

GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD
MODEL QUESTION PAPER-2 2024-25
II PUC - PHYSICS (33)

Time: 3 hours.

Max Marks: 70

No of questions: 45

General Instructions:

1. All parts (A TO D) are compulsory. PART-E is only for visually challenged students.
2. For Part – A questions, first written-answer will be considered for awarding marks.
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.

PART – A

I. Pick the correct option among the four given options for ALL of the following questions:

15 × 1 = 15

1. 'The total electric flux through a closed surface in air is equal to $\frac{1}{\epsilon_0}$ times the total charge enclosed by that surface'. This is the statement of

- (A) Coulomb's law in electrostatics (B) Gauss's law in magnetism
(C) Gauss's law in electrostatics (D) Ampere's circuital law

2. The electric potential due to a negative point charge at a distance 'r' is

- (A) positive and it varies as $\frac{1}{r^2}$ (B) positive and it varies as $\frac{1}{r}$
(C) negative and it varies as $\frac{1}{r^2}$ (D) negative and it varies as $\frac{1}{r}$

3. Identify the WRONG statement from the following

- (A) The drift speed acquired by free electrons per unit electric field is called mobility.
(B) The conductivity of semiconductors decreases with increase in temperature.
(C) The conductivity of conductors decreases with increase in temperature.
(D) Alloys are widely used in the construction of standard resistors.

4. The physical quantities related to magnetism are listed in column I and the dimensions are listed in column II. Identify the correct match

Column I	Column II
(i) Magnetic field	(a) $[MLT^{-2}A^{-2}]$
(ii) Magnetic permeability	(b) $[L^2 A]$
(iii) Magnetic moment	(c) $[M T^{-2}A^{-1}]$

- (A) (i) - (b), (ii) - (c), (iii) - (a) (B) (i) - (c), (ii) - (b), (iii) - (a)
(C) (i) - (a), (ii) - (b), (iii) - (c) (D) (i) - (c), (ii) - (a), (iii) - (b)

5. The ferromagnetic material among the following is

- (A) copper (B) nickel (C) lead (D) calcium

6. The following are the statements related to self-inductance:

(i) The self-inductance of a coil depends on its geometry and on the permeability of the medium inside it.

(ii) The self-inductance is a measure of electrical inertia and opposes the change in current in the coil.

- (A) Both the statements are wrong (B) Only statement (i) is correct
(C) Both the statements are correct (D) Only statement (ii) is correct

7. In a transformer, N_P and N_S are the number of turns present in its primary and secondary coils respectively. The transformer is said to be a step-up transformer if

- (A) $N_P < N_S$ (B) $N_P > N_S$ (C) $N_P = N_S$ (D) $N_P \gg N_S$

8. The expression for displacement current i_d is

- (A) $i_d = \epsilon_0^2 \frac{d\phi_E}{dt}$ (B) $i_d = \mu_0 \epsilon_0 \frac{d\phi_E}{dt}$ (C) $i_d = \mu_0 \frac{d\phi_E}{dt}$ (D) $i_d = \epsilon_0 \frac{d\phi_E}{dt}$

9. Identify the statement which is true for a compound microscope from the following.

- (A) Its objective is a convex lens of greater aperture.
(B) Its eyepiece is a convex lens of smaller aperture.
(C) The image formed by its objective is real and inverted.
(D) Its eyepiece produces the final image, which is virtual and diminished.

10. Diffraction effect is exhibited by _____ .

- (A) only sound waves (B) only light waves
(C) only matter waves (D) all types of waves

11. In photoelectric effect experiment if only the frequency of incident radiation is increased, then

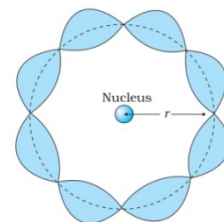
- (A) the maximum kinetic energy of photoelectrons decreases. (B) the stopping potential increases.
(C) the photoelectric current increases. (D) the photoelectric current decreases.

12. The impact parameter is minimum in alpha (α) - scattering experiment for the scattering angle of

- (A) 180° (B) 0° (C) 120° (D) 90°

13. The standing wave pattern of matter waves associated with an electron revolving in a stable orbit is shown in the diagram. The principal quantum number (n) and radius (r_n) of the orbit are respectively

- (A) 8 and $\frac{4\lambda}{\pi}$ (B) 4 and $\frac{4\lambda}{\pi}$
(C) 8 and $\frac{2\lambda}{\pi}$ (D) 4 and $\frac{2\lambda}{\pi}$



14. The radioactive decay in which very high energy photons are emitted is called _____ .

- (A) gamma decay (B) alpha decay (C) negative β decay (D) positive β decay

15. When a forward bias is applied to a p-n junction, it

- (A) raises the potential barrier. (B) reduces the majority carrier current to zero.
(C) lowers the potential barrier. (D) raises the width of depletion region.

