**Class XII | Session 2026-27**
**Subject - Physics**
**Sample Question Paper - Set 3**

**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 CBQ 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.

## Section A

1. In forward bias the width of depletion layer **[1]**

   a) independent of V
   b) decreases with increase in V
   c) increases with increase in V
   d) dependent of V

2. According to Kirchhoff's Loop Rule, **[1]**

   a) The algebraic sum of changes in potential around any closed loop must be positive.
   b) The algebraic sum of changes in potential around any closed loop must be negative.
   c) The absolute sum of changes in potential around any closed loop must be zero.
   d) The algebraic sum of changes in potential around any closed loop must be zero.

3. If an object is placed unsymmetrically between two plane mirrors inclined at 70°, then the total number of images formed is **[1]**

   a) 4
   b) 5
   c) 1
   d) 3

4. The major contribution of magnetism in substances is due to **[1]**

   a) equally due to orbital and spin motions of electrons
   b) orbital motion of electrons

c) spin motion of electrons

d) hidden magnets.

5. A parallel plate capacitor has capacitance C. If it is equally filled with parallel layers of materials of dielectric constants $\kappa_1$ and $\kappa_2$, its capacity becomes $C_1$. The ratio of $C_1$ to C is **[1]**

a) $\kappa_1 + \kappa_2$

b) $\frac{\kappa_1\kappa_2}{\kappa_1+\kappa_2}$

c) $\frac{2\kappa_1\kappa_2}{\kappa_1+\kappa_2}$

d) $\frac{\kappa_1+\kappa_2}{\kappa_1\kappa_2}$

6. A thin ring of radius R metre has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in $Wb/m^2$ at the centre of the ring is: **[1]**

a) $\frac{\mu_0 q}{2\pi f R}$

b) $\frac{\mu_0 q f}{2R}$

c) $\frac{\mu_0 q f}{2\pi R}$

d) $\frac{\mu_0 q}{2fR}$

7. A square loop of wire of each side 50 cm is kept so that its plane makes an angle $\theta$ with a uniform magnetic field of induction IT. The magnetic field is withdrawn in 0.1 s. It is found that the induced emf across the loop is 125 mV. The angle $\theta$ is: **[1]**

a) $45^o$

b) $60^o$

c) $90^o$

d) $30^o$

8. The magnetic moment of a revolving electron around the nucleus varies with principal quantum number n as **[1]**

a) $\mu \propto \frac{1}{n}$

b) $\mu \propto n$

c) $\mu \propto n^2$

d) $\mu \propto \frac{1}{n^2}$

9. In a diffraction pattern due to a single slit of width a, the first minimum is observed at an angle $30^o$ when light of wavelength 5000 $\mathring{A}$ is incident on the slit. The first secondary maximum is observed at an angle of **[1]**

a) $\sin^{-1}\left(\frac{1}{2}\right)$

b) $\sin^{-1}\left(\frac{1}{4}\right)$

c) $\sin^{-1}\left(\frac{3}{4}\right)$

d) $\sin^{-1}\left(\frac{2}{3}\right)$

10. The magnitude of electric force, F is: **[1]**

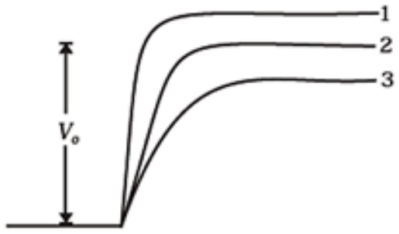
a) directly proportional to the product of both charges.

b) constant

c) directly proportional to the distance between both charges

d) directly proportional to the square of the distance between both charges.

11. In the given Fig., $V_o$ is the potential barrier across a p-n junction, when no battery is connected across the junction **[1]**




a) 3 and 1 both correspond to reverse bias of junction.

b) 3 corresponds to forward bias of junction and 1 corresponds to reverse bias of junction

c) 1 corresponds to forward bias and 3 corresponds to reverse bias of junction.

d) 1 and 3 both correspond to forward bias of junction

12. Which of the following is used in optical fibers? **[1]**

a) Refraction

b) Scattering

c) Total internal reflection

d) Diffraction

13. **Assertion (A):** If the frequency of the incident light on a metal surface is doubled, the kinetic energy of emitted electrons is more than doubled. **[1]**

**Reason (R):** The metal will provide additional energy to the emitted photoelectron for light of higher frequency than that for lower frequency.

