Quiz #3

PHYSICS 102

Feb. 21, 2001

1) At time \( t=0 \) the switch in the figure below is closed. In the following questions, tell us if the quantity goes up, down, or stays the same. Circle the correct answer. (5 pts)

![Switch diagram]

a) The intensity of bulb A goes \( \uparrow \) down, or stays the same.
b) The intensity of bulb C goes \( \uparrow \) down, or stays the same.
c) The current through the battery goes \( \uparrow \) down, or stays the same.
d) The voltage drop across bulb C goes \( \uparrow \) down, or stays the same.
e) The total power used goes \( \uparrow \) down, or stays the same.

When the switch is closed, the net resistance across the battery is reduced \( \Rightarrow \) more current flows \( \Rightarrow \) light is brighter.

2) At time \( t=0 \) the switch in the circuit below is put in position A. The light bulb brightens, dims, and then goes out as the capacitor charges. After some time, the switch is placed in position B at time \( t_b \). Sketch the intensity of the light as a function of time, starting at \( t_b \), on the plot below. (1 pt)

![Circuit diagram]

Approximately exponential decay of \( \int \int \int \approx e^{-t/\tau} \)

where \( \tau = \frac{RC}{R} \).

With real light bulbs, \( R = R_{\text{Temp}} \) and so \( \tau \) changes slightly with time.

All we were looking for was an exponential decay.

(Continued on other side)

Rewrite and sign the honor pledge: “I pledge my honor that I have not violated the Honor Code during this examination.”

Signature __________________________
3) What is the voltage across the 4 Ohm resistor in the diagram below? (4 pts)

Using Kirchhoff's Loop Law

1st Loop: \[ 10V = 4I_1 + 9(I_1 + I_2) + 2 \]  \( \text{(1)} \)

2nd Loop: \[ 15V = 9I_2 + 9(I_1 + I_2) + 2 \]  \( \text{(2)} \)

Rewriting \( \text{(1)} \) and \( \text{(2)} \):

\[
(8 = 13I_1 + 9I_2) \times 2
\]

\[ 13 = 9I_1 + 18I_2 \]

\[ 3 = 17I_1 \]

\[ I_1 = \frac{3}{17} \]

Voltage across 4 \( \Omega \):

\[ V = I_1 R \]

\[ = \frac{3}{17} (4) \]

\[ = \frac{12}{17} \approx 0.71 \text{ V} \]