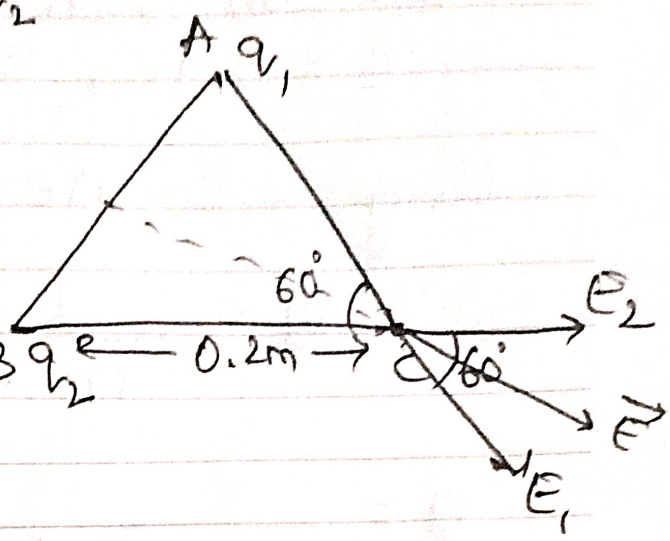
VI

45. $q_1 = +2\times10^{-6}\,C = q_2$

$r = 0.2\,m$

$E = ?$



Electric field is given by

$$E = \frac{1}{4\pi\epsilon_0}\cdot\frac{q}{r^2}$$

Electric field at C due to q_1 is.

$$E_1 = \frac{1}{4\pi\epsilon_0}\cdot\frac{q_1}{r_1^2} = \frac{9\times10^9\times 2\times10^{-6}}{(0.2)^2} = \frac{18\times10^3}{4\times10^{-2}}$$

$\therefore E_1 = 4.5\times10^5\,NC^{-1}$ along AC.

Electric field at C due to q_2 is.

$$E_2 = \frac{1}{4\pi\epsilon_0}\cdot\frac{q_2}{r_2^2} = \frac{9\times10^9\times2\times10^{-6}}{(0.2)^2} = 4.5\times10^5\,NC^{-1}$$ along BC.

Resultant electric field at C is

To do $E = \sqrt{E_1^2+E_2^2+2E_1E_2\cos\theta} = \sqrt{(4.5\times10^5)^2+(4.5\times10^5)^2+}$

$= \sqrt{E_1^2+E_1^2+2E_1^2\times\frac{1}{2}} = \sqrt{3}\,E_1 = 4.5\times10^5\times\sqrt{3}.$

$\boxed{E = 7.78\times10^5\,NC^{-1}}$ Perpendicular to AB.

To take shelter of the lotus feet of the Lord means to take shelter of the pure devotees. The pure devotees whose only business is serving are honored by the names Prabhupāda and ... indicate such devotees to be representatives of the lotus feet of the Lord.

18 Tuesday JAN 2011

46. $n = 8.5 \times 10^{28}\ m^{-3}$.
$l = 3\ m$, $A = 2 \times 10^{-6}\ m^2$
$I = 3\ A$, $v_d = ?$ $t = ?$

Using $I = neAv_d$.

$$\therefore v_d = \frac{I}{neA} = \frac{3}{8.5 \times 10^{28} \times 1.6 \times 10^{-19} \times 2 \times 10^{-6}}$$

$$v_d = \frac{3}{27.2 \times 10^{3}} \Rightarrow \boxed{v_d = 0.11 \times 10^{-3}\ ms^{-1}}$$

Drift velocity is $v_d = \frac{l}{t}$

$$\Rightarrow t = \frac{l}{v_d} = \frac{3}{0.11 \times 10^{-3}}$$

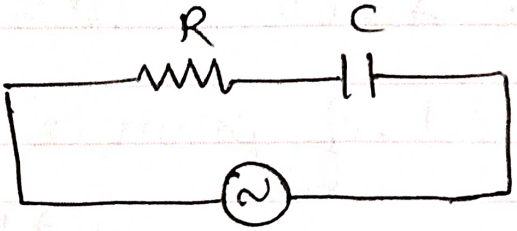
$$\boxed{t = 27.2 \times 10^{3}\ s}$$

$$\boxed{t = 7.55\ Hrs}$$

To do: The electrons take $27.2 \times 10^3\ s$ [7.55 hrs] to drift from one end to another.

47. $V_{rms} = 200\,V$, $f = 50\,Hz$

$R = 5\,\Omega$, $C = 800\,\mu F$



i) $Z = ?$

ii) $I = ?$

We have Capacitive reactance X_C,

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{2 \times 3.14 \times 50 \times 800 \times 10^{-6}}$$

$$X_C = \frac{10^6}{251200} = 3.98$$

$\therefore$ $\boxed{X_L = 3.98\,\Omega}$

or $\boxed{X_L = 4\,\Omega}$

i) Impedance is given by $Z = \sqrt{R^2 + X_C^2}$

$$Z = \sqrt{5^2 + 4^2} = \sqrt{25 + 16} = \sqrt{41}$$

$$\boxed{Z = 6.4\,\Omega}$$

ii) Current is $I_{rms} = \frac{V_{rms}}{Z} = \frac{200}{6.4}$

To do $\boxed{I_{rms} = 31.25\,A}$

48. $A = 60^\circ$, $D = 40^\circ$, $n_g = ?$

Prism formula. $n_g = \dfrac{\sin\left(\frac{A+D}{2}\right)}{\sin A/2}$

$$n_g = \frac{\sin\left(\frac{60+40}{2}\right)}{\sin(60/2)} = \frac{\sin 50}{\sin 30} = \frac{0.766}{0.5}$$

$$\boxed{n_g = 1.532}$$

In air, $\dfrac{n_g}{n_a} = \dfrac{\sin\left(\frac{A+D_1}{2}\right)}{\sin(A/2)} \rightarrow (1)$

Under Water $\dfrac{n_g}{n_w} = \dfrac{\sin\left(\frac{A+D_2}{2}\right)}{\sin(A/2)} \rightarrow (2)$

Eqn (1) ÷ (2) gives, $\dfrac{n_w}{n_a} = \dfrac{D_1}{D_2}$.

$$\therefore D_2 = \frac{D_1}{n_w} = \frac{40^\circ}{1.33} \Rightarrow \boxed{D_2 = 30^\circ}$$

To do

$\therefore$ Angle of minimum deviation under water is 30° //.