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 of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** The potential of earth is assumed zero. **[1]**

**Reason (R):** Earth is insulator and so earth can not hold any charge.

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 of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** When a light wave travels from rarer to denser medium, its speed decreases. Due to this reduction of speed the energy carried by the light wave reduces. **[1]**

**Reason (R):** Energy of wave is proportional to the frequency.

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 of A.

c) A is true but R is false.

d) A is false but R is true.

16. A resistor, a capacitor and an inductor are connected in series. The combination is connected across an ac source of frequency 50 Hz. **[1]**

**Assertion:** Peak current through each remains same.

**Reason:** Average power delivered by source is equal to average power developed across resistance.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

## Section B

17. The magnetic field of a beam emerging from a filter facing a floodlight is given by $B_0 = 12 \times 10^{-8} \sin (1.20 \times 10^7 z - 3.60 \times 10^{15} t)$ T. What is the average intensity of the beam? **[2]**

18. A straight solenoid of length 50 cm has 1000 turns and a mean cross-sectional area of $2 \times 10^{-4}$ $m^2$. It is placed with its axis at 30°, with a uniform magnetic field of 0.32 T. Find the torque acting on the solenoid when a current of 2A is passed through it. **[2]**

OR

Two similar bars, made from two different materials P and Q, are placed, one-by-one, in a non-uniform magnetic field. It is observed that

i. bar P tends to move from the weak to the strong field region.

ii. bar Q tends to move from the strong to the weak field region.

What is the nature of the magnetic materials used for making these two bars?

Show, with the help of a diagram, the behaviour of the field lines, due to an external magnetic field, near each of these two bars.

19. An a.c. supply of 230 V is applied to a half wave rectifier circuit through a transformer of turn ratio 10 : 1. Find the output d.c. voltage. Assume the diode to be ideal. **[2]**

20. The ground state energy of hydrogen atom is -13.6 eV . What are the kinetic and potential energies of the electron in this state? **[2]**

21. Answer the following: **[2]**

a. Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?

b. Does a bar magnet exert a torque on itself due to its own field? Justify your answer.

c. When an electron revolves around a nucleus, obtain the expression for the magnetic moment associated with it.

## Section C

22. a. State Ohm's Law. Represent it mathematically. **[3]**

b. Define 1 ohm.

c. What is the resistance of a conductor through which a current of 0.5 A flows when a potential difference of 2V is applied across its ends?

23. Ultra-violet light of wavelength 200 nm from a source is incident on a metal surface. If the stopping potential is -2.5 V, **[3]**

a. Calculate the work function of the metal, and

b. How would the surface respond to a high intensity red light of wavelength 6328 A produced by a laser?

24. What is a Zener diode? Draw its V-I characteristic. Explain with the help of a circuit diagram how a Zener diode can be used as a voltage regulator. **[3]**

25. i. The density of the nuclear matter is tremendously larger than the physical density of the material. Explain. **[3]**

ii. The nuclear forces are not coulomb forces between nucleons. Explain.

iii. Draw a plot of the potential energy between a pair of nucleons as a function of distance between them inside a nucleus.

26. State Bohr's quantization condition of angular momentum. Calculate the shortest wavelength of the Bracket series and state to which part of the electromagnetic spectrum does it belong. **[3]**

27. In single slit diffraction, explain why the maxima at $\theta = \left(n + \frac{1}{2}\right)\left(\frac{\lambda}{a}\right)$ becomes weaker and weaker as n increases. State two important differences between interference and diffraction pattern. **[3]**

28. A coil of number of turns N, area A, is rotated at a constant angular speed $\omega$ , in a uniform magnetic field B, and connected to a resistor R. **[3]**

Deduce expressions for: (i) maximum emf induced in the coil. (ii) power dissipation in the coil.

OR

Define the term self-inductance of a solenoid. Obtain the expression for the magnetic energy stored in an inductor of self-inductance L to build up a current I through it.

**Section D**

29. **Read the text carefully and answer the questions:** **[4]**

Maxwell showed that the speed of an electromagnetic wave depends on the permeability and permittivity of the medium through which it travels. The speed of an electromagnetic wave in free space is given by c = $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. The fact led Maxwell to predict that light is an electromagnetic wave. The emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory. The speed of an electromagnetic wave in any medium of permeability $\mu$ and permittivity $\varepsilon$ will be $\frac{c}{\sqrt{K\mu_r}}$ where K is the dielectric constant of the medium and $\mu_r$ is the relative permeability.

