

29/03/2020

[Electronics]
Circuits

Engineering Science

2
Coursework
Circuit Board

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1) 12 V

a) $P = ?$

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

$$P = I^2 R$$

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

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

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

$$A = \pi r^2$$

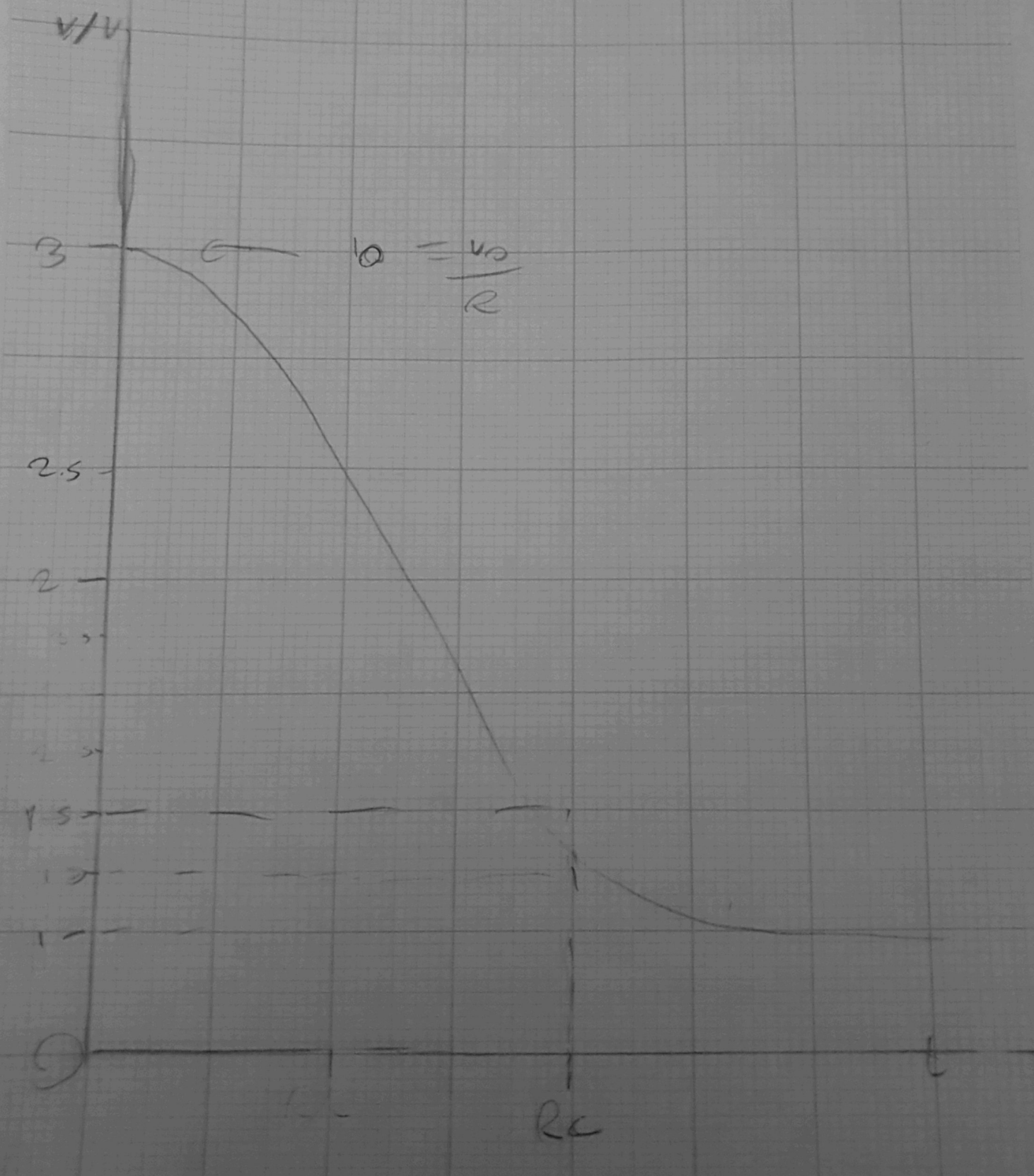
$$A = \frac{\pi D^2}{4}$$

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

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

ii) A steel wire has a high resistance, 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.

