TEST PAPER: PHYSICS

Time: 75 Minutes **Class:** I.S.C/C.B.S.E 12

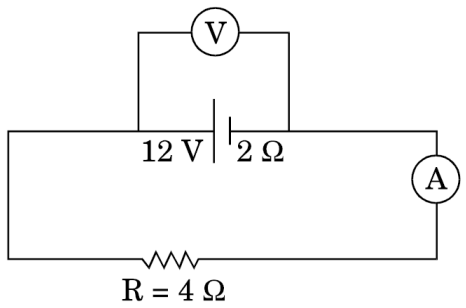
Max. Marks: 30 Marks **Date:** 17th October 2018

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

Question 1:

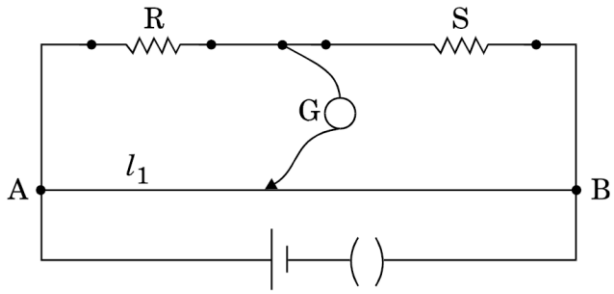
a. Define mutual inductance between a pair of coils. Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other.

b. In the figure shown, an ammeter A and a resistor of 4 Ω are connected to the terminals of the source. The emf of the source is 12 V having an internal resistance of 2 Ω. Calculate the voltmeter and ammeter readings.



c. i. Write the principle of working of a metre bridge.

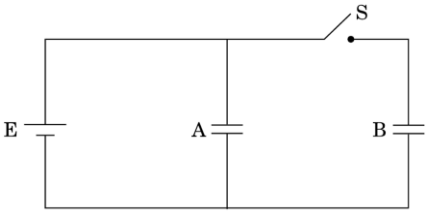
ii. In a metre bridge, the balance point is found at a distance l_1 with resistances R and S as shown in the figure.



An unknown resistance X is now connected in parallel to the resistance S and the balance point is found at a distance l_2. Obtain a formula for X in terms of l_1, l_2 and S.

Question 2.

a. Two identical parallel plate capacitors A and B are connected to a battery of V volts with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant K. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.



b. i. Derive an expression for the electric field E due to a dipole of length '2a' at a point distant r from the centre of the dipole on the axial line.

ii. Draw a graph of E versus r for r >> a.

c. i. State Biot – Savart law and express this law in the vector form.

ii. Two identical circular coils, P and Q each of radius R, carrying currents 1 A and 3 A respectively, are placed concentrically and perpendicular to each other lying in the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils.

Question 2.

a. A 12·5 eV electron beam is used to excite a gaseous hydrogen atom at room temperature. Determine the wavelengths and the corresponding series of the lines emitted.

b. i. Monochromatic light of wavelength 589 nm is incident from air on a water surface. If refractive index for water is 1·33, find the wavelength, frequency and speed of the refracted light.

ii. A double convex lens is made of a glass of refractive index 1·55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20 cm.

c. i. Use Gauss's theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density σ.

ii. An infinitely large thin plane sheet has a uniform surface charge density + σ. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point, distant r, in front of the charged plane sheet.