PhyzJob: Parallel Circuits
NUMBER PUZZLES

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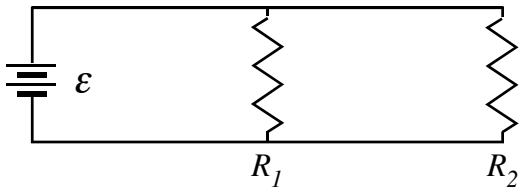
Apply Ohm's law, Joule's law, and your understanding of the nature of parallel circuits to solve the numerical problems that follow.

Ex. If $\varepsilon = 8$ V, $R_1 = 12\ \Omega$ 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 current through R_2?



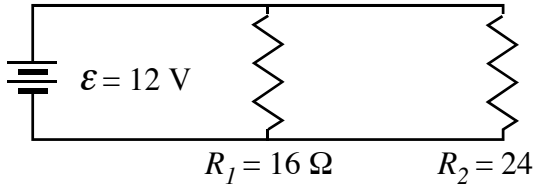
a. $R_{EQ} = R_1R_2 / (R_1 + R_2)$
$R_{EQ} = 12\ \Omega \cdot 6\ \Omega / (12\ \Omega + 6\ \Omega)$
$R_{EQ} = 4\ \Omega$

b. $I_{TOT} = \varepsilon / R_{EQ}$
$I_{TOT} = 8\ V / 4\ \Omega$
$I_{TOT} = 2\ A$

c. $P_1 = \varepsilon^2 / R_1$
$P_1 = (8\ V)^2 / 12\ \Omega$
$P_1 = 5.3\ W$

d. $I_2 = \varepsilon / R_2$
$I_2 = 8\ V / 6\ \Omega$
$I_2 = 1.3\ A$

1. If $\varepsilon = 12$ V, $R_1 = 16\ \Omega$ and $R_2 = 24\ \Omega$, 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 current through R_2?



a. $R_{EQ} = R_1R_2 / (R_1 + R_2)$
$R_{EQ} = 16\ \Omega \cdot 24\ \Omega / (16\ \Omega + 24\ \Omega)$
$R_{EQ} = 9.6$

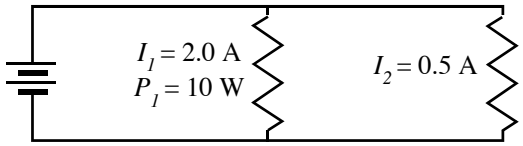
b. $I_{TOT} = \varepsilon / R_{EQ}$
$I_{TOT} = 12\ V / 9.6\ \Omega$
$I_{TOT} = 1.3\ A$

c. $P_1 = \varepsilon^2 / R_1$
$P_1 = (12\ V)^2 \cdot 16\ \Omega$
$P_1 = 9.0\ W$

d. $I_2 = \varepsilon / R_2$
$I_2 = 12\ V / 24\ \Omega$
$I_2 = 0.5\ A$

1.a 9.6 Ω b. 1.3 A c. 9.0 W d. 0.5 A

2. If $I_1 = 2.0$ A, $P_1 = 10$ W, and $I_2 = 0.5$ A, what is
a. the voltage across R_1?
b. the resistance of R_2?
c. the power dissipated in the circuit?
d. the equivalent resistance of the circuit?



a. $V_1 = P_1/I_1$
$V_1 = 10$ A / 2.0 A
$V_1 = 5.0$ V

b. $R_2 = \varepsilon/I_2$
$R_2 = 5.0$ V / 0.5 A
$R_2 = 10\ \Omega$

c. $P_{TOT} = I_{TOT}\,\varepsilon$
$P_{TOT} = (2.0$ A + 0.5 A) · 5 V
$P_{TOT} = 13$ W

d. $R_{EQ} = \varepsilon/I_{TOT}$
$R_{EQ} = 5$ V / (2.5 A)
$R_{EQ} = 2\ \Omega$

3. If $I_1 = 1.5$ A, $R_1 = 8.0\ \Omega$, and $R_2 = 6.0\ \Omega$, what is the voltage across R_2?

$V_2 = V_1 = I_1R_1$
$V_2 = 1.5$ A · 8 Ω
$V_2 = 12$ V

4. If $\varepsilon = 9.0$ V, $I_1 = 0.4$ A, and $I_2 = 1.2$ A, what is the power dissipated in the circuit?

$P_{TOT} = I_{TOT}\varepsilon$
$P_{TOT} = (0.4$ A + 1.2 A) · 9 V
$P_{TOT} = 14$ W

5. If $\varepsilon = 32$ V, $R_1 = 18\ \Omega$, and $P_2 = 48$ W, what is the current
a. through R_1?
b. through R_2?
c. through the battery (total current in the circuit)?

a. $I_1 = \varepsilon / R_1 = 32$ V / 18 Ω = 1.8 A

b. $I_2 = P_2 / \varepsilon = 48$ W / 32 V = 1.5 A

c. $I_{TOT} = I_1 + I_2 = 1.8$A + 1.5 A = 3.3 A

2. a. 5 V b. 10 Ω c. 13 W d. 2.5 Ω 3. 12 V 4. 14 W 5. a. 1.8 A b. 1.5 A c. 3.3 A