PHYS 102: General Physics 2 **KOÇ UNIVERSITY** **Spring Semester 2011**

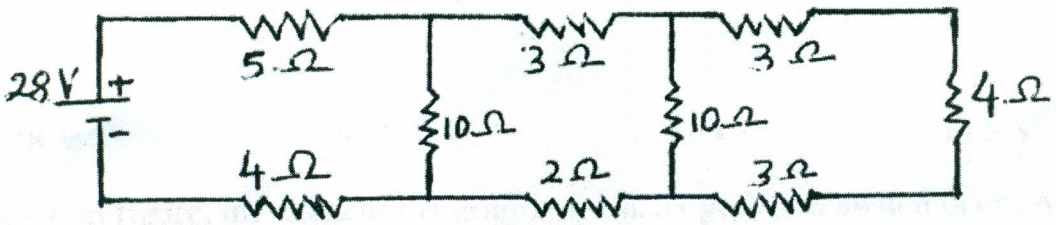
College of Sciences

Section 1 **Quiz 5** **24 March 2011**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

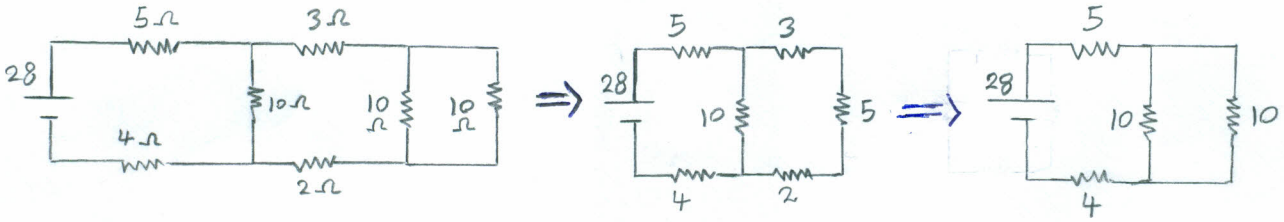
Name: **Student ID:** **Signature:**

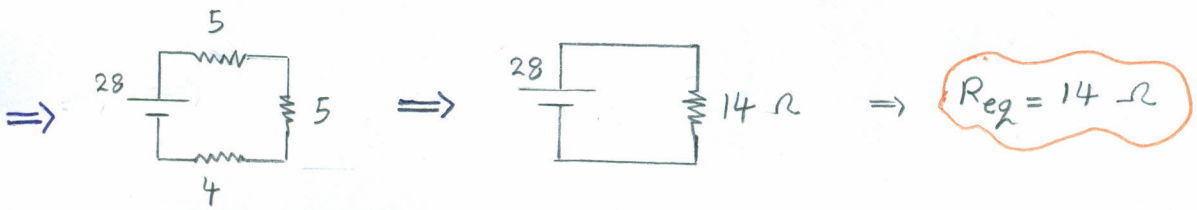
Consider the circuit shown in the figure.



a) Calculate the current in 5 Ω resistor.
b) What power is dissipated by the entire circuit?

a)





$R_{eq} = 14\ \Omega$

$I = \frac{V}{R_{eq}} = \frac{28}{14} = 2A \Rightarrow$ the same current passes through 5 Ω resistor.

b)

$$P = \frac{V^2}{R}$$

$$= \frac{(28)^2}{14}$$

$P = 56\ W$

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Section 2 **Quiz 5** **24 March 2011**

