The Ohio State University
Department of Electrical and Computer Engineering

ECE 205
Spring 2009

Quiz #1

April 10, 2009

Name (print) _____

Grade_____

- Note -

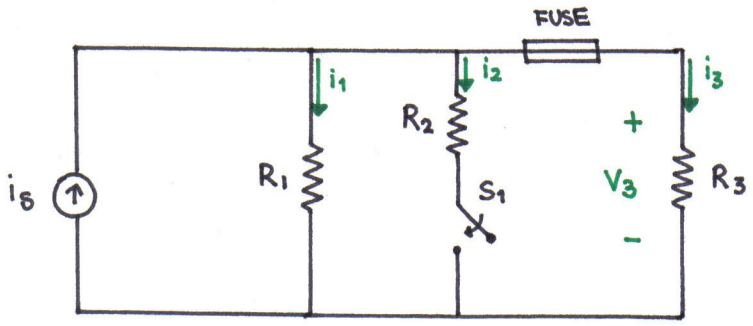
- **There is 1 problem on the following pages.**
- **Please read the questions carefully.**

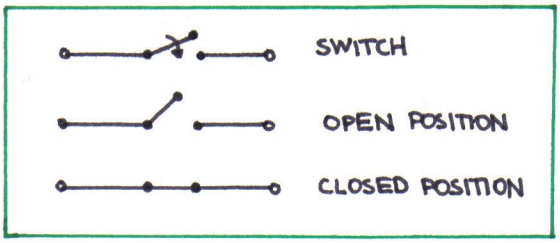
"No aid is given, received or observed" **Signature**_____

NOTE : THE FUSE IS A DEVICE THAT MELTS WHEN TOO MUCH CURRENT FLOWS THROUGH IT.

BY MELTING, IT BREAKS THE CIRCUIT IN WHICH IT IS CONNECTED PROTECTING THE OTHER COMPONENTS FROM DAMAGES DUE TO EXCESSIVE CURRENT.

THE RATED CURRENT IS THE MAX CURRENT THAT THE FUSE CAN PASS WITHOUT MELTING.





(a) If the fuse is rated 5 mA, S_1 is closed, $i_s = 10$ mA and $R_1 = R_2 = 8\ k\Omega$ then $V_3 = 24$ V.

(1) Find R_3

(2) Does the fuse melt? If yes, why?

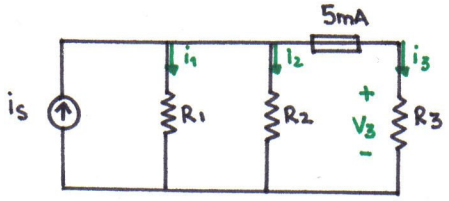
(b) If the fuse is rated 5 mA, S_1 is open, $R_1 = R_2 = 8\ k\Omega$, $R_3 = 6 k\Omega$ and $i_s = 10$ mA

(3) Find i_1, i_2 and i_3

(4) Does the fuse melt? If yes, why?

SOLUTION

(a)



$i_s = 10\ mA$

$R_1 = R_2 = 8k\Omega$

$V_3 = 24V$

(1) R_1, R_2 and R_3 are connected in parallel so $V_1 = V_2 = V_3 = 24V$

$$i_1 = \frac{V_1}{R_1} = \frac{24}{8\cdot10^3} = 3\cdot10^{-3} = 3\,mA$$

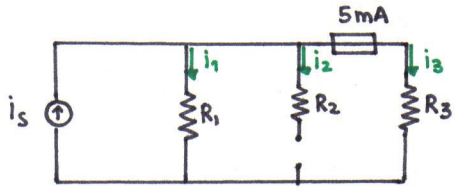
$$i_2 = \frac{V_2}{R_2} = \frac{24}{8\cdot10^3} = 3\cdot10^{-3} = 3\,mA$$

$$i_s = i_1 + i_2 + i_3 \Rightarrow i_3 = i_s - i_1 - i_2 = 10 - 3 - 3 = 4mA$$

$$\boxed{R_3} = \frac{V_3}{i_3} = \frac{24}{4\cdot10^{-3}} = 6\cdot10^3 = \boxed{6k\Omega}$$

(2) since $i_3 = 4mA < 5\,mA$ = FUSE RATED CURRENT the fuse does not melt

(b)



$R_1 = R_2 = 8k\Omega$

$R_3 = 6\,k\Omega$

$i_s = 10\ mA$

(3) since s_1 is open $\Rightarrow$ $\boxed{i_2 = 0A}$

$$i_3 = \frac{R_1}{R_1 + R_3} i_s = \frac{8}{8+6} \cdot 10\ mA = \frac{80}{14} > \frac{70}{14}\ mA = 5mA = \text{FUSE RATED CURRENT}$$

(4) since $i_3 >$ fuse rated current, the fuse melts $\Rightarrow$ $\boxed{i_3 = 0A}$

$\boxed{i_1 = i_s = 10\ mA}$