Directorate of Education, GNCT of Delhi

Practice Paper (Session: 2023-24)

Class: XII **Subject: Physics**

Duration:3 h **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.

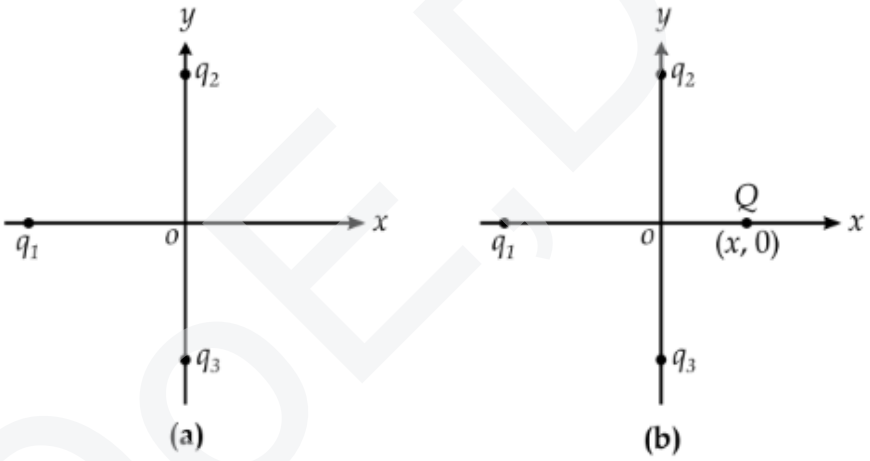
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each Case study based questions in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

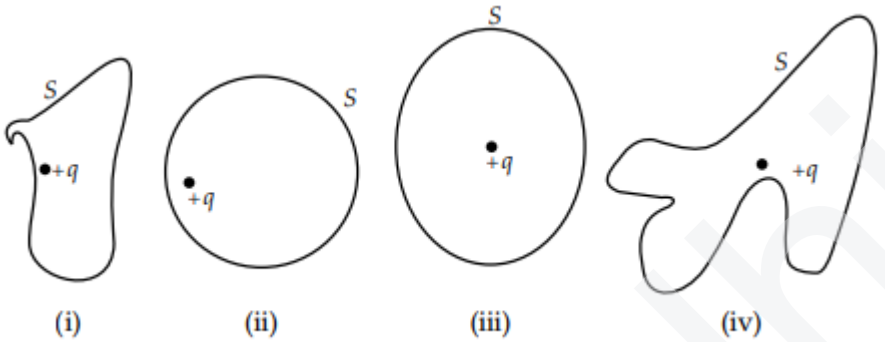
(6) Use of calculators is not allowed.

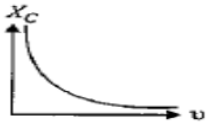
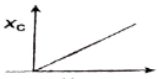
(7) You may use the following values of physical constants wherever necessary.

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. $\mu_0 = 4\pi \times 10^{-7}$ $Tm\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

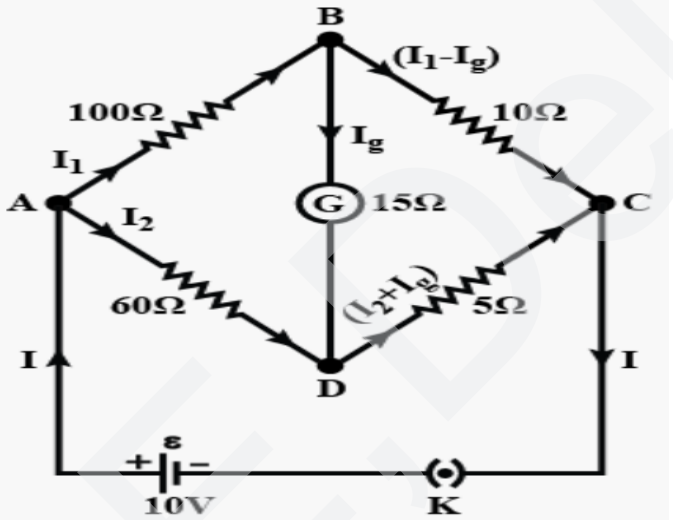
Q.No	Questions
	SECTION A
1	**Electric field lines provide information about** **(1) electric field strength** **(2) direction of electric field** **(3) nature of source charge** **a) Only (1) and (2)** **b) Only (1)** **c) Only (2)** **d) All (1),(2) and (3)**

