

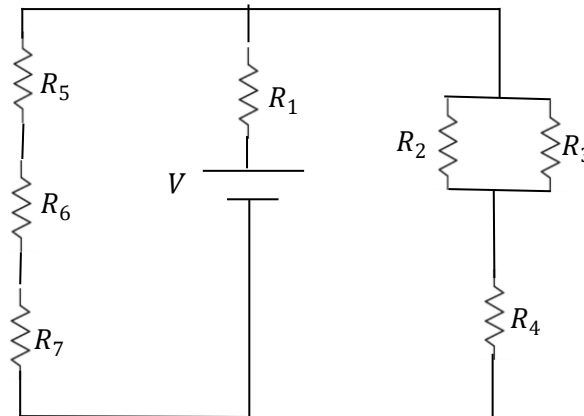
Name _____

Physics 121 Quiz #5 October 21, 2022

Please show all work, thoughts and/or reasoning in order to receive partial credit. The quiz is worth 10 points total.

I affirm that I have carried out my academic endeavors with full academic honesty.

Consider the circuit shown below in which some resistors each with $R = 100\Omega$ are wired to a $10V$ battery.



1. What is the equivalent resistance of the circuit?

$$R_5, R_6, \text{ and } R_7 \text{ are in series: } R_{567} = R_5 + R_6 + R_7 = 100\Omega + 100\Omega + 100\Omega = 300\Omega$$

$$R_2 \text{ and } R_3 \text{ are in parallel: } \frac{1}{R_{23}} = \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{100\Omega} + \frac{1}{100\Omega} = \frac{2}{100\Omega} \rightarrow R_{23} = 50\Omega$$

$$R_{23} \text{ and } R_4 \text{ in series: } R_{234} = R_{23} + R_4 = 50\Omega + 100\Omega = 150\Omega$$

$$R_{234} \text{ and } R_{567} \text{ are in parallel: } \frac{1}{R_{234567}} = \frac{1}{R_{234}} + \frac{1}{R_{567}} = \frac{1}{150\Omega} + \frac{1}{300\Omega} = \frac{3}{300\Omega} \rightarrow R_{234567} = 100\Omega$$

$$R_1 \text{ and } R_{234567} \text{ in series: } R_{eq} = R_{1234567} = R_1 + R_{234567} = 100\Omega + 100\Omega = 200\Omega$$

2. What is the total current produced by the battery?

$$I_{total} = \frac{V}{R_{eq}} = \frac{10V}{200\Omega} = 0.050A = 50mA$$

3. What is the current that flows through resistor R_6 ?

$$V_{R_1} = I_{total}R_1 = 0.050A \times 100\Omega = 5V$$

$$V_{R_{567}} = V_{R_{234}} = V - V_{R_1} = 10V - 5V = 5V$$

$$I_{R_{567}} = I_{R_6} = \frac{V_{R_{567}}}{R_{567}} = \frac{5V}{300\Omega} = 0.0167A = 16.7mA$$

4. What is the potential drop across resistor R_2 ?

$$I_{total} = I_{R_{567}} + I_{R_{234}} \rightarrow I_{R_{234}} = I_{total} - I_{R_{567}} = 0.050A - 0.0167A = 0.0333A = 33.3mA$$

$$I_{R_{234}} = I_{R_2} + I_{R_3} = 2I_{R_2} \rightarrow I_{R_2} = \frac{I_{R_{234}}}{2} = \frac{0.0333A}{2} = 0.0167A$$

$$V_{R_2} = I_{R_2}R_2 = 0.0167A \times 100\Omega = 1.67V$$

5. What fraction of the energy produced per second by the battery is dissipated as heat across resistor R_1 ?

$$\frac{P_{R_1}}{P_{Req}} = \frac{I_{total}^2 R_1}{I_{total}^2 R_{eq}} = \frac{R_1}{R_{eq}} = \frac{100\Omega}{200\Omega} = 0.5$$