmolysis
c. Acidolysis d. Electrolysis

14. What types of epithelial cells are responsible for the absorption of digested food material by the intestine:
a. Stratified squamous epithelium
b. Ciliated epithelium
c. Spindle fibres
d. cuboidal epithelium

15. Epidermis of ________ has a coating of cutin.
a. Fungi b. Green Plants
c. Desert plant d. All of the above

16. Generally, Paramecium moves with the help of
a. Villi b. Oral grove
c. Cilia d. None of these

Qs. 17 to 20 are Assertion-Reasoning based questions.
These consist of two statements - Assertion (A) and Reason (R). Answer these questions by selecting the appropriate options given below:
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true and R is not the correct explanation of A.
c) A is true but R is false
d) A is false but R is true.

17. Assertion (A): As a ball falls downwards, potential energy keeps decreasing but kinetic energy keeps increasing.
Reason (R): Energy can neither be created nor be destroyed.

18. Assertion (A): Elephants communicate with each other through ultrasonic sounds.
Reason (R): The sound of frequencies higher than 20 KHz, are known as ultrasonic sounds.

19. Assertion (R): The basic objective in mixed cropping is to minimize the risk and insurance against total crop failure due to abnormal weather conditions.
Reason (R): Wheat and chick Pea are examples of intercropping.

20. Assertion (A): Nucleus contain chromosome.
Reason (A): The nucleus is the only organelle present in the cell which have DNA.

SECTION-B

(Q.no. 21 to 26 are very short answer questions) (2 marks each)

21. Differentiate True Solutions and Suspension on the basis of their visibility and stability.

22. Why does steam causes more severe burns than boiling water?
23. Differentiate mixtures and compounds.
24. Calculate the relative abundance of B-10, and B-11. If the average atomic mass of 'B' is 10.8u

25. Write down the configuration of:

a. Mg (12)	b. P (15)
c. CI (17)	d. Ca (20)

26. Which organelle is called the Power House of the Cell and why?

SECTION-C

(Q.no.27 to 33 are short answer questions. (3 marks each)

27. A load of 200 kg is pulled upto 5 meter calculate the work done.

28. (i) Explain the effect of the concentration of the solution on the cell?
(ii) list two functions of stomata.

29. Differentiate three types of muscles on the basis of their structure and functions. Draw a neat labelled diagram of these three types of muscles.

30. The brakes applied to a car produces deceleration of 6 m/s^2 in opposite directions to the motion. If the car requires 2 seconds to stop after the application of brakes, calculate the distance travelled by the car during this time.

31. (i) Why does a gunman get jerked on a firing of a bullet
(ii) Explain why seat belts are provided in the car ?

32. State Archimedes Principle. Write its two applications.

33. Derive the formula for kinetic energy.

SECTION-D

(Q.no.34 to 36 are long answer questions) (5 marks each)

34. (i) Draw a well-labeled diagram of mitochondria .
(ii) State any two functions of the Golgi body.
(iii) Which cell organelle is called "Digestive Bag".

35. A scooter acquires a velocity of 36 Km/hr in 10 sec just after the start. Calculate the acceleration of the scooter and the distance covered by the scooter in 10s.

36. (i) Write down the Chemical formula of
a. Magnesium Chloride
b. Aluminium Sulphate
c. Calcium Nitrate
(ii) Calculate the molecular mass of
a. Potassium Hydroxide
b. Sodium Oxide
(K=40, H= 1, 0=16, Na = 23)

SECTION-E

(Q.no. 37 to 39 are case based/data-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.) (4 marks each)

37. Sound is a mechanical energy that produces a sensation of hearing. It is produced due to the Vibrations of different objects. It propagates as compressions and rarefactions in the medium and is called longitudinal waves. The vibration of different objects causes changes in the pressure and density of the medium Audible range of hearing of the average human being is in the frequency of 20 H, to 20 kHz
a. In which medium sound waves travel faster.
b. A sound produces 50 crests and 50 troughs in 0.5 seconds. What is the frequency of the wave?

or

c. What are longitudinal waves? How sound produces from different objects?

38. Gases are highly compressible as compared to solids and liquids. The LPG cylinder that we get in our home for cooking has compressed gas. CNG is used as fuel these days in vehicles. The liquid takes the Shape of the container in which they are kept. Liquids flow and change shape, so they are not rigid but can be called as fluids. Aquatic animals can breathe underwater. The rate of diffusion of liquids is greater than solids.

a. Why is CNG used as fuel these days in vehicles?
b. Liquids have no fixed shape but have fixed volume. Why?
c. How aquatic animals can breathe underwater?

or

d. Why the rate of diffusion of liquids is greater than solids?

39. Different crops require different climatic conditions of temperature and photo periods for their growth and completion of their cycle. Paddy, soybeans, and pigeon pea are Kharif crops and are grown in the rainy season from June to October. Whereas crops such as wheat, gram, and mustard are Rabi crops which are grown in the winter season from November to April. In India, there has been increasing in the production of food grains from 1952 to 2010 to 4 times with only a 25% increase in cultivable land area.

a. What is Kharif and Rabi cropping season?
b. Plant manufacture their food in sunlight by a process called ______
c. An increase in the production of crops can be achieved through
   i. Crop production improvement
   ii. Crop protection improvement
   iii. Crop protection management
   iv. All of these

or

Give two examples of each Kharif and Rabi crops.

PRACTICE PAPER
(Class-IX)
Subject - SCIENCE (Code:) 086

Times allowed : 3 Hrs **Maximum Marks : 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 objective type questions carrying 1 mark each.
4. Section B consists of 6 very short questions carrying 02 mark each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer of these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based /case-based units of assessment of 04 marks each with sub parts.

Saction A

1. What is mean by sublimation?

a) change of state directly from solid to liquid without changing into gas state.
b) change of state directly from solid to gas after changing into liquid state.
c) change of state directly from solid to gas without changing into ice state.
d) change of state directly from solid to gas without changing into liquid state.

2. Which of the following is a chemical changes:

a) cutting of trees,
b) making a fruit salad with raw fruits
c) rusting of almirah,
d) melting of wax

OR

Which of the following is a physical changes:

a) melting of butter in a pan,
b) dissolving common salt in water,
c) burning of paper and wood.
d) digestion of food

3. An international scientific organization which approves name of elements, symbol and unit called..

a) Periodic table

b) IUPAC nomenclature

C) Name system

d) None of the above

OR

How to calculate molecular mass.

a) Sum of proton number and electron number

b) Multiplication of proton number and electron number

c) Sum of proton number and neutron number

d) Multiplication of proton number and neutron number

4.

From the given v-t graph, it can be inferred that the object is

a) At rest

b) In uniform motion

c) Moving with uniform acceleration

d) in non-uniform motion

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

If the displacement of an object is proportional to square of time, then the object moves with :

a) Uniform velocity

b) Uniform acceleration

c) Increasing acceleration

d) decreasing acceleration.

5. A passenger in a moving train tosses a coin that falls behind him. It means that the motion of the train is

a) Uniform

b) Accelerated

c) Retarded

d) Along circular tracks

OR

A goalkeeper in a football game pulls his hands backwards after holding the ball shot at the goal. This enables the goalkeeper to

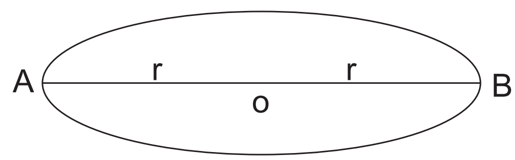
a) increase the rate of change of momentum

b) decrease the rate of change of momentum

c) increase the force exerted by the balls on the hands

d) exert larger force on the ball

6. A particle is moving in the circular path of radius r.



The displacement after half a circle would be:

a) Zero b) r

c) 2r d) 2 r

Or (ONLY FOR VISUALLY IMPAIRED STUDENTS)

Which of the following can sometimes be 'zero' for a moving body?

(i) Average velocity (ii) Distance traveled

(iii) Average speed (iv) Displacement

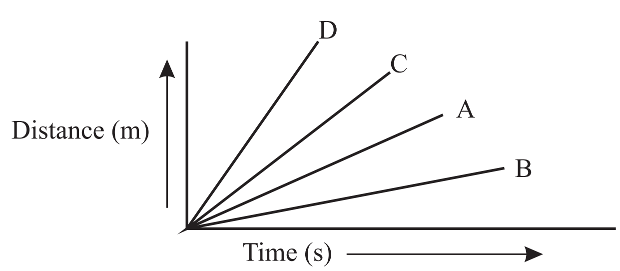
(a) Only (i)

(b) (i) and (ii)

(c) (i) and (iv)

(d) Only (iv)

7. Four cars A, B, C and D moving on a leveled, straight road. Their distance time graphs are shown in the figure below. Which of the following is the correct statement regrading the motion of these cars?



a) Car A is faster than car D b) Car B is the slowest

c) Car D is faster than car C d) Car C is the fastest

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

In a free fall the velocity of a stone is increasing equally in equal intervals of the under the effect of gravitational force of the earth. Then what can you say about the motion of this stone? Whether the stone is having :

a) Uniform acceleration
b) Non-uniform acceleration
c) Retardation
d) Constant speed

8. Which of the following is true for the third law of motion?

a) Action-Reaction pair always acts on the same body.
b) They act on different bodies in opposite directions.
c) Action-Reaction pairs have the same magnitudes and directions.
d) Act on either body at normal to each other.

