2025-26 II PUC PREPARATORY EXAMINATION

SUBJECT: PHYSICS (33)   **MAXIMUM MARKS: 70**
TIME: 3 HOURS   **NUMBER OF QUESTIONS: 45**

General Instructions:

1. *All parts (A TO D) are compulsory.*
2. *For Part – A questions, only first written-answer will be considered for evaluation.*
3. *Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.*
4. *Direct answers to numerical problems without relevant formula and detailed solutions will not carry any marks.*
5. *For questions having diagram/ figure/ graph, alternate questions are given at the end of the question paper in a separate section Part – E for visually challenged students.*

PART – A

I. Pick the correct option among the four given options for ALL of the following questions: **15 × 1 = 15**

1. The expression for electric field at a point due to an infinite line of charge is (Symbols have their usual meanings)

   (a) $E = \dfrac{\lambda}{2\pi \in_0 r^2}$
   (b) $E = \dfrac{\lambda}{2\pi \in_0 r}$
   (c) $E = \dfrac{\lambda}{4\pi \in_0 r}$
   (d) $E = \dfrac{\lambda}{4\pi \in_0 r^2}$

2. When a conductor having a cavity is placed in an electrostatic field, the electric field inside the cavity is zero. This is called

   (a) dielectric breakdown. (b) electrostatic earthing.
   (c) electrostatic shielding. (d) electrostatic polarisation.

3. As the temperature decreases, the resistivity of:

   (a) metals increases and semiconductors decreases. (b) metals remains constant but semiconductors increases.
   (c) both metals and semiconductors decreases. (d) metals decreases and semiconductors increases.

4. A galvanometer can be converted into a voltmeter by connecting:

   (a) a low resistance in series with it. (b) a high resistance in parallel with it.
   (c) a low resistance in parallel with it. (d) a high resistance in series with it.

5. Pick out the correct statement about bar magnets among following.

   (a) A freely suspended bar magnet points in the east-west direction.
   (b) A freely suspended bar magnet points in the north-south direction.
   (c) Poles of a bar magnet can be separated by breaking it.
   (d) The magnetic field lines present around a bar magnet are discontinuous.

6. Lenz's law signifies the law of conservation of

   (a) charge   (b) mass   (c) energy   (d) charge and mass

7. The power factor, $\cos \phi = 0$ in an AC circuit containing

   (a) only inductor. (b) a capacitor and a resistor in series.
   (c) an inductor and a resistor in series. (d) only resistor.

8. **Displacement current is the current due to**
   (a) time varying magnetic field.
   (b) charges moving through a conducting wire.
   (c) charges moving with constant speed.
   (d) time varying electric field.

9. **The graph representing the variation of the angle of deviation (δ) with the angle of incidence (i) for a triangular prism is**

   (a)
   (b)
   (c)
   (d)
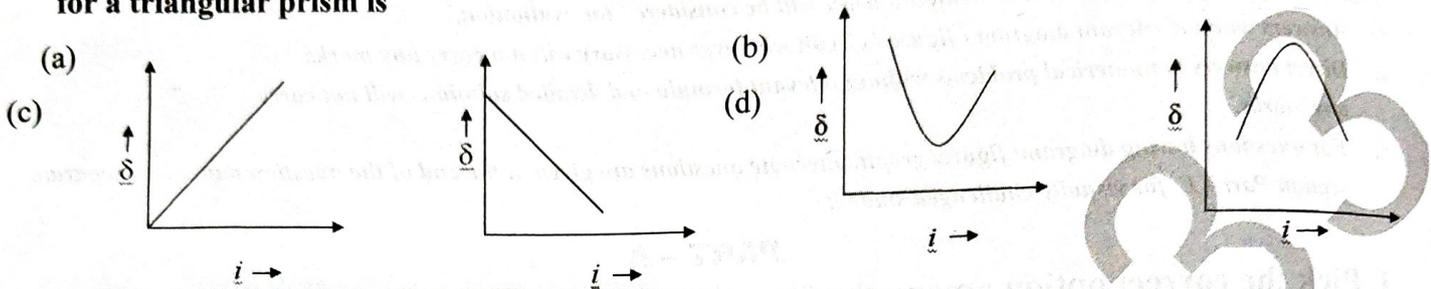
10. **When light passes through narrow holes, it turns around corners and enters shadow region. This effect is called**
    (a) refraction of light.
    (b) diffraction of light.
    (c) interference of light.
    (d) polarisation of light.

11. **If unpolarised light of intensity 'I_0' is passed through a polaroid, the intensity of emergent light is**
    (a) $\dfrac{I_0}{2}$
    (b) $\dfrac{2I_0}{3}$
    (c) I_0
    (d) $\dfrac{I_0}{4}$

12. **In the following table, the column I is the list of types of electron emission and the column II is the modes of energy supplied for the process. Identify the correct match.**

Column I	Column II
(i) Thermionic emission	(p) Electric field energy
(ii) Field emission	(q) Light energy
(iii) Photoelectric emission	(r) Heat energy

   (a) (i) → (p), (ii) → (q), (iii) → (r)
   (b) (i) → (r), (ii) → (q), (iii) → (p)
   (c) (i) → (q), (ii) → (r), (iii) → (p)
   (d) (i) → (r), (ii) → (p), (iii) → (q)

13. **In alpha – scattering experiment, an alpha particle rebounds back along the same path. Then**
    (b – impact parameter and θ – angle of scattering)
    (a) b = 0 and $\theta = 180^0$
    (b) b = 0 and $\theta = 0^0$
    (c) b > 0 and $\theta = 0^0$
    (d) b > 0 and $\theta = 180^0$

14. **Isotones are the nuclei having**
    (a) same number of nucleons.
    (b) different number of protons.
    (c) same number of protons.
    (d) same number of neutrons.