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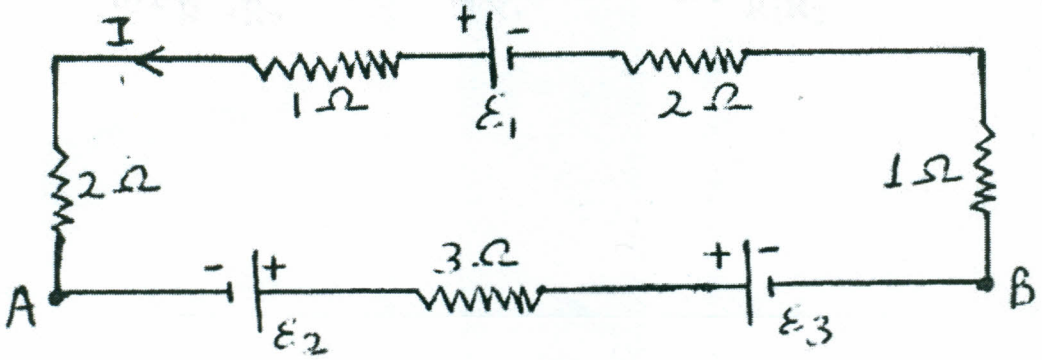
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Three batteries of emf $\varepsilon_1 = 8\text{V}$, $\varepsilon_2 = 12\text{V}$, and $\varepsilon_3 = 2\text{V}$ are connected with five resistors in a circuit as shown in the figure.



a) Find the current I flowing in the circuit.
b) Find the potential difference between points A and B, $V_B - V_A$.

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a) Start from point A and go around the circuit counterclock wise.

$$V_A + \varepsilon_2 - I\times 3 - \varepsilon_3 - I\times 1 - I\times 2 + \varepsilon_1 - I\times 1 - I\times 2 = V_A$$

$$\Rightarrow \quad 12 - 3I - 2 - I - 2I + 8 - I - 2I = 0$$

$$\Rightarrow \quad 18 - 9I = 0$$

$$\Rightarrow \quad I = \frac{18}{9} = 2\ A > 0 \Rightarrow \text{The direction of } I \text{ has chosen correctly.}$$

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b)

$$V_A + \varepsilon_2 - 3I - \varepsilon_3 = V_B$$

$$\Rightarrow \quad V_B - V_A = 12 - 3\times 2 - 2$$

$$\Rightarrow \quad V_B - V_A = 4\ V$$

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Section 3 **Quiz 5** **24 March 2011**

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Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

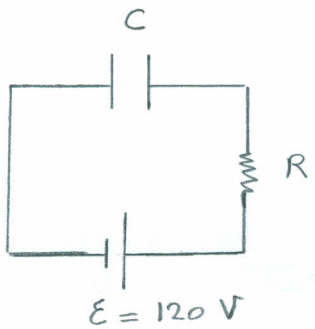
A capacitor C that is initially uncharged is connected in series with a resistor R and emf source $\varepsilon = 120V$. Just after the circuit is completed, the current through the resistor is 6×10^{-5} A. The time constant for the circuit is 10s.
Find the resistance of the resistor and the capacitance of the capacitor.

$I_0 = 6 \times 10^{-5}\ A$

at $t = 0$ we can ignore capacitor :

$$R = \frac{\varepsilon}{I_0} = \frac{120}{6\times10^{-5}}$$

$$\Rightarrow \quad R = 2 \times 10^{6}\ \Omega$$



$\tau = 10\ s$

$$\tau = RC \quad \Rightarrow \quad C = \frac{\tau}{R} = \frac{10}{2\times10^{6}}$$

$$\Rightarrow \quad C = 5\times10^{-6}\ F = 5\ \mu F$$

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Section 4 **Quiz 5** **24 March 2011**

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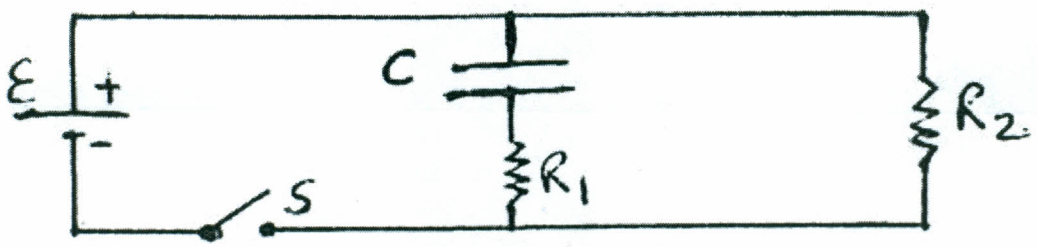
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

In the circuit shown in the figure, the capacitor is originally uncharged with switch open. At t=0 the switch is closed.



a) What is the current supplied by the emf just after the switch is closed?
b) What is the current long time after the switch is closed?

