



PRINCE ACADEMY

OF HIGHER EDUCATION

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BOARD SAMPLE PAPER- II (2025-26)

Time : 03 : 00 Hours

CLASS :- XII-PHYSICS (042)

M.M. : 70

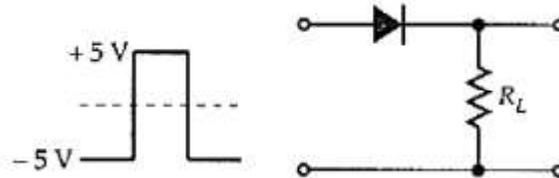
General Instructions:

- (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 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.

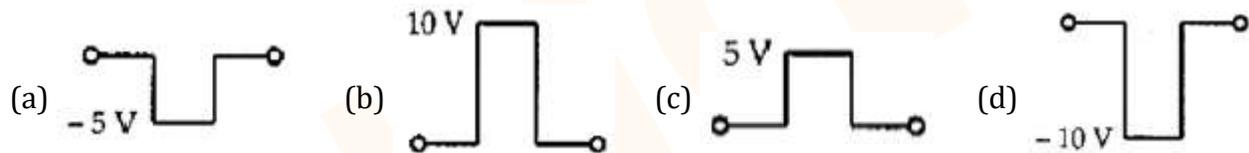
SECTION - A

1. When trivalent impurity is mixed in a pure semiconductor, the conduction is mainly due to
(a) Holes (b) Protons (c) Electrons (d) Positive ions
2. Focal length of a mirror is given by
(a) $f = \frac{R}{2}$, $R =$ radius of curvature (b) $f = R^2$, $R =$ radius of curvature
(c) $f = R$, $R =$ radius of curvature (d) $f = \frac{R}{4}$, $R =$ radius of curvature
3. A bar magnet of pole strength (m) and magnetic moment (M) is cut perpendicular to its axis in two equal halves. The new pole strength (m') and magnetic moment (M') of each part are respectively:
(a) m and $\frac{M}{2}$ (b) m and M (c) $2m$ and $\frac{M}{2}$ (d) $\frac{M}{2}$ and $2M$
4. Between the plates of a parallel plate condenser, a plate of thickness t_1 and dielectric constant k_1 is placed, in the rest of the space there is another plate of thickness t_2 and dielectric constant k_2 . The potential difference across the condenser will be
(a) $\frac{Q}{A\epsilon_0} \left(\frac{t_1}{k_1} + \frac{t_2}{k_2} \right)$ (b) $\frac{\epsilon_0 Q}{A} \left(\frac{t_1}{k_1} + \frac{t_2}{k_2} \right)$ (c) $\frac{\epsilon_0 Q}{A} (k_1 t_1 + k_2 t_2)$ (d) $\frac{Q}{A\epsilon_0} \left(\frac{t_1}{k_1} + \frac{t_2}{k_2} \right)$

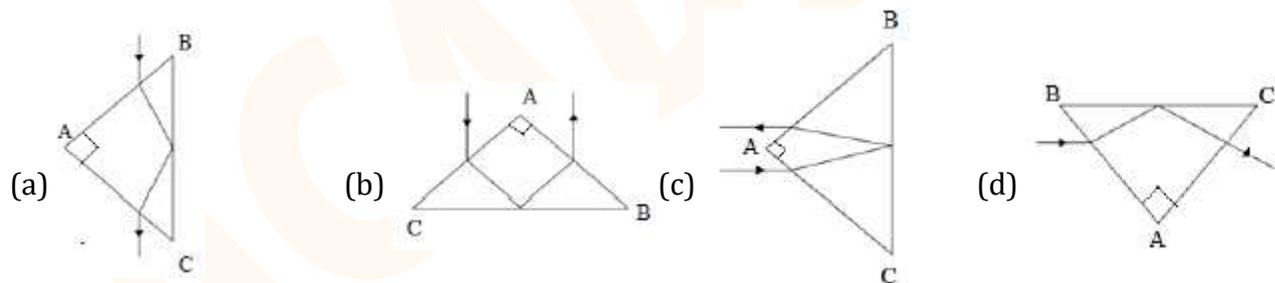
5. A magnet make 5 oscillations per minute in earth's magnetic field ($B = 0.5$ gauss). By what amount should the field be increased so that the magnet may make 20 oscillations per minute?
 (a) 10 gauss (b) 7.5 gauss (c) 8 gauss (d) 1.5 gauss
6. Wavefront is
 (a) Series of points on the wave with same amplitude
 (b) Locus of all adjacent points at which the electric field is the same
 (c) Series of points on the wave with same frequency
 (d) Locus of all adjacent points at which the phase of oscillation is the same
7. If in a p-n junction, a square input signal of 10 V is applied as shown,



