



<b>Date:</b>	<b>SAMPLE PAPER-4</b>	<b>Subject:PHYSICS</b>
<b>Class: XII</b>	<b>Name of the student:</b>	<b>Max. Marks:70</b>

**General Instructions:**

- All questions are compulsory.
- Questions 1 to 5 are one mark questions.
- Questions 6 to 10 are two marks questions.
- Questions 11 to 22 are three marks questions.
- Question 23 is value based question carrying four marks.
- Question 24 to 26 are five marks questions.
- There is no overall choice in the question paper. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the choices in such questions.
- Use of calculator is not permitted. However you may use log tables if necessary.
- You may use the following values of physical constants wherever necessary:

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

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

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

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

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

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

$$m_p = 1.675 \times 10^{-27} \text{ kg}$$

$$m_n = 1.673 \times 10^{-27} \text{ kg}$$

1. Sketch the electric lines of force due to point charges i)  $q > 0$  and ii)  $q < 0$
2. A carbon resistor of  $34 \text{ K}\Omega$  is said to be marked with rings of different colours for its specification. Write down the sequence of the colours.
3. Differentiate giving one point of difference between susceptibility and permeability of a material with respect to the magnetic field in which it is kept.
4. Name the series of hydrogen spectrum which has highest wavelength.
5. What is the change in collector current in a transistor if ac current gain is 140 for a  $100 \mu\text{A}$  change in base current?
6. Define electric dipole moment. What would be the relation in terms of direction for the net electric field and dipole moment at an equatorial point?
7. Two identical loops, one of aluminium and the other of copper are rotated with the same angular speed in the same magnetic field. Compare the induced emf and the current produced in the two coils.

8. What do you mean by critical angle? Give one practical application of total internal reflection.

OR

Write down the four differences between interference and diffraction.

9. With the help of ray diagrams explain, variation in stopping potential in a photoelectric emission depends on the (i) intensity of the incident radiation in a photocell and (ii) the frequency of the incident radiation?

10. Represent the outline of Communication system with the help of a block diagram.

11. A dipole with charges  $-q$  and  $+q$ , located at points  $(0, -b, 0)$  and  $(0, +b, 0)$  is present in a uniform electric field  $E$ . The equipotential surfaces of this field are planes parallel to the  $y$ - $z$  plane.

i) What is the direction of the electric field  $E$ ?

ii) How much torque would the dipole experience in this field?

12. Find expressions for equivalent emf and equivalent internal resistance for series combination of cells.

13. A moving coil galvanometer of resistance  $G$  gives full scale deflection when a current  $I$  flows through its coil. It can be converted to an ammeter of range  $(0 \text{ to } I)$  ( $I > I_g$ ) when a shunt of resistance  $S$  is connected across its coil. If this galvanometer is connected to an ammeter of range  $0 \text{ to } 2I$ , find expression for the shunt required in terms of  $S$  and  $G$ .

14. Show that current lags voltage by  $\pi/2$  for ac current applied across an inductor. Also show that the average power loss is zero.

OR

An alternating voltage  $\mathcal{E} = 200 \sin 300t$  is applied across a series combination of  $R = 10\Omega$  and an inductor of  $800\text{mH}$ . Calculate i) impedance of the circuit ii) peak value of current iii) power factor of the circuit.

15. Name the constituent radiation of electromagnetic spectrum which

i) is used in study of crystal structure ii) is absorbed from sunlight by ozone layer iii) is used in satellite communication iv) produces intense heating effect v) to detect fracture in bones vi) to see through fog and haze.

16. Draw the corresponding wavefronts for a plane wavefront incident on i) concave mirror ii) convex lens and iii) prism.

17. What are de Broglie waves? What is the de Broglie wavelength associated with an electron accelerated through a potential difference of  $100 \text{ V}$ ?

18. According to Bohr, when is the energy emission possible for an electron orbiting the nucleus? The ionization potential of hydrogen is  $13.6\text{eV}$ . What will be the energy emitted in  $\text{eV}$  when the transition takes place from  $n=3$  to  $n=2$ ?

19. Discuss the working of transistor as an amplifier.

20. Suggest working of the processes of Modulation and Demodulation with block diagrams.

21. A radioactive isotope has a half life of 25 years. How long will it take for the activity to reduce to  $3.125\%$ ?

22. A beam of light consisting of two wavelengths  $600\text{nm}$  and  $450\text{nm}$  is used to obtain interference fringes in a Young's double slit experiment. Find the least from the central maximum where the bright

fringes due to both these wavelengths coincide. The distance between the two slits is 4mm and the screen is at a distance of 1m from the slits.

23. During summer vacations, Aanshi and her elder sister Ahana visited her grandparents house in the village. One evening there was a power cut due to problem with the electrical fuse in the house. Aanshi's grandfather removed the fuse and started replacing the burnt wire with a new one. Aanshi asked her grandfather what was the use of the fuse? Grandfather replied that it protects the electrical equipments in the house from high currents. He also said there are many good values that we can learn from the working of the electrical fuse. At that time Ahana came and said we have MCB's in the cities which work better than the old fuse.

i) Which human values was Aanshi's grandfather trying to explain based on the working of the electrical fuse.

ii) What is the advantage of MCB?

iii) What should be the rating of the fuse to be connected with an appliance of power rating 100W-220V?

24. (a) State Biot Savart's law and find the expression for the magnetic field at an axial point due to a circular loop carrying current.

(b) For a wire placed along the north-south direction carries a current from south to north. Find the direction of the magnetic field at a point 200cm north-east of the wire.

OR

(a) Explain the phenomenon of self induction and derive an expression for it.

(b) Over a solenoid of 50cm length and 2cm radius and having 500 turns, is wound another wire of 50 turns near the centre. Calculate i) mutual inductance of the two coils and ii) induced emf in the second coil when the current in the primary changes from 0 to 5A in 0.02s.

25. Describe Davisson-Germer experiment to establish the wave nature of electrons. Draw a labeled diagram of the apparatus used and show the necessary calculations.

OR

(a) Establish Einstein's photoelectric equation and use this to explain the laws of photoelectric effect.

(b) Two monochromatic radiations, blue and violet of same intensity are incident on a photosensitive surface and cause photoelectric emission. Would i) the number of electrons emitted per second and ii) the maximum kinetic energy of the electrons be equal in the two cases? Justify your answer.

26. (a) Calculate the electric potential for a short dipole at an axial point and an equatorial point.

(b) Two charges  $\pm 10\mu\text{C}$  are placed 5mm apart. Determine electric field at i) a point P on the axis of the dipole 15cm away from the centre O on the side of the positive charge. ii) a point, 15cm away from O on a line passing through O and normal to the axis of the dipole.

OR

(a) Deduce an expression for the capacitance of a parallel plate capacitor when a dielectric slab is inserted between the plates. Assume that the slab thickness to be less than the plate separation.

(b) What energy is stored in a capacitor when charged through a potential difference of 200V and having charge 0.1C. How much energy will be released when it discharges?

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