CLASS : XII
SESSION: 2023-24
Practice Paper
SUBJECT: PHYSICS (THEORY)

Maximum Marks: 70 **Time Allowed: 3 hours**

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.

i. $c = 3 \times 10^{8}$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $e = 1.6 \times 10^{-19}$ C
iv. $\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$
vii. Avogadro's number = 6.023×10^{23} per gram mole

Q.No	Questions
	SECTION A
1	**A galvanometer can be converted into an ammeter by connecting** **a. high resistance in series** **b. low resistance in parallel** **c. high resistance in parallel** **d. low resistance in parallel**

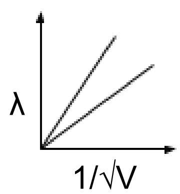
2	**Which of the following radiations has the least wavelength?** a. Alpha Rays b. Beta rays c. Gamma Rays d. X-rays
3.	**What is the root mean square value of the alternating current?** a. Peak value b. Half of the peak value c. 1/√2 times the peak value . d. thrice of the peak value
4.	**Ohm's law is true** a. for metallic conductor at low temperature b. for metallic conductor at high temperature c. for electrolyte when current passes through it. d. for GaAs semiconductor alloy when current passes through it.
5.	**When light waves go from air into water ,which physical quantity remains unchanged ?** a. wavelength b. amplitude c.speed d. frequency
6.	**When current ‘i’ is flowing through a conductor, the drift velocity is ‘v’. If the value of current through the conductor and its area of cross-section is doubled, then new drift velocity will be-** a. V’ = 2V b. V’ = V/2 c. V’ = V d. V’ = 3V
7.	**A p -type semiconductor can be obtained by adding ……….to pure silicone** a. Gallium b. Arsenic c. Antimony d. Phosphorus
8.	**When the distance between the charged particles is halved the force between them becomes-** a. One Third b. Twice c. half d. four times

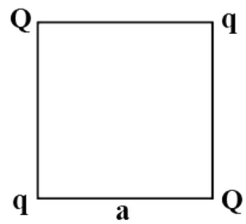
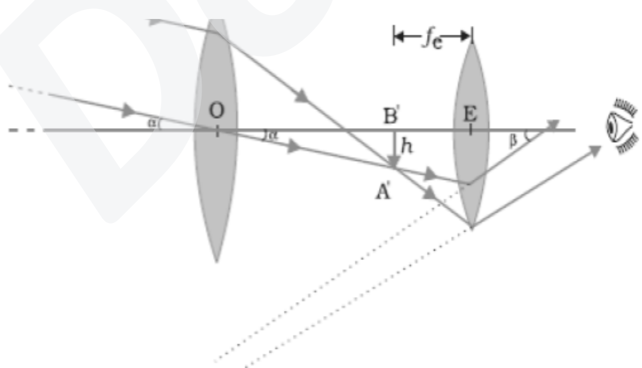
9.	**When air in a capacitor is replaced by a medium of dielectric constant K the capacity-** **a. decreases K times** **b. increases 3K times** **c. increases K times** **d. remains constant**
10	**The aperture of a telescope is made large** **a. to decrease the intensity of image** **b. to have lesser magnification** **c. to have greater magnification** **d. to increase intensity of image**
11	**A diffraction is obtained by using a beam of red light .What will happen to band width if red light is replaced by blue light?** **a. there will be no change in bandwidth** **b. bandwidth will increase** **c. bandwidth will decrease** **d. band will disappear**
12	**Number of electrons present in a negative charge of 8C is** **a. 5×10^{19}** **b. 6×10^{18}** **c. 1.6×10^{19}** **d. 3×10^{20}**
	Instructions: For Question numbers 13 to 16, two statements are given - **One labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options (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 and R is not the correct explanation of A.** **(c) A is true but R is false.** **(d) A is false and R is also false.**
13	**Assertion: If a metal emits photoelectrons when red light falls on it then the same metal will emit photoelectrons when blue light falls on it.** **Reason : Blue light has higher frequency hence possesses higher energy.**