OR

The inertia of an object causes the object to

a) decrease its speed
b) increase its speed
c) resist any change in the state of its motion.
d) decelerate due to friction.

9. The gravitational force between two bodies does not depend on :

a) their masses
b) their separation
c) the product of their masses
d) the medium between two bodies

OR

What is the value of the acceleration due to gravity on the surface of the Earth?

a) 9.8m/s2
b) 18.8 m/s2
c) 4 m/s2
d) 12 m/s2

10. A ball is released from certain height. Which of the following statement is correct about this example?

a) Kinetic energy decreases at each second.
b) Potential energy decreases at each second.
c) Total energy decreases at each second.
d) All of the above.

OR

In which of the following examples does the work done not be zero?

a) The stone is rolling of frictionless surface with constant velocity.

b) A small child pushes a truck but truck remains stationary.

c) Moon revolves around earth because of gravitational force exerted by earth.

d) None of the above.

11. The distance which compression or a rarefaction travels per unit of time gives ....

a) The density of sound wave

b) Speed of sound

c) Wavelength of sound

d) Frequency of sound

OR

The phenomenon where a sound produced is heard again due to reflection is called...

a) Sound bounce   b) Mirage

c) An echo   d) Interference

12. Which of the following statements are correct ?

(i) Hybridisation means crossing between genetically dissimilar plants.

(ii) Cross between two varieties is called inter specific hybridisation.

(iii) Introducing genes of desired character into a plant gives genetically modified crop.

(iv) Cross between plants of two species is called as inert-varietal hybridisation.

a) (i) and (iii)   b) (iii) & (iv)

c) (i) & (ii)   d) (ii) & (iv)

13. Rate of evaporation does not increases with

a) Increase of surface area

b) Increase in humidity

c) Increase in temperature

d) Increase in wind speed

14. When no more solute can be dissolved in solution at given temperature is called ..... Solution

a) Homogenous

b) Heterogeneous

c) Saturated

d) Solubility

15. Energy can neither be created nor destroyed. It is a .....

a) Low of Energy reformation

b) Low of Energy recreation

c) Low of conservation of energy

d) Low of conservation of mass

OR

Choose the low of conservation of mass

a) Mass can neither be created nor formed

b) Mass can neither be created nor reform

c) Mass can neither be created nor destroyed

d) Mass can neither be created nor alive.

16. If the L shell accommodate by 8 electrons then valency of element is ....

a) 5 b) 2 c) 6 d) 0

OR

Those elements whose valency is always zero are called as ....

a) Halogen

b) Metals

c) Nonmetals

d) Noble gaseous

For question numbers 17-20 two statements are given- one labeled as Assertion (A) and the other labeled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true, and R is correct explanation of the assertion.

b) Both A and R are true, but R is not the correct explanation of the assertion.

c) A is true, but R is false.

d) A is false, but R is true.

17. Assertion A :- Cell membrane is called selectively permeable membrane.

Reason R :- Cell membrane allows or permits the entry of only usefully material and exit of waste material across it.

18. Assertion A :- Apical meristem is present at the growing tips of stems and roots.

Reason R :- Apical meristem is always located upper side of plants.

19. Assertion A :- Speed of a moving body is its velocity in a given direction

Reason R :- Velocity of a moving body is its speed in a given direction .

20. Assertion A:- Newton's first law of motion is also known as the law of inertia.

Reason R :- Inertia is the property of an object by virtue of which it resists any change in his position.

SECTION -B

21. A ball is thrown vertically upwards with a velocity of 49m/s^2. Calculate

a) The maximum height to which is rises,

b) The total time it takes to return to the surface of the earth.

OR

Answer the following questions:-

a) What is the acceleration of free fall?

b) What do we call the gravitational force between the earth and an object?

22. Answer the following questions:-

a) A freely falling object eventually stops on reaching the ground. What happens to its kinetic energy?

b) Find the energy in kW h consumed in 10 hours by four devices of power 500W each.

OR

a) Geeta says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why?

b) Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60km/h.

23. Answer the following questions:-

a) Explain how sound is produced by your school bell.

b) Why are sound waves called mechanical waves?

24. Answer the following questions:-

a) Helium atom has an atomic mass of 4u and two protons in its nucleus. How many neutrons does it have?

b) Which one of the following is a correct electronic configuration of sodium?

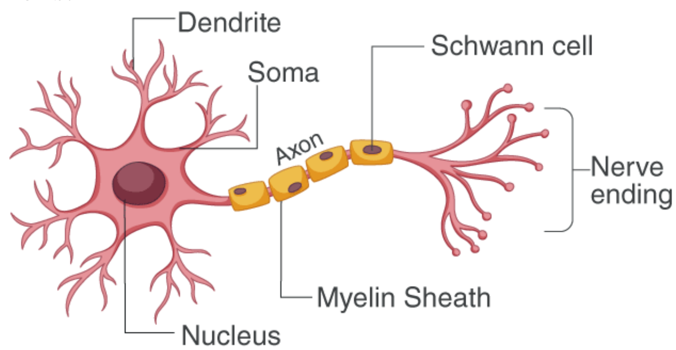
(i) 2,5 (ii) 8. 2, 1 (iii) 2, 1, 8 (iv) 2, 8, 1

25. Answer the following questions:-

a) Why are the lysosomes known as suicidal bags?

b) Where are proteins synthesised inside the cell?

26. Look at the following given picture carefully and answer the following questions.



1. The given picture is of which of the following type of cell?

a) Muscle cell b) Cardiac cell

c) Bone cell d) Nerve cell

2. The structural and functional unit of the nervous system are

a) Neurons b) WBC

c) RBC d) Platelets

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

Answer the following questions:-

1. The longest cell in the humans body is

a) Cardiac cell

b) Bone cell

c) Nerve cell

d) Sperm cell

2. A nerve impulse jumps from one neuron to another through .... during saltatory conduction.

a) Synpase

b) Axon

c) frontal part of neuron

d) terminal part of neuron

SECTION - C

27. Which of the following is true for displacement? Justify your answer with example.

i) It can be zero.

ii) Its magnitude is greater than the distance traveled by the object.

iii) It can not be zero.

28. A ball thrown up vertically returns to the thrower after 6s. Find

a) The velocity with which it was thrown up.

b) The maximum height it reaches, and

c) Its position after 4s.

OR

A stone is allowed to fall from the top of a tower 100m height and at the same time another stone is projected vertically upwards from the ground with a velocity of 25m/s. Calculate when and where the two stones with meet.

29. Answer the following questions:-

a) Name the three types of simple permanent tissues.

b) What are the constituents of phloem?

c) What are the functions of areolar tissue?

30. Read out the activities listed below carefully. Reason out whether or not work is done in the light of your understanding of the term 'work'.

a) Suma is swimming in a pond.

b) A donkey is carrying a load on its back.

c) A wind-mill is lifting water from a well.

OR

a) An engine is pulling a train.

b) Food grains are getting dried in the sun.

c) A sailboat is moving, due to wind energy.

31. Answer the following questions:-

a) Suppose you and your friend are on the moon. Will you be able to hear any sound produced by your friend?

b) Which wave property determines (i) loudness, (ii) pitch?

c)Guess which sound has a higher pitch. Guitar or car horn?

RO

a) How are the wavelength and frequency of a sound wave related to its speed?

b) Distinguish between loudness and intensity of sound.

c) In which of the three media, air , water or iron, does sound travel the fastest at a particular temperature?

32. Answer the following questions:-

a) Which of the following conditions will give the most benefits? Why?

i) Farmers use high-quality seeds, do not adopt irrigation or use fertilizers.

ii) Farmers use ordinary seeds, adopt irrigation and use fertilizer.

iii) Farmers use quality seeds, adopt irrigation, use fertilizer and use crop protection measures.

b) Why should preventive measures and biological control methods be preferred for protecting crops?

c) What factors may be responsible for losses of grains during storage?

OR

a) Which method is commonly used for improving cattle breeds and why?

b) What management practices are common in dairy and poultry farming?

c) Name two methods or ways of obtaining fish.

33. Answer the following questions:-

a) Define inter-cropping and crop rotation.

b) What are the advantages of inter-cropping and crop rotation?

OR

a) What is genetic engineering ? How is it useful in agricultural practices?

b) What are the benefits of cattle farming?

SECTION-D

34. Answer the following questions:-

a) Tabulate the differences in the characteristics of states of matter,

b) Comment upon any four of the following: (i) rigidity, (ii) compressibility, (iii) fluidity, (iv) filling a gas container, (v) shape, (vi) Kinetic energy and (vii) density.

OR

Give suitable reasons for the following

a) A gas fill completely the vessel in which it is kept.

b) A gas exerts pressure on the wall of the container.

c) A wooden table should be called a solid.

d) We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert.

e) Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water, why?

35. Answer the following questions:-

a) Classify each of the following as a homogeneous or heterogeous mixture: soda water, wood, air , oil, vinegar, filtered tea.

b) How would, you confirm that a colorless liquid given to you is pure water?

c) Which of the following materials fall in the category of a "pure substance"? (i) Ice (ii) Milk (iii) Iron (iv) Hydrochloric acid (v) Calcium oxide (vi) Mercury (vii) Wood (vii) Air.

d) Identify the type of solutions among the following mixtures. (i) Soil (ii) Sea water (iii) Air (iv) Coal (v) Soda water.

e) Which of the following will show "Tyndall effect"? (i) Salt solution (ii) Milk (iii) Copper sulphate solution (iv) Starch solution.

