10-19

a) $\tau = R_{TH} C$

$R_{TH} = 100k\Omega$

$C = 5.6\mu F$

$\tau = 100\,000\Omega \; 5.6\times10^{-6} F$

$= 0.56s \quad = 560ms$

b) $V_c = V_f + (V_i - V_f)e^{-t/\tau}$

$V_f = 20V$

$V_i = 0V$ Assuming capacitor fully discharged prior to shutting switch.

$\Rightarrow$ $V_c(t) = 20V - 20Ve^{-t/560ms}$

c) $V_c(1\tau) = 20V - 20Ve^{-1\tau/\tau}$

$V_c(1\tau) = 12.6V$

$V_c(3\tau) = 20V - 20Ve^{-3\tau/\tau}$

$V_c(3\tau) = 19.0V$

$V_c(5\tau) = 20V - 20Ve^{-5\tau/\tau}$

$V_c(5\tau) = 19.9V$

d) $i_c = \frac{E - V_c}{R} = \frac{20 - (20 - 20e^{-t/560ms})}{100k\Omega}$

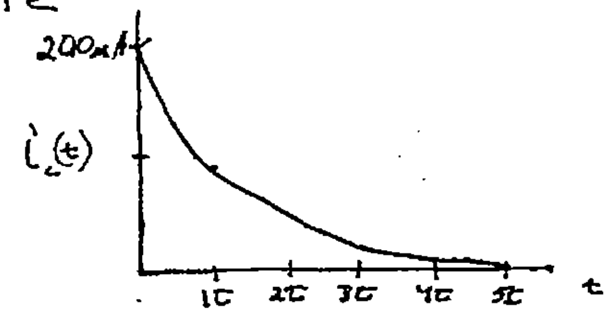
$= \frac{20V}{100e^3\Omega} e^{-t/560ms}$

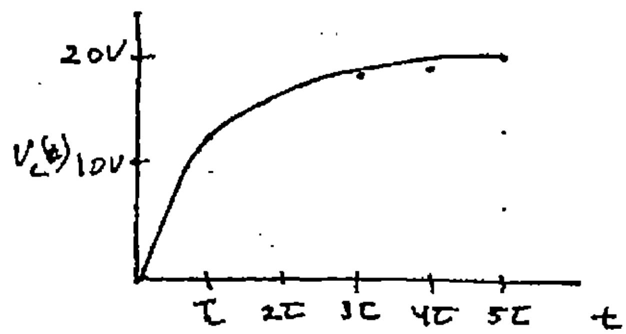
$i_c = 200mA\, e^{-t/560ms}$

KVL: $V_r = E - V_c = 20Ve^{-t/560ms} = V_r$

TOPS 35500

10-19 e





10-25.

a. $\tau = R_{TH}C = 4.7k\Omega \; 56\mu F = 263.2ms$

b. $V_c(t) = V_f + (V_i - V_f)e^{-t/\tau}$

$V_f = 22V$

$V_i = 0V$ Assuming CAP is fully discharged to start

Pos. 1 $\boxed{V_c(t) = 22V(1 - e^{-t/263.2ms})}$ $0 < t \leq 1s$

$i_c(t) = \frac{V_r(t)}{R}$

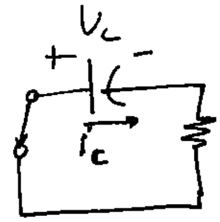
KVL: $V_r(t) = E - V_c(t) \Rightarrow i_c(t) = \frac{E - V_c(t)}{R} = \frac{22Ve^{-t/263.2ms}}{4.7k\Omega}$

Pos. 1 $\boxed{i_c(t) = 4.68mA\, e^{-t/263.2ms}}$ $0 < t < 1s$

10-25c

$$V_c(1s) = 22V\left(1 - e^{-1s/.2632s}\right)$$

$$\boxed{= 21.51V}$$



$$i_c(1s) = -\frac{V_c(t = 1sec)}{R}$$

$$= -\frac{21.51}{4.7k\Omega}$$

$$= \boxed{-4.58mA}$$

d) $$V_c(t) = V_f + (V_i - V_f)e^{-t/\tau}$$

For this problem τ Remains the same

$V_f = 0$

$V_i = 21.51V$ The voltage V_c the instant the switch was thrown to position 2.

