

29/03/2020

[Electronics]
Grog

Engineers Science

2
Coursework
Circuit board

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1) 12 V

a) $P = ?$

$$I = 8 \text{ A}$$

$$P = I^2 R$$

$$P = \frac{V^2}{R} = \frac{12^2}{8} = 18 \text{ W}$$

$$\begin{aligned}
 \text{c) } A &= \pi r^2 \\
 &= \pi \times (0.1 \times 10^{-3})^2 \\
 &= 3.14 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 2) \quad 1.0 \text{ km} &= 1000 \text{ m} \\
 7.4 \text{ } \mu\text{m} &= 7.4 \times 10^{-3} \text{ m}
 \end{aligned}$$

$$A = \pi r^2$$

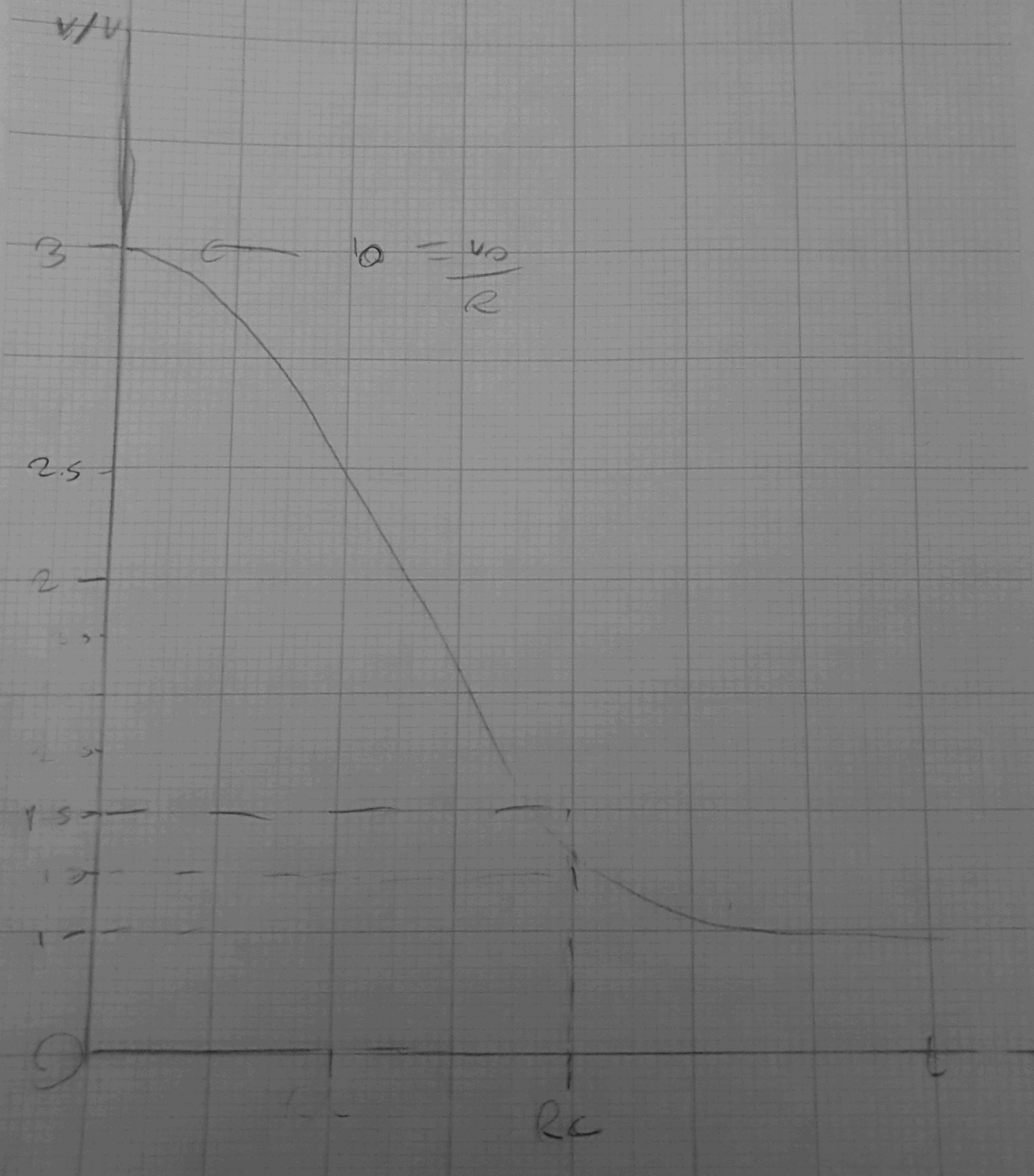
$$A = \frac{\pi D^2}{4}$$

$$A = \frac{\pi \times (7.4 \times 10^{-3} \text{ m})^2}{4} = 4.30 \times 10^{-5} \text{ m}^2$$

