Physics Midterm 2 Tanner Barnes

#1.) (a) $R = 1k\Omega = 10^3\Omega$ time $= 100 \times 10^{-6}$ s

$\tau = RC$

$$C = \frac{100 \times 10^{-6}}{10^3} F = \boxed{100nF}$$

b. No, it is not difficult to make a capacitor with capacitance less than 100n F

C. $R = 10^3\Omega$ $V_0 = 60mV$
$V = 30mV$

$V = V_0(1 - e^{-t/RC})$

$30 = 60(1 - e^{-t/1.00 \times 10^{-6}})$

$0.5 = e^{-t/1.00 \times 10^{-6}}$

$0.693 = \frac{t}{1.00 \times 10^{-6}}$

$\boxed{t = 6.93 \times 10^{-5} \text{ seconds}}$

#2) a). $\Phi = 0$ $V(t) = V_0 \sin(2\pi f t)$

$V(t) = 0$ when $\sin(2\pi f t) = 0$

$2\pi f t = \pm n\pi$

$V(t) = 0$ when $\boxed{t = \pm \frac{n}{2f}}$ for $n = 0, 1, 2 \ldots$

Because sin function will hit 0 over & over.

b.) $P_{max} = \frac{V^2_{max}}{4R_L} = \frac{(120)^2}{4 \times 1000} = \boxed{14.4W \text{ to } 1k\Omega \text{ Resistor}}$

c.) Since its alternating between 0 + a max of 14.4w, the average would be 7.2W delivered to the resistor

3 Power of Refridgerator

$U = 110$ Volts $\times$ $I = 3A$ = 330 Watts

Lamp = 100W
Overhead Lights = 60W
All other = 3W

total power consumed = 493 Watts

Per Day: $12 \times 493 = 5916$ watt hours = 5.916 kwatt hr.

Kwatt cost 0.2 dollars

$0.2 \times \underbrace{5.916}_{day} \times \underbrace{30}_{Month} = 35.496$ dollars

$\approx \$35.50$

3.1 Left Hand Side (LHS)

$U - i_2R - i_1R = 0$

(RHS)

$R_{eq_2 (parallel)} \quad \frac{R_1 \times R_2}{R_1 + R_2} = \frac{2R \times 2R}{(2R + 2R)} = R$

$U - i_3R - i_1R = 0$

Junction Rule $i_1 = i_2 + i_3$

$\underbrace{U - i_2R - i_1R = U - i_3R - i_1R}_{equal}$

$i_2 = i_3$ so $\boxed{i_1 = 2 \cdot i_2}$

$U = 12V$

$R = 1000\ \Omega$

$i_2 = \frac{U}{3R} = 4mA$

$i_2 + i_3 = 4mA$

therefore $i_1 = 8mA$

Total Power Consumed in Resistors

$i_2^2 \cdot R + i_3^2 \cdot R + i_1^2 \cdot R$

$= (16 + 16 + 64)1000 \times 10^{-6}W$

$= \boxed{96mW}$

#3.2 a) $I_1 r_1 - I_2 r_2 + E_2 - E_1 = 0$

$0.25 I_1 - 0.25 I_2 + 1.5 - 1.5 = 0$ Loop 1 Abcfa

$I_1 = I_2$

Loop 2 fcdef $I_2 r_2 + (I_1 + I_2) R - E_2 = 0$

substitute I_2 because $I_1 = I_2$ so

$I_2 r_2 + (I_2 + I_2) R - E_2 = 0$

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

$I_2 = 0.015 A$

I = Current = $I_1 + I_2$ which is $I_2 + I_2 = 2(0.015A) = \boxed{0.030 A}$

b.) $I = 2q/t$ $q = 2.5$ A hr

$t = 2q/I = 2(2.5)/0.030 = \boxed{166.67 \text{ hrs.}}$

4.1 a. Into the page and to the left.

By applying the left hand rule we find that this particle therefore must be moving upward which is the positive direction and therefore the particle is positive.

b. It's strange it was an electron because it was found to be a positively charged particle so therefore it must be an antiparticle of an electron.

c. $F = qvB \sin\theta$ $F = 1.6 \times 10^{-19} \times 10^{6} \times \sin(90) =$

$F = 8.0 \times 10^{-15}$ N

Direction of Force is to the left based on our findings in part a.