TEST PAPER: PHYSICS

Time: 75 Minutes **Class:** ISC/CBSE 12

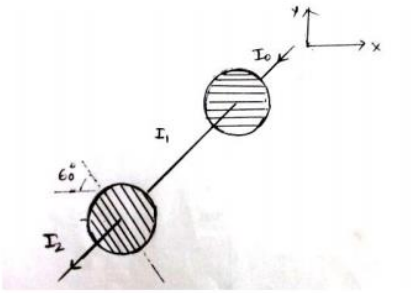
Max. Marks: 30 Marks **Date:** 12th December 2018

Marking Scheme: *All questions carry 10 marks each. Subparts (A) and (B) carry 3 marks each and subpart (C) carries 4 marks.*

Question 1:

A. Answer the following:

i. Figure shows a system of two polarizing sheets in the path of initially unpolarized light. The polarizing direction of first sheet is parallel to x-axis and that of second sheet is 60° clockwise from x-axis. Calculate what fraction of intensity of light emerges from the system.

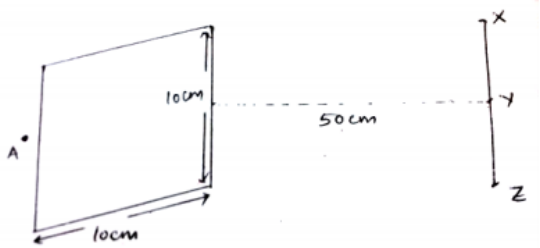


ii. State Huygen's principle. Using it, construct a ray diagram for a plane wave front getting incident on a denser medium.

B. Given a uniformly charged plane/ sheet of surface charge density $\sigma = 2X10^{17}$ C/m^2

i. Find the electric field intensity at a point A, 5mm away from the sheet on the left side.

ii. Given a straight line with three points X, Y & Z placed 50 cm away from the charged sheet on the right side. At which of these points, the field due to the sheet remain the same as that of point A and why?



C. Answer the following:

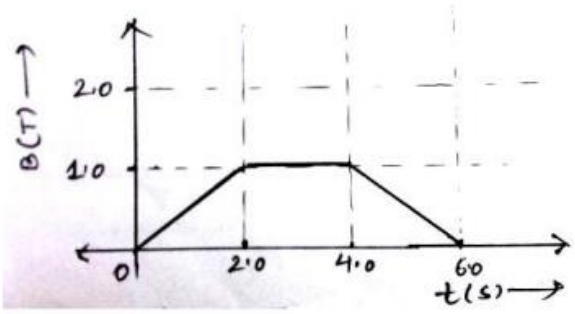
i. A monochromatic light source of power 5mW emits $8*10^{15}$ photons per second. This light ejects photoelectrons from a metal surface. The stopping potential for this set up is 2V. Calculate the work function of the metal.

ii. The following table shows some measurements of the decay rate of a radionuclide sample. Find the disintegration constant.

Time (min)	lnR (Bq)
36	5.08
100	3.29
164	1.52
218	1.00

Question 2:

A. The magnetic field through a single loop of wire, 12cm in radius and 8.5Ω resistance, changes with time as shown in the figure. The magnetic field is perpendicular to the plane of the loop. Plot induced current as a function of time.



B. Compare the photoelectric effect on the basis of photon theory and wave theory of light and hence explain why the wave theory failed to explain it.

C. Answer the following:

i. With the help of a diagram, explain the principle and working of a device which produces current that reverses its direction after regular intervals of time.

ii. If a charged capacitor C is short circuited through an inductor L, the charge and current in the circuit oscillate simple harmonically.

1. In what form the capacitor and the inductor stores energy?
2. Write two reasons due to which the oscillations become damped.

Question 3:

A. A compound microscope consists of an objective of focal length 1cm and eye piece of focal length 5cm separated by 12.2cm.

i. At what distance from the objective should an object be placed so that the final image is formed at least distance of distinct vision?

ii. Calculate the angular magnification in this case

B. You are given two sets of potentiometer circuit to measure the emf E1 of a cell.
Set A: consists of a potentiometer wire of a material of resistivity ρ1, area of cross-section A1 and length l.
Set B: consists of a potentiometer of two composite wires of equal lengths l/2 each, of resistivity ρ1, ρ2 and area of cross-section A1, A2 respectively.

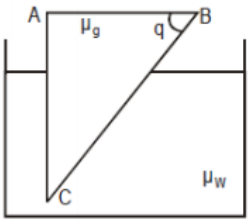
i. Find the relation between resistivity of the two wires with respect to their area of cross section, if the current flowing in the two sets is same

ii. Compare the balancing length obtained in the two sets.

C. Answer the following:

i. Draw a graph showing the variation of angle of deviation 'δ' with that of angle of incidence 'i' for a monochromatic ray of light passing through a glass prism of refracting angle 'A'. What do you interpret from the graph? Write a relation showing the dependence of angle of deviation on angle of incidence and hence derive the expression for refractive index of the prism.

ii. Calculate the value of θ, for which light incident normally on face AB grazes along the face BC. $\mu_g = 3/2$ $\mu_w = 4/3$.



Use the following values of constants if required.

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

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

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

$\mu_o = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2}

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

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}