OR

a) Classify the following into elements, compounds and mixtures.

(I) Sodium (ii) Soil (iii) Sugar solution (iv) Silver (v) Calcium carbonate (vi) Tin (vii) Silicon (viii) Coal (ix) Air (x) Soap (xi)Methane (xii) Carbon dioxide (xiii) Blood

b) Give the names of the elements present in the following compounds:

i) Quick lime

ii) Hydrogen bromide

iii) Baking powder

iv) Potassium sulphate

c) Arrange the following in order of increasing density-air exhaust from chimney, honey, water, chalk, cotton, and iron.

36. Answer the following questions:-

a) Write down the formulae of (i) Sodium oxide (ii) Aluminum chloride (iii) Sodium sulphide (iv) Magnesium hydroxide.

b) Calculate the formula unit masses of (i) ZnO, (ii) Na_2O, (iii) K_2CO_3. given atomic masses of Zn=65u, Na=23u, I-39u, C-12u and O=16u.

OR

a) Write the chemical formulae of the following:

i) Magnesium chloride

ii) Copper nitrate

iii) Aluminum chloride

iv) Calcium carbonate

b) Calculate the molar mass of the following substances.

I) Ethyne, C_2H_2

ii) Phosphorus molecule, P_4 (Atomic mass of phosphorus=31)

iii) Hydrochloric acid, HCl

iv) Nitric acid, HNO_3.

SECTION-E

37. Protons are present in the nucleus of an atom and determine its atomic number. It is denoted by 'Z'. All atoms of an element have the same atomic number, Z. In fact, elements are defined by the number of protons they possess. The mass of an atom is practically due to protons and neutrons alone. These are present in the nucleus of an atom. Hence protons and neutrons are also called nucleons. Therefore, the mass of an atom resides in its nucleus. It is denoted by 'A'.

Answer the following questions:-

1) Atomic number is denoted by

a) X b) Y

c) Z d) A

2. The sum of the total number of protons and neutrons present in the nucleus of an atom.

a) Atomic number

b) Mass number

c) Atomic weight

d) None of the above

3. Mass number is denoted by

a) A

b) B

c) C

d) Z

4. Identify the correct statement.

Statement 1 - Protons are present in the nucleus of an atom.

Statement 2 - Atomic number is the number of protons of an atom.

Statement 3 - Atomic number is denoted by "Z"

Statement 4 - The mass of an atom is due to protons and neutrons alone.

a) Only 2

b) Both 3 & 4

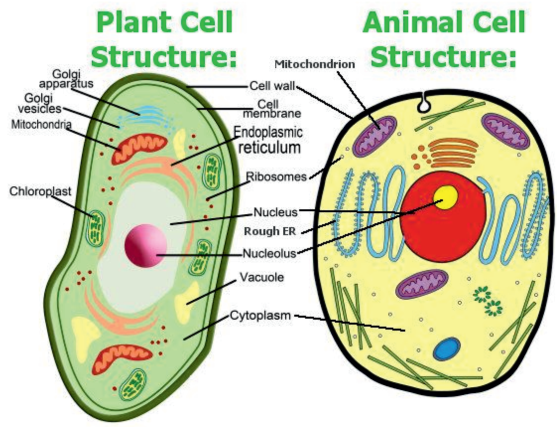
c) Both 1 & 2

d) All of the above

OR

4. Why mass of carbon is 12u give the reason?

38. Based on the below given picture of plant and animal cell, answer the following questions:-



1) Fluid content present in cell called as :

a) Cytoplasm

b) Vacuole

c) Proteins

d) Chromosomes

2. The cell organelle which plays crucial role in detoxifying many poisons and drugs is :

a) Endoplasmic Reticulum

b) Mitochondria

c) SER (Smooth Endoplasmic Reticulum)

d) RER (Rough Endoplasmic Reticulum)

3. The membrane bound sacs in the cell which are filled with digestive enzymes are :

a) Cytoplasm

b) Vacuole

c) Proteins

d) Lysosomes

4. Numerous membrane layers present in chloroplast called ....

a) Cytoplasm

b) Vacuole

c) Mitochondria

d) Stroma

OR

The cell organelle which generates and provide energy to the cell for its activities, in the form of ATP is :

a) Nucleus

b) Golgi Body

c) Endoplasmic Reticulum

d) Mitochondria

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

A cell is capable of forming the structure of the body of the organisms and independently carrying out all necessary activities of life. So, the are called basic structural as well as functional unit of the life. Its, all activities are carried out by different cell organelles present in ti.

Answer the following questions:-

1) The cell organelles which have their own genetic material are

a) Chloroplast

b) Mitochondria

c)Ribosome and Golgi body

d) A and B both

2. Which cell organ belle is known as power house of the cell

a) Ribosome

b) Mitochondria

c) Nucleus

d) Endoplasmic reticulum

3. Which cell organelle is known as kitchen house of the cell?

a) Mitochondria

b) Chloroplast

c) Endoplasmic reticulum

d) Golgi body

4. The cell organelle which control the activities of the cell is

a) Nucleus b) Ribosomes

c) Lysosomes d) Mitochondria

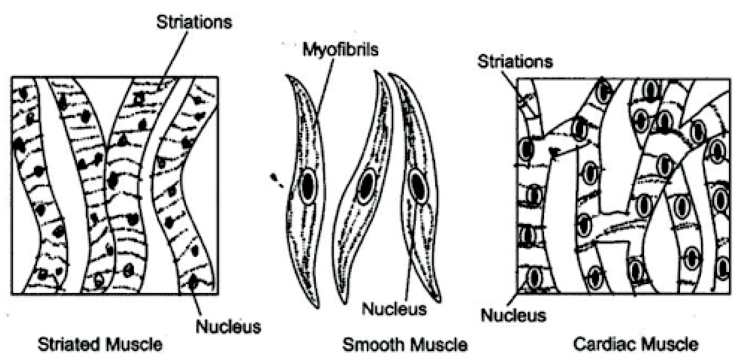
OR

Cell organelle through which materials passes in and out of the cell is:-

a) Nucleus b) mitochondria

c) Cell membrane d) Ribosome

39. Three pictures of the three types of muscle fibres such as striated muscles, smooth muscels (unstriated muscle fiber) and cardiac muscles are given below. Look at all the pictures carefully and based on their structure and site/ location in the body, differentiate between these three types of muscles.



OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

In a family, a paralytic patient was unable to walk. "The family member of the patient took the utmost care of the patient.

Answer the following questions:-

a) Name two tissues responsible for the movement of a body.

b) Name the tissues present in brain and spine.

c) Name the tissue which joins muscle to bone.

d) Name the muscle filare present in heart.

Set-1
Subject - SCIENCE (Code :) 86
(MARKETING SCHEME)
Time Allowed : 3 Hrs
Maximum Marks : 80

SECTION A

1. d) Change of state directly from solid to gas without changing into liquid state.
2. a) rusting of almirah,

OR

a) melting of butter in a pan

3. b) IUPAC nomenclature

OR

c) Sum of proton number and neutron number

4. b) In uniform motion

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

b) Uniform acceleration

5. b) accelerated

OR

b) decrease the rate of change of momentum

6. c) 2r

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

c) (i) Average velocity and (iv) Displacement.

7. b) Car B is the slowest

OR E(ONLY FOR VISUALLY IMPAIRED STUDENTS)

a) Uniform acceleration

8. b) Action and Reaction act on different bodies in opposite directions.

OR

c) resist any change in the state of its motion .

9. d) the medium between the two bodies

OR

a) 9.8 m/s2

10. b) potential energy decreases at each second.

OR

d) none of the above

11. d) Speed of sound

OR

c)An echo

12. c) (i) & (ii)
13. b) Increase in humidity
14. c) Saturated

OR

d) Solubility

15. c) Lo of conservation of energy

OR

C) Mass can neither be created nor destroyed

16. d) 0

OR

d) Noble gaseous

17. A) 0
18. B)
19. D)
20. B)

SECTION B

21. Initial velocity u=49 m/s

Final speed v at maximum height = 0

Acceleration due to earth gravity g=-9.8 m/s2 (thus negative as ball is thrown up).

a) By third equation of motion,

$2gH=v^2-u^2$

2x(-9.8) x H=0-(49)2

-19.6H = -2401

H = 122.5 m

b) Total time T = Time to ascend (T_a) + Time to descend (T_d)

v = u + gt

0 = 49 + (-9.8) x T_a

T_a = (49 / 9.8) = 5s

Also, T_d = 5s

Therefore T = T_a + T_d

T = 5 +5

T = 10s

OR

a) Acceleration due to gravity is the acceleration gained by an object due to gravitational force. On Earth, all bodies experience a downward force of gravity which earth's mass exerts on them. The Earth's gravity is measured by the acceleration of the freely falling objects. At Earth's surface, the acceleration of gravity is 9.8 ms2 and it is denoted by 'g'. Thus, for every second an object is in free falk, its speed increases by about 9.8 meters per second.

b) The gravitational force between the earth and an object is called weight. Weight is equal to the product of acceleration due to the gravity and mass of the object.

a) When an object falls freely towards the ground, its potential energy decrease, and kinetic energy increase; as the object touches the ground, all its potential energy becomes kinetic energy. Since the object hits the ground, all its kinetic energy becomes heat energy and sound energy. It can also deform the ground depending upon the ground's nature and the amount of kinetic energy possessed by teh object.

b) Given,
Power rating of the deice (P) = 500 W == 0.50 kW
Time for which the device runs (T) = 10h
Energy consumed by an electric device can be obtained by the expression
Power = Energy consumed / Time taken
Energy consumed = Power x Time
Energy consumed = 0.50 x 10
Energy consumed = 5 kWh
Thus, the energy consumed by four equal rating devices in 10 h will be
=> 4 x 5 kWh
= 20 kWh

OR

a) Acceleration in an object could be zero even when many forces work on it. This happens when all the forces get rid of one another, i.e., the online force working on the object is zero. For a uniformly moving object, the online force working on the it is Zero. Hence, the acceleration of the thing is zero. Hence, Soni is corrects.

b) Given
The Mass of the body = 1500kg
Velocity v = 60 km/hr
= 60 x 1000 m
3600 s
=50/3 m/s
The work required to stop the moving car = change in kinetic energy.

