PhyzJob: Series Circuits
NUMBER PUZZLES

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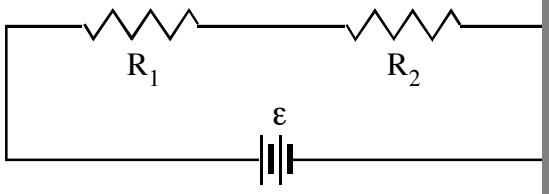
Apply Ohm's law, Joule's law, and your understanding of the nature of series circuits to solve the numerical problems that follow.

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?



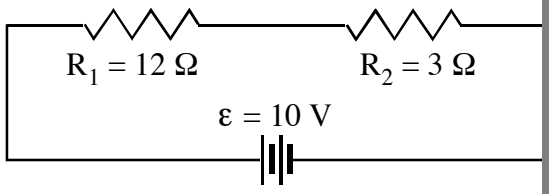
a. $R_{EQ} = R_1 + R_2$ (for series circuit)
$R_{EQ} = 3.0 + 6.0$
$R_{EQ} = 9.0$

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

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

d. $V_2 = IR_2$
$V_2 = 1.3\ A \cdot 6.0$
$V_2 = 8.0\ V$

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?



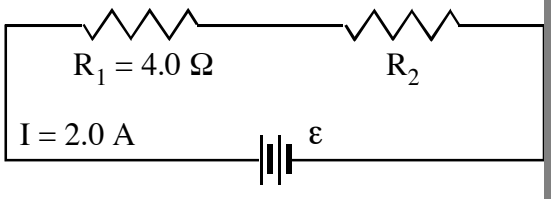
a. $R_{EQ} = R_1 + R_2$ (for series circuit)
$R_{EQ} = 12 + 3.0$
$R_{EQ} = 15$

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

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

d. $V_2 = IR_2$
$V_2 = 0.67\ A \cdot 3$
$V_2 = 2.0\ V$

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

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

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

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

1.a. 15 Ω b. 0.67 A c. 5.4W d. 2.0V 2.a. 8.0V b. 2.5 Ω c. 26W d. 13V

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

$I = \varepsilon / R_{EQ}$
$I = 24\ V / (8 \quad + 6 \quad)$
$I = 1.7\ A$

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

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

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

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

c. $\varepsilon = V_1 + V_2 = 4.5\ V + 11.3\ V = 15.8\ V$