Physics 302
Winter Quarter 1995
March 15, 1995
George Williams

6

FINAL EXAM

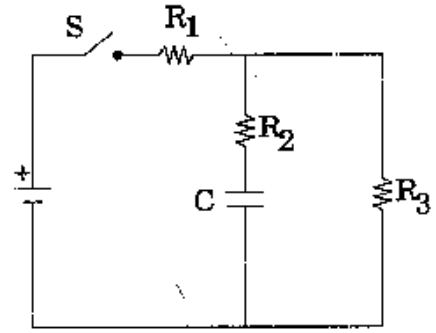
Name (print) Zhukov Name (signed)_____

Discussion Instructor (circle): Brown Chakhbazian Condella Portnoi Zhukov

Discussion Section # _____

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

For the circuit shown the switch is open for a long time and then closed for *exactly* 2.00 time constants, and then opened.



8 (a) Calculate the charge on the capacitor the instant the switch is opened.
8 (b) Find the magnitude of the current in R_3 6.00×10^{-3} seconds after the switch is opened.
14 (c) As discussed in class, show in detail how to obtain the time constant for charging the capacitor and obtain a numerical value for that time constant.

$C = 2.40 \times 10^{-6}$ F
$\varepsilon = 225$ V
$R_1 = 1.50 \times 10^3$ ohms
$R_2 = 0.700 \times 10^3$ ohms
$R_3 = 1.10 \times 10^3$ ohms

For discharging $Q(t) = Q_0 e^{-t/\tau}$, $\tau = C(R_2 + R_3)$

$Q_0 = Q_\infty (1 - e^{-2})$, $Q_\infty = \dfrac{C \varepsilon R_3}{R_1 + R_3}$

8 a) $Q_0 = \dfrac{2.40 \times 10^{-6} \times 225 \times 1.1 \times 10^3}{1.5 \times 10^3 + 1.1 \times 10^3}(1 - e^{-2}) =$

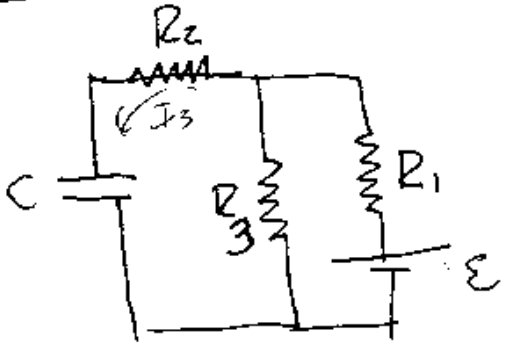
$= 228.46 \times 10^{-6}(1 - 0.1353) = 1.975 \times 10^{-4}$ C

8 b) $\tau = 4.32 \times 10^{-3}$ s $\quad I(t) = I_0 e^{-t/\tau} = \dfrac{Q_0}{\tau} e^{-\frac{t}{\tau}}$

$t = 6.00 \times 10^{-3}$, $\quad I = \dfrac{1.98 \times 10^{-4}}{4.32 \times 10^{-3}} e^{-1.39} = 1.14 \times 10^{-2}$ A

Chargius

c)



-6 Missing Loop or Junct

$$\tau' = C\left(R_2 + \frac{R_1 R_3}{R_1 + R_3}\right) = 2.4\times10^{-6}\left(0.7\times10^{-3} + 0.655\times10^{-3}\right)$$

$$\tau' = 3.20 \times 10^{-3}\ s$$