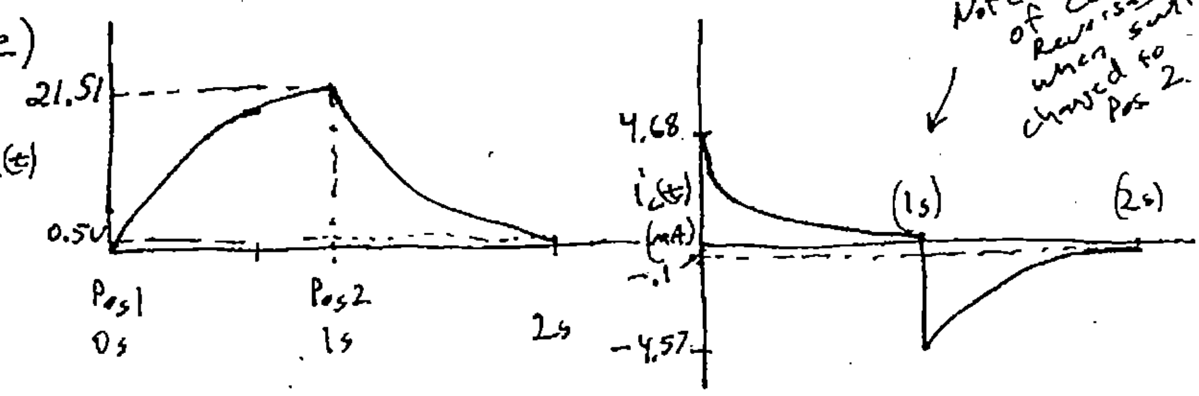
$$\boxed{V_c(t) = 21.51Ve^{-(t-1)/263.2s}} \quad \text{for } t \geq 1s$$

KVL: $V_R(t) = -V_c(t)$

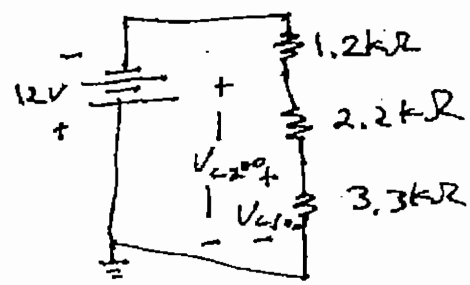
$$\Rightarrow i_c(t) = \frac{-V_c(t)}{R} = \frac{-21.51Ve^{-t/263.2s}}{4.7k\Omega}$$

$$\boxed{i_c(t) = -4.57mA\, e^{-(t-1)/263.2s}} \quad \text{for } t > 1s$$

e)



55) Energy stored by a capacitor is given by $W_C = \frac{1}{2} C V^2$ therefore to answer the question we must know the voltage across each capacitor. Under steady state conditions capacitors act as an ~~shor~~ open circuit therefore we can simply find the voltages using voltage division.



$$V_{C100} = -12 \frac{3.3k\Omega}{6.7k\Omega}$$

$$= -5.91V$$

$$V_{C200} = -12 \left(\frac{5.5k\Omega}{6.7k\Omega}\right)$$

$$= -9.85V$$

$$W_{C100\mu F} = \frac{1}{2}(100\times10^{-6}F)(-5.91V)^2$$

$$= \boxed{1.75mJ}$$

$$W_{C200\mu F} = \frac{1}{2}(200\times10^{-6}F)(-9.85V)^2$$

$$= \boxed{9.7mJ}$$