Chapter 9

1. a)

$$\text{time} = 100\,\mu s \left(\frac{10^{-6}\,s}{1\,\mu s}\right) = 0.0001 \quad \text{or} \quad 1\times10^{-4}$$

$$\text{resistance} = 1.00\,k\Omega \left(\frac{10^{3}\,\Omega}{1\,k\Omega}\right) = 1000 \quad \text{or} \quad 1\times10^{3}$$

$t = Cr \Rightarrow C = t/r$

$$C = \frac{1\times10^{-4}}{1\times10^{3}}$$

$$\boxed{C = 1\times10^{-7}\ F} \rightarrow \text{maximum capacitance}$$

b) No, it would not be difficult to limit the capacitance.

c) $V_0(t) = e_i(1-\exp(-t/\tau))$ & find t

known: $R = 1\times10^{3}$ $V_0 = 60mV = 0.06V$ $V = 30mV = 0.03V$

$\tau = 1\times10^{-4}$

$V = V_0(1-\exp(-t/\tau))$

$0.03 = 0.06(1-\exp(-t/1\times10^{-4}))$

$0.5 = 1-\exp(-t/1\times10^{-4})$

$-0.5 = -\exp(-t/1\times10^{-4})$

$0.5 = \exp(-t/1\times10^{-4})$

$\ln(0.5) = \ln[\exp(-t/1\times10^{-4})]$

$$-0.693 = \frac{-t}{1\times10^{-4}}$$

$-6.931\times10^{-5} = -t$

$$\boxed{t = 6.931\times10^{-5}}$$

2. a) $f = 60Hz$ $V_0 = 120V$ $\phi = 0$ $V(t) = 0$

$V(t) = V_0\sin(2\pi ft + \phi)$

$0 = 120\sin(2\pi(60)t)$

$0 = \sin(120\pi t)$ $\sin(\pi) = 0$ which means:

$120\pi t = \pi$

$$t = \frac{\pi}{120\pi} = \frac{1}{120}$$

$t \approx 8.3\bar{3}\times10^{-3}$

b) $1\,k\Omega\left(\frac{10^3\,\Omega}{1\,k\Omega}\right) = 1\times10^3\,\Omega$

$P_{max} = \frac{V_0^2}{R} = \frac{(120)^2}{1\times10^3\,\Omega} = \frac{1.44\times10^4}{1\times10^3} = \boxed{1.44\times10^1 \text{ watts}}$

c) $1\,k\Omega\left(\frac{10^3\,\Omega}{1\,k\Omega}\right) = 1\times10^3\,\Omega$

$P_{aver} = \frac{1}{2}\frac{V_0^2}{R} = \frac{1}{2}(1.44\times10^1) = \boxed{7.2 \text{ watts}}$

3. current = 3.00 A voltage = 110 V total watts = 100W + 60W + 3W

0.2 kW/hr ⇒ 200 W/hr 12 hrs per day for one month.

$P = IV$

$P_{total} = (3\cdot110) + (100+60+3)$

$= 493$ watts

$E_{total} = 493\,W \cdot 12\,hr \cdot 30\,days$

$= 1.7748\times10^5\,W/hr \Rightarrow 177.48\,kW/hr$

$= (177.48\,kW/hr)(.2\,\$/kW/hr)$

$= \$35.50$ total cost

Chapter 10

1. equations: $V - i_2R - i_1R = 0$ (1)

$V - i_3R - i_1R = 0$ (2)

$i_1 = i_2 + i_3$ (3)

since (1) & (2) both equal 0 then,

$V - i_2R - i_1R = V - i_3R - i_1R$

$-i_2R = -i_3R$

$i_2 = i_3$

knowing this then (3)

$i_1 = i_2 + i_2$

$i_1 = 2i_2$

$V = 12\ V \quad R = 1\ k\Omega = 1000\ \Omega$

(1) $12 - i_2(1000) - i_1(1000) = 0$

$1000(-i_2 - i_1) = -12$

$-i_2 - 2i_2 = \frac{-12}{1000}$

$-3i_2 = -0.012$

$\boxed{i_2 = 0.004\ A}$

which also means $\boxed{i_3 = 0.004\ A}$

then

$i_1 = 2i_2$

$= 2(0.004)$

$\boxed{i_1 = 0.008\ A}$

Total power consumed $= V \cdot I$

$= 24 \cdot (0.004 + 0.004 + 0.008) \times 1000$

$= 384\ W$

2. a) abcfa loop:

$\mathcal{E}_1 - I_1 r_1 + I_2 r_2 - \mathcal{E}_2 = 0$

$1.5 - I_1(0.25) + I_2(0.25) - 1.5 = 0$

$I_2(0.25) = I_1(0.25)$

$I_2 = I_1 \quad (1)$

fcdef loop:

$\mathcal{E}_2 - I_2 r_2 - IR = 0$

$1.5 - I_2(0.25) - (I_1 + I_2)50 = 0$

$1.5 - I_2(0.25) - (2I_2)50 = 0$

$-I_2(0.25) - (2I_2)50 = -1.5$

$-0.25I_2 - 100I_2 = -1.5$

$-100.25\ I_2 = -1.5$

$\boxed{I_2 \approx 0.01496\ A}$

so that means that $\boxed{I_1 \approx 0.01496\ A}$

then $I = I_1 + I_2$

$\boxed{I \approx 0.029925\ A}$

knowns:

$\mathcal{E} = 1.5V$

$r = 0.25\Omega$

$R = 50\Omega$

R needs to btw 1.4 & 2.

$I = I_2 + I_1$

b) $I = \frac{q}{t} \Rightarrow t = \frac{q}{I}$ knowns: $q = 2.5\,A\,hr$

$t = \frac{2.5\,A\,hr}{0.029925\,A}$

$\boxed{t \approx 83.54166397\,hr}$

chapter 11

1. a) positive

b) It is weird because the particle has the mass of an electron. It is like a contradiction because an electron is negatively charged. which is why it is strange.

c) knowns:

$B = 0.05\,T \quad V = 10^6\,m/s \quad particle = +1.6 \times 10^{-19}\,C$

$F = q\vec{v} \times \vec{B}$

$F = 1.6 \times 10^{-19} \cdot 10^6 \cdot 0.05$

$\boxed{F = 8 \times 10^{-15}\,N}$