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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.

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

1.2

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

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

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

$Q_{tot} = 9.6C$

1.3

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

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

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

1.4

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

a. The charge is moving from a higher voltage to a lower voltage. Due to the equation $\Delta E = q(V_f - V_i)$
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.
$v = 1.5V$ $t = 1hr * \frac{3600s}{1hr} = 3600s$ $i = 2400mA * \frac{10^{-3}A}{1mA} = 2.4A$

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

1.6

Find how many Joules of energy can be provided from the given known values.
$p = 40W$ $t = 24hr = 86400s$ $w = \int p * dt \Rightarrow w = pt$

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

$w = 3456kJ$

1.7

Determine power in mW based on change of energy provided.
$w_o = 14500J$ $p = \frac{w}{t}$

a. $t = 12min * \frac{60s}{1min} \Rightarrow t = 720s$ $\Delta w = 14500 - 14400 = 100J$
$p = \frac{100}{720} \Rightarrow p = 0.01389W * \frac{10^3mW}{1W} = 13.89mW$

b. $t = 9min * \frac{60s}{1min} \Rightarrow t = 540s$ $\Delta w = 14400 - 14137.5 = 262.5J$
$p = \frac{262.5}{540} \Rightarrow p = 0.4861W * \frac{10^3mW}{1W} = 486.11mW$

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

1.8

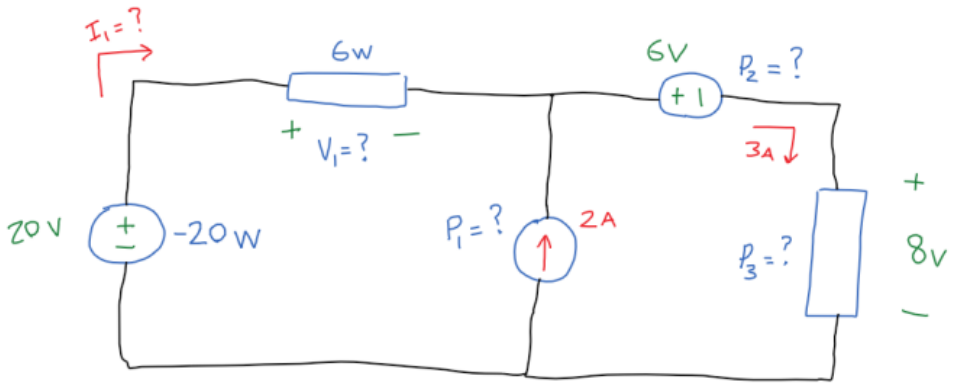
$v(t) = 170 * sin(377 * t)V \qquad i(t) = 250 * e^{-.01*t} mA$

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. $t_o = 0s \qquad t_1 = 3s \qquad Q_{tot} = \int_{t_o}^{t_1} i * dt$
$Q_{tot} = \int_0^3 250 * e^{-.1*t} \Rightarrow Q_{tot} = -2500 * e^{-.3} \Rightarrow$
$Q_{tot} = -1852mC * \frac{10^{-3}C}{1mC} \Rightarrow$
$Q_{tot} = -1.852C$

1.9

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



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

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

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

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

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

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