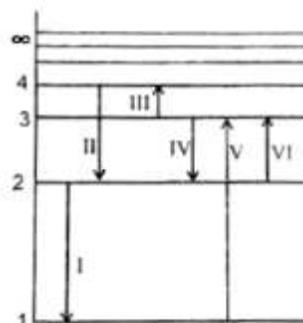
then the output across R_L will be



8. A coil contains N turns of insulated copper wire of diameter d and resistivity ρ wound on a cylinder of diameter D . What is the total resistance between the two ends of the coil of copper wire?
 (given: $D \gg d$)
 (a) $\frac{4\rho ND}{d^2}$ (b) $\frac{8\rho ND}{d^2}$ (c) $\frac{2\rho ND}{d^2}$ (d) $\frac{12\rho ND}{d^2}$
9. A glass prism has internal angles of 45° , 45° and 90° . The glass has a critical angle of 45° . Which of the following ray diagrams depicts the possible path the of light through the prism?



10. Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength?



- (a) I (b) III (c) IV (d) VI

11. In a coil of self-induction 5 H, the rate of change of current increase is 2 As^{-1} . Then emf induced in the coil is
 (a) 10 V (b) -10 V (c) 5 V (d) -5 V
12. A capacitor of capacitance $\frac{10^{-4}}{\pi} \text{ F}$, an inductor of inductance $\frac{2}{\pi} \text{ H}$ and a resistor of resistance 100Ω are connected to form a series RLC circuit. When an AC supply of 220 V, 50 Hz is applied to the circuit, determine the impedance of the circuit.
 (a) 14.14Ω (b) 141.4Ω (c) 200Ω (d) 100Ω

Direction (Q: 13 to 16) Two statements are given-one labelled Assertion (A) and 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 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): Two protons placed at different distances, between the plates of a parallel plate capacitor experience the same force.
 Reason (R): The electric field between the plates of the capacitor is constant.
14. Assertion (A): A transformer does not work on DC.
 Reason (R): DC neither changes direction nor magnitude.
15. Assertion (A): The potential inside a hollow spherical charged conductor is zero.
 Reason (R): Inside the hollow spherical conductor electric field is constant.
16. Assertion (A): When a battery is short circuited, the terminal voltage is zero.
 Reason (R): In short circuit, the current varies with time.

SECTION - B

17. A capacitor of unknown capacitance is connected across a battery of V volt. A charge of $360\mu\text{C}$ is stored in it. When the potential across the capacitor is reduced by 120 V, the charge stored in the capacitor becomes $120\mu\text{C}$. Calculate V and the unknown capacitance. What would have been the charge on the capacitor if the voltage were increased by 120 V?
18. A hydrogen atom initially in the ground level absorbs a photon, which excites it to the $n = 4$ level. Determine the wavelength and frequency of photon.
19. An alpha particle is projected with velocity $\vec{v} = (3.0 \times 10^5 \text{ m/s})\hat{i}$ into a region in which magnetic field $\vec{B} = [(0.4\text{T})\hat{i} + (0.3\text{T})\hat{j}]$ exists. Calculate the acceleration of the particle in the region. \hat{i}, \hat{j} and \hat{k} are unit vectors along x, y and z axis respectively and charge to mass ratio for alpha particle is $4.8 \times 10^7 \text{ C/kg}$.

20. Using Huygens' principle, draw a ray diagram showing the propagation of a plane wave refracting at a plane surface separating two media. Also verify Snell's law of refraction.
21. Suppose, we think of fission of a ${}^{56}_{26}\text{Fe}$ nucleus into two equal fragments, ${}^{28}_{13}\text{Al}$. Is the fission energetically possible? Argue by working out Q of the process. Given $m({}^{56}_{26}\text{Fe}) = 55.93494 \text{ u}$ and $m({}^{28}_{13}\text{Al}) = 27.98191 \text{ u}$.

OR

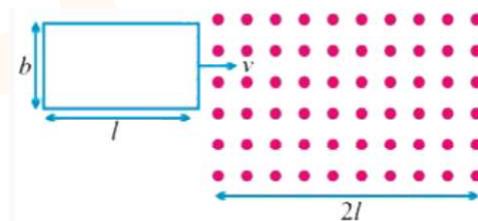
Write any two limitations of Bohr's atomic model.

