

Sample Paper-05
Physics (Theory)
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:

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

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

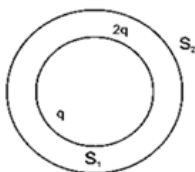
$$e = 1.6 \times 10^{-19} \text{ C}$$

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

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

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

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. S₁ and S₂ are two hollow concentric spheres enclosing charges q and 2q respectively.
 - (i) What is the ratio of electric flux through S₁ and S₂
 - (ii) How will the electric flux through sphere S₁ change if a medium of dielectric constant 5 is introduced in the sphere S₁ in place of air?



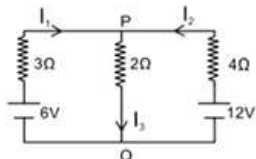
7. Distinguish between paramagnetic, diamagnetic and ferromagnetic material.
8. State the laws of photoelectric effect. Explain it on the basis of Einstein equation.

9. Draw the graph showing the variation of inductive reactance and capacitive reactance with frequency of applied a.c. voltage source.
10. The oscillating electric field of an electromagnetic wave is given by $E_y = 30 \sin (2 \times 10^{11}t + 300\pi x) \text{ Vm}^{-1}$. Find the dirⁿ of propagation of wave and write down the expression for magnetic field?
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 of 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

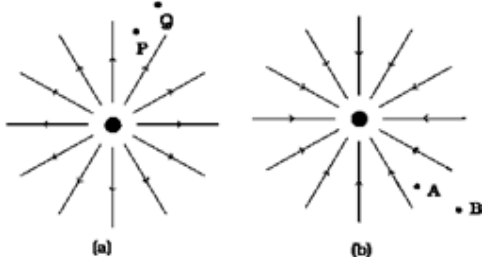
Two magnetic poles, one of which is four times stronger than the other exert a force of 10 gf on each, when placed at a distance of 10 cm in air. Find the strength of each pole.

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? ($e = 1.6 \times 10^{-19} \text{ C}$, $m = 1.67 \times 10^{-27} \text{ kg}$). Express your answer in units of MeV. ($1 \text{ MeV} = 1.602 \times 10^{-13} \text{ J}$)
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 $E_2 = 1.5\text{V}$ 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,
 - (i) The potential at the centre of the square.
 - (ii) Potential energy of the system of four charges.
24. Calculate the value of current I_1 , I_2 and I_3 in the circuit given below using Kirchhoff's law.



Or

The diagram given below shows the field lines of a positive and negative point charge respectively.



- (a) Give the signs of the potential difference $V_P - V_Q$; $V_B - V_A$.
 - (b) Give the sign of the potential energy difference of a small negative charge between the points Q and P; A and B.
 - (c) Give the sign of the work done by the field in moving a small positive charge from Q to P.
 - (d) Give the sign of the work done by the external agency in moving a small negative charge from B to A.
 - (e) Does the kinetic energy of a small negative charge increase or decrease in going from B to A?
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. You have learnt in the text how Huygens's principle leads to the laws of reflection and refraction. Use the same principle to deduce directly that a point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the object distance from the mirror.

Or

Answer the following:

- (a) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?
- (b) In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?
- (c) When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?
- (d) Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily?
- (e) Ray optics is based on the assumption that light travels in a straight line. Diffraction effects disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments. Justify?