15. **An example for trivalent impurity is**
    (a) Arsenic
    (b) Antimony
    (c) Boron
    (d) Phosphorous

II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL the following questions: 5 × 1 = 5

(an AC generator, concave, negative, matter, transformer, positive)

16. Magnetic susceptibility of a ferromagnetic material is _____.
17. Mechanical energy is converted into electrical energy in _____.
18. The device which works on the principle of mutual induction is _____.
19. Reflecting telescopes use _____ mirrors as objectives.
20. During interaction of radiation with _____, radiation exhibits particle nature.

PART – B

III. Answer any FIVE of the following questions: 5 × 2 = 10

21. State and explain Coulomb's law in electrostatics.
22. What is an equipotential surface? Draw equipotential surfaces for a point charge.
23. Mention any two limitations of Ohm's law.
24. When is the force on a charged particle moving in a uniform magnetic field (a) maximum and (b) zero?
25. The magnetic flux linked with a coil changes from 5×10^{-3} Wb to 3×10^{-3} Wb in 0.01 second. Calculate the magnitude of the induced emf in the coil.
26. Name the electromagnetic waves produced by
    a) accelerated motion of charges in conducting wires and b) hot bodies and molecules.
27. Write the expression for the radius of nth orbit of electron in a hydrogen atom and explain the terms.
28. Name the majority and minority charge carriers in p-type semiconductors.

PART – C

IV. Answer any FIVE of the following questions: 5 × 3 = 15

29. Write the three basic properties of electric charge.
30. Derive the expression for effective capacitance of two capacitors connected in parallel.
31. Using Ampere's circuital law, obtain the expression for magnetic field at a point due to an infinitely long straight conductor carrying current.
32. State and explain Gauss's law in magnetism. Give its significance.
33. Derive the expression for energy stored in a current carrying inductor.
34. Show that the radius of curvature of a spherical mirror is equal to twice its focal length.
35. Mention any three experimental results of photoelectric effect.
36. Calculate the binding energy of an α - particle ($_2^4 He$) in MeV from the following data.
    Mass of α-particle = 4.00260 u, Mass of neutron=1.008662 u, Mass of proton = 1.007825 u

PART – D

### V. Answer any THREE of the following questions: 3 × 5 = 15

37. Derive the expression for electric potential at a point due to a point charge.

38. Assuming the expression for drift velocity, derive the expression for conductivity of a material $\sigma = \frac{ne^2\tau}{m}$ where symbols have their usual meaning.

39. Obtain the expression for force per unit length between two infinitely long straight parallel conductors carrying currents and placed in vacuum. What is the nature of force between the two conductors if the currents are in opposite direction?

40. i) What is a wavefront? (1)

   ii) State Huygen's principle. Using the same, show that the angle of incidence is equal to the angle of reflection during reflection of the plane wavefront by a plane surface. (4)

41. i) Classify solids into conductors, insulators and semiconductors on the basis of band theory. (3)

   ii) What is a rectifier? Which property of a p-n junction diode is used in rectification? (2)

VI. Answer any TWO of the following questions:

$2 \times 5 = 10$

42. Four point charges of +6 nC, −3 nC, +6 nC and +3 nC are placed respectively at the corners A, B, C and D of a square ABCD of side 0.2 m. Calculate the magnitude and direction of the resultant electric field at the centre of the square.

43. Find the potential difference across 10 Ω resistor in the following network.
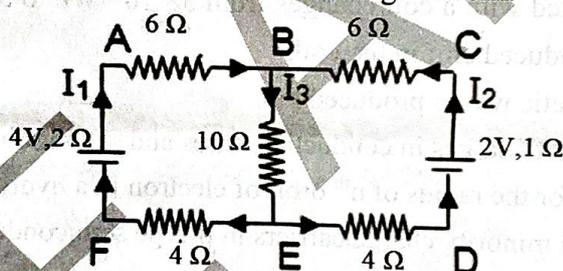
44. A series LCR circuit containing an inductor of 0.194 H, a capacitor of 35 μF and a resistor of 40 Ω is connected to ac source of 200 V and 50 Hz. Calculate (i) the impedance and (ii) power factor of the circuit.

45. An object of height 3 mm is placed at a distance 14 cm in front of a concave lens of focal length 21 cm. Find the position, nature and size of the image formed.

PART – E
(For Visually Challenged Students only)

9. For the refraction of light through a triangular prism, as the angle of incidence (i) increases, the angle of deviation (δ)

   (a) increases linearly
   (b) first decreases and then increases
   (c) decreases linearly
   (d) first increases and then decreases

43. The positive terminals of two cells of emfs 4 V and 2 V with internal resistances 2 Ω and 1 Ω are connected by a uniform wire of resistance 12 Ω. Their negative terminals are connected by a second uniform wire of resistance 8 Ω. The mid points of these two wires are connected by a third uniform wire of resistance 10 Ω. Find the potential difference across 10 Ω wire.