Generated Question Paper

PHYSICS (Code No. 042) Class XII (2024-25)

Time Allowed: 3 hours Maximum Marks: 70

General Instructions:

1. All questions are compulsory.
2. There are 5 sections in the question paper.
3. Section A contains 16 questions of 1 mark each.
4. Section B contains 5 questions of 2 marks each. Internal choice is provided in 1 question.
5. Section C contains 7 questions of 3 marks each. Internal choice is provided in 1 question.
6. Section D contains 2 case study based questions of 4 marks each. Internal choice is provided in each case study based question.
7. Section E contains 3 questions of 5 marks each. Internal choice is provided in all 3 questions.
8. Use of calculators is not permitted.
9. Use of logarithmic tables is not permitted.
10. Assume all physical constants to be their standard values unless otherwise stated.

Section A (1 Mark each):

1. A charge Q is placed at the center of a cube. What is the flux through one face of the cube?
2. Define drift velocity.
3. What is the SI unit of magnetic flux density?
4. State Lenz's law.
5. What is the power factor of an LCR circuit in resonance?
6. Define refractive index.
7. What is the principle of superposition of waves?
8. What is the de Broglie wavelength associated with a particle of mass m and velocity v?
9. Define mass defect.
10. What is the purpose of a rectifier?
11. (MCQ) The electric field inside a conductor is: (a) zero, (b) constant, (c) infinite, (d) depends on the charge.
12. (MCQ) The unit of magnetic dipole moment is: (a) Ampere-meter, (b) Ampere/meter, (c) Ampere-meter^2, (d) Ampere^2/meter.
13. (MCQ) Which of the following electromagnetic waves has the shortest wavelength? (a) Radio waves, (b) X-rays, (c) Infrared rays, (d) Microwaves.
14. (MCQ) The phenomenon of bending of light around an obstacle is called: (a) Interference, (b) Diffraction, (c) Polarization, (d) Refraction.
15. (Assertion-Reasoning) Assertion: The energy of an electron in a hydrogen atom is quantized. Reason: Electrons revolve in stationary orbits around the nucleus.
16. (Assertion-Reasoning) Assertion: Nuclear fusion releases more energy than nuclear fission. Reason: The binding energy per nucleon is higher for heavier nuclei.

Section B (2 Marks each):

17. Define electric potential. Write the expression for the electric potential at a point due to a point charge.
18. State Ohm’s law. Draw the V-I characteristics of an Ohmic conductor.

19. Define self-inductance. Give its SI unit.
20. Explain total internal reflection. State the conditions necessary for total internal reflection.
21. (Internal Choice) (a) Define photoelectric effect. (b) What are matter waves? Briefly describe de Broglie's hypothesis.

Section C (3 Marks each):

22. Derive an expression for the electric field intensity due to an infinitely long charged straight wire using Gauss's law.
23. Explain the principle of a Wheatstone bridge. How can it be used to determine the unknown resistance of a wire?
24. Explain the working of an AC generator.
25. Explain Young's double slit experiment. Write the expression for the fringe width.
26. Describe the Bohr model of the hydrogen atom. Write the expression for the energy of an electron in the nth orbit.
27. Draw the energy band diagrams for conductors, semiconductors, and insulators.
28. (Internal Choice) (a) Explain the working of a semiconductor diode as a rectifier. (b) Describe the nuclear fission process.

Section D (4 Marks each):

29. (Case Study Based Question: Optics)
A student performs an experiment to determine the focal length of a convex lens using the u-v method. He obtains the following data:

u (cm)	v (cm)
30	20
40	15
60	12

(a) Plot a graph of 1/u versus 1/v.
(b) From the graph, determine the focal length of the lens.
(c) What is the significance of the intercept on the axes?

(Internal Choice) A ray of light is incident on a glass prism. Explain how the phenomenon of dispersion takes place.

30. (Case Study Based Question: Electromagnetism)
A coil of wire is connected to a galvanometer. A bar magnet is moved towards the coil. The galvanometer shows a deflection.

(a) Explain why a deflection is observed.
(b) What will happen if the magnet is moved away from the coil?
(c) What factors influence the magnitude of the induced EMF?
(d) State the rule that determines the direction of the induced current.

(Internal Choice) Explain the concept of displacement current. What is its significance in Maxwell's equations?

Section E (5 Marks each):

31. (Internal Choice) (a) Derive the expression for the torque on a rectangular current loop placed in a uniform magnetic field. (b) Derive an expression for the energy stored in a capacitor.

32. (Internal Choice) (a) Explain the phenomenon of diffraction of light. Describe the diffraction pattern obtained due to a single slit. (b) Explain the working of a compound microscope and derive an expression for its magnifying power.

33. (Internal Choice) (a) Describe the alpha-particle scattering experiment. How did it lead to the development of Rutherford's model of the atom? What were the limitations of this model? (b) Explain the mass-energy equivalence. What is binding energy? Describe the variation of binding energy per nucleon with mass number.

This question paper adheres to the specified format and incorporates internal choices as requested. The difficulty level is intended to be medium, requiring students to demonstrate a good understanding of core concepts and their application. Remember to adjust the numerical values and specific details to create a unique and fair assessment.