DIRECTORATE OF EDUCATION, GNCT OF DELHI

PRACTICE PAPER FOR (SESSION: 2024-25)

CLASS: XII SUBJECT: PHYSICS (042)

DURATION:3 HOURS **MAXIMUM MARKS:70**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) All the sections are compulsory.

(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.

(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each Case study-based questions in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

(7) You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^8$ m/s

$h = 6{\cdot}63 \times 10^{-34}$ Js

$e = 1{\cdot}6 \times 10^{-19}$ C

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8{\cdot}854 \times 10^{-12}$ C^2 N^{-1} m^{-2}

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2}

Mass of electron $(m_e) = 9{\cdot}1 \times 10^{-31}$ kg

Mass of neutron $= 1{\cdot}675 \times 10^{-27}$ kg

Mass of proton $= 1{\cdot}673 \times 10^{-27}$ kg

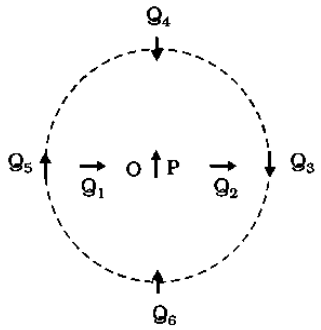
Avogadro's number $= 6{\cdot}023 \times 10^{23}$ per gram mole

Boltzmann constant $= 1{\cdot}38 \times 10^{-23}$ JK^{-1}

SECTION [A] [16X1=16]		
Q.N.	**DESCRIPTION OF QUESTION**	**MARKS**
1.	Chose incorrect statement for nuclear force in the following: (a) The nuclear force is much stronger than the Coulomb force (b) The nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same. (c) The nuclear force between two nucleons falls rapidly to zero. (d) The nuclear force depends on the electric charge between two protons.	1
2.	Which of the following characteristics of electrons determines the current in a conductor? (a) Drift velocity alone (b) Thermal velocity alone (c) Both drift velocity and thermal velocity (d) Neither drift nor thermal velocity.	1
3.	A conductor of length 'l' is connected to a dc source of potential 'V'. If the length of the conductor is tripled by gradually stretching it, keeping 'V' constant, the resistance of the conductor increased by: (a)3 times (b)6times (c)9times (d)12times	1
4.	n identical capacitors joined in parallel are charged to a common potential V. The battery is disconnected. Now, the capacitors are separated and joined in series. For the new combination: (a) energy and potential difference both will remain unchanged (b) energy will remain same, potential difference will become nV (c) energy and potential both will become n times (d) energy will become n times; potential difference will remain V.	1
5.	A copper ring is held horizontally and a north pole of magnet is dropped through the ring with its length along the axis of the ring. Then (a)no current induced in the ring (b)current induced in clockwise when seen from upward (c) current induced in anti-clockwise when seen from upward (d) current induced in anti-clockwise when seen from downward.	1

6.	Correct match of column I with column II column I(Electromagnetic wave) / column I (Production Of wave) 1.Microwave / A. inner shell electrons 2.Ultraviolet / B. Klystron valve or magnetron valve 3.X-rays / C. Vibration of atoms 1. and molecules 4.Infra-red / D. Inner shell electrons in atoms moving from higher -energy level to a lower level (a)1-A,2-B,3-D,4-C (b) 1-A,2-B,3-D,4-C (c)1-A,2-B,3-D,4-C (d) 1-B,2-D,3-A,4-C	1
7.	Double-convex lenses are to be manufactured from a glass of refractive index 1.5, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20cm? (a)20cm (b)20m (c)2.0cm (d)2.0m	1
8.	. In YDS experiment two slits are made 1mm apart and the screen is placed 1m away. The fringe separation when a light of wavelength 500 nm is used: (a)0.5cm (b)5.0mm (c)0.5mm (d)0.5cm	1
9.	In Huygens theory, light waves (a) are transverse waves and require a medium to travel. (b) are longitudinal waves and require a medium to travel. (c) are transverse waves and require no medium to travel. (d) are longitudinal waves and require no medium to travel.	1
10.	The ratio of the speed of the electrons in the ground state of hydrogen to the speed of light in vacuum is: (a) 10/137 (b) 2/237 (c) 1/137 (d) 1/237	1
11.	The process involve in the formation pf p-n junction are: (a) drift only (b) diffusion only (c) drift and diffusion both (d) None of these	1

