

MODEL QUESTION SET 1

Class: 12
Subject: Physics

Full Marks: 75
Time: 3:00 hours

Candidates are required to give their answers in their own words as far as practicable.
Attempt all questions.

Group: A

1. Answer, in brief, any FOUR questions: **(2×4=8)**
 - a. Why does conductivity of metal is high as compared to that of an electrolyte?
 - b. A ferromagnetic substance becomes paramagnetic above Curie temperature. Why?
 - c. Why does K.E. of a charged particle moving in a magnetic field remain constant?
 - d. Two closely wound circular coils have the same number of turns, but one has twice the radius of the other, how are the self-inductances of the two coils related? Explain your reasoning.
 - e. Why is a choke coil better to use than a pure resistor to limit the current in a.c. circuits?
 - f. 220 V A.C. is more dangerous than 220 V D.C., why?

2. Answer, in brief, any FOUR questions: **(2×4=8)**
 - a. Electrons and protons beams having same initial kinetic energy inter into an electric field normally, which one will deflect more and why?
 - b. Matter waves are not observed in our daily life. Why?
 - c. Can you explain the photoelectric effect on the basis of wave theory of light? Explain.
 - d. What do you mean by acid rain?
 - e. Write down the quark combination of proton and neutron.
 - f. Is a p-type semiconductor positively charged? Justify your answers.

3. Answer, in brief, any one question: **(1×2=2)**
 - a. An empty vessel produces loud sound than filled one. Why?
 - b. A solid can propagate both longitudinal and transverse waves but liquid and gas can propagate only longitudinal wave. Why?

4. Answer, in brief, any ONE question: **(1×2=2)**
 - a. Differentiate between wavelets and wavefront.
 - b. Does the polarizing angle for a transparent medium depend upon the wavelength of the light?

Group: B

5. Attempt any THREE questions: **(3×4=12)**
 - a. Define drift velocity and obtain the general expression for electric current density.
 - b. What is the principle of Wheatstone bridge? Describe Meter Bridge to obtain unknown resistance of wire.
 - c. State Biot's Savart law and use it to obtain an expression for the magnetic field at the centre of a circular coil.
 - d. What is an LCR circuit? Derive the condition for resonant frequency for an LCR series circuit with an a.c. supply.

6. Attempt any THREE questions: **(3×4=12)**
 - a. Describe the theory of Millikan's oil drop experiment to determine the charge of an electron.

- b. Describe the construction and working of He-Ne laser.
- c. What is rectifier? How can you use semiconductor diodes for a full wave rectifier?
- d. Differentiate between nuclear fission and fusion. Explain the production of energy in the sun.

7. Attempt any ONE question: **(1×4=4)**

- a. What do you understand by harmonics and overtones in the case of organ pipes? Prove that only odd harmonics are produced in closed organ pipe.
- b. What is Doppler's effect in sound? Obtain an expression for the apparent frequency when both source of sound and observe move towards each other.

8. Attempt any ONE question: **(1×4=4)**

- a. Discuss Young's double slit experiment and show that the widths of bright and dark fringes are equal.
- b. Describe Foucault's method of determining the speed of light.

Group: C

9. Solve any TWO numerical problems: **(2×4=8)**

- a. The resistance of the coil of a pivoted coil galvanometer coil is 9.36Ω and a current of 0.0224 A cause it to deflect full scale. We want to convert this galvanometer to an ammeter reading 20.0 A full scale. The only shunt available has a resistance of 0.025Ω . What resistance R must be connected in series with the coil?
- b. A rectangular sample of a metal is 3.0 cm wide and $680 \mu\text{m}$ thick. When it carries a 42 A current and is placed in a 0.80 T magnetic field, it produces a $6.5 \mu\text{V}$ Hall e.m.f. Determine (a) the Hall field in the conductors (b) density of free electrons in metal.
- c. An iron cored coil of inductance 2 H and a resistance 500Ω is connected in series with a resistor of 950Ω and 220 V , 50 Hz a.c. supply. Find the current flowing in the circuit and the voltage across the coil.

10. Solve any TWO numerical problems: **(2×4=8)**

- a. An x-ray tube works at a p.d. of 50 KV and the current through the tube is 0.5 mA . Find (i) the energy falling on the target per second as the K.E. of the electrons (ii) the minimum wavelength of x-ray emitted. $[h = 6.62 \times 10^{-34} \text{ JS}, 3 \times 10^8 \text{ m/s}]$
- b. What will be the amount of energy released in the fusion of three alpha particles into a C^{12} nucleus if mass of He^4 and C^{12} nuclei are respectively 4.00263 amu and 12 amu .
- c. If the half-life period of a radioactive substance is 2 days , after how many days will $\left(\frac{1}{64}\right)^{\text{th}}$ part of the substance be left behind?

11. An organ pipe is tuned to a frequency of 440 Hz when the temperature is 27°C . Find its frequency when the temperature drops to 0°C . Assume both ends of the pipe open. **(4)**

12. A diffraction grating has 400 lines per mm and is illuminated normally by a monochromatic light of wavelength 6000 \AA . Calculate the grating spacing, the angle at which first order maximum is seen and the maximum number of diffraction maxima obtained. **(3)**