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ENGR201
HW 1

1.1.

Convert

a.

$$102,000\Omega * \frac{1k\Omega}{10^3\Omega} = 102k\Omega$$

b.

$$10.4 \frac{g}{cm^3} * \frac{1\mu g}{10^6 g} * \frac{1cm}{10mm} * \frac{1cm}{10mm} * \frac{1cm}{10mm} = 10.4 * 10^{-9} \frac{\mu g}{mm^3}$$

c.

$$25 \frac{C}{min} * \frac{1min}{60s} = .41667A * \frac{10^3mA}{1A} = 416.67mA$$

1.2

Find Q_{tot}

$$i = 120mA * \frac{10^{-3}A}{1mA} = .12A \quad q_o = 8.4C \quad t = 10s \quad \Delta Q = ?$$

$$\Delta Q = \int_a^b i * dt \Rightarrow \Delta Q = i * t \Rightarrow \Delta Q = .12 * 10 \Rightarrow \Delta Q = 1.2C$$

$$Q_{tot} = q_o + \Delta Q \Rightarrow Q_{tot} = 8.4 + 1.2$$

$$Q_{tot} = 9.6C$$

1.3

Find $i(t)$

$$q(t) = 1.28 - 8t^2C \quad t = 0 < t < 0.4s \quad \Delta t = .4s$$

$$i(t) = \frac{dq}{dt} \frac{C}{s} \Rightarrow i(t) \frac{d}{dt} (1.28 - 8t^2) \Rightarrow i(t) = -16t \frac{C}{s}$$

$$i(t) = -16t \frac{C}{s}$$

1.4

$$v = \frac{dw}{dq} \frac{J}{C} \quad \Delta w = 12J \quad Q = 2.4C$$

a.

b. $v = \frac{12J}{2.4C} \Rightarrow v = 5V$

1.5

Find how many Joules of energy can be provided from the given known values.

$$v = 1.5V \quad t = 1hr * \frac{3600s}{1hr} = 3600s \quad i = 2400mA * \frac{10^{-3}A}{1mA} = 2.4A$$

$$w = \int p * dt \Rightarrow w = \int_0^{3600} v * i * dt \Rightarrow w = v * i * 3600 \Rightarrow w = 1.5 * 2.4 * 3600 \Rightarrow w = 12960J$$

1.6

Find how many Joules of energy can be provided from the given known values.

$$p = 40W \quad t = 24hr = 86400s \quad w = \int p * dt \Rightarrow w = pt$$

$$w = 40 * 86400 \Rightarrow w = 3,456,000J * \frac{10^{-3}kJ}{1J}$$

$$w = 3456kJ$$

1.7

Determine power in mW based on change of energy provided.

$$w_o = 14500J \quad p = \frac{w}{t}$$

a. $t = 12min * \frac{60s}{1min} \Rightarrow t = 720s \quad \Delta w = 14500 - 14400 = 100J$

$$p = \frac{262.5}{720} \Rightarrow p = 0.01389W * \frac{10^3mW}{1W} = 13.49mW$$

b. $t = 9min * \frac{60s}{1min} \Rightarrow t = 540s \quad \Delta w = 14400 - 14137.5 = 262.5J$

$$p = \frac{262.5}{540} \Rightarrow p = 0.4861W * \frac{10^3mW}{1W} = 486.1mW$$

c. $t = 6\text{min} * \frac{60s}{1\text{min}} \Rightarrow t = 360s$ $\Delta w = 14137.5 - 11512.5 = 2625J$
 $p = 2625/360 \Rightarrow p = 7.29167W * \frac{10^3mW}{1W} = 7291.67mW$

1.8

$v(t) = 170 * \sin(377 * t)V$ $i(t) = 250 * e^{-.01*t}mA$

a. $t = 1.5s$

$p = v(t) * i(t) \Rightarrow p = 170 * \sin(377 * t) * 250 * e^{-.1*t} \Rightarrow$

$p = 170 * \sin(377 * 1.5) * 250 * e^{-.15} \Rightarrow$

$p = 487.32mW$

b. $t_o = 0s$ $t_1 = 3s$ $Q_{tot} = \int_{t_o}^{t_1} i * dt$

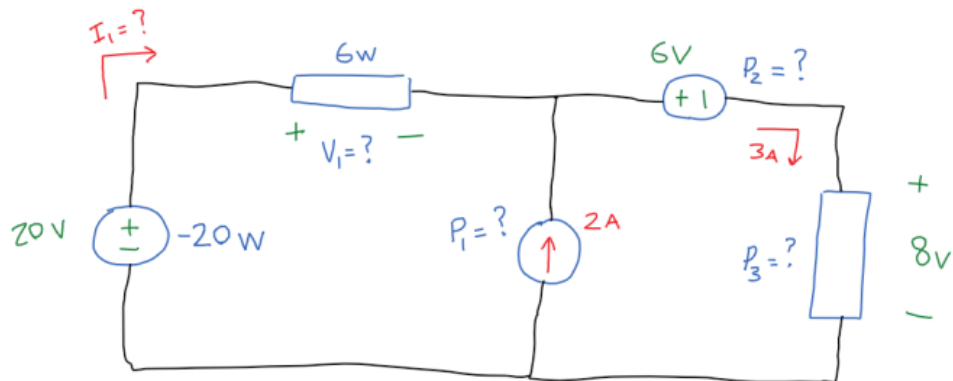
$Q_{tot} = \int_0^3 250 * e^{-.1*t} \Rightarrow Q_{tot} = -2500 * e^{-.3} \Rightarrow$

$Q_{tot} = -1852mC * \frac{10^{-3}C}{1mC} \Rightarrow$

$Q_{tot} = -1.852C$

1.9

Find I_1, V_1, P_1, P_2, P_3 in the following circuit.



$$p = vi \quad v = \frac{p}{i} \quad i = \frac{p}{v} \quad P_{tot} = 0$$

$$I_1 = \frac{20W}{20V} = 1A$$

$$V_1 = \frac{6W}{1A} = 6V$$

$$P_2 = 6V * 3A = +18W$$

$$P_3 = 8V * 3A = +24W$$

$$P_{tot} = 0 = -20W + 6W + 18W + 24W + P_1 \Rightarrow P_1 = -28W$$