PhyzJob: Series Circuits
NUMBER PUZZLES

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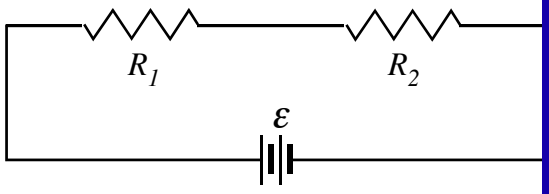
Apply Ohm's law, Joule's law, and your understanding of the nature of series circuits to solve the numerical problems that follow.

Ex. If $\mathcal{E} = 12$ V, $R_1 = 3.0\ \Omega$ and $R_2 = 6.0\ \Omega$, what is
a. the equivalent resistance of the circuit?
b. the total current in the circuit?
c. the power dissipated in R_1?
d. the voltage across R_2?



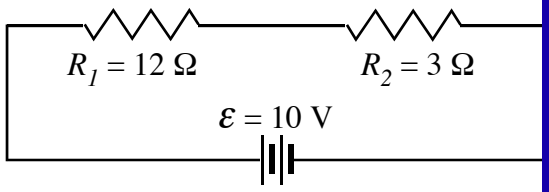
a. $R_{EQ} = R_1 + R_2$ (for series circuit)
$R_{EQ} = 3.0\ \Omega + 6.0\ \Omega$
$R_{EQ} = 9.0\ \Omega$

b. $I = \mathcal{E}/R_{EQ}$
$I = 12\ V / 9.0\ \Omega$
$I = 1.3$ A

c. $P_1 = I^2R_1$
$P_1 = (1.3\text{ A})^2 \cdot 3.0\ \Omega$
$P_1 = 5.1$ W

d. $V_2 = IR_2$
$V_2 = 1.3\text{ A} \cdot 6.0\ \Omega$
$V_2 = 8.0$ V

1. If $\mathcal{E} = 10$ V, $R_1 = 12\ \Omega$ and $R_2 = 3.0\ \Omega$, what is
a. the equivalent resistance of the circuit?
b. the total current in the circuit?
c. the power dissipated in R_1?
d. the voltage across R_2?



a. $R_{EQ} = R_1 + R_2$ (for series circuit)
$R_{EQ} = 12\ \Omega + 3.0\ \Omega$
$R_{EQ} = 15\ \Omega$

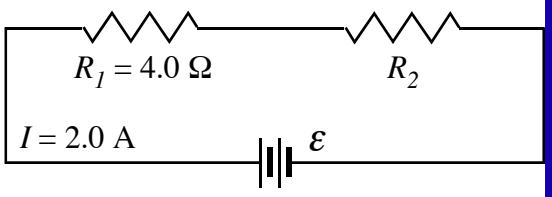
b. $I = \mathcal{E}/R_{EQ}$
$I = 10\ V / 15\ \Omega$
$I = 0.67$ A

c. $P_1 = I^2R_1$
$P_1 = (0.67\text{ A})^2 \cdot 12\ \Omega$
$P_1 = 5.4$ W

d. $V_2 = IR_2$
$V_2 = 0.67\text{ A} \cdot 3\ \Omega$
$V_2 = 2.0$ V

1.a. 15 Ω b. 0.67 A c. 5.4 W d. 2.0 V

2. If $I = 2.0$ A, $R_1 = 4.0\ \Omega$, and $V_2 = 5.0$ V, what is
a. the voltage across R_1?
b. the resistance of R_2?
c. the power dissipated in the circuit?
d. the voltage of the battery?



a. $V_1 = IR_1$
$V_1 = 2.0\ A \cdot 4.0\ \Omega$
$V_1 = 8.0\ V$

b. $R_2 = V_2/I$
$R_2 = 5.0\ V / 2.0\ A$
$R_2 = 2.5\ \Omega$

c. $P_{TOT} = I^2R_{EQ}$
$P_{TOT} = (2.0\ A)^2(4\ \Omega + 2.5\ \Omega)$
$P_{TOT} = 26\ W$

d. $\mathcal{E} = IR_{EQ}$
$\mathcal{E} = 2.0\ A \cdot (4\ \Omega + 2.5\ \Omega)$
$\mathcal{E} = 13\ V$

3. If $\mathcal{E} = 24$ V, $R_1 = 8.0\ \Omega$, and $R_2 = 6.0\ \Omega$, what is the current through R_2?

$I = \mathcal{E}/R_{EQ}$
$I = 24\ V / (8\ \Omega + 6\ \Omega)$
$I = 1.7\ A$

4. If $\mathcal{E} = 9.0$ V, $R_1 = 5.0\ \Omega$, and $R_2 = 13\ \Omega$, what is the power dissipated in the circuit?

$P_{TOT} = \mathcal{E}^2/R_{EQ}$
$P_{TOT} = (9\ V)^2 / (5\ \Omega + 13\ \Omega)$
$P_{TOT} = 4.5\ W$

5. If $I = 0.75$ A, $R_1 = 6\ \Omega$, and $R_2 = 15\ \Omega$, what is the voltage
a. across R_1?
b. across R_2?
c. of the battery?

a. $V_1 = IR_1 = 0.75\ A \cdot 6\ \Omega = 4.5\ V$

b. $V_2 = IR_2 = 0.75\ A \cdot 15\ \Omega = 11.3\ V$

c. $\mathcal{E} = V_1 + V_2 = 4.5\ V + 11.3\ V = 15.8\ V$

2. a. 8.0 V b. 2.5 Ω c. 26 W d. 13 V 3. 1.7 A 4. 4.5 W 5. a. 4.5 V b. 11.3 V c. 15.8 V