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

$5 \times 1 = 5$

(zero, paramagnetic, transverse, ac generator, one, diamagnetic)

16. The magnetic susceptibility is negative for _____ materials.
17. The device which works on the principle of electromagnetic induction is _____.
18. The power factor of an AC circuit containing pure resistor is _____.
19. The light waves are _____ in nature.
20. The charge of a photon is _____.

PART – B

III. Answer any FIVE of the following questions:

$5 \times 2 = 10$

21. 'The charges are additive in nature'. Explain.
22. What is an equipotential surface? What will be the shape of equipotential surfaces corresponding to a single point charge?
23. Give any two differences between current and current density.
24. A moving coil galvanometer gives a deflection of 10 divisions when $200 \mu\text{A}$ of current is passed through it. Find the current sensitivity of the galvanometer.
25. State Faraday's law and Lenz's law of electromagnetic induction.
26. Name the electromagnetic waves used for the following applications.
 - a) The radar systems used in aircraft navigation.
 - b) The remote switches of household electronic systems such as TV.
27. How is total energy of an electron revolving in an orbit of hydrogen atom related to the principal quantum number of the orbit? What is the significance of the negative sign in the expression for total energy of electron in a hydrogen atom?
28. What are intrinsic and extrinsic semiconductors?

PART – C

IV. Answer any FIVE of the following questions:

$5 \times 3 = 15$

29. What is an electric dipole? Define electric dipole moment. Give its direction.
30. What is a capacitor? Mention any two factors on which the capacitance of a parallel plate capacitor depends.
31. Derive an expression for angular frequency of revolution for a charged particle moving perpendicular to a uniform magnetic field.
32. Mention any three properties of magnetic field lines.
33. A horizontal straight wire 10 m long is falling with a speed of 5.0 m s^{-1} , at right angles to a magnetic field, $0.30 \times 10^{-4} \text{ Wbm}^{-2}$. Find the instantaneous value of the emf induced in the wire.

34. Derive the relation between radius of curvature and focal length in case of a concave mirror.
35. Give Einstein's explanation of photoelectric effect and write Einstein's photoelectric equation.
36. Define 'binding energy' and 'mass defect'. Write the relation between them.

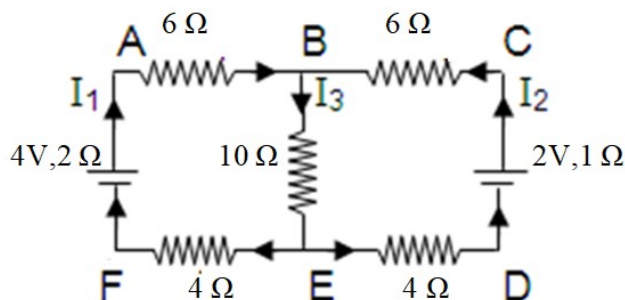
PART – D

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

37. a) Obtain an expression for potential energy of an electric dipole placed in a uniform electric field. (3)
 b) Define energy density of a charged capacitor. How is the energy density related to electric field present between the plates of capacitor? (2)
38. Derive an expression for effective emf and effective internal resistance of two cells of different emfs and internal resistances connected in parallel.
39. Derive an expression for force per unit length on two infinitely long thin parallel straight conductors carrying currents and hence define 'ampere'.
40. a) What is a wavefront? (1)
 b) Explain the refraction of a parallel plane wave through a thin prism with a neat diagram. (2)
 b) Give any two differences between constructive and destructive interferences of light. (2)
41. What is a half-wave rectifier? Explain the working of a half-wave rectifier using neat circuit diagram. Also draw input-output waveforms corresponding to it.

VI. Answer any TWO of the following questions: **2 × 5 = 10**

42. Two point charges of +4 nC and +8 nC are placed at the points A and B respectively separated by a distance 0.2 m in air. Find the magnitude of the resultant electric field at the midpoint 'O' of the line joining A and B. What will be the magnitude of resultant electric field at 'O' if +4 nC is replaced by another +8 nC charge?
43. Find the currents I_1 and I_2 in the given electrical network.



44. A series LCR circuit contains a pure inductor of inductance 5 H, a capacitor of capacitance 20 μ F and resistor of resistance 40 Ω . If the AC source of 200 V, 50 Hz is present in the circuit, find the impedance. Also find the resonant frequency of the circuit.
45. An object is placed at a distance 0.3 m from a convex lens of focal length 0.2 m. Find the position and nature of the image formed. Also find the distance through which the object should be moved to get an image of linear magnification '-1'.

PART – E

(For Visually Challenged Students only)

13) The standing wave pattern of matter waves associated with an electron revolving in a stable orbit is containing 4 complete waves. The principal quantum number (n) and radius (r_n) of the orbit are respectively

(A) 8 and $\frac{4\lambda}{\pi}$

(B) 4 and $\frac{4\lambda}{\pi}$

(C) 8 and $\frac{2\lambda}{\pi}$

(D) 4 and $\frac{2\lambda}{\pi}$

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

&&&&