12. Figure shows a small magnetized needle P placed at a point O. The arrow shows the direction of its magnetic moment. The other arrows show different positions (and orientations of the magnetic moment) of another identical magnetized needle Q Find the correct match from the table given below:



Column 1 Configuration	Column 2 position of Q with respect to P
(A) Stable equilibrium	(i)PQ_6
(B) Unstable equilibrium	(ii)PQ_1 and PQ_2
(C) Lowest potential energy	(iii)PQ_5 and PQ_4
(D) Not in equilibrium	(iv) PQ_3 and PQ_6

(a) (A) i (B)ii (C)iii (D)iv (b) (A) iii (B)iv (C)i (D)iv

(c) (A) iv (B) iii (C) i (D)ii (d) (A) ii (B) iii (C)I (D)iv

1

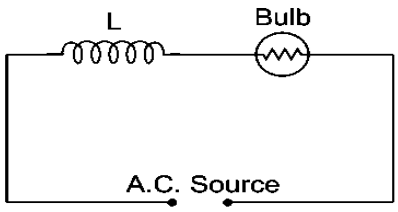
For visually impaired students

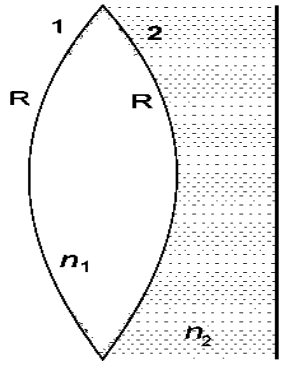
A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of 2A. If the number of turns is 1000 per meter, the magnetic field B is given by:

(a)1.0 T (b) 2.0T (c)8.0T (d)0.1T

1

	(Questions number 13 to 16 are Assertion (A) and Reason (R) type questions. Two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below. **(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).** **(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).** **(C) Assertion (A) is true, but Reason (R) is false.** **(D) Assertion (A) is false and Reason (R) is also false.**	
13.	**Assertion:** The resistance of a wire is increased by n^2 R, if it is stretched to n times its original length. **Reason:** The resistance of a wire depends on shape and size of the conductor**.**	1
14.	**Assertion:** Torque on a coil is maximum when it is suspended radially in a magnetic field. **Reason:** Torque tends to rotate a coil.	1
15.	**Assertion:** Magnetic poles cannot be separated by breaking a bar magnet into two pieces. **Reason:** When a magnet is broken into two pieces, the magnetic moment will be increased.	1
16.	**Assertion**: Mutual inductance becomes minimum when coils are wound on each other. **Reason:** Mutual inductance is independent of orientation of coils.	1
	SECTION [B] [05X2=10]	
17.	A solenoid has 2000 turns wound over a length of 0.3 m. The area of cross-section is 1.2×10^{-3} m^2. Around its central section a coil of 300 turns is closely wound. If an initial current of 2A is reversed in 0.25 s, find the emf induced in the coil.	2
18.	A pure inductor of 25.0 mH is connected to a source of 220 V. Find the inductive reactance and rms current in the circuit if the frequency of the source is 50 Hz.	2
19.	A heavy nucleus X of mass number 240 and binding energy per nucleon 7.6 MeV is split into two fragments Y and Z of mass numbers 110 and 130. The binding energy per nucleon in Y and Z is 8.5 MeV per nucleon. Calculate the energy Q released per fission in MeV.	2
2O[A]	(i) State the condition under which a large magnification can be achieved in an astronomical telescope. (ii) Why a reflecting telescope is preferred over a refracting telescope? Give two reasons to explain it.	2