23. a) When the school bell is hit with a hammer, it moves forward and backwards, producing compression and rarefaction due to vibrations. This is how sound is produced by teh school bell.
b) Sound waves require a medium to propagate to interact with the particles present in them. Therefore, sound waves are called mechanical waves.

24. a) Answer :
Atomic mass of He = 4u.
Atomic mass = No. of protons + No of neutrons
4 = 2 + no. of neutrons.
No. of neutrons = 4 - 2 = 2
Helium atom has 2 neutrons
b) Answer : - (iv) 2, 8, 1

25 a) When the cell gets damaged, lysosomes may burst, and the enzymes digest their own cell. Therefore, lysosomes are known as suicide bags.

b) The proteins are synthesised in teh ribosomes that are also known as protein factories.

26. 1. d) Nerve cell

2. a) Neurons

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

1. c) Nerve Cell

2. a) Synapse

SECTION -C

27. a) Neither of the statements is true.

(i) Given statement is false because the displacement of an object which travels a certain distance and comes back to its initial position is zero.

(ii) Given statement is false because the displacement of an object can be equal to, but never greater than the distance traveled.

b) Yes, an object which has moved through a distance can have zero displacement if it comes back to its initial position.

Example : If a person jogs in a circular park which is circular and completes one round. His initial and final position is the same.
Hence, his displacement is zero .

28. Given data :
$g = 10\ m/s^2$
Total time T = 6 sec
$t_a = t_d = 3$ sec

a) Final velocity at maximum height v = 0
From first equation of motion :-
$v = u - gt_a$
$u = v + gt_a$
$= 0 + 10 \times 3$
$= 30$ m/s
The velocity with which stone was thrown up is 30 m/s.

b) From second equation of motion
$s = ut_a - \frac{1}{2} g\ (t_a)^2$
$= 30 \times 3 - (1/2) \times 10 \times (3)2$
$= 90 - 45 = 45$m
The maximum heigh stone reaches is 45 m.

c) In 3 sec, it reaches the maximum height.
Distance traveled in another 1 sec = s’

$s = ut_a - \frac{1}{2} g\, (t_a)^2$

$s = 0 + 10 \text{ x } 1 \text{ x } 1$
$s = 5m.$

The distance traveled in another 1 sec = 5 m
Therefore in 4 sec, the position of point p (45 - 5)
= 40m from the ground.

OR

(i) When the stone from the top of the tower is thrown,
Initial velocity u' = 0
Distance traveled = x
Time taken = t
Therefore,

$s = ut + \frac{1}{2} gt^2$

$x = 0 + (1/12)gt^2$
$x = 5t^2$ ....(a)

(ii) When the stone is thrown upwards,
Initial velocity u = 25 m/s
Distance traveled = (100 - x)
Time taken = t

$s = ut - \frac{1}{2} gt^2$

$(100 - X) = 25t - (1/2) \text{ x } 10 \text{ x } t^2$
$x = 100 - 25t + 5t^2$..........................(b)

From equations (a) and (b)
$5t2 = 100 - 25t + 5t^2$
t = (100/25) = 4sec.
After 4 sec, two stones will meet
from (a)
$x = 5t^2 = 5 \text{ x } 4 \text{ x } 4 = 80$
putting the value of x in (100 - x)
= (100 - 80) = 20 m
This means that after 4 sec, 2 stones meet a distance of 20 m from the ground.

29. a) Parenchyma, collenchymas, and sclerenchyma are the three forms of simple permanent tissues. Aerenchyma and chlorenchyma are two types of parenchyma tissue.

b) The food-conducting tissue of plants is termed as phloem. Sieve tubes, Companion cells, Phloem parenchyma and phloem fibers are the four components.

c) Areolar tissues are commonly seen in animals. They are connective tissues that exist between the skin and the muscles. They can also be found in the bone marrow and around blood arter5ies adn nerves. These tissues take up a lot of room inside the organs. They protect the internal organs and aid in tissue restoration in the event of harm.

30. Work is finished whenever the given 2 conditions are satisfied :
(i) A force acts on the body.

(ii) There's a displacement of the body by applying force in or opposite to the direction of the force.

a) While swimming, suma applies a force to push the water backwards. Therefore, Suma swims in the forward direction caused by the forward reaction of water. Here, the force causes a displacement. Hence, the work is done by Seema while swimming.

b) While carrying a load, the donkey has to apply a force in the upward direction. But, displacement of the load is in the forward direction. Since displacement is perpendicular to force, the work done is zero.

c) A windmill works against gravity to elevate water. The windmill lift water by applying a force in an upward direction, and thus the water is moving in the same upward direction itself. Hence, work is done by the windmill to lift water from the well.

OR

a) When an engine is pull in a train, it is applying a force in the forward direction. So, it is moving in the forward direction. Since displacement and force are in the same direction. Hence, work is done by the engine.

b) There is no force involved in the process of drying food grains in the sun and the grains do not move. Since there is no force or displacement. Hence, no work is done.

c) When a saiboat is moving due to wind energy, it is applying force in the forward direction. So, it is moving in the forward direction. Since displacement and force are in the same direction. Hence, work is done.

31. a) No. Sound waves require a medium to propagate. Due to the absence of an atmosphere on the moon and since sound cannot travel in a vaccume.; I will not be able to hear any sound produced by my friend.

b) (i) Amplitude :- The loudness of the sound and its amplitude is directly related to each other. The larger the amplitude, the louder the sound.

(ii) Frequency :- The pitch of the sound and its frequency is directly related to each other. If the pitch is high, then the frequency of sound is also high.

c) The pitch of the sound is directly proportional to its frequency. Therefore, the guitar has a higher pitch when compared to a car horn.

OR

a) Wavelength, speed and frequency are related in the following way :
Speed = Wavelength x frequency
v = v.

b) The amount of sound energy passing through an area every second is called the intensity of a sound wave. Loudness is defined by its amplitude.

c) Sound travels faster in solids when compared to any other medium. Therefore, at a particular temperature, sound travels fastest in iron and slowest in gas.

32. a) Here answer is (iii) Farmers use quality seeds, adopt irrigation, use fertilizer and use crop protection measures. Use of any quality seeds is not sufficient until they are properly irrigated, enriched with fertilizers and protected from biotic factors. Hence, option (c) will give the most benefits.

b) Diseases in plants are caused by pathogens. To get rid of pathogens, some preventive measures and biological control methods are used as they are simple, economic and minimise popullation without affecting the soil quality.

c) The factors responsible for losses of grains during strorage are :

(i) A biotic factors like moisture (present in food grains) humidity of air and temperature.

(ii) Biotic factors like insects, rodents, birds, mites, bacteria and fungi.

OR

a) Cross breeding is a process in which indigenous varieties of cattle are crossed by exotic breeds to get a breed wich is high yielding. During cross breeding, the desired characters are taken into consideration. The offspring should be high yielding, should have early maturity and should be resistant to climatic conditions.

b)

(i) Shelter : Dairy animals and poultry birds require proper shelter, i.e. well designed dairy and hygienic shelter.

(ii) Feeding : To get good yield of food product, proper feed is provided to dairy animals and poultry birds.

(iii) Caring for animal health : Animal and birds must be protected from diseases caused by virus, bacteria or fungi.

c) There are two ways of obtaining fish. One is from natural resources, which is called capture fishing. The other way is by fisth farming, which is called culture fishery.

a) Intercropping can be defined as growing of two or more crops with different nutrient requirements, simultaneously on the same field in a definite pattern.

Crop rotation is a system of growing different kinds of crops in recurrent succession on the same land.

(b) Advantages of using inter-cropping :

1. It helps to maintain soil fertility.
2. It increases productivity per unit area.
3. Save labour and time.
4. Both crops can be easily harvested and processed separately.

Advantages of using crop rotation :
1. It improves the soil fertility.
2. It avoids deception of a particular nutrient from soil.
3. It minimize pest infestation and disease.
4. It helps in weed control.
5. It prevents change in the chemical nature of the soil.