14	**Assertion:Rutherford Model of atom failed to explain the stability of atom** **Reason:Nuclear force between two protons is stronger than the electrostatic force.**
15	**Assertion: Nuclear mass is always less than the mass of its constituents.** **Reason:The difference in mass of a nucleus and its constituents is called the binding energy of the nucleus**
16	**Assertion:For fixed frequency of incident radiation and accelerating potential the photoelectric current increases linearly with increase in intensity of incident light.** **Reason: For a fixed frequency and intensity of incident light photoelectric current increases with increase in potential applied to the collector.**
Section B	
17	**Give two points to differentiate between a paramagnetic and a diamagnetic substance.**
18	**If light of wavelength 412.5 nm is incident on each of the metals given below,which ones will show photoelectric emission and Why?**

Metal	Work function(eV)
Na	1.92
K	2.15
Ca	3.20
Mo	4.17

19	**Derive an expression for the electric field at a point due to an infinitely long thin charged straight wire using Gauss law.** **OR** **Two spherical conductors of radii 4 cm and 5 cm are charged to the same potential. If σ1 and σ2 be the respective values of the surface density of charge on both the conductors, What is the ratio of σ1/ σ2 ?**

20	Two electric bulbs P and Q have their resistances in the ratio of 1:2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs.
21	a. Why are infrared waves often called heat waves? Explain. b. What do you understand by the statement “electromagnetic wave transport medium”?
	Section C
22	Write the two processes that take place in the formation of a p-n. junction. Explain with the help of a diagram, the formation of depletion region and barrier potential in a p-n junction diode.
23	 Two lines, A and B, in the plot given above show the variation of de-Broglie wavelength, λ versus $1/\sqrt{V}$, Where V is the accelerating potential difference, for two particles carrying the same charge. Which one of two represents a particle of smaller mass ?Justify.
24	a) Define inductance of an inductor. b) An inductor of inductance L is connected in series with bulb B and a.c source.How would the brightness of the bulb change when- (i) number of turns in the inductor is reduced? (ii) an iron rod is inserted in the inductor? (iii) a capacitor of reactance $X_C=X_L$ is inserted in series in the circuit. Justify your answer in each case
25	Atomic radius of the first orbit of a hydrogen atom is 0.53 Å. What is the radius of its fifth orbit?
26	Four point charges Q,q,Q and q are placed at the corners of a square of side 'a’ as shown in the fig(a)

	 fig(a) Find the a) Resultant electric force on a charge Q,and b) Potential energy of this system OR The electric field components in fig. are Ex=ax^½,Ey=Ez=0 in which a= 800 N/Cm^½.Calculate a)The flux through the cube b) Charge within cube if a=0.1m
27	a)Define the term conductivity of a metallic wire and write its SI unit. b)Using the concept of free electrons in a conductor, derive the expression for conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and applied electric field E.
28	Give two advantages of LEDs over the conventional incandescent lamps.
	Section D
29	CASE STUDY QUESTIONS  An astronomical telescope is an optical instrument which is used for observing distinct images of heavenly bodies like stars, planets etc. It consists of two lenses. In normal

adjustment of the telescope, the final image is formed at infinity. Magnifying power of an astronomical telescope in normal adjustment is defined as the ratio of the angle subtended at the eye by the final image to the angle subtended at the eye, by the object directly,when the final image and the object both lie at infinite distance from the eye. It is given by,

$$m_0=f_0/f_e$$

To increase magnifying power of an astronomical telescope in normal adjustment, the focal length of the objective lens should be large and the focal length of the eye lens should be small.

(i) An astronomical telescope of magnifying power 7 consists of the two thin lenses 40 cm apart, in normal adjustment. The focal lengths of the lenses are-
(a) 5 cm, 35 cm
(b) 7 cm, 35 cm
(c) 17 cm, 35 cm
(d) 5 cm, 30 cm

(ii) An astronomical telescope has a magnifying power of 10. In normal adjustment, the distance between the objective and eyepiece is 22 cm. The focal length of objective lens is
(a) 25 cm
(b) 10 cm
(c) 15 cm
(d) 20 cm