20[B]	**OR** A ray of light incident on an equilateral glass prism propagates parallel to the base line of the prism inside it. Find the angle of incidence of this ray. Given refractive index of material of glass prism is $\sqrt{3}$.	2
21.	Write two characteristic features to distinguish between a pure semiconductor doped with Bi and a pure semiconductor doped with Ga.	2
	SECTION[C] **[07X3=21]**	
22.	Draw a circuit diagram of Wheatstone bridge. Using Kirchhoff's rules to obtain the balance condition in terms of the resistances of four arms of Wheatstone Bridge. **(For Visually impaired students)** Name the device where balance condition of Wheatstone bridge is use to find value of unknown resistance. And write necessary mathematical formula for it. How sensitivity of Wheatstone bridge can be increased.	3
23.	A charge particle is situated at the origin of coordinate axis where uniform electric and magnetic field mutually perpendicular to each other were present. If charge particle starts moving perpendicular to both field it experience no force. Give reason by doing necessary calculation. If electric field is switched off then state the trajectory of particle.	3
24.	Two identical coils X and Y each of radius r are lying in perpendicular planes such that they have a common Centre. Find the magnitude and direction of magnetic field at the common Centre of the two coils, if they carry currents equal to I and $I\sqrt{3}$ respectively.	3
25[A]	]. An inductor L of inductive reactance X_L is connected in series with a bulb B to an ac source as shown in figure. Explain briefly how does the brightness of the bulb change when (i) number of turns of the inductor is increased (ii) an iron rod is inserted in the inductor and (iii) a capacitor of reactance $X_C = X_L$ is connected in the circuit.  	3

	OR	
25[B]	The primary coil of an ideal step-up transformer has 100 turns and transformation ratio is also 100. The input voltage and power are 220 V and 1100 W respectively. Calculate (a) the number of turns in the secondary coil. (b) the current in the primary coil. (c) the voltage across the secondary coil.	3
26.	A biconvex lens with its two faces of equal radius of curvature R is made of a transparent medium of refractive index n_1. It is kept in contact with a medium of refractive index n_2 as shown in the figure.  (a) Find the equivalent focal length of the combination. (b) Obtain the condition when this combination acts as a diverging lens. (c) Draw the ray diagram for the case $n_1 > (n_2 + 1)/2$, when the object is kept far away from the lens. Point out the nature of the image formed by the system.	3
27.	Draw the intensity distribution for (i) the fringes produced in interference in YDS experiment, and (ii) the diffraction bands produced due to single slit. Write two points of difference between the phenomena of interference and diffraction. **(For Visually impaired students)** (a) What are coherent sources of light? State two conditions for two light sources to be coherent. (b)why two independent monochromatic sources cannot be coherent. Explain.	3
28.	When an electron in hydrogen atom jumps from the third excited state to the ground state, how would the de Broglie wavelength associate with the electron change? Justify your answer.	3

SECTION [D] [CASE STUDY 02X4=8]

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29. An equipotential surface is a surface with a constant value of potential at all points on the surface. For a single charge q, the potential is given by $V = \frac{1}{4\pi\epsilon_0}\frac{Q}{R}$ This shows that V is a constant if R is constant. Thus, equipotential surfaces of a single point charge are concentric spherical surfaces centered at the charge and the electric field lines for a single charge q are radial lines starting from or ending at the charge, depending on whether q is positive or negative. Clearly, the electric field at every point is normal to the equipotential surface passing through that point. This is true in general: for any charge configuration, equipotential surface through a point is normal to the electric field at that point.

(i) Which one of the following is incorrect for equipotential surfaces 1

(a) are closer in regions of large electric fields compared to regions of lower electric fields.
(b) will be more crowded near sharp edges of a conductor.
(c) will be more crowded near regions of large charge densities.
(d) will always be equally spaced.

(ii) The angle between electric field and equipotential surface is: 1

(a) 90° always (b) 0° always

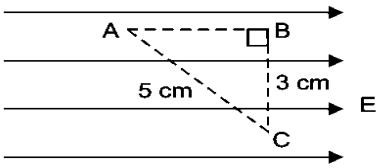
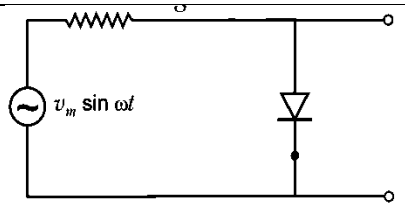
(c) 0° to 90° (d) 0° to 180°

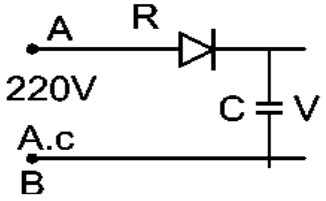
(iii) Equipotential surface associated with an electric field, which is increasing in magnitude along the X-direction, are 1

(a) planes parallel to XZ-plane.
(b) planes parallel to YZ-plane.
(c) planes parallel to XY-plane.
(d) coaxial cylinder of increasing radii around the X-axis.