OR

a) Genetic manipulation is a process of incorporating desirable (genes) characters into crop varieties by hybridisation. Hybridisation involved crossing between generically dissimilar plants. This is done for production of varieties with desirable characteristics like produce branching in fodder crops, high yielding varieties in maize, wheat, etc. Genetic manipulation is useful in developing varieties which shows :
1. Increased yield
2. Better quality
3. Shorter and early maturity period.
4. Better adaptability to adverse environmental conditions
5. Desirable characteristics

b) Cattle farming is beneficial in the following ways:
1. Mild production is increased by high yielding animals.
2. Good quality of meat, fiber and skin can be obtained.
3. Good breed of drought animals can be obtained.

SECTION-D

34. (a) Differences in the characteristics of 3 states of matter

Characteristics	**Solid**	**Liquid**	**Gas**
1. Shape	fixed shape	no fixed shape	no fixed shape
2. Volume	fixed volume	fixed volume	no fixed volume
3. Rigidity/ Fluidity	are rigid, cannot flow	can flow, not rigid	can flow, not rigid
4. Intermolecular force	maximum	less then solids	very less
5. Intermolecular space	very less	more then solids	maximum and less then gas
6. Compressibility	negligible	compressible	highly compressible

b)
(i) Rigidity : The tendency of a substance to retain/maintain their shape when subjected to outside force.

(ii) Compressibility : The matter has intermolecular space. The external force applied on the matter can bring these particles closer. This property is called compressibility. Gases and liquids are compressible.
(iii) Fluidity : The tendency of particles to flow is called fluidity- liquids and gases flow.

(iv) Filling of a gas container : Gases have particles which vibrate randomly in all the directions. The gas can fill the container.

(v) Shape : Solids have maximum intermolecular force and definite shape. Whereas liquids and gases takes the shape of container.

(vi) Kinetic energy : The energy possessed by particles due to their motion is called kinetic energy. Molecules of gases vibrate randomly as they have maximum kinetic energy.

(vii) Density : It is defined as mass per unit volume, the solids have highest density.

OR

(a) The molecules of gas have high kinetic energy due to which they keep moving in all directions and hence fill the vessel completely in which they are kept.

(b) A gas exerts pressure on the walls of the container because the molecules of the gas are in constant random motion due to high kinetic energy. These molecules constantly vibrate, move and hit the walls of the container thereby exerting pressure on it.

(c) The molecules / particles of wooden table are tightly packed with each other, there is no intermolecular space, it cannot be compressed, it can not flow, all these characteristics are of solid. So wooden table sound be called a solid.

(d) We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert. It is because the molecules of air has less force of attraction between them and a very small external force can separate them and pass through it. But in case of solids, the molecules have maximum force of attraction, the particles are tightly bound due to this force. Hence large amount of external force is required to pass through solid.

(e) Ice is a solid but its density is lower than water due to its structure. The molecules in ice make a cage like structure with lot of vacant spaces, this makes ice float on water.

35. a) Homogeneous : Soda water, vinegar, filtered tea.
Heterogeneous : wood, air , soil.

b) By finding the boiling point of a given colorless liquid. If the liquid boils at 100 0C at atmospheric pressure, then it is pure water. this is because pure substances have fixed melting and boiling point.

c) Pure substances are : Ice, Iron, Hydrochloric acid, calcium oxide and mercurry.

d) Solutions are : Sea water, soda water and air.

e) Milk and starch solution.

OR

(a)

Elements	Compounds	Mixtures
Sodium	Calcium carbonate	Sugar solution
Silver	Methane	Soil
Tin	Carbon dioxide	Coal
Silicon	Soap	Air, Blood

(b)

(i) Quick lime (Calcium oxide) Elements - Calcium and oxygen

(ii) Hydrogen bromide, Elements - Hydrogen and bromine

(iii) Baking powder (Sodium hydrogen carbonate) Elements - Sodium, hydrogen, carbon and oxygen

(iv) Potassium sulphate-Elements - Potassium, sulphur and oxygen

(c)
Air < Exhaust from chimney < Cotton < Water < Honey < Chalk < Iron.

36. (a)

(i) Formula of sodium oxide

Symbol	Na	O
Charge	+1	-2
Formula	Na_2O	

(ii) Formula of aluminium chloride

Symbol	Al	Cl
Charge	+3	-1
Formula	$AlCl_3$	

(iii) Formula of Sodium sulphide

Symbol	Na	S
Charge	+1	-2
Formula	Na_2S	

(iv) Formula of Magnesium Hydroxide

Symbol	Mg	OH
Charge	+2	-1
Formula	$Mg(OH)_2$	

(b)
(i) ZnO = 65 u + 16 u = 81u

(ii) Na_2O = (23 u x 2) + 16 u = 46 u + 16 u = 62 u

(iii) K_2CO_3 = (39 u x 2) + 12 u +16 u X 3 = 78 u + 12 u + 48 u = 138 u

(c)
(i) Quick lime ---> Calcium oxide - Elements --> Calcium and oxygen

(ii) Hydrogen bromide _ Element - > Hydrogen and bromine

(iii) Backing Powder - Sodium hydrogen carbonate - Elements --> Sodium, Hydrogen, carbon and oxygen

(iv) Potassium sulphate - Elements --> Potassium, sulphur and oxygen

OR

a)
(i) Magnesium chloride - symbol --> Mg^{2+}, Cl^- - Charge----> +2 -1Formula ----> $MgCl_2$

(ii) Copper nitrate - Symbol---> Cu^{2+} , NO_3^- charge +2 -1 Formula -4------> $Cu(NO_3)_2$

(iii) Aluminium chloride - symbol ---> Al^{3+}, Cl^---- Charge----> +3 -1 Formula-----> $AlCl_3$

(iv) Calcium carbonate - symbol ---> Ca^{2+}, CO_3^{2-} Charge ---> +2 -2 Formula ---> $CaCO_3$

b)
(i) Ethyne, C_2H_2 = 2 x 12 + 2 x 1 = 24 +2 = 26g

(ii) phosphorus molecule, P_4 = 4 x 31 = 124g

(iii) Hydrochloric acid, HCl = 1 x 1 + 1 x 35.5 = 1 + 35.5 = 36.5g

(iv) Nitric acid, HNO_3 = 1 x 1 + 1 x 14 + 3 x 16 = 1 + 14 + 48 = 63g

(c)
(i) Given mass of water = 20g molar mass of water (H2O) = (2 x 1) + 16 = 18g Mole of water = 20/18 = 1.12mole

(ii) Given mass of Carbon dioxide = 22g Mole mass of carbon dioxide (CO2) = (1x12) + (2x16) = 12 x 32 = 44g : Mole of carbon dioxide = 22/44 = 0.5Mole

SECTION E

37. (1) (c) Z

(2) (b) Mass number

(3) (a) A

(4) (d) All of the above

OR

Mass of carbon is 12 u because it has 6 protons and 6 neutrons,
6 u + 6 u = 12 u

38. (1) (a) Cytoplasm

(2) (c) SER (Smooth Endoplasmic Reticulum)

(3) (d) Lysosomes

(4) (d) Stroma

OR

(d) Mitochondria

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

(1) (b) A and B both

(2) (b) Chloroplast

(3) (a) Nucleus

OR

(C) Cell membrane

39. Differences between striated, unstriated and cardiac muscles:-

Striated muscle	**Unstriated muscle**	**Cardiac muscle**
On the basis of structure :		
Cells are cylindrical	Cells are long	Cells are cylindrical
Cells are not branched	Cells are not branched	Cells are branched
Cells are multinucleate	Cells are uninucleate	Cells are uninucleate
Alternate light and dark bands are present	There are no bands present	Faint bands are present
Its ends are blunt	Its ends are tapering	It ends are flat and wavy
On the basis of location :		
These muscles are present in body parts such as hands, legs, tongue, etc.	These muscles control the movement of food in the alimentary canal, the contraction and relaxation of blood vessels, etc.	These muscles control the contraction and relaxation of the heart.

OR (ONLY FOR VISUALLY IMPAIRED STUDENTS)

A)The two tissues responsible for movement of the body are muscular tissues and nervous tissues.

(b) The tissues present in brain and spine are nervous tissues.

© Tendon

(d) Cardiac Muscle.

PRACTICE PAPER -02
(Class-IX)
Subject - SCIENCE (Code:) 086

Times allowed : 3 Hrs **Maximum Marks : 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 objective type questions carrying 1 mark each.
4. Section B consists of 6 very short questions carrying 02 mark each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer of these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based /case-based units of assessment of 04 marks each with sub parts.

