

SAMPLE PAPER-03
PHYSICS (Theory)
(Questions)
Class – XII

Time allowed: 3 hours

Maximum Marks: 70

General Instructions:

- a) All the questions are compulsory.
- b) There are **26** questions in total.
- c) Questions **1 to 5** are very short answer type questions and carry **one** mark each.
- d) Questions **6 to 10** carry **two** marks each.
- e) Questions **11 to 22** carry **three** marks each.
- f) Questions **23 to 26** carry **five** marks each.
- g) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
- h) Use of calculators is **not** permitted. However, you may use log tables if necessary.
- i) You may use the following values of physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

- 1. Explain the significance of direction of electric current in a circuit?
- 2. The horizontal component is $\sqrt{3}$ times the vertical component of earth's magnetic field at a place. What is the angle of dip at that place?
- 3. Why sky waves are not used in the transmission of television signals?
- 4. Draw the block diagram of basic element of communication system.
- 5. An electron and a proton have same De Broglie wavelength associated with them. How are their K.E. related to each other?
- 6. Explain the effect of increase of intensity and potential difference on photoelectrons K.E.?
- 7. Explain why when current is in circular, the magnetic field is straight.

Or

- An electron is describing a circle in a magnetic field of 10^{-4} tesla. Calculate the frequency of revolutions. Given mass of electron = 9×10^{-31} kg and charge on electron = 1.6×10^{-19} C.
8. Calculate the number of photons emitted per second by transmitter of 10 KW power, radio wave frequency of 6×10^5 Hz.
 9. Draw a sketch of a plane electromagnetic wave propagating along x axis. Depict clearly the direction of electric and magnetic field varying sinusoid ally.
 10. Calculate current drawn by the primary of a transformer which steps down 200V to 20V to operate a device of resistance 20Ω . Assume the efficiency of transformer to be 80%.
 11. A proton and an alpha particle having the same K.E. are in turn allowed to pass through a uniform magnetic field perpendicular to their direction of motion compare the radii of paths of proton and α particle.
 12. A double convex lens made of glass if refractive index 1.5 has its both surface of equal radii of curvature of 20cm each. An object of 5cm height is placed at a distance of 10cm from the lens. Find the position nature and size of image.
 13. A magnetized steel wire 31.4 cm long has pole strength of 0.2 Am. It is then bent in the form of a semicircle. Calculate magnetic moment of the needle.

Or

- Two magnetic poles, one of which is four times stronger than the other exert a force of 10 gf on each, when placed at a distance of 10 cm in air. Find the strength of each pole.
14. A cyclotron's oscillator frequency is 10 MHz what should be the operating magnetic field for accelerating protons? If the radius of its disc is 0.60 m what is the kinetic energy of the proton beam produced by the accelerator? ($e=1.6 \times 10^{-19}$ C, $m=1.67 \times 10^{-27}$ kg). Express your answer in units of MeV. (1 MeV = 1.602×10^{-13} J)
 15. What is meant by sensitivity of a potentiometer? A battery E_1 of 4V and variable resistance R are connected in series with wire AB. Length of wire is 1m. When cell of emf $E_2 = 1.5$ V is connected b/w A & C, no current flows through E_2 length of AC is 60cm.
 - (i) Find the potentiometer difference b/w A & B.
 - (ii) Would the method work if the battery E_1 is replaced by a cell of emf of 1V.
 16. Derive an expression for the impedance of an a.c. circuit with series L.C.R. combination
 17. Calculate the de Broglie wavelength for electrons and protons if their speed is 10^5 m s $^{-1}$?
 18. Give reason for the following – Lighter elements are better moderators for a nuclear reactor than heavier elements?

19. Why do we require modulation? Explain the AM with block diagram.
20. State the principle of potentiometer. Draw a circuit diagram used to compare the emf of two primary cells. Write the formula used?
21. Three light rays red (R), green (G) and blue (B) are incident on a right angled prism ABC at face 'AB' the refractive index of the material of the prism for red, green and blue wavelength are 1.39, 1.44 respectively. Out of three which ray will emerge out of face AC.
22. Draw a diagram to show the behaviour of magnetic field lines near a 'bar' of (i) copper (ii) Aluminium and (iii) mercury cooled to a very low temperature.
23. Shyam was given a square of each side 1.0m with four charges $+1 \times 10^{-8} \text{ C}$, $-2 \times 10^{-8} \text{ C}$, $+3 \times 10^{-8} \text{ C}$ and $+2 \times 10^{-8} \text{ C}$. His teacher asked him to find,
 - a) The potential at the centre of the square.
 - b) Potential energy of the system of four charges.
24. Coulomb's law for electrostatic force between two point charges and Newton's law for gravitational force between two stationary point masses, both have inverse-square dependence on the distance between the charges/masses.
 - i) Compare the strength of these forces by determining the ratio of their magnitudes (a) for an electron and a proton and (b) for two protons.
 - ii) Estimate the accelerations of electron and proton due to the electrical force of their mutual attraction when they are 1 \AA ($= 10^{-10} \text{ m}$) apart? ($m_p = 1.67 \times 10^{-27} \text{ kg}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$)

Or

A straight thick long wire of uniform cross section of radius 'a' is carrying a steady current I.

- a) Use Ampere's circuital law to obtain a relation showing the variation of the magnetic field (B_r) inside and outside the wire with distance r, ($r \leq a$) and ($r > a$) of the field point from the centre of its cross section.
- b) Plot a graph showing the nature of this variation.
- c) Calculate the ratio of magnetic field at a point $a/2$ above the surface of the wire to that at a point $a/2$ below its surface.
- d) What is the maximum value of the field of this wire?

25. Draw a graph to show the variation of angle of deviation D with that of the angle of incidence i for a monochromatic ray of light passing through a glass prism of refracting angle A . hence deduce relation,

$$\mu = \sin \left(\frac{\frac{A + \delta_m}{2}}{\sin \frac{A}{2}} \right)$$

Or

With the help of diagram explain the basic principle of working a.c. generator. In an a.c. generator coil of N turns and area A is rotated at rotation per second in a uniform magnetic field B . Write the expression of the emf produced.

26. Differentiate ammeter and voltmeter.

Or

- The earth's magnetic field varies from point to point in space. Does it also change with time? If so, on what time scale does it change appreciably?
- A system displaying a hysteresis loop such as a Ferro magnet is a device for storing memory. Explain.
- Does the magnetisation of a paramagnetic salt depend on temperature? Justify your answer.
- Give the basic use of hysteresis curve.