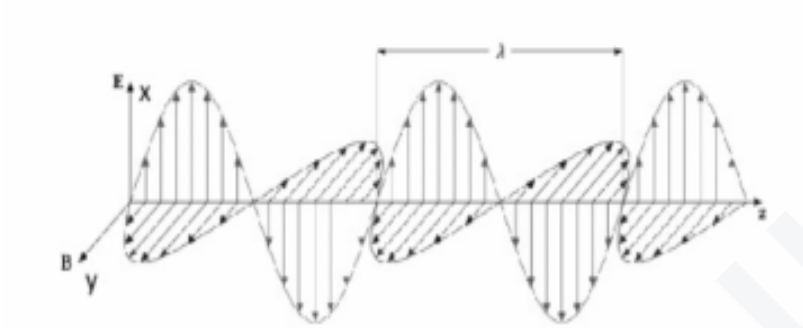
2	**If the energy band gap Eg> 3 eV then such materials are called as** **a) conductors** **b) semiconductors** **c) insulators** **d) superconductors**
3.	**The current flowing in case of forward bias is in** **a) Ampere** **b) Milliampere** **c) Microampere** **d) Nanoampere**
4.	**In given figure (a), two positive charges q2 and q3 fixed along the y-axis, exert a net electric force in the + x direction on a charge q1 fixed along the x axis. If a positive charge Q is added at (x, 0)as shown in fig(2),the force on q1**  **(a) shall increase along the positive x-axis.** **(b) shall decrease along the positive x-axis.** **(c) shall point along the negative x-axis.** **(d) shall increase but the direction changes because of the intersection of Q with q2 and q3.**
5.	**Refracted light moves parallel to the baseline of the prism inside it, the prism is set** **a) in maximum deviation condition** **b) in medium deviation condition**

	c) in minimum deviation condition **d) in zero deviation condition**
6.	**The electric flux through the surface :**  **(a) in Figure (iv) is the largest.** **(b) in Figure (iii) is the least.** **(c) in Figure (ii) is the same as Figure (iii) but is smaller than Figure (iv).** **(d) is the same for all the figures.**
7.	**In a semiconductor, what is responsible for conduction?** **a. Electrons only** **b. Holes only** **c. Both electrons and holes,** **d. Neither electrons nor holes**
8.	**An object has charge of 1 C and gains 5.0 x 10^18 electrons. The net charge on the object becomes** **(a) -0.80 C** **(b) +0.80 C** **(c) +1.80 C** **(d) +0.20 C**
9.	**Equipotential surfaces-** **(a)are closer in regions of large electric fields compared to the regions of lower electric fields** **(b) will be more crowded near sharp edges of a conductor** **(c) will always be equally spaced** **(d) Both (a) and (b) are correct.**
10	**Lenz's law is the consequence of the law of conservation of :** **(a) charge** **(b) energy** **(c) mass** **(d) momentum**

11	The phase difference between the current and the voltage in series LCR circuit at resonance is : (a) π (b) π/3 (c) π/2 (d) zero
12	Which of the following graph represents the correct variation of capacitive reactance Xc with frequency? (a)  (b)  (c)  (d) None of the above
	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 codes (a), (b), (c) and (d) are 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 (A) : When the radius of the circular loop carrying current is doubled, its magnetic moment becomes eight times. Reason (R) : Magnetic moment does not depend on the area of the loop.
14	Assertion:- The frequencies of incident, reflected and refracted beams of monochromatic light at the interface of two media are the same. Reason:-The incident,reflected and refracted lights are coplanar.
15	Assertion:- Coils of a spring come close to each other when current is passed through it.

	Reason:- It is because, coils of a spring carry current in the same direction and hence attract each other.
16	**Assertion:- No diffraction is produced in a sound wave near a very small opening.** **Reason:- For diffraction to take place, the aperture or opening should be of the same order as wavelength of waves.**
	Section B
17	**Define the term threshold frequency and stopping potential in photoelectric effect.**
18	**Arrange the following electromagnetic radiations in ascending order of their frequencies.** **(a)Microwaves (b) Gamma rays (c) Ultraviolet (d) X – rays**
19	**State the two essential conditions for total internal reflection to take place.**
20	**What is the basic difference between the atom or molecule of a diamagnetic and a paramagnetic material? Why are elements with even atomic numbers more likely to be diamagnetic?** **OR** **Derive an expression for the force acting on a current carrying conductor placed in a uniform magnetic field.**
21	**Two cells of emfs 1.5 V and 2 V having internal resistances 0.2 ohm and 0.3 ohm respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.**
	Section C
22	**The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5 Ohm and at steam point is 5.23 Ohm. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795 Ohm. Calculate the temperature of the bath.**
23	**A light bulb is rated at 100W for a 220 V supply. Find** **(a) the resistance of the bulb;** **(b) the peak voltage of the source; and** **(c) the rms current through the bulb.**
24	**Write three examples for diamagnetic, paramagnetic and ferromagnetic materials.**

	Write three points of differences between diamagnetic, paramagnetic and ferromagnetic materials.
25	**a)A loop of irregular shape carrying current is located in an external magnetic field. If the wire is flexible, why does it change to a circular shape?** **b)A circular coil of wire consisting of 100 turns, each of radius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field B at the centre of the coil?**
26	**The four arms of a Wheatstone bridge (Figure below) have the following resistances:** **AB = 100W, BC = 10W, CD = 5W, and DA = 60W.**  **Calculate the current through the galvanometer of 15 Ohm resistance when a potential difference of 10 V is maintained across AC.**
27	**Define the term 'self – inductance' of a coil and write its S.I. unit. Show that magnetic energy required to build up the current I in a coil of self inductance L is given by ½ L I² .** **Or** **Define the term 'mutual inductance' . Deduce the expression for the mutual inductance of two long coaxial solenoids having different radii and different number of turns.**
28	**Monochromatic light of frequency 6.0 x10^14 Hz is produced by a laser.The power emitted is 2.0 x10^–3 W.** **(a) What is the energy of a photon in the light beam?** **(b) How many photons per second, on an average, are emitted by the source?**