$$P = \frac{EA}{L} = \frac{(3.3 \times 10^{11} \text{ N/m}^2) \times (4.30 \times 10^{-5} \text{ m}^2)}{1000} = 1.4 \times 10^7 \text{ N}$$

ii) A steel wire has a high resistivity, as it is a worse conductor than Aluminium wire. The resistance of the Aluminium is one third of steel which is three times as much. This will flow through each Aluminium wire. The Aluminium has six wires for each steel wire. ~~Aluminium~~ Aluminium is six times total area of steel. They effectively behave like parallel resistors.

iii) $(1700 + 6 \times 5115) = 32 \text{ kW}$ ~~Loss of Power~~
(Loss of power)



2.1.7) The reason why the movement causes the ~~difference~~ difference in potential difference is because, there was no movement, no change in C and no signal. As the charge changes at 50 Hz the voltage changes. $V_C + I_C$ is equal to a constant.

As C ~~is~~ changes Q changes and a ~~the~~ flows through R as $V = IR$ for the resistors as a signal.

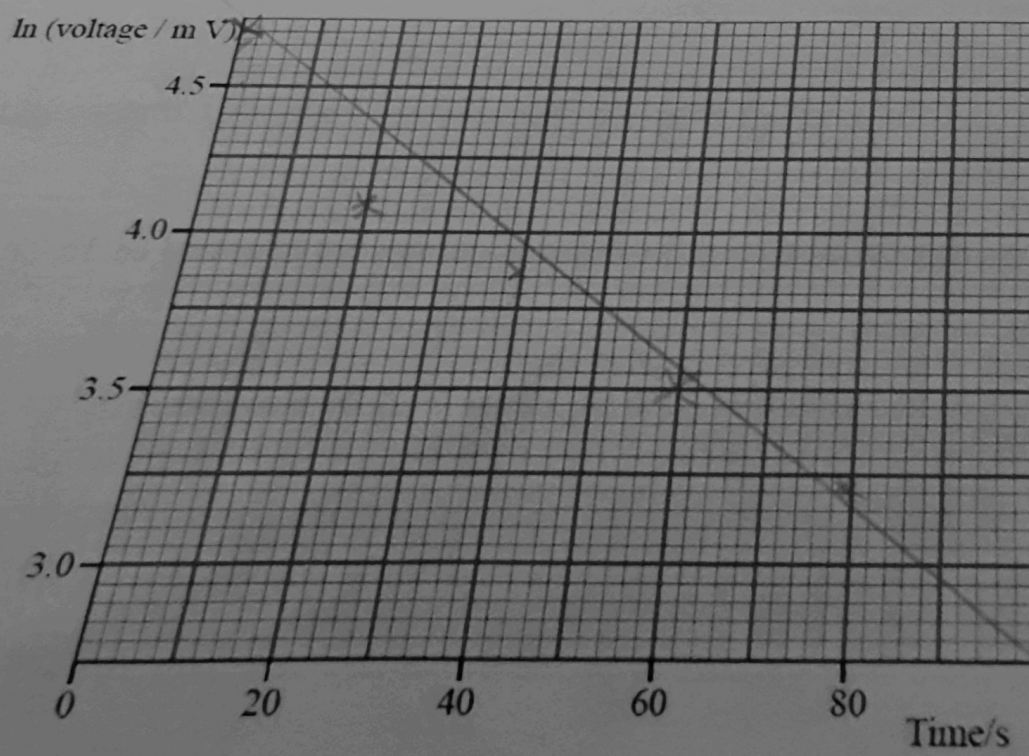
ii) $Q = CV$

$$(0.22 \times 95 \times 10^{-3}) / (0.22) (95 \times 10^{-3})$$

$$= 0.021 C$$

This tells me the Voltmeter has a very high resistance.

vi) Time / s	Voltage	In (Voltage / mV)
0	95	4.55
20	67	4.20
40	46	3.83
60	33	3.50
80	22	3.09



vii) The graph shows the voltage decrease by the straight line on by the negative scales

