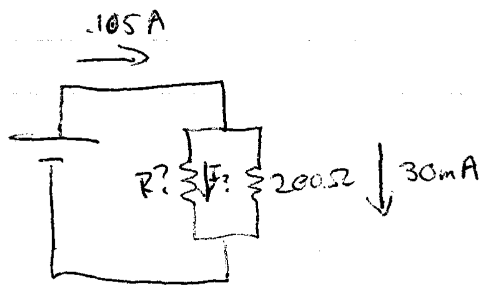
HW IV-V - Phy 132

Session IV.3

1)



Since 200Ω & R? are in parallel, they have the same $\Delta V = IR$

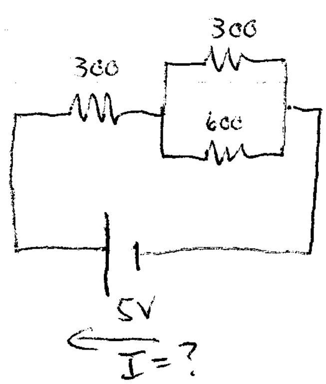
$= .03A \cdot 200\Omega = \underline{6V}$

By junction equation, current through R?, call it $I_?$, is given by $.105A = I_? + .03A \Rightarrow I_? = .075A$

So, R? is given by $V = 6V = I_? R_? \Rightarrow R? = \frac{6V}{.075A} = \boxed{80\Omega}$

(Many other ways to argue this.)

2)

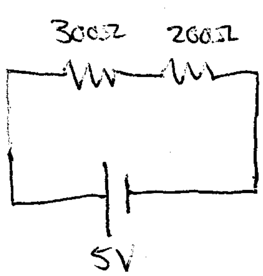


This can be done by equivalent resistors: First 2 in parallel:

$$\frac{1}{R_{par}} = \frac{1}{300} + \frac{1}{600} = \frac{3}{600} = \frac{1}{200}$$

$$R_{par} = 200\Omega$$

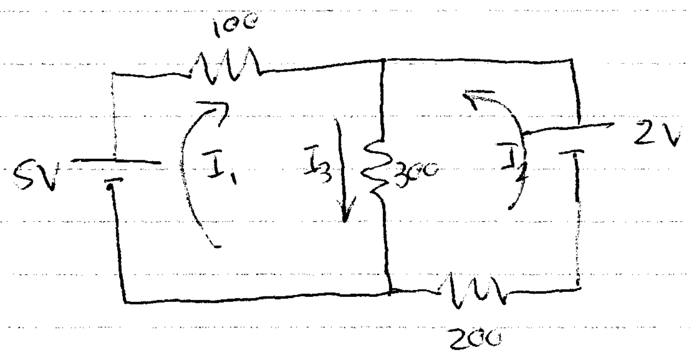
So, this becomes



These in series are equivalent to 500Ω, so $I = \frac{V}{R} = \frac{5V}{500\Omega}$

$\boxed{= .01A}$

3) This must be done by Kirchhoff:



Need 2 loops, 1 junction

$5V - I_1 \cdot 100\Omega - I_3 \cdot 300\Omega = 0$ 1)

$2V - I_3 \cdot 300\Omega - I_2 \cdot 200\Omega = 0$ 2)

$I_1 + I_2 = I_3$ 3)

First, let's eliminate I_1. Use $I_1 = I_3 - I_2$, so, eq'n 1) become

$$5V - (I_3 - I_2) \cdot 100\Omega - I_3 \cdot 300\Omega = 0$$

or $5V + I_2 \cdot 100\Omega - I_3 \cdot 400\Omega = 0$. Let's double this:

$10V + I_2 \cdot 200\Omega - I_3 \cdot 800\Omega = 0$ & add to 2

$$2V - I_2 \cdot 200\Omega - I_3 \cdot 300\Omega = 0$$

$$12V + 0 - I_3 \cdot 1100\Omega = 0$$

$$\boxed{I_3 = \frac{12V}{1100\Omega} = 1.09 \times 10^{-2} A}$$

Now, we plug this into 1):

$$5V - I_1 \cdot 100\Omega - (1.09 \times 10^{-2} A) \cdot 300\Omega = 0$$

$$1.73V - I_1 \cdot 100\Omega = 0 \Rightarrow \boxed{I_1 = \frac{1.73V}{100\Omega} = .0173A}$$

And finally, use 3: $I_2 = I_3 - I_1 = (1.09 \times 10^{-2} - 1.73 \times 10^{-2}) A$

$$\boxed{I_2 = -6.4 \times 10^{-3} A}$$

Session V.1

1) $C = 200\mu F$, $V = 5V \Rightarrow Q = C \cdot V$

$$= 2\times10^{-4}F \cdot 5V$$

$$\boxed{= 10^{-3}C}$$

To double this, must double V, since Q is proportional to V — $\boxed{\text{so } 10V}$

2) $C = 2\times10^{-3}F \qquad I = 10^{-3}A = \frac{dQ}{dt}$

$$Q = \int I\,dt = I\cdot\Delta t = 10^{-3}A \cdot 3\,sec = \boxed{3\times10^{-3}C}$$

since I constant

After 5 sec,

$$V = \frac{Q}{C} = \frac{10^{-3}A\cdot 5sec}{2\times10^{-3}F} = \boxed{2.5V}$$

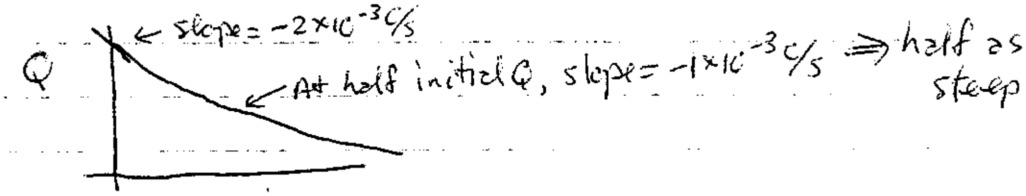
After t sec

$$V = \frac{Q}{C} = \frac{10^{-3}A\cdot t\,sec}{2\times10^{-3}F} = \frac{t}{2}V$$

3) a) Immediately after connection to R, C is still charged to 4V — no appreciable charge has left yet. So, initial I is $V/R = 4V/2000\Omega = 2\times10^{-3}A$.

b) When $V = 2V$, $I = 2V/2000\Omega = 1\times10^{-3}A$

c)



4) $C_1 = 10^{-3}F$ $\quad$ $C_2 = 5\times10^{-4}F$

$= 1mF$ $\quad$ $= 0.5mF$

a) in parallel, $C_T = C_1 + C_2 = 1.5\times10^{-3}F = \boxed{1.5mF}$

b) in series $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{1mF} + \frac{1}{.5mF} = \frac{3}{1mF}$

$C_T = \frac{1}{3}\ mF = \boxed{3.3\times10^{-4}F}$