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Engineering Science II (M4X00386)

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Q1)

i) $\mathcal{E} = 9.0 \text{ V}$

$$\frac{1}{R_t} = \frac{1}{2.0} + \frac{1}{2.0} = 1 \Omega$$

$$V = IR = (1)(1) = 1 \text{ V}$$

iii) $P = IV$

$$P = (1)(9) = 9 \text{ W} \quad \text{Energy} = (9)(300) = 2700 \text{ J}$$

iv) because low internal resistance cause low energy wast.

ii) Loss volts

$$V = IR$$

$$V = (1)(6.0) = 6 \text{ V}$$

$$\text{voltage drop} = 9 - 1 - 6 = 2 \text{ V}$$

$$R = \frac{V}{I} = \frac{2}{1} = 2 \Omega$$

Q2)

i) $F = \frac{1}{T} =$

$$T = \frac{1}{f}$$

ii) $V_{\text{rms}} = \frac{V_0}{\sqrt{2}} = \frac{45}{\sqrt{2}} = 31.8 \text{ V}$ or 31.8 V

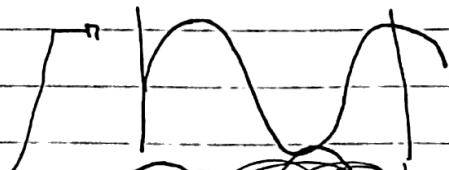
$$\langle v \rangle = \frac{1}{2} V_0^2 = 1012.5$$

$$\langle v \rangle = \sqrt{1012.5} = 31 \text{ V}$$

iii) $V_0 = 15 \times 3 = 45 \text{ V}$

iv) Peak to Peak = $15 \times 6 = 90 \text{ V}$

v) if the base was switched off the graphic would be like the one I did.



vi) the waves would be more open



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Q2)

$$V_{rms} = 230V$$

$$V_{rms} = \frac{V_0}{\sqrt{2}} \quad \therefore V_0 = \sqrt{2} V_{rms}$$

$$= \sqrt{2} \times 230 = 325.27V$$

Peak to peak is the double = 650.54V

~~Power dissipated~~

$$P = (0.26)(230) = 59.8W = 59.8J/s$$

Q3) A capacitance is a battery with charging and discharging effect, different than a capacitor that is a device for storing electrical charge.

$$C = 330\mu F$$

$$Q = I t = \text{~~4.30~~}$$

$$V = 90V$$

$$C = \frac{Q}{V}$$

$$W = \frac{1}{2} Q V \quad \text{Sub } Q = CV$$

$$I = 470k\Omega$$

$$t = 60s$$

$$\therefore W = \frac{1}{2} C V^2 = \frac{1}{2} \times 330 \times 10^{-6} \times 9^2$$

$$W = 13.365 \times 10^{-3}$$

$$\tau = RC = (470 \times 10^3)(330 \times 10^{-6}) = 155 \text{ secs}$$

$$V = V_0 e^{-t/\tau} \quad \therefore V = 9 e^{-60/155} = 6.11V$$

$$c) \quad Q = 0.37 \times (0.10 \times 10^{-6}) = 3.7 \times 10^{-8} C$$

$$Q = Q_0 e^{-t/RC}$$

$$Q_0 = 0.10nC$$



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Question 4)

$$m = 5 \text{ kg}$$

initial

$$x_1 = 0.35721$$

$$P_1 = 100 \text{ kPa}$$

$$x_2 = 1$$

Question 5)

$$P_1 = 120 \text{ kPa}$$

$$P_2 = 100.0 \text{ kPa}$$

$$T_1 = 20^\circ\text{C}$$

$$T_2 = 300^\circ\text{C}$$

values given by table A-2

$$Q = 10\% \text{ of } W_{in}$$

$$R = 0.2870$$

$$W_{in} = 4 \text{ kW}$$

Mass balance:

$$\sum \dot{m}_{in} = \sum \dot{m}_{out} \therefore \dot{m}_{in} = \dot{m}_{out} = \dot{m}$$

Energy balance

$$\dot{Q} - \dot{W} = \dot{m} \left(h + \frac{1}{2} \cdot c^2 \right) - \left(h + \frac{1}{2} \cdot c^2 \right)$$

$$= -10\% - 4 \text{ kW} = \dot{m} \left(h_1 + \frac{1}{2} \cdot c^2 \right) - \left(h_2 + \frac{1}{2} \cdot c^2 \right)$$

Power is = $\dot{W}$

$$4 \text{ kW} = \dot{W} = \dot{m} \cdot \dot{V}$$

$$P \cdot V = R \cdot T \therefore V_{in} = \frac{R \cdot T_{in}}{P_{in}} = \frac{0.2870 \cdot (20 + 273)}{120}$$

$$0.7 \text{ m}^3/\text{kg}$$

$$\dot{V} = \frac{\dot{m} \cdot V}{\dot{m}} = \frac{0.7 \text{ m}^3/\text{kg} \cdot 4 \text{ kW}}{0.7 \text{ m}^3/\text{kg}}$$

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$$v_{out} = \frac{0.287 \cdot (300 + 273)}{100} = 9.39 \text{ m}^3/\text{kg}$$

mass flow rate:

$$\dot{m} = \frac{9.39}{0.7} = 13.42 \text{ kg/s}$$

power =

$$4 \text{ kW} = \dot{W} - 13.42 \text{ kg}$$

$$\dot{W} = \frac{13.42 \cdot 4}{13.42} = 298.06 \times 10^3$$

$$-10\% - W = m(h_{out} - h_{in})$$

$$-0.1 - W = 13.42 \times$$

$$W = 1.005(20 - 330)$$

$$W = -311.55 \text{ kJ kg} \therefore$$

mass balance

$$\sum \dot{m}_{in} = \sum \dot{m}_{out}$$

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

Energy balance

$$-Q - \dot{W} = \dot{m}(h_{out} - h_{in})$$

$$-Q - W = c_p(T_{in} - T_{out})$$



Q6)

initial

$$V_1 = 0.8 \text{ m}^3$$

$$P_1 = 1.2 \text{ MPa}$$

$$T_1 = 120^\circ\text{C}$$

final

$$V_2 = 0.5 \text{ m}^3$$

$$P_2 = 600 \text{ kPa}$$

$$T_2 = 90^\circ\text{C}$$

$$h_e = \frac{h_1 + h_2}{2} = \frac{354.11 + 329.46}{2} = 341.785 \text{ kJ/kg}$$

$$Q = ?$$

$$v =$$

$$w_b = \frac{1.2 + 0.6}{2} (0.8 - 0.5) =$$

$$Q - w_b = m_e h_e + m_2 u_2 - m_1 u_1$$

$$Q = w_b + m_e h_e + m_2 u_2 - m_1 u_1$$

$$Q =$$