	Section D
29	**CASE STUDY QUESTIONS** **Electromagnetic Waves**  **If EX is the electric field along X axis, then BY is the magnetic field along Y axis and both are perpendicular to the Z axis showing direction of propagation. The light waves are also electromagnetic waves and may travel through vacuum also. So, we can find the velocity of a light travelling through the material medium having permittivity 'ε' and magnetic permeability 'μ' as v = 1/ √εμ.** **The most technological importance of EM waves is that they have a strong capacity to take energy from one place to another place** **The best examples are radio waves, TV signals which also carry energy from their broadcasting stations.** **Also, life is possible on the earth only because of the sunlight coming from the sun to the earth which also carries energy and it is nothing but the EM waves. Due to which EM waves are considered as the transverse waves.** **(i) The ratio of permittivity of the medium to the permittivity of vacuum is called _____.** **(a) Permeability** **(b) Permittivity of free space** **(c) Dielectric constant of the medium** **(d) Electric intensity** **(ii) Who demonstrated that the electromagnetic waves actually exist?** **(a) Maxwell** **(b) Hertz** **(c) Ampere** **(d) Michelson and Morley**

	(iii) The pressure exerted by the electromagnetic wave is called as **(a) Light pressure** **(b) Electric pressure** **(c) Magnetic pressure** **(d) Radiation pressure** **(iv) In electromagnetic waves the phase difference between electric and magnetic field vectors are** **(a) zero** **(b) π/4** **(c) π/2** **(d) π** **OR** **The correct option, if speeds of gamma rays, X-rays and microwave are Vg, Vx an Vm respectively will be.** **(a) Vg > Vx > Vm** **(b) Vg < Vx < Vm** **(c) Vg > Vx > Vm** **(d) Vg = Vx = Vm**
30.	**Semiconductor:** **Intrinsic semiconductors are those semiconductors which exist in pure form and intrinsic semiconductors have a number of free electrons equal to the number of holes.** **The semiconductors doped with some impurity in order to increase its conductivity are called extrinsic semiconductors.** **Two types of dopants are used; they are trivalent impurity and pentavalent impurity also. The extrinsic semiconductors doped with pentavalent impurity like Arsenic, Antimony, Phosphorus etc are called n – type semiconductors.** **In n type semiconductors electrons are the majority charge carriers and holes are the minority charge carriers. When trivalent impurities like Indium, Boron, Aluminium etc are added to extrinsic semiconductors then p type semiconductors will be formed.** **(i) In case of p-type semiconductors___** **a) nh << ne** **b) nh = ne** **c) nh>> ne** **d) nh = ne = 0**

	(ii) An intrinsic semiconductor behaves like _____ at T = 0K. **a) conductor** **b) metal** **c) non metal** **d) insulator** **(iii) If the energy band gap Eg >3 eV then such materials are called as** **a) conductors** **b) semiconductors** **c) insulators** **d) superconductors** **(iv) In a semiconductor, what is responsible for conduction?** **a. Electrons only** **b. Holes only** **c. Both electrons and holes** **d. Neither electrons nor hole** **OR** **(v) What happens to the forbidden energy gap of a semiconductor with the fall of temperature?** **a. Decreases** **b. Increases** **c. Unchanged** **d. Sometimes decreases and sometimes increases**
31	**Define the capacitance of a capacitor.** **Obtain the expression for the capacitance of a parallel plate capacitor in vacuum in terms of plate area A and separation d between the plates.** **Or** **(i) Derive an expression for torque on a dipole in a uniform electric field. Give the conditions for stable and unstable equilibrium.** **(ii) Derive electric field due to ideal dipole at an equatorial point.**
32	**(i) What is the function of a transformer? State its principle of working with the help of a diagram. Mention any two energy losses in this device.** **(ii) The primary coil of an ideal step up transformer has 100 turns and the transformation ratio is also 100. The input voltage and power are respectively 220 V and 1100 W.** **Calculate**

	(a) Number of turns in secondary **(b) Current in primary** **OR** **In a series LCR circuit connected to an ac source of variable frequency and voltage $v = V_m \sin \omega t$, draw a plot showing the variation of current (I) with angular frequency (ω) for two different values of resistance R_1 and R_2 ($R_1 > R_2$).** **a)Write the condition under which the phenomenon of resonance occurs.** **b) For which value of the resistance out of the two curves, a sharper resonance is produced?**
33	**(i) Explain how Rutherford's experiment on scattering of alpha particles led to the estimation of the size of the nucleus.** **(ii) How Rutherford failed to give an explanation on account of the stability of an atom?** **OR** **a)Write any two characteristic properties of nuclear force.** **b) Two nuclei have mass numbers in the ratio 1: 8. What is the ratio of their nuclear radii?** **c)Two nuclei have mass numbers in the ratio 2 : 5. What is the ratio of their nuclear densities?**