SECTION - C

22. (a) State the underlying principle of a moving coil galvanometer.
- (b) Give any reason to explain why a galvanometer cannot as such be used to measure the value of current in given circuit
- (c) Define the terms-
- (i) Voltage sensitivity.
- (ii) Current sensitivity

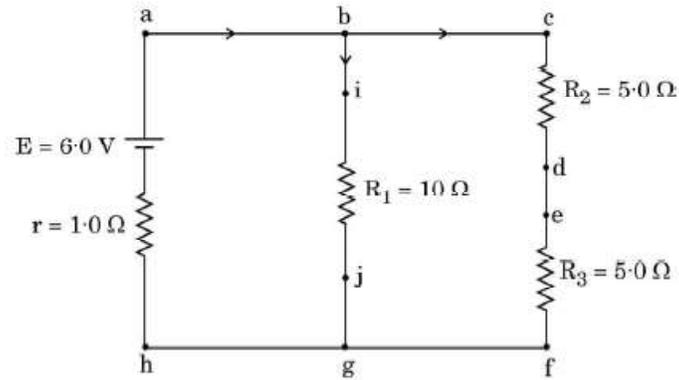
OR

- (a) Define self-inductance.
- (b) A rectangular conducting loop of length ' l ' and breadth ' b ' enters in a uniform magnetic field as shown. The loop is moving at constant velocity v and at $t = 0$ it just enters the field. Sketch the following graphs for time interval $t = 0$ to $3l/v$.
- (i) Magnetic flux - time
- (ii) Induced emf - time



23. Two charges $14\mu\text{C}$ and $-4\mu\text{C}$ are placed at $(-12 \text{ cm}, 0, 0)$ and $(12 \text{ cm}, 0, 0)$ in an external electric field $E = \frac{B}{r^2}$, where $b = 1.2 \times 10^6 \frac{\text{Nm}^2}{\text{C}}$ and r is in meter. Calculate the electrostatic potential energy of the configuration.

24. The following figure shows a circuit diagram. We can find the currents through and potential differences across different resistors using Kirchoff rules.



Answer the following questions based on the above :

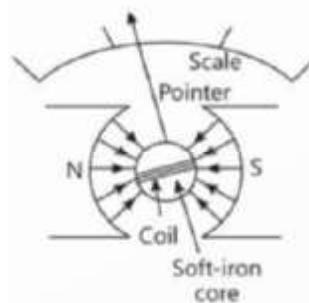
- (a) Which points are at the same potential in the circuit ?
 (b) What is the current through arm bg ?
 (c) Find the potential difference across resistance R_3 .
25. Suppose a pure Si crystal has 5×10^{28} atom m^{-3} . It is doped by 1 ppm concentration of pentavalent As. Calculate the number of electrons and holes. Given that $n_i = 1.5 \times 10^{16} m^{-3}$.
26. (a) For a given a.c., $i = i_m \sin \omega t$, show that the average power dissipated in a resistor R over complete cycle is $\frac{1}{2} i_m^2 R$.
 (b) A light bulb is rated at 100 W for a 220 V a.c. supply. Calculate the resistance of the bulb.
27. How does Einstein's photoelectric equation explain the emission of electrons from a metal surface? Explain briefly.
 Plot the variation of photocurrent with :
 (a) collector plate potential for different intensity of incident radiation, and
 (b) intensity of incident radiation.
28. Suppose that the electric field amplitude of an electromagnetic wave is $E_0 = 120$ N/c and that its frequency is $\nu = 50$ MHz.
 (i) Determine B_0 , ω , K and λ .
 (ii) Find expression for E and B.

SECTION - D

29. **Read the following paragraph and answer the questions that follow.**

Moving coil galvanometer operates on Permanent Magnet Moving Coil (PMMC) mechanism and was designed by the scientist d'Arsonval. Moving coil galvanometers are of two types:

- (I) Suspended coil (II) Pivoted coil type or tangent galvanometer.



Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the magnetic flux passing through the coil is maximum.

(i) A moving coil galvanometer is an Instrument which:

- (a) is used to measure emf
- (b) is used to measure potential difference
- (c) is used to measure resistance
- (d) is a deflection instrument which gives a deflection when a current flows through its coil

(ii) To make the field radial in a moving coil galvanometer:

- (a) number of turns of coil is kept small
- (b) magnet is taken in the form of horse-shoe
- (c) poles are of very strong magnets
- (d) poles are cylindrically cut

(iii) The deflection in a moving coil galvanometer is:

- (a) directly proportional to torsional constant of spring
- (b) directly proportional to the number of turns in the coil
- (c) inversely proportional to the area of the coil
- (d) inversely proportional to the current in the coil

(iv) In a moving coil galvanometer, a coil of N-turns of area A and carrying current I is placed in a radial field of strength B, experienced torque is:

- (a) NA^2B^2I
- (b) $NABI^2$
- (c) N^2ABI
- (d) $NABI$

OR

To increase the current sensitivity of a moving coil galvanometer, we should decrease:

- (a) strength of magnet
- (b) torsional constant of spring
- (c) number of turns in coil
- (d) area of coil

30. **Read the following paragraph and answer the questions that follow.**

Types of Lenses and their combination

A convex or converging lens is thicker at the centre than at the edges. It converges a beam of light on refraction through it. It has a real focus. Convex lens is of three types: Double convex lens, Plano convex lens and Concavo-convex lens.