(exponential + ~~line~~ decrease).

viii) $95 \text{ mV} \div 3 = 31.67 \text{ mV}$
 $R = 240 - 280 \text{ } \Omega$

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Engineering Science

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course work

$$E_{in} - E_{out} = \Delta E_{system}$$

$$-Q_{out} = \Delta u_A + \Delta u_B = [m(u_2 - u_1)]_A + [m(u_2 - u_1)]_B$$

$$P_{1A} = 1.6 \text{ MPa} = 1600 \text{ kPa} \quad \left. \begin{array}{l} v_6 = 0.0009400 \text{ m}^3/\text{kg} \\ u_{6A} = 134.43 \text{ kJ/kg} \\ T_6 = 330.55 \\ 381.63 \text{ kJ/kg} \end{array} \right\}$$

$$OC_1 = 0.4$$

$$T_{1B} = 120^\circ\text{C}$$

$$P_{1B} = 1.2 \text{ MPa} = 1200 \text{ kPa}$$

$$\left. \begin{array}{l} v_6 = 0.0008934 \text{ m}^3/\text{kg} \\ u_6 = 116.70 \text{ kJ/kg} \end{array} \right\}$$

$$T_{1B} = 128^\circ\text{C} \quad v_6 = 0.077717 \text{ m}^3/\text{kg}$$

$$v_{1B} = v_6 + OC_1 v_{6g} = 0.077717 + [0.40 \times 0.0008934 - 0.077717 + 116.70] \\ = 0.04698756 \text{ m}^3/\text{kg}$$

$$u_{1B} = u_6 + OC_1 u_{6g} = 116.70 + (0.40 \times 381.63) \\ = 261.35 \text{ kJ/kg}$$

Total volume and total mass of system

$$V = V_A + V_B = m_A v_{1A} + m_B v_{1B} \\ = (3 \text{ kg}) (0.0009400 \text{ m}^3/\text{kg}) + (2.5 \text{ kg}) (0.0008934 \text{ m}^3/\text{kg}) \\ = 4.92 \text{ m}^3 \quad (2.56)$$

$$M = m_A + m_B = 3 + 2.5 = 5.5 \text{ kg}$$

$$v_2 = \frac{V}{m} = \frac{4.92}{5.5} = 0.89 \text{ m}^3/\text{kg}$$

$$\cancel{Q_{out}} = \cancel{\Delta h_A} + \Delta h_D = [m (v_5 - v_6)] + [m (v_5 - v_6)]_B$$

$$= (3.15)(26.1)$$

$$\frac{v_2 - v_6}{v_5 - v_6} = \frac{0.89}{11670} = 0.0008934$$

$$= 7.62 \times 10^{-3} \text{ m}^3$$

$$- Q_{out} = \Delta h_A + \Delta h_B = [m (v_2 - v_1)]_A + [m (v_2 - v_1)]_B$$

mass Balance

$$\dot{m}_i - \dot{m}_{out} = \Delta \dot{m} = 0$$

$$\dot{m}_i = \dot{m}_{out}$$

$$\dot{m}_1 = \dot{m}_2 = \dot{m}_3 = \dot{m}_4$$

$$\dot{m}_3 = \dot{m}_4 = \dot{m}_6$$

Energy Balance

$$\dot{E}_{in} - \dot{E}_{out} = \dot{E}_{storage} = 0$$

$$\dot{E}_{in} = \dot{E}_{out}$$

$$\dot{m}_1 h_1 + \dot{m}_3 h_3 = \dot{m}_2 h_2 + \dot{m}_4 h_4$$

combine energy balance

$$\dot{m}_3 (h_3 - h_1) = \dot{m}_2 (h_2 - h_4)$$

$$P_1 = 82 \text{ kPa} \quad \dot{m} = 2257.5 \text{ kg/s}$$

$$P_1 = 82 \text{ kPa} \quad h_2 = h_6 = 417.51 \text{ kJ/kg}$$

(sat liquid)

$$T_1 = T_2 = 99.61^\circ\text{C}$$

~~P2 =~~

$$P_3 = 50 \text{ kPa} \quad \dot{m}_3 = \dot{m}_6 = 2257.5 \text{ kg/s}$$

$$T_3 = 200^\circ\text{C}$$

$$P_4 = 4 \text{ kPa}$$

$$T_4 = 99.61 - 10 = 89.61^\circ\text{C}$$