SECTION - A

1. Two velocity time graphs are shown in the given figure which indicates a higher rate of change?

a) Only A

b) Only B

c) Both A and B

d) Cant be said

2. Who discovered free living cells for the first time ?

a) Robert hooke

b) A.V. leeuwen hoek

c) R. Virchow

d) Both (b) and ©

3. The tissue responsible for the growth of plant is

a) Permanent tissue b) meristematic tissue

c) Epidermis d) None of the above

4. **Suppose two bodies of A and B or masses m1 and m2 are lying at a distance d from each other. Let the force of attraction between two bodies be F. How does the force of gravitation change when the distance between A and B is reduced to half?**

(a) The force would become 2 times

(b) The force would become 3 times

(c) The force would become 4 times

(d) The force would become 5 times

5. **Water stored in a dam has potential energy due to**

a) Position

b) Shape

c) Colour

d) Motion

6. **Valency of an element A is +3 which of the following would be the chemical formula of its oxide?**

a) AO　　b) A_2O_3

c) A_3O_2　　d) AO_3

7. **When a second wave goes from one medium to another, which one o9f the following quantities remains unchanged?**

a) speed

b) Wavelength

c) Frequency

d) Amplitude

8. **Bronze is an alloy made up of**

a) Copper + Tin

b) Copper + Zinc

c) Copper + Zinc + Nickel

d) None of the above

9. **Which of the following instruments is based on archimedes principle?**

a) Galvanometer

b) Hydrometer

c) Odometer

d) Ohm meter

10. The value of G on earth is 6.67 x 10^{-11} Nm^2 Kg^{-2} what will be value of G on moon?

a) 6.67 x 10^{-8} Nm^2 Kg^{-2}

b) 6.67 x 10^{-10} Nm^2 Kg^{-2}

c) 6.67 x 10^{-9} Nm^2 Kg^{-2}

d) 6.67 x 10^{-11} Nm^2 Kg^{-2}

11. The frequency of waves used in ultrasonography is

a) 2 Hz to 20 Hz

b) 20 Hz to 20000 Hz

c) 2000 Hz to 20000 Hz

d) 2 MHz to 18 MHZ

12. The number of electrons in an element X is 15 and the number of neutrons is 16. Which of the following is the correct representation of the element?

a) X^{31}_{15}

b) X^{31}_{16}

c) X^{16}_{15}

d) X^{15}_{16}

13. If a cell is placed in a hypotomic solution, wats will move ....the cell, causing it to ....

a) into , swell

b) out of , shrink

c) in and out of the cell, stay the same

d) none of the above

14. In case of negative work, the angle between the force and displacement is

a) 0^0

b) 45^0

c) 90^0

d) 180^0

15. Which among the following decreases the rate of evaporation ?

a) Temperature

b) Humidity

c) Surface area

d) Wind speed

16. Osmosis is a special kind of

a) Regulation

b) Absorption

c) Diffusion

d) Adsoption

For question numbers 17-20 two statements are given- one labeled as Assertion (A) and the other labeled as Reason ®. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true, and R is correct explanation of the assertion.

(b) Both A and R are true, but R is not the correct explanation of the assertion.

c) A is true, but R is false.

d) A is false, but R is true.

17. (A) : A mellifera bee are used for commercial honey production.

(R) : A mellifera bee have high honey collection capacity and also they breed very well.

18. (A) : Isotopes show the same chemical properties.

(R) : Since different isotopes have the same electronic configurations, they have the same chemical properties.

19. (A) : Muscles are connected to bones by tendons.

(R) : Tendons are tough, inelastic bundles which connect skeletal muscles with bones.

20. (A) : The value of displacement can be negative, positive and zero, whereas distance gives a positive value.

(R) : Displacement is a vector quantity and distance is a scalar quantity.

SECTION B

(Question 21 to 26 are very short answer questions)

21. A man of weight 400 Kg lifted a weight of 200 Kg up to 3 meter flight of stairs. What exactly is the power of the man?

22. Broiler, production is a solution to increase the production of nutritions animal protein food. List four factors that need to be considered for broiler production.

23. a. Camphor disappears with time without leaving any solid. Give the reason?
 b) Gases diffuse quickly. why?

24. A person drinks a concentrated solution of salt and after sometime, he starts vomiting. What is the phenomenon responsible for such a situation?

25. Rohit was going to Haridwar with his family in a taxi. He saw the driver tied the luggage kept on the roof of the taxi with a rope. What could be the reason for that?

26. Rutterford selected a gold foil in his alpha ray scattering experiment. Justify his selection.

SECTION C

(Q No,. 27 to 33 are short answer questions)

27. a) What is the situation where a body's average velocity and average speed are the same?
 b) Is it possible that the train you are on appears to be moving while it is actually stationary?
 c) A trolley, while going down on inclined plane, has an acceleration of $2ms^{-2}$. What will be its velocity 3 sec after the start?

28. a) In chemistry class, teacher asked Komal that the electronic configuration of Fluoride ion and neon is the same. Then what is the difference between them?
b) Why do inert gases have zero valencies?
c) Name three isotopes of Hydrogen.

29. Rahul prepared temporary mounts of onion peel cell and human cheek cell in the laboratory. Mention any three differences between these two types of cells.

30. Define crop rotation. while choosing crops for crop rotation, what factors should be kept in mind?

31. If the earth's density is halved but its radius remains unchanged, what will be the change in acceleration due to gravity?

32. In a house, six bulbs of 100 w, two fans of 60W and two ACs of 2Kw are operated for 4 hours everyday. Calculate the following :
a) Total power consumed everyday
b) Total power utilized in 30 days
c) Total electrical energy consumed in 30 days

33. Write balanced chemical equations for the following reactions :
a) Burning of magnesium ribbon in air
b) Zinc with dilute sulphuric acid
c) Sodium sulphate with barium chloride in the form of their solutions in water

SECTION - D

(Q no. 34 to 36 are long answer questions)

34. Two objects of masses m_1 and m_2 having the same size are dropped simultaneously from heights h1 and h2 respectively. Find out the ratio of

time they would take in reaching the ground, will this ratio remain the same if

a)one of the objects is hollow and the other one is solid

b) both of them are hollow; size remaining the same in each case? give a reason

35. a) Differentiate between rough and smooth endoplasmic retiunlum, how is edoplasmic retiulum important for membrane biogenesis?

    b) What happens when plasma membrane of a cell breaks down?

36. a) If 18 gm of pure water is electrolysed, 2 gm of hydrogen and 16 gm of oxygen is obtained. Which law of chemical combination is illustrated by this statement?

    b) State the law of constant proportion. Illustrate with the help of an example.

    c) Which postulate of Dalton's atomic theory is the result of law of conservation of mass?

    d) Which point of Dalton's atomic theory came from law of constant proportions?

SECTION E

(Q no. 37 to 39 are case based / data based questions with 2 to 3 sheet sub-parts)

37. While going on a trip, Rehan found that the taxi was moving along a straight line with a uniform velocity of 108 Km/h. The velocity of the taxi slows down to 72 Km/h in 4 sec by an external force. The mass of the texi is 600 Kg.

    a) Find the initial velocity and final velocity in meter per second

    b) Find the change of momentum.

    c) How much external force is applied on the taxi?

38. Reena and Tina were exploring different processes for separating different components from a mixture. They were given the mixture of iron filings

and sulphur powder. Reena heated the mixture strongly and she observed that a new sobstance was formed. Tina did not do anyting with the iron filings and the sulphur powder that was given to her.

a) After heating Reema get a new substance. What is the nature of this new substance, mixture or compound? What is the name and colour of this new compounds?

b) How will you differentiate between mixtures and compounds?

39. In the physics laboratory, Rishi was doing an experiment on a tuning foke. He observed that the object is vibrating 1200 times in one minute, if the velocity of sound in air is 360m/s

a) Calculate the frequency of sound

b) What will be the wavelength of sound?

c) A sound travels at a speed of 339m/s. If its wavelength is 3.2 cm, what is the frequency of the wave? Will it be audible?

PRACTICE PAPER -03

(Class-IX)

Subject - SCIENCE (Code:) 086

Times allowed : 3 Hrs **Maximum Marks : 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 objective type questions carrying 1 mark each.
4. Section B consists of 6 very short questions carrying 02 mark each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer of these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based /case-based units of assessment of 04 marks each with sub parts.

SECTION - A

The rate of diffusion will be higher in :

a Liquids b) Solids

c) Gases d) Semi solids

2. **Under normal condition, the maximum temperature that can be achieved by heating water is :**

   a) 100 ^{0}C b) 120 ^{0}C

   c) 0 ^{0}C d) above 120 ^{0}C

3. **The correct symbol of sodium element is :**

   a) Na b) Sa

   c) NA d) S

4. **The constituent charged particles present in Sodium chloride are :**

   a)Negatively charged sodium ion and positively charged chloride ion

   b)Positively charged sodium ion and positively charged chloride ion

c) Negatively charged sodium ion and negatively charged chloride ion

d) Positively charged sodium ion and negatively charged chloride ion

5. The subatomic particles and their correct representation is :

(i) Proton (P-)

(ii) Proton (P+)

(iii) Electron (e-)

(iv) Electron (e+)

(a) i and iii (b) ii and iii

(c) ii and iv (d) i and iv

6. The number of valence electron in an atom having atomic number 14 is :

a) 2 b) 4

c) 8 d) 14

7. Generally, Nucleus of the plants cell are not centrally located due to:

a) large sized vacuoles

b) insufficient space in the cell

c) small sized vecuoles

d) none of the above

8. Xanthium and Parthenium are examples of

a) Pesticides b) Diseases

c) Pathogens d) Weeds

9. Which is not a connective tissue:

a) blood b) cartilage

c) muscle d) bone

10. The relation between speed (v) wavelength (l) and frequency (f) of a sound wave is :

a) v = l x f b) l = f x v

c) v = f / l d) l = f + v

11. Cattle husbandry is done for :

(i) increasing milk production (ii) increasing meat production.

