

THIRD MIDTERM

4

Name: _____ Student ID #: _____

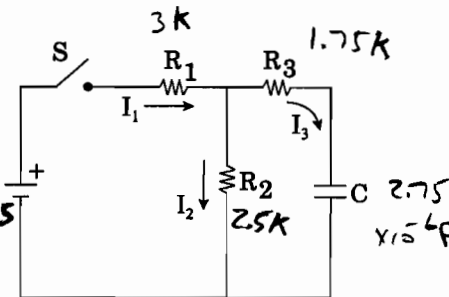
Discussion Instructor (circle): Barcikowski El-Gendy Johnson Rodriguez

Points Allowed

SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Q=

Use the numerical values below for the components in the circuit. At $t = 0$ the switch is closed after being opened for a long time.



- (a) Calculate the current in R_3 when 0.75 time constants have elapsed after $t = 0$.
- (b) Calculate the current in R_1 at $t = \infty$.
- (c) Calculate the charge on the capacitor after 0.75 time constants have elapsed since $t = 0$.
- (d) Using the full loops and junctions, and **NO** shortcuts, calculate the time constant for charging the capacitor. (Use the currents indicated.)

$\epsilon = 125 \text{ V}; R_1 = 3000 \Omega; R_2 = 2500 \Omega; R_3 = 1750 \Omega; C = 2.75 \times 10^{-6} \text{ F}$

$$a) \frac{\epsilon}{R_1 + R_{23} \parallel (R_2 + R_3)} e^{-0.75} = (0.031)(0.5882)(0.472) = 8.61 \text{ mA}$$

$$b) I_1 = \frac{\epsilon}{R_{eq}} = \frac{125}{5500} = 22.7 \text{ mA}$$

$$c) V_3 = V_2 = 125 - (3000)(22.7 \text{ mA}) = 56.9 \text{ V}$$

$$Q_{\infty} = C V_3 = (2.75 \times 10^{-6} \text{ F})(56.9 \text{ V}) = 156 \times 10^{-6}$$

$$Q(1 - e^{-\frac{t}{\tau}}) = 156 \times 10^{-6} (1 - e^{-0.75})$$

$$= 82.5 \times 10^{-6} \text{ C}$$