GREENHILL ACADEMY-SECONDARY.

TERM 3 HOLIDAY WORK

S.5 PHYSICS 2 (P510/2)

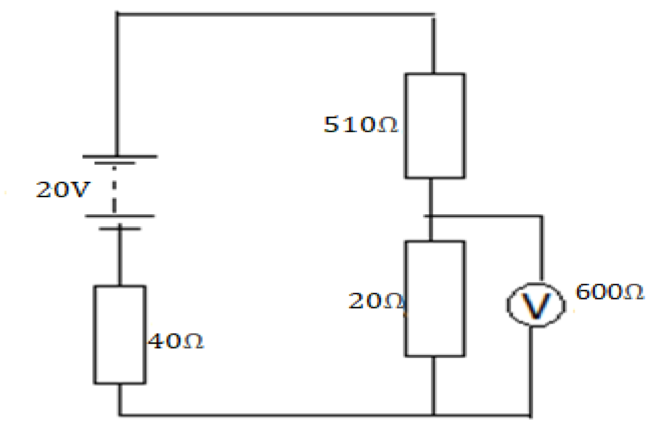
Answer **all** questions.

Assume where necessary the following constants;

- ✓ Acceleration due to gravity, g = $9.81ms^{-2}$
- ✓ Electron charge, e = $1.6x10^{-19}C$
- ✓ Electron mass = $9.11x10^{-31}kg$
- ✓ Speed of light in a vacuum, c = $3.0x10^{8}ms^{-1}$
- ✓ Permittivity of free space ε_0 = $8.85 \times 10^{-12}\ Fm^{-1}$
- ✓ The constant $\frac{1}{4\pi\varepsilon_0}$ = $9.0 \times 10^{9}\ F^{-1}m$

DIRECT CURRENT (20 marks)

1. A battery of e.m.f 12v and internal resistance 2Ω is connected to a wire of resistance 10 Ω
   - (i) calculate the p.d across the wire (3 marks)
   - (ii) what will be the p.d across the wire when a 15 Ω resistor is connected in parallel with it? (4 marks)
2. Explain how a moving coil galvanometer which has resistance of 25Ω and full scale deflection of 4.0mA can be converted to an ammeter reading a maximum of 1A. (3 marks)
3. In the circuit below V is a voltmeter of resistance 600 Ω



   - (i) find the reading of the voltmeter (3 marks)
   - (ii) calculate the power dissipated in the 40Ω resistor (2 marks)

4. A battery of e.m.f 90V and negligible internal resistance is connected in series with a 600Ω and a 400Ω resistor. A voltmeter connected across the 600Ω resistor reads 45V. Determine the resistance of the voltmeter. (5marks)

CAPACITORS (15 marks)

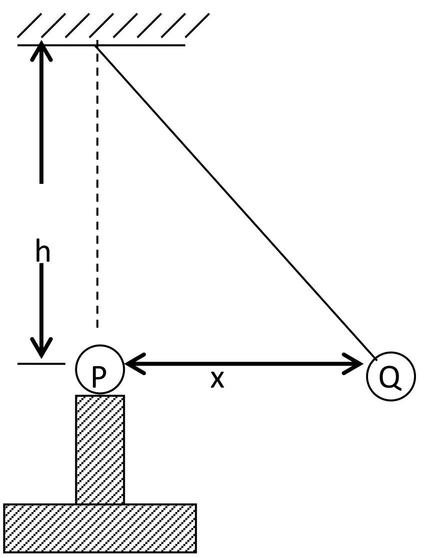
5. A voltage of 100v is applied across the plates of a parallel plates capacitor whose plates are of dimensions 15 cm by 12 cm separated by an insulator of thickness 8mm and relative permittivity 2.3.
   (i) Determine the capacitance of the capacitor. (3 marks)
   (ii) Calculate the charge stored by the capacitor (3 marks)

6. Two identical parallel plates capacitors of capacitance C are connected in series across a source of p.d V. A dielectric of relative permittivity, ε_r is inserted in one of the capacitors;
   (i) Determine the effective capacitance of the capacitors. (3 marks)
   (ii) Determine the energy stored in the network before and after the dielectric is inserted. Hence Show that the energy stored increases by a factor of

$$\frac{2\varepsilon_r}{(1+\varepsilon_r)}$$ (6 marks)

ELECTROSTATICS (15 marks)

7. The figure below shows two identical metal balls P and Q of mass m, arranged in air with P fixed on an insulating stand and Q suspended by a silk thread from a height h, above P.

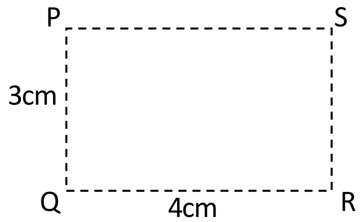


When the balls are given identical charge q they repel. In equilibrium, the balls are at a distance x apart as shown in the diagram above.

(i) Show that the charge $q = \sqrt{\frac{4\pi\varepsilon_o mgx^3}{h}}$ (4 marks)

(ii) Sketch the electric field patter between the charges P and Q (2 marks)

8. Charges of -3μC, +4μC and +3μC are placed at the corners P, Q and R of a rectangle PQRS in which PQ = 3 cm and QR = 4 cm as shown in the figure below



(i) If the charges are in vacuum, calculate the electric intensity at S. (7 marks)

(ii) Sketch the electric field pattern for the above charge distribution. (2 marks)

END