(iii) agriculture work (iv) egg production

(a) i, ii, and iii (b) i and ii

(c) ii, iii and iv (d) i , iii and iv

12. **Note is :**
    (a) a sound of single frequency
    (b) a sound of mixture of several frequency
    (c) a sound of two frequency
    (d) unpleasant of hear.
13. **Universal Law of Gravitation does not explain:**
    a) the force that binds us with the earth
    b) motion of moon around the earth
    c) the tides due to the moon and the sun
    d) volcanic eruption
14. **The intercellular space is present in :**
    a) Parenchyma
    b) Collenchyma
    c) Sclerenchyma
    d) Epidermis
15. **A student placed an onion partially dipped in water. After few days she observed the root which grow in size. The tissue present on the tip of these root is :**
    a) Apical meristem
    b) Intercalary meristem
    c) Lateral meristem
    d) Both a and b
16. **Which is not a accelerated motion:**
    a) uniform velocity
    b) constant velocity
    c) circular motion
    d) both a and b

For question numbers 17-20 two statements are given- one labeled as Assertion (A) and the other labeled as Reason ®. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true, and R is correct explanation of the assertion.

b) Both A and R are true, but R is not the correct explanation of the assertion.

c) A is true, but R is false.
d) A is false, but R is true.

17. Assertion (A) : Tyndall effect can be observed when beam of light passes through a colloidal solution.
Reason (R) : The particles of colloidal solution are very small but can easily scatter a beam of light.

18. Assertion (A) : Lysosomes areknown as cleaner of the cell
Reason (R) : enzymes present in the lysosomes are powerful enough to breakdown all organic materials.

19. Assertion (A) : A sharp axe cut swiftly.
Reason (R) : The effect of the thrust depends on the area on which is acts.

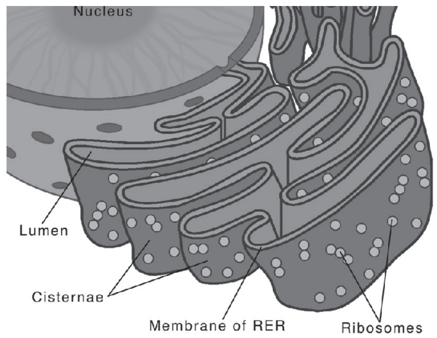
20. Assertion (A) : Weeds are harmful to crop.
Reason (R) : Unwanted plants in the field competes for nutrient with the crop.

SECTION B
Q no. 21 to 26 are very short answer questions

21. During a chemical reaction the temperature in the test tube increased to 303K.
a) Convert this temperature to ^{0}C scale.
b) What will be the physical state of water at this temperature?

22. a) A student write the electronic configuration of an atom having atomic number 16 as : 6,2,8. Is it correct? Explain?
b) How many electrons can be filled L shell of an atom?

23. In the given picture, a organelle is shown which is directly connected to the nucleus.



a) Identify the organelle and the particle R attached to this organelle.
b) White the main function of R

24. While moving on a circular path of 10m. What will be the distance and displacement of an object after completing one num? and why?

25. Which among the following pot will you use to put water in during summer season and why? Earthern or Iron?

26. A girl mass 35kg runs up a ladder of 12 steps in 10s. If the height of each step is 20 cm, find her power ($g = 10ms^{-2}$)

OR

The work done by a force can either negative or positive. Give one examples of each condition.

SECTION C

27. a) How isotopes are different from Isobars.
b) Write two applications of Isotopes.

28. a) Which gases are exchanged at the side of the cell in animal?
b) Why cell is called the structural and functional unit of life?

29. Name the functional unit of nervous system. Also draw its labeled diagram.

OR

Why blood is called connective tissue. What are its components?

30. A bike starting from rest attains a uniform velocity of 36 Km/h 3 minute. Find : I) The acceleration and (ii). The distance traveled by the bike for attaining this velocity.

OR

A bus travels from destination A to B with a speed of 36km/h and then returns back to A with a speed of 72 km/h. Find
a) Average speed of the bus.
b) Distance traveled by the bus
c) Displacement of the bus

31. The mass of the mars is $6.42 x 10^{23}$ kg and that one of its moon is $1.08 x 10^{15}$Kg. If the distance between the mars and its moon is $1.01 x 10^{5}$Km, calculate the force exerted by the mars on the moon.
($G = 6.7 x 10^{-11}\ Nm^2 Kg^{-2}$)

32. a) A sound wave travels at a speed of 346 ms^{-1}. If its wavelength is 1.8 cm, what is the frequency of the wave?
b) Will the above sound is audible? Explain?

33. What are different cropping patterns adopted to maximize benefits? Discuss any three

Section - D

Q no. 34 to 36 are long answer questions

34. i) Write down the chemical formulae of the following compound. Also write the ions (Cation and anions) present in them.
a) Sodium nitrate

b) ammonium sulphate

OR

a) What are Ions? Give examples:

b) State the law of constant proportion. What is the ratio by mass of carbon and oxygen present in carbon dioxide compound?

c) Define Atomicity.

35. During an experiment Reema placed few raisins in a liquid. After some times she observed that shape of raisins is changed as shown in the picture.

a) What could be the nature / Type of the solution in which these raisins were placed. Explain the reason for this change.

b) What happen if we put these (swollen) raisins in a highly saturated solution of sugar.

OR

Draw a neat labeled diagram of plants cell (label at least six parts)

36. Give reason:

a) In which direction does the passenger fall when a bus accelerates from rest.

b) A fielder pulls his hand gradually with the moving ball while holding a catch.

c) which will have greater momentum between a truck or a car moving with same velocity.

SECTION E

Q no. 37 to 39 are case based / data based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.

37. Mixtures are constituted by more than one kind of pure from of matter, known as a substance. Depending upon the nature of the components that from a mixture we can have different types of mixtures i.e. homogeneous and heteogeneous mixtures.

a) A student mixed few drops of egg white in 50ml of water in a test tube.

What type of mixture will be formed inside the test tube.

b) Classify the following in mixture and compound:

Blood, soil, air, water, milk, common salt

c) How will you form a suspension mixture.

OR

c) List two difference between homogeneous and heterogeneous

38. During a sport event an athlete run very fast and win the race but just after crossing the finishing line, he got an accident. During medical examination it is found that his leg bone gets fractured and ligament is treated.

Answer the following:

i) What is ligament?

ii) how muscles are attached to the bones.

iii) Is bone a connective tissue, answer on the bases of its structure.

OR

iii) Name a tissue located at the head of the bone which protect them from wearing and tearing. This tissue is also present in the nose and outer ear. Write its two characteristics.

39. Different from of energy can be changed from one form to another, so that the total energy of a system during or after the transformation remains the same. During free fall of an object its potential energy will change into kinetic energy.

A student dropped an object of mass 20kg from a height of 4m and tabulated the energy conversion as show below: ($g=10ms^{-2}$)

answer the following questions :

i) Write the energy transformation in above case.

ii) In the above case when will the kinetic energy of the object is minimum and maximum?

iii) Complete the above table by calculating the values from A to D

OR

iii) What will be the potential and kinetic energy of the above object at a height of 6m?

PRACTICE PAPER -04

(Class-IX)

Subject - SCIENCE (Code:) 086

Times allowed : 3 Hrs **Maximum Marks : 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 objective type questions carrying 1 mark each.
4. Section B consists of 6 very short questions carrying 02 mark each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer of these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based /case-based units of assessment of 04 marks each with sub parts.

Section - A

Select and write the most appropriate option out of the four option given for each of the questions 1-20. There is no negative mark for incorrect response.

1. Melting point of ice is

a) 73K b)173K

c) 273K d)373 K

2. Which of the following mixtures is not a colloidal solution?

a) Starch solution b) Milk and water

c) Milk of magnesia d) Alum in water

3. Identify the correct statement among the following.

a) Iron sulphide is a compound whereas iron and sulphur are elements.

b) Iron sulphide is a mixture whereas iron and sulphur are compounds.

c) Iron, sulphur and iron sulphide are all compounds.

d) Iron and sulphur from a mixture and iron sulphide is an element.

4. **Rupali was asked to distinguish between the correct and incorrect pairs of elements and symbols given in a list. She picked up one of the options are incorrect among the following identify the option.**

a) Silver-Ag b) Sodium-Na

c) Potassium -K d) Iron-In

5. **The correct chemical formula of aluminium sulphate is**

a) $Al(SO_4)_3$ b) $Al_2(SO)_3$

c) $Al_2(SO_4)_3$ d) $Al_3(SO_4)_2$

6. **Atoms of different elements having sam mass number are known as**

a) Isotopes b) Isomers

c) Isotones d) Isobars

7. **When a cell is kept inside a hypertonic solution it**

a) swells up

b) does not change

c) shrinks

d) swells first and then shrinks

8. **What is used to shift a specimen from watch glass to the side while preparing a temporary slide?**

a) Needle b) Brush

c) Blade d) Cover slip

9. **Presence of which chemical in cork cells makes them impervious to water and gases?**

a) Lignin b) Suberin

c) Melanin d) Cutin

10. **Which of the following is not a characteristic of skeletal muscle?**

a) Uninucleated b) Cylindrical shape

c) Striated d) Voluntary

11. **In uniform circular motion, which of the following does not happen?**

a) The direction of motion changes at every point.

b) Magnitude of velocity is constant.

c) Direction of velocity is tangential to the circular path.

d) There is no acceleration.