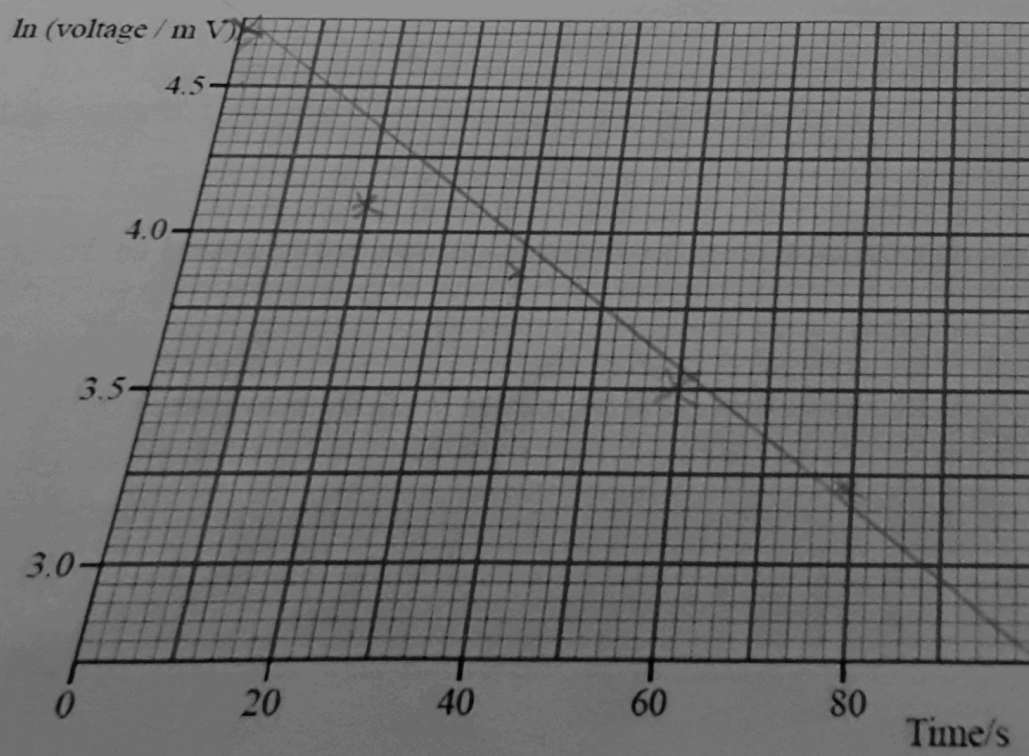
As C ~~is~~ changes Q changes and a ~~the~~ flows through R as $V = IR$ for the resistors as a signal.

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 and by the negative slopes

(exponential + ~~linear~~ decrease).

viii) $95 \text{ mV} \div 3 = 31.67 \text{ mV}$
 $R = 2410 - 280 \text{ } \Omega$

Q3

$$\frac{1}{25}$$

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Engineering Science

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course work

02/04/2020

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

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

$$P_A = 1.6 \text{ MPa} = 1600 \text{ kPa} \quad \left. \begin{array}{l} v_A = 0.0009400 \text{ m}^3/\text{kg} \\ u_A = 134.43 \text{ kJ/kg} \end{array} \right\}$$

$$Q_1 = 0.4$$

$$v_B = 330.55$$

$$381.63 \text{ kJ/kg}$$

$$T_B = 120^\circ\text{C}$$

$$P_B = 1.2 \text{ MPa} = 1200 \text{ kPa}$$

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

$$T_B = 128^\circ\text{C} \quad v_B = 0.0077717 \text{ m}^3/\text{kg}$$

$$v_{1B} = v_B + Q_1 v_{B1} = 0.0077717 + (0.40 \times 0.0008934 - 0.0077717) = 0.004648756 \text{ m}^3/\text{kg}$$

$$u_{1B} = u_B + Q_1 u_{B1} = 116.70 + (0.40 \times 381.63 - 116.70) = 261.38 \text{ kJ/kg}$$

Total volume and total mass of system

$$V = V_A + V_B = m_A v_A + m_B v_B$$

$$= (3 \text{ kg}) (0.0009400 \text{ m}^3/\text{kg}) + (2.5 \text{ kg}) (0.0008934 \text{ m}^3/\text{kg})$$

$$= 4.92 \text{ m}^3 \quad (2.56)$$

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

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

$$\cancel{Q_{OW}} = \cancel{\Delta u_A} + \Delta u_B = [m (u_5 - u_6)] + [m (u_5 - u_6)]_B$$

$$= (3.15)(26.1)$$

$$\frac{v_2 - v_6}{u_5 - u_6} = \frac{0.89}{115.70} = 0.0008934$$

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

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

mass Balance

$$\dot{m}_i - \dot{m}_o = \Delta \dot{m} = 0$$

$$\dot{m}_i = \dot{m}_o$$

Q4 :

$$\frac{2}{25}$$

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

$$\dot{m}_3 = \dot{m}_4 = \dot{m}_5$$

Energy Balance

$$\dot{E}_i - \dot{E}_o = \dot{E}_{store} = 0$$

$$\dot{E}_i = \dot{E}_o$$

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

combine energy balance

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

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

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

(sat liquid)

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

~~P2 =~~

$$P_3 = 50 \text{ kPa} \quad h_3 = h_8 = 2877.8 \text{ kJ/kg}$$

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

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

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