Concave lens is thinner at the centre than at the edges. It diverges a beam of light on refraction through it. It has a virtual focus. Concave lenses are of three types: Double concave lens, Plano-concave lens and Convexo-concave lens.

When two thin lenses of focal lengths f_1 and f_2 are placed in contact with each other along their common principal axis, then the two lens system is regarded as a single lens of focal length f and

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

If several thin lenses of f_1, f_2, \dots, f_n are placed in contact, then the effective focal length of the combination is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \dots + \frac{1}{f_n}$$

and in terms of power, we can write $P = P_1 + P_2 + \dots + P_n$

The value of focal length and power of a lens must be used with proper sign consideration.

(i) Two thin lenses are kept coaxially in contact with each other and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, the focal length of the other would be

- (a) -26.7 cm (b) 60 cm (c) 80 cm (d) 30 cm

(ii) A spherical air bubble is embedded in a piece of glass. For a ray of light passing through the bubble, it behaves like a

- (a) converging lens (b) diverging lens (c) mirror (d) thin plane sheet of glass

(iii) Lens generally used in magnifying glass is

- (a) single concave lens
 (b) single convex lens
 (c) combination of convex lens of lower power and concave lens of lower focal length
 (d) planoconcave lens

(iv) The magnification of an image by a convex lens is positive only when the object is placed

- (a) at its focus F. (b) between F and 2F.
 (c) at 2F. (d) between F and optical centre.

OR

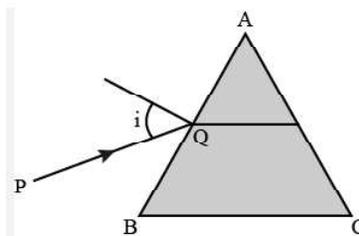
(iv) A convex lens of 20 cm focal length forms a real image which is three times magnified. The distance of the object from the lens is

- (a) 13.33 cm (b) 14 cm (c) 26.66 cm (d) 25 cm

SECTION - E

31. (i) A ray PQ of light is incident on the face AB of a glass prism ABC (as shown in the figure) and emerges out of the face AC. Trace the path of the ray. Also show that $\angle i + \angle e = \angle A + \delta$

Where, δ and e denotes the angle of deviation and angle of emergence.



Also find out the relation between the refractive index (μ) in case of minimum deviation (δ_m).

(ii) If the radii of curvature of the faces of a double convex lens are 9 cm and 15 cm respectively and refractive index of glass is 1.5, then determine the focal length and the power of the lens.

OR

(i) Draw a labelled ray diagram showing the formation of a final image by a compound microscope at least distance of distinct vision and find the magnifying power of compound microscope.

(ii) A tank is filled with water to a height of 12.5 cm. The apparent depth of a needle lying at the bottom of the tank, is measured by a microscope to be 9.4 cm. What is the refractive index of water? If water is replaced by a liquid of refractive index 1.63 upto the same height, then by what distance would the microscope have to be moved to focus on the needle again ?

32. A free pith ball of 8g carries a positive charge of $5 \times 10^{-8} C$. What must be the nature and magnitude of charge that should be given to a second pith ball fixed 5 cm vertically below the former pith-ball, so that upper pith-ball is stationary ? 5

OR

(a) Use Gauss law to derive the expression for the electric field due to straight uniformly charged infinite line of charge density ' λ ' c/m. 3

(b) Draw a graph to show the variation of E with perpendicular distance r from the line of charge. 1

(c) Find the workdone in bringing a charge q from perpendicular distance r_1 to r_2 ($r_2 > r_1$). 1

33. (i) Explain the processes of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (E_{bn}) verses the mass number (A). 2

(ii) A 60W source emits monochromatic light of wavelength 662.5 nm. Find the value of number of photons emitted per second. 3

OR

(i) In Geiger-Mardsen experiment, calculate the distance of the closest approach to the nucleus of $Z = 80$, when an α - particle of 8 MeV energy impinges on it before comes momentarily to rest and reverse its direction. 3

(ii) Draw a curve between no. of scattered α - particles and deflection angle θ . 2
