



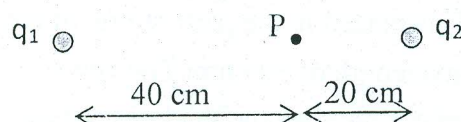
Answer All Questions

Questions No. 1: (12 Marks)

1-a) For a conducting sphere of radius a and charge Q , plot both of (i) the electric field, E , and (ii) the electric potential, V , versus the distance, r , from the sphere's center. (4 Degrees)

1-b) Write down only the mathematical relation of the followings: (i) Gauss' law. (ii) The relation between electric potential and electric field, (iii) The relation between electric potential difference and electric potential energy difference. (iv) The relation between magnetic force and magnetic field. (4 Degrees)

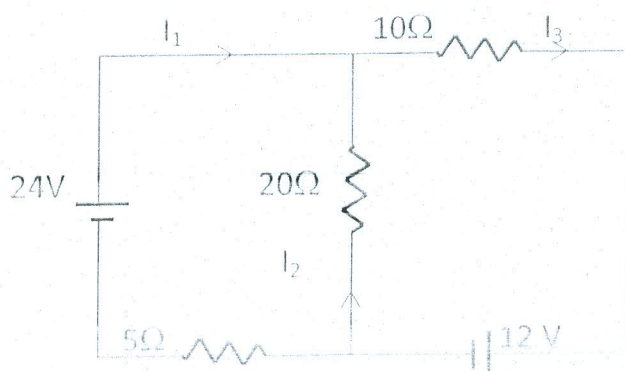
1-c) The charge q_1 is $-4 \mu\text{C}$ and the electric field at point P is zero. (i) What is the sign of the charge q_2 ? (ii) Find magnitude of the charge q_2 . (4 Degrees)



Questions No. 2: (13 Marks)

2-a) A parallel-plate capacitor of capacitance $5 \times 10^{-11} \text{ F}$ is connected with 24 V battery, (i) calculate the charge and the energy stored on the capacitor. (ii) If the battery is then disconnected and a slab of dielectric material of $k = 4$ is inserted between the plates, calculate the energy stored on the capacitor after inserting the dielectric. (5 Degrees)

2-b) Consider the circuit in the figure shown. Find the currents I_1 , I_2 and I_3 . (4 Degrees)



2-c) An electron of kinetic energy 800 eV moves perpendicular to a uniform magnetic field of intensity 0.02 T. (i) Calculate magnetic force acting on the proton. (ii) What is the radius of its orbit. For electron, take $m = 9.1 \times 10^{-31}$ Kg and $e = 1.6 \times 10^{-19}$ C. (4 Degrees)

Questions No. 3: (9 Marks)

3-a) Sketch the Michelson's interferometer. (2 Degrees)

3-b) Write down, with illustrating sketch مع التوضيح بالرسم, the mathematical expression of the maximum acceptance angle of step-index optical fibre. (4 Degrees)

3-c) Concerning the interaction of radiation with matter, explain with illustrating sketch, the followings; (i) absorption, (ii) spontaneous emission (iii) stimulated emission. (3 Degrees)

Questions No. 4: (16 Marks)

4-a) A thin sheet of transparent material ($n = 1.5$) is placed in the path of one of the interfering beams in Fresnel biprism experiment using a light of wavelength of 500 nm. The central fringe shifts to a position normally occupied by the 10th bright fringe. Calculate the thickness of the sheet. (4 Degrees)

4-b) Monochromatic light of wavelength 500 nm is incident normally on a diffraction grating containing 6000 lines/cm. Find the angle of the first-order maximum. (4 Degrees)

4-c) In using two polarizing sheets in the polarization experiment, the axis of the first sheet (polarizer) is vertical and the axis of the second sheet (analyzer) is 45° to the vertical. Find the ratio of the intensity beam after the analyzer to the original intensity before the polarizer. (4 Degrees)

4-d) An electron moves with a speed of 0.8c. Find the followings; (i) its total energy in MeV (ii) its kinetic energy in MeV. Take, for the electron, $m = 9.1 \times 10^{-31}$ Kg and $e = 1.6 \times 10^{-19}$ C and the speed of light is 3×10^8 m/s. (4 Degrees)