**PHYSICS (Code No. 042)  CLASS XII (2024-25)**

**Time Allowed: 3 hours  Maximum Marks: 70**

**General Instructions:**

1. All questions are compulsory.
2. The question paper consists of five sections – A, B, C, D and E.
3. Section A contains 16 questions of 1 mark each. Section B contains 5 questions of 2 marks each. Section C contains 7 questions of 3 marks each. Section D contains 2 case-study based questions of 4 marks each. Section E contains 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labelled diagrams should be drawn.
6. Use of calculators is not permitted.
7. You may use the following values of physical constants wherever necessary:
   * c = 3 x 10<sup>8</sup> m/s
   * h = 6.63 x 10<sup>-34</sup> Js
   * e = 1.6 x 10<sup>-19</sup> C
   * μ<sub>0</sub> = 4< , Ç7W âÓsÂ÷7W â TmA<sup>-1</sup>
   * ;SÇ7V#ã Â÷7V#â Ò ,ãƒR , Ç7W âÓ #Â÷7W â 3Ç7W ã#Â÷7W äãÇ7W âÓ Âð sup>m<sup>-2</sup>
   * k = 9 x 10<sup>9</sup> Nm<sup>2</sup>C<sup>-2</sup>
   * g = 10 m/s<sup>2</sup>
8. **Specific Instructions for Visually Impaired Candidates (V.I. candidates):** Alternative questions are provided for some questions in each section. These are indicated by (V.I.).

**Section A (1 mark each)**

**(1-12) Multiple Choice Questions:**

1. The SI unit of electric flux is:
   (a) N m<sup>2</sup> C<sup>-1</sup>  (b) N C m<sup>-2</sup>  (c) N m C<sup>-1</sup>  (d) N m<sup>-2</sup> C

2. The phenomenon of bending of light around corners is called:
   (a) Reflection (b) Refraction  (c) Diffraction (d) Polarization

3. Which of the following is NOT a characteristic of electromagnetic waves?
   (a) They travel with the speed of light.
   (b) They are transverse waves.
   (c) They can be polarized.

(d) They carry only energy, not momentum.

4. The de Broglie wavelength of a particle is inversely proportional to its:
   (a) Mass (b) Velocity (c) Momentum (d) Energy

5. In a p-n junction diode, the depletion region is:
   (a) Positively charged (b) Negatively charged (c) Neutral (d) Highly conductive

6. A transformer works on the principle of:
   (a) Self-induction (b) Mutual induction (c) Electromagnetic induction (d) both b and c

7. The energy of a photon is given by:
   (a) E=mc<sup>2</sup> (b) E=hv (c) E=1/2mv<sup>2</sup> (d) E=h/;°

8. The focal length of a convex lens is:
   (a) always positive (b) always negative (c) can be positive or negative (d) zero

9. What is the effect of temperature on diamagnetic material? (a) increase (b) decrease (c) no effect (d) depend on temperature

10. What type of wave is represented by light? (a) transverse (b) longitudinal (c) electromagnetic (d) both a and c

11. An object is placed at a distance of 2f from a convex lens. The image formed will be:
   (a) Real, inverted, same size (b) Virtual, erect, magnified (c) Real, inverted, diminished (d) Virtual, erect, diminished

12. Which of the following quantities has the same dimensions as that of energy?
   (a) Force x time (b) Force x distance (c) Pressure x volume (d) Power x time

**(13-16) Assertion-Reasoning Questions:**

13. **Assertion:** The electric field inside a conductor is zero.
   **Reason:** Charges reside on the outer surface of a conductor.

14. **Assertion:** The speed of light in vacuum is constant.
   **Reason:** Light is an electromagnetic wave.

15. **Assertion:** A convex lens can produce both real and virtual images.
   **Reason:** The position of the object relative to the focus determines the nature of the image.

16. **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 and potential difference. Give their SI units.

18. State Lenz's law. Give one example to illustrate it.

19. Explain the working principle of a moving coil galvanometer. (OR) What is a transformer? Briefly explain its working.

20. Define the terms (i) Isothermal process (ii) adiabatic process.

21. Write the expression for the time period of a simple pendulum. On what factors does it depend?

**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 photoelectric effect. State Einstein's photoelectric equation.

24. Draw a labelled ray diagram to show the formation of an image by a convex lens when the object is placed between F and 2F. Also derive the lens formula. (OR) Explain the construction and working of a compound microscope.

25. A parallel plate capacitor is charged and then disconnected from the battery. What happens to the potential difference between the plates if the separation between the plates is doubled? Explain your answer.

26. Explain the terms: (i) Nuclear fission (ii) Nuclear fusion (iii) Binding energy.

27. Explain the working of a half-wave rectifier with the help of a circuit diagram and waveform. (OR) Discuss the characteristics of a semiconductor diode in forward and reverse bias. Include a graph.

28. State Huygens' principle. Explain how it can be used to explain the laws of reflection.

**Section D (Case-study based questions, 4 marks each)**

29. **Case Study 1:** A student is performing an experiment to study the characteristics of a p-n junction diode. He observes that the current flows easily when the positive terminal of the battery is connected to the p-side and the negative terminal to the n-side (forward bias). However, the current is negligible when the polarity is reversed (reverse bias).

(a) Draw a labelled circuit diagram for the experimental setup.

(b) Explain the difference in current flow in the forward and reverse bias conditions.

(c) What are the applications of a p-n junction diode? Give two examples.

(OR)

**Case Study 1 (V.I.):** A student is studying electrical circuits using different components. Describe the behavior of a p-n junction diode, and contrast how current flows in forward and reverse bias. List two applications.

30. **Case Study 2:** A convex lens of focal length 15 cm forms a real image of an object. The image is three times the size of the object.

(a) Calculate the object and image distances.

(b) Draw a neat ray diagram for this situation.

(OR)

**Case Study 2 (V.I.):** A lens makes a real image three times larger than an object. If the focal length is 15 cm, what are the object and image distances?

**Section E (5 marks each)**

31. Derive an expression for the torque on a rectangular current-carrying loop placed in a uniform magnetic field. Explain its application in a moving coil galvanometer. (OR) Discuss the factors that affect the internal resistance of a cell.

32. Explain the principle, construction, and working of a transformer. Derive the expression for the transformer ratio. (OR) What are electromagnetic waves? Explain their characteristics and give examples of different types of electromagnetic waves with their applications.

33. Explain the Bohr model of the hydrogen atom. Derive an expression for the energy of the electron in the nth orbit. (OR) Explain the concept of mass defect and binding energy. How does the binding energy per nucleon vary with mass number? Sketch a graph to illustrate this variation and explain nuclear fission and nuclear fusion.

**Note:** This question paper is a sample and the actual question paper may vary slightly in terms of specific questions and numerical values. The overall structure, types of questions, and marking scheme will be similar to the above.