

Engineering Science 2

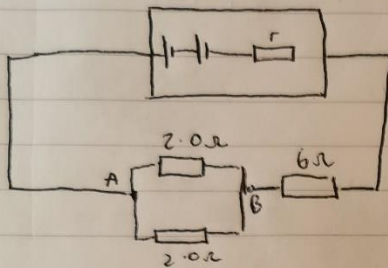
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1:00



$$V = IR \quad \frac{1}{R_{\text{total}}} = \frac{1}{2} + \frac{1}{2}$$

$$V = 1 \times 1$$

$$V = 1V$$

$$\text{ii.) } V = IR \quad 6 \times 1 = 6V$$

$$3 = 9V$$

$$V = 3 - Ir$$

$$V + Ir = 3$$

$$Ir = 3 - V$$

$$Ir = \frac{3 - 1}{1}$$

$$r = 2\Omega$$

$$\text{iii.) } P = IV \quad P = 1 \times 9 \quad P = 9W$$

$$4 \times (5 \times 60) = 2700J$$

iv.) The benefit to low internal resistance is a greater current and less voltage lost.

i.) RMS produces the same heating effect as a dc equivalent.

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

$$P = I \times R_{ms} \times V_{rms}$$

$$P = 0.26 \times 230$$

$$P = 59.8 \text{ W}$$

$$F = \frac{1}{t} \quad t = \frac{1}{F} \quad \frac{1}{50}$$

$$t = 0.02 \text{ s}$$

4 squares per waveform

$$F = \frac{1}{t} \quad F = \frac{1}{4 \times 10^{-3}} \quad \text{freq } 250 \text{ Hz}$$

$$F = 25 \text{ Hz}$$

$$V_{rms} = \frac{V_0}{\sqrt{2}} \quad \frac{45}{\sqrt{2}} = 31.82 \text{ V}$$

iii.) 45 V

$$45 \times 2 = 90 \text{ V}$$

It would be a vertical line from peak to peak.

There are 4 times as many complete cycles.

3.) The ability of a system to hold charge.

b.) $E = \frac{1}{2} CV^2$

$E = \frac{1}{2} \times 330 \times 10^{-6} \times 9^2 = 0.0135$

ii.) $\tau = 470 \times 10^3 \times 330 \times 10^{-6} = 155.15$

iii.)

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~~scribbles~~

$V = \frac{V_0 e^{-t/\tau}}{1}$

$V = V_0 e^{-t/\tau}$

$V = 9 \times e^{-\frac{60}{155.1}}$

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$9 \times e^{-\frac{60}{155.1}} = 6.11V$

c.) $0.37 \times 0.1 \times 10^{-6}$

Time constant is time taken for capacitor to discharge to 67% of Voltage.

$0.19C \times 0.67$

$0.000127C = 127$

ii.) Capacitance = $0.17C$

d.) $\log(2.15) = 0.33v$

i.) Capacitor discharge is in 5
time constants (tc)

Therefore time constants is $\therefore 10s$

4) $P_1 = 100 \text{ kPa}$
 $x = 0.35721$
 $M = 5 \text{ kg}$

$$\Delta U = Q - W$$

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

$$Q = 0$$

~~work~~ $W_e = V \cdot T \cdot \Delta t$

$$V_1 = V_2 \quad \text{constant.}$$

$$V_g \text{ at } 100 \text{ kPa} = 1.6941 \text{ m}^3/\text{kg}$$

$$V_f \text{ at } 100 \text{ kPa} = 0.001043 \text{ m}^3/\text{kg}$$

~~gas~~ ~~work~~

$$V_{fg} = V_g - V_f$$

$$V_{fg} = V_g - V_f$$

$$V_{fg} = 1.6941 - 0.001043 = 1.693057 \text{ m}^3/\text{kg}$$

$$V_{fg} = 1.693057 \text{ m}^3/\text{kg} \times 5 \quad V_{fg} = 8.465285 \text{ m}^3/\text{kg}$$

5.) $x = 0.1$ $T_1 = 20^\circ\text{C}$ $P_1 = 120\text{ kPa}$
 $Q = 10\% \text{ of } W_1$ $T_2 = 300^\circ\text{C}$ $P_2 = 1000\text{ kPa}$
 $W_{in} = 4\text{ kW}$

i.) $4\text{ kW} = 4000$
 $4000 \times 0.1 = 400\text{ W}$

$M.1 = M.2$

Energy balance:

$-400 + 4000 = \sum \text{Out } M \cdot h_2 - \sum \text{In } M \cdot h_1$

$c_p = 1.005$

$Q = -400$

$-400 + 4000 = \cancel{\sum \text{Out}} \quad \cancel{\sum \text{In}}$

$-400 + 4000 = \cancel{Q} - W = M \cdot (h_2 - h_1)$

$-400 + 4000 = Q - W = M \cdot (c_p \times T_2 - T_1)$

$-400 + 4000 = -400$

$Q - W = \dot{m} (h_2 - h_1)$

$\cancel{Q} - \dot{W} = \dot{m} \times c_p (T_2 - T_1)$

$\frac{Q - \dot{W}}{c_p (T_2 - T_1)} = \dot{m} \quad \dot{m} = 12.79\text{ kg}$

6.)

$$\overset{\text{Mass}}{m_i} - \overset{\text{Mass}}{m_e} = m_2 - m_1$$

$$Q - W = \sum_{out} m_h - \sum_{in} m_h + (m_2 v_2 - m_1 v_1)$$