12. **Momentum can be expressed numerically as**

a) p=ma b) F=ma c) p=mv d) p=F/m

13. Carefully observe the diagram given below. What is responsible for decreased length of rubber spring?

a) Pressure

b) Buoyancy

c) Gravity

d) Inertia

14. Water is stored in a dam to generate electricity. The stored water possesses

a) no energy

b) electrical energy

c) kinetic energy

d) potential energy

15. To increase of a sound we need to

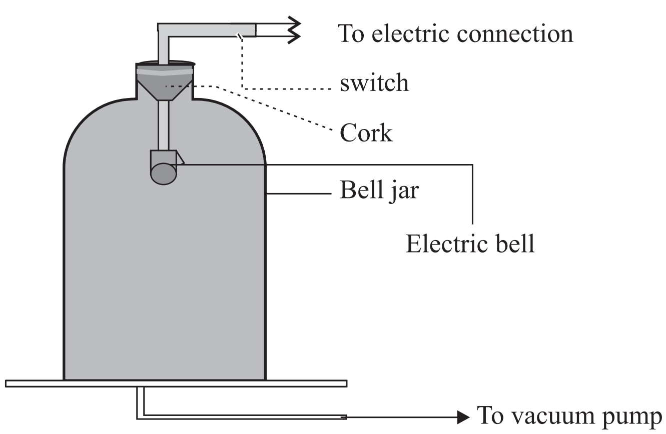
a) increase speed

b) decrease wavelength

c) increase amplitude

d) decrease frequency

16. Look at the picture given below carefully. What will happen if the vacuum pump does not function properly?



a) Sound is heard in the beginning but not later

b) Sound is heard later but not in the beginning

c) Sound is heard at regular intervals of time

d) Sound is heard continuously without change

17. Assertion (A) :- Solid carbon dioxide is stored under high pressure.
Reason (R) :- Solid carbon dioxide converts to liquid state gradually and then vaporizes.

18. A :- Adipose tissue regulates body temperature.
R :- It serves as a fat reservoir which acts as an insulator to reduce heat loss

19. A :- A person of mass 50 kg goes up a flight to stairs and by virtue of his position 10 m above the surface (g =10ms^{-2}), he has potential energy of 5000J
R :- Potential energy is found out by product of mass acceleration due to gravity and height.

20. A :- Fertilizers are substances providing nutrients like nitrogen, phosphorus and potassium to crop plants in fields.
R :- They are fully absorbed by plants, are totally safe and do not lead to water pollution.

SECTION B

Q. no. 21 to 26 are very short answer question

21. A solution contains 50 grams of sugar in 350 grams of water, Calculate the concentration in terms of mass by mass percentage of the solution.

22. Prabha was given 2 mixture A and B. One of the mixtures was a colloid and another was a suspension. With the help of a torch how can she analyze and identify them.

23. If an element has Z=13, what would be its valency? Draw its schematic atomic structure showing the distribution of electrons.

OR

If an element has Z=11 and A=23, what would be the number of various sub-atomic particles present in it?

24. Name the two organelles present in the cell that have their own DNA and ribosomes. Mention one important function of each.

25. If an object starts from A, covers a distance of 100m in a linear path and reaches B in 15s, find its speed

OR

A signal traveling at a speed of 300km/s takes one minute to be detected by a radar. How far is its point of origin from the radar?

26. Write the difference between broilers and layers in poultry farming. How are their poultry feeds different?

SECTION C

Q no. 27 to 33 are short answer questions.

27. Describe how change in surface area, temperature and humidity affect the rate of evaporation.

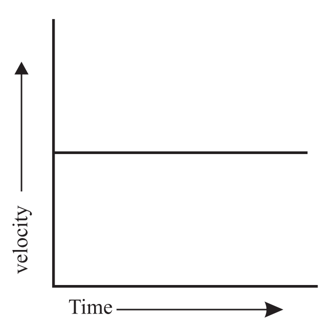
28. Why are lysosomes known as suicide bags of cell?

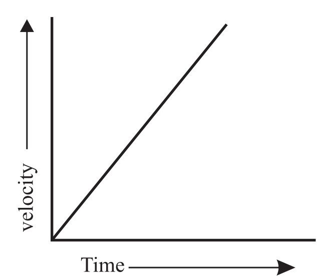
OR

Why is plasma membrane celled a selectively permeable membrane?

29. Distinguish between various types of simple permanent tissues in plants based on their (a) cell well (b) intercellular spaces © function.

30.





Analyse carefully the above velocity time graphs. What do they represent?

31. How is work defined and expressed mathematically? What are the two conditions for work to be done? Is it a scalar of a vectro quantity. Why ?

32. Draw graph to represent sound waves having
a) Low pitch and high pitch
b) Soft sound and loud sound

33. Describe the three different ways of cropping patterns used by farmers to get maximum benefit.

SECTION D

Q. no. 34 to 36 are long answer questions

34. Rutherford designed an experiment which led to the discovery of nucleus in an atom.
a) For which reason was gold foil selected?
b) With which high energetic particles was gold foil bombarded?
c) Mention three observations that were made.

OR

i) Distinguish between isotopes and isobars using examples.
ii) Give three uses of isotopes in various fields in daily life.

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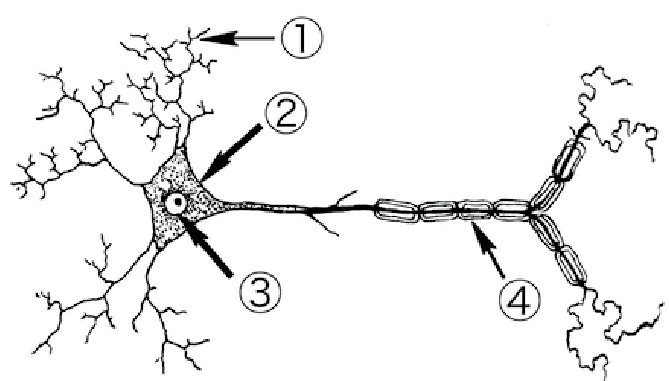
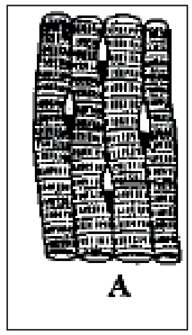
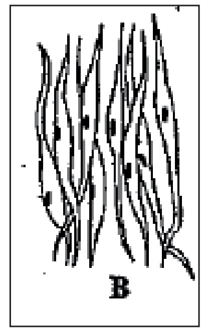


i) Label the marked parts in the diagram given above.
ii) In which organs can the above cells be found?
iii) How do they help in carrying messages in the body?

OR





i) Identify the tissues shows above.

ii) Give any two parts of the body where they are located.

iii) Compare and contrast their characteristics based on the diagrams given above.

36. i) what do you understand by acceleration?

ii) When will you say a body is in uniform of no-uniform acceleration?

iii) A bus decreases its speed from 80 km/h to 60km/h is 5s. Find its acceleration.

OR

i) A person starts from point P, walks 2km and reaches point Q in 30 mins. He then comes back to P again in 20 mins. How much displacement has happened?

ii) Differentiate between speed and velocity.

iii) A car starting from rest moves with a uniform acceleration of $0.1ms^{-2}$ for 2 minutes. Find the speed acquired and the distance traveled.

SECTION E

Q no. 37 to 39 are case based / source based questions. Read the case carefully and answer the questions that follow.

37. Read the passage given below carefully and answer the questions that follow. All the substances around us are made up to basic building blocks known as elements. Two or more elements bond together ot

form compounds. The smallest unit of a compound is a molecule that can be made up of two of more atoms. Compounds are composed of charged species of metals and non-metals. They carry opposite charges. Sometimes a charged species may be formed from a group of atoms.

i) What are the charged species present in compounds known as ?

ii) Which charged species made up of a group of atoms is found in ammonium chloride? Write its chemical formula.

iii) Calculate the molecular mass of the ammonium chloride.

OR

iii) X is a charged species of a metal with valency 2. Y is another charged species of a non-metal with valency 3. What will be the chemical formula of the compound formed by X and Y? Also give a chemical formula of oxide and chloride of X.

38. Read the text carefully and answer the questions.

New cells are formed in organisms by the process of cell division. This helps to replace old, dead or injured cells. Cell division not only helps in growth of a living organism, it also ensures that reproduction happens for propagation of new generations.

i) What are the two main ways of cell division?

ii) In which cells do these two kinds of cell division take place?

iii) Formulate a flow chart to show what happens to chromosome numbers during the above two ways of cell division.

OR

iii) How is chromosome number restored in the organisms that reproduce sexually? Explain using a flowchart.

39. Read the case study given below carefully and answer the questions that follow. Stanley bought a gold ring in the polar region weighing 10g when he went to Antarctica on an expedition. He came back home in Africa that was located near the equatorial region and gifted the ring to his wife. Stanley's wife said that he had been deceived and did not get the full value of money he spent on purchase of the gold ring.

i) What do we understand by the weight of an object?
ii) Why does 'g' vary from place to place on the earth?
iii) Find out the weight of an object on the moon, when its mass is given as 20kg. ($g = 9.8ms^{-2}$)

OR

iii) What is the mass of an object if it weight is 25N on the moon?

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