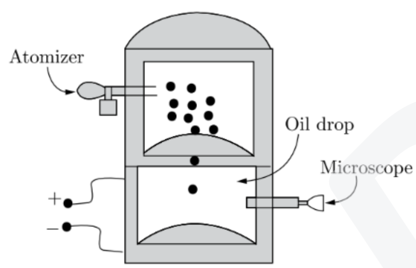
(iii) In astronomical telescope compare to eye piece, objective lens has
(a) negative focal length
(b) zero focal length
(c) small focal length
(d) large focal length

(iv) To observe stars, We use
(a) simple microscope
(b) compound microscope
(c) endoscope
(d) astronomical telescope

OR

For large magnifying power of astronomical telescope
(a) fo << fe
(b) fo= fe
(c) fo >> fe
(d) only for fo= fe=1 cm

30. **In 1909, Robert Millikan was the first to find the charge of an electron in his now-famous oil-drop experiment. In that experiment, tiny oil drops were sprayed into a uniform electric field between a horizontal pair of oppositely charged plates. The drops were observed with a magnifying eyepiece, and the electric field was adjusted so that the upward force on some negatively charged oil drops was just sufficient to balance the downward force of gravity.**



That is, when suspended, upward force qE just equalled Mg. Millikan accurately measured the charges on many oil drops and found the values to be whole number multiples of 1.6x10^-19C the charge of the electron. For this, he won the Nobel prize.

(i) If a drop of mass is 1.08x10^-14 kg remains stationary in an electric field of 1.68x10^5NC^-1, then the charge of this drop is-

(a) 6.40x10^-19 C

(b) 3.2x10^-19 C

(c) 1.6x10^-19 C

(d) 1.08x10^-14 C

(ii) Extra electrons on this particular oil drop (given the presently known charge of the electron) are

(a) 4

	(b) 3 **(c) 5** **(d) 8** **(iii) A negatively charged oil drop is prevented from falling under gravity by applying a vertical electric field 100 Vm^–1. If the mass of the drop is 1.6x10^-3g, the number of electrons carried by the drop is (g = 10 m s–2)** **(a) 10^18** **(b) 10^15** **(c) 10^12** **(d) 10^9** **(iv) The important conclusion given by Millikan's experiment about the charge is** **(a) charge is never quantized** **(b) charge has no definite value** **(c) charge is quantized** **(d) charge on oil drop always increases.** **OR** **If in Millikan's oil drop experiment, charges on drops are found to be 8 μC, 12 μC, 20 μC,then quanta of charge is** **(a) 8 μC** **(b) 20 μC** **(c) 12 μC** **(d) 4 μC**
31	**Derive a mathematical expression for the force acting on a current carrying straight conductor kept in a magnetic field. State the rule used to determine the direction of this force. Under what conditions if this force is** **(1) zero and (2) maximum?** **OR**

	Using Ampere's circuital law, obtain an expression for the magnetic field along the axis of a current carrying solenoid of length l and having N number of turns.
32	**What is the energy level diagram for an atom? Calculate the energies of the various energy levels of a hydrogen atom and draw an energy level diagram for it.** **OR** **In the ground state of a hydrogen atom, its Bohr radius is given as 5.3x10 ^-11m. The atom is excited such that the radius becomes 21.2 x 10^- 11m. Find-** **1. The value of the principal quantum number.** **2. Total energy of the atom in this excited state.**
33	**(a) The electric field $\overline{E}$ due to a point change at any point near to it is defined as:** $\overline{E} = Lim \frac{\overline{F}}{q}$; $q \rightarrow o$ **where q is the test charge and $\overline{F}$ is the force acting on it. What is the significance of lim $q \rightarrow o$ in this expression?** **(b) Two charges ($2\times10^{-7}C$) and (- $2\times10^{-7}C$) form a system. These charges are located at points A (0,0, -10) cm and B (0,0, +10) cm respectively. What is the total charge and electric dipole moment of the system?Find the direction of the electric dipole moment?** **OR** **a) The expression for the electrostatic energy stored in a capacitor C and having charge 'Q'.** **b) Net capacitance of three identical capacitors in series is 3 pF. What will be their net capacitance if connected in parallel?** **Find the ratio of energy stored in the two configurations if they are both connected to the same source.**