(a) The dimensions of $\frac{1}{2}\varepsilon_0 E^2$ ($\varepsilon_0$ : permittivity of free space; E = electric field) is

a) $ML^2T^{-2}$ b) $MLT^{-1}$

c) $ML^2T^{-1}$ d) $ML^{-1}T^{-2}$

(b) Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of the vacuum. If M = mass, L = length, T = time and A = electric current, then

a) $[\varepsilon_0] = MLT^{-2}A^{-2}$ b) $[\varepsilon_0] = ML^2T^{-1}$

c) $[\varepsilon_0] = M^{-1}L^{-3}T^4A^2$ d) $[\varepsilon_0] = M^{-1}L^{-3}T^2A$

(c) An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon$ = 4. Then

a) wavelength is doubled and the frequency becomes half

b) wavelength and frequency both remain unchanged

c) wavelength is doubled and the frequency remains unchanged

d) wavelength is halved and the frequency remains unchanged.

**OR**

Which of the following are not electromagnetic waves?
cosmic rays, $\gamma$-rays, $\beta$-rays, X-rays

a) $\gamma$-rays b) $\beta$-rays

c) X-rays d) cosmic rays

(d) The electromagnetic waves travel with

a) the speed of light c = $3 \times 10^8$ m $s^{-1}$ in free space

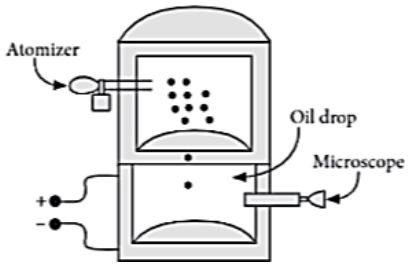
b) the same speed in all media

c) the speed of light c = $3 \times 10$ m $s^{-1}$ in solid medium

d) the speed of light c = $3 \times 10^8$ m $s^{-1}$ in fluid medium.

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 equaled Mg. Millikan accurately **[4]**

measured the charges on many oil drops and found the values to be whole number multiples of $1.6 \times 10^{-19}$ C the charge of the electron. For this, he won the Nobel prize.




i. If a drop of mass $1.08 \times 10^{-14}$ kg remains stationary in an electric field of $1.68 \times 10^{5}$ $NC^{-1}$, then calculate the charge of this drop.

ii. A negatively charged oil drop is prevented from falling under gravity by applying a vertical electric field 100 V $m^{-1}$. Then what will be the number of electrons carried by the drop, if the mass of the drop is $1.6 \times 10^{-3}$ g? ($g = 10$ $ms^{-2}$)

iii. The important conclusion given by Millikan's experiment about the charge is that charge is _____.

iv. If in Millikan's oil drop experiment, charges on drops are found to be $8\mu C, 12\mu C, 20\mu C$, then what is the quanta of charge?

**Section E**

31. i. Draw a ray diagram showing the formation of a real image of an object placed at a distance **u** in front of a concave mirror of radius of curvature **R**. Hence, obtain the relation for the image distance **v** in terms of u and R. **[5]**

ii. A 1.8 m tall person stands in front of a convex lens of focal length 1 m, at a distance of 5 m. Find the position and height of the image formed.

OR

A narrow monochromatic beam of light of intensity I is incident on a glass plate. Another identical glass plate is kept close to the first one and parallel to it. Each plate reflects 25% of the incident light and transmits the remaining. Calculate the ratio of minimum and maximum intensity in the interference pattern formed by two beams obtained after reflection from each plate.

32. a. Deduce the expression for the energy stored in a charged capacitor **[5]**

b. Show that the effective capacitance C of a series combination of three capacitors $C_1$, $C_2$ and $C_3$ is given by $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$.

OR

A capacitor of capacitance $C_1$ is charged to a potential $V_1$ while another capacitor of capacitance $C_2$ is charged to a potential difference $V_2$. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other.

i. Find the total energy stored in the two capacitors before they are connected.

ii. Find the total energy stored in the parallel combination of two capacitors.

iii. Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected

33. i. Describe, with the help of a suitable diagram, the working principle of a step-up transformer. Obtain the relation between input and output voltages in terms of the number of turns of primary and secondary windings and the currents in the input and output circuits. **[5]**

ii. Given the input current 15 A and the input voltage of 100 V for a step-up transformer having 90% efficiency, find the output power and the voltage in the secondary if the output current is 3 A.

OR

A series L-C-R circuit is connected to an AC source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.