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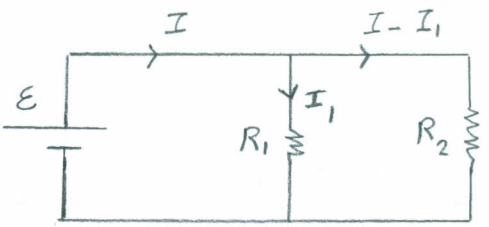
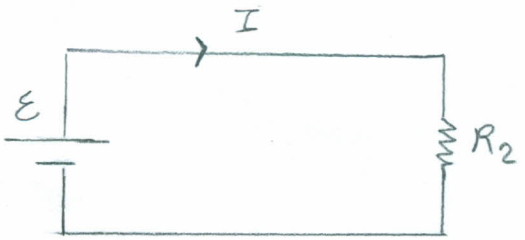
a) At t=0 we can ignore capacitor and the circuit is like below:



$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

$$I = \frac{\mathcal{E}}{R_{eq}} = \frac{R_1 + R_2}{R_1 R_2}\,\mathcal{E}$$

b) As $t \to \infty$ the capacitor becomes fully charged and $I_1 = 0$, In this case the circuit becomes:



$$I = \frac{\mathcal{E}}{R_2}$$

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Section 5 Quiz 5 24 March 2011

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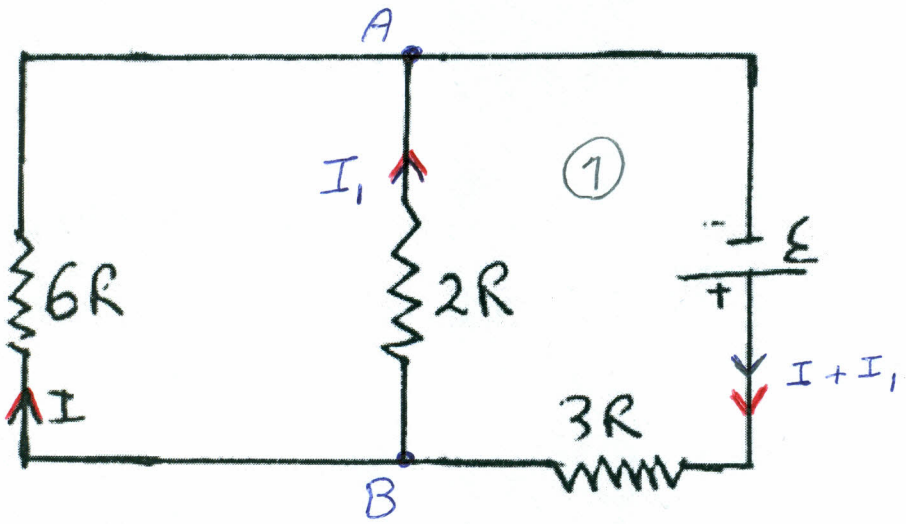
Quiz duration: 10 minutes

Name: Student ID: Signature:

In the circuit shown in the figure, if R=50 Ω and I=20mA, determine ε.



Potential difference across resistor 6R is:

$$V_{AB} = I(6R) = 20 \times 10^{-3} \times 6 \times 50$$

$$\Rightarrow \quad V_{AB} = 6 \text{ V}$$

$$\Rightarrow \quad I_1 = \frac{V_{AB}}{2R} = \frac{6}{2 \times 50} = 0.06 \text{ A} \quad \Rightarrow \quad I_1 = 60 \text{ mA}$$

$$\Rightarrow \quad I_{total} = I + I_1 = 80 \text{ mA}$$

$$R_{eq} = \frac{(6R)(2R)}{6R + 2R} + 3R = \frac{12}{8}R + 3R = \frac{3}{2}R + 3R = 4.5\,R = 4.5 \times 50$$

$$\Rightarrow \quad R_{eq} = 225\ \Omega$$

$$\mathcal{E} = I_{total} \cdot R_{eq} = 80 \times 10^{-3} \times 225 = 18 \text{ V} \quad \Rightarrow \quad \mathcal{E} = 18 \text{ V}$$