CLASS XII
SAMPLE PAPER
PHYSICS(Theory)

Time: Three Hours **Full Marks: 70**

General Instructions:

- All questions are compulsory.
- 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 questions of five marks. You have to attempt only one the choice in such questions.
- Question numbers 1 to 5 are very short answer type questions, carrying 1 mark each.
- Questions numbers 6 to 10 are short answer type questions carrying 2 marks each.
- Question numbers 11 to 22 are also short answer type questions, carrying 3 marks each.
- Question numbers 23 is a value based type question, carries 4 marks.
- Question numbers 24 to 26 are long answer type questions, carrying 5 marks each.
- Use of calculators is not permitted. However, you may use log tables, if necessary.
- You may use the following values of physical constants wherever necessary:

  $C = 3 \times 10^8$ ms^{-1},
  $h = 6.626 \times 10^{-34}$ Js,
  $e = 1.602 \times 10^{-19}$ C
  $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1},
  $1/4\pi\varepsilon_0 = 9 \times 10^9$ Nm^2 C^{-2}
  $M_e = 9.1 \times 10^{31}$ kg.

1. A charge of 200 μC is moved between two points on an equipotential surface. Calculate work done during this process. 1
2. The maximum kinetic energy of photoelectron for a metal is 3 eV. What is its stopping potential? 1
3. At what angle of incidence a light beam should strike on a glass slab of refractive index 3/2, so that the reflected and the refracted rays are perpendicular to each other. 1
4. What should be the length of the dipole antenna for a carrier wave of frequency $3x10^8$ Hz?
5. Why is the conductivity of n-type semiconductor greater than that of the p-type semiconductor even when both of these have same level of doping?
6. Show that an electric dipole will be in translator equilibrium in external uniform electric field.

7. An iron bar falling vertically through the hollow region of a thick cylindrical shell made of copper experiences a retarding force and attains a terminal velocity. What can you conclude about the iron bar?

   Or

   Explain Faraday's law of electromagnetic induction.
8. What is total internal reflection? What are conditions for it? Name any one of its practical application.
9. A transmitting antenna at the top of a tower has a height 32 m and the height of the receiving antenna is 50 m. What is the maximum distance between them for satisfactory communication in LOS mode? Given radius of earth 6.4×10^6 m.
10. Name the device used for data transmission from one computer to another. Justify the name. Using this device draw the block diagram for data Communication and explain it briefly
11. Define the term current density of a metallic conductor. Deduce the relation between current density and the conductivity of the conductor, when an electric field E is applied to it.
12. A short bar magnet of magnetic moment m = 0.32 JT^{-1} is placed in a uniform external magnetic field of 0.15 T. If the bar magnet is free to rotate in the plane of the field, which orientation would correspond to (i) its stable and (ii) unstable equilibrium? What is potential energy of the magnet in each case?
13. A small compass needle of magnetic moment m is free to turn about an axis perpendicular to the direction of uniform magnetic field B. The moment of inertia of the needle about the axis is I. The needle is slightly disturbed its stable position and then released. Prove that it executes simple harmonic motion. Hence deduce the expression for its time period.
14. A voltage $V = V_o \sin \omega t$ is applied to a series LCR circuit. Derive the expression for the average power dissipated over a cycle.

    Under what condition is (i) no power dissipated even through the current flows the circuit, (ii) maximum power dissipated in the circuit?

15. Find the wavelength of electromagnetic wave of frequency 5×10^{19} Hz in free space. Give its two application.
16. A double convex lens of glass of refractive index 1.5 has its both surfaces of equal radius of curvature of 20 cm each. An object of height 5 cm is placed at a distance of 15 cm from the lens. Calculate size of image formed.

    Or

    A converging lens has a focal length of 23 cm in air. It is made of a material of refractive index 1.5. It is immersed in a liquid of refractive index 1.2. Calculate its new focal length.
17. Draw a labelled ray diagram to show the image formed in a reflecting telescope. Write its two advantages over refracting type telescope. On what factors does its resolving power depend?
18. Write Einstein's photoelectric equation and point out any two characteristic properties of photons on which this equation is based.

Briefly explain the three observed features which can be explained by this equation.

19. Discuss in brief the distance of closest approach.
20. (a) Using Bohr's postulates, obtain the expression for total energy of the electron in the n^{th} orbit of hydrogen atom.
    (b) What is the significance of negative sign in the expression for the energy?
21. (a) Why is zener diode fabricated by heavily doping both p- and n-sides of the junction ?
    (b) Draw the circuit diagram of zener diode as a voltage regulator and briefly explain its working.
22. State the principle of working of p-n diode as a rectifier. Explain, with the help of a circuit diagram, the use of p-n diode as a full wave rectifier or half wave rectifier. Draw a sketch of the input and output waveforms.

23. Kumaran wanted to pay electricity bill that day. He realized that the consumption shown by the meter was unbelievably low. He thought that the meter must have been faulty. He wanted to check the meter. But unfortunately he did not have any idea as to how to do this. There came his friend Subhash to help him. He told Kumaran to run only the electric heater rated 1kW in his house for some time keeping other appliances switched off. He also calculated the power consumed in kilowatt hour and compared the value with the meter. . Kumaran was happy and thanked Subhash for his timely help and the knowledge.
    (1) What are the values displayed by the friends?
    (2) Express kWh in joules. Find the resistance of the heater.

24. derive the mirror formula which gives the relation between u,v and f. What is the corresponding formula for a thin lens? 5

Or

Draw the ray diagram to show the formation of image of a distinct object by an astronomical telescope in the normal adjustment position. Obtain an expression for the magnifying power of the telescope in this adjustment. Define resolving power of a telescope. How would it change with increase of (i) aperture of an objective and wavelength of light. 5

25. (a) Draw a labelled circuit diagram of a moving coil galvanometer. Prove that in a radial magnetic field, the deflection of the coil is directly proportional to the current flowing in the coil.
    (b) How a galvanometer can be converted into a voltmeter or ammeter.

Or

Obtained an expression for the magnetic field at a point on the axis of a current carrying circular loop.

26. An a.c. source of voltage $V = V_o \sin \omega t$ is connected one by one to three circuit elements X,Y and Z. It is observed that the current flowing in them:
(i) is in phase with the applied voltage for element X.
(ii) lags the applied voltage, in phase by $\pi/2$ for element Y.
(iii) leads the applied voltage, in phase by $\pi/2$ for element Z.
Identify the three circuit elements.
Find an expression for the (a) current flowing in the circuit, (b) net impedance of the circuit, when the same a.c. source is connected across a series combination of the elements X,Y and Z.
If the frequency of the applied voltage is varied, set up the condition of the frequency when the current amplitude in the circuit is maximum. Write the expression for this current amplitude.

Or

What does the phasors in a.c. circuit analysis mean?
An a.c. source of voltage $V = V_o \text{ Sin } \omega t$, is applied across a pure inductor of inductance L. Obtain an expression for the current i flowing in the circuit. Also draw the
(i) phasor diagram.
(ii) graphs of V and i versus ωt for this circuit.

Papers Submitted By:

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