(iv)A Two charges -q and +q is located at points A (0, 0, -a) and B (0,0, +a) respectively. How much work is done in moving a test charge from point P (7,0,0) to Q (-3,0,0)? 1

(a)2Kq/10 (b) Kq/10 (c) 4Kq/10 (d)zero

	OR	
(iv)B	Three points A, B and C lie in a uniform electric field (E) of 5×10^3 NC^{-1} as shown in the figure. Find the potential difference between A and C. (a) 200V (b)20V (c) 100V (d)10V 	1
30.	P-N junction diode plays a very important role in digital era, it can convert alternating voltage to direct voltage. A junction diode allows current to pass only when it is forward biased. So, if an alternating voltage is applied across a diode the current flows only in that part of the cycle when the diode is forward biased. A junction diode does not allow current to pass when it is reverse biased. This property is used to rectify alternating voltages and the circuit used for this purpose is called a rectifier. The p-n junction diode can be used as half wave and full wave rectifier.	
(i)	In a full-wave rectifier, the current in each of the diodes flows for (a) Complete cycle of the input signal (b) Half cycle of the input signal (c) Less than half cycle of the input signal (d) Only for the positive half cycle of the input signal.	1
(ii)	In forward biased: (a)junction offers low resistance and allowed to pass current (b) junction offers high resistance and allowed to pass current (c) junction offers low resistance and do not allow to pass current (d) junction offers high resistance and do not allow to pass current.	1
(iii)A	The output of the given circuit shown in figure. (a) would be zero at all times. (b) would be like a half wave rectifier with positive cycles in output. (c) would be like a half wave rectifier with negative cycles in output. (d) would be like that of a full wave rectifier 	1

(iii)B	**OR** A 220 V A.C. supply is connected between points A and B (shown in figure). What will be the potential difference V across the capacitor? (a) 220 V (b) 110 V (c) 0 V (d) 220√2V  	1
(iv)	An alternating voltage of frequency of 50 Hz is applied to a full-wave rectifier. Then the ripple frequency of the output will be: (A) 100 Hz (B) 50 Hz (C) 25 Hz (D) 150 Hz	1
	SECTION [E] **[03X5=15]**	
31[A] 31[B]	An early model for an atom considered it to have a positively charged point nucleus of charge Ze, surrounded by a uniform density of negative charge up to a radius R. The atom as a whole is neutral. For this model, using Gouss's theorem derive an expression for the electric field at a distance(i) r>R (ii)r<R from the nucleus? **OR** Derive an expression for the electric potential at any point 'o' due to an electric dipole r>>a, where 'a' is half length of dipole. If the point o is lying (i)along the axis of dipole and (ii) normal to dipole. Find the value of electric potential in both cases.	5
32[A]	(i)Draw a ray diagram showing the image formation of a distant object by a refracting telescope. Define its magnifying power and write the two important factors considered to increase the magnifying power. (ii)A small telescope has an objective lens of focal length 144 cm and an eye piece of focal length 6.0 cm. What is the magnifying power of the telescope? What is the separation between the objective and the eye-piece?	5

32[B]	**OR** **(i)** Show that sum of the angle of deviation and angle of prism is equal to sum of angle of incidence and angle of emergent. (ii) An equilateral glass prism has a refractive index 1.6 in air. Calculate the angle of minimum deviation of the prism, when kept in a medium of refractive index $4\sqrt{2}/5$.	5
33[A]	(i) The wavelength 'λ' of a photon and the de Broglie wavelength of an electron has the same value. Show that the energy of photon is $\frac{2\lambda mc}{h}$ the kinetic energy of electron, where m, c, h has their usual meanings. (ii)An α-particle and a proton are accelerated from rest by the same potential. Find the ratio of their de- Broglie wavelengths	5
33[B]	**OR** (i) Draw a schematic arrangement of Geiger-Marsden experiment for studying a-particle scattering by a thin foil of gold. Describe briefly, by drawing trajectories of the scattered a-particles. (ii) How this study can be used to estimate the size of the nucleus?	5