PhyzJob: Parallel Circuits
NUMBER PUZZLES

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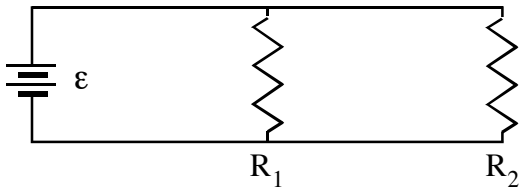
Apply Ohm's law, Joule's law, and your understanding of the nature of parallel circuits to solve the numerical problems that follow.

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?



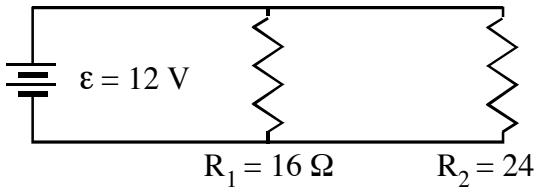
a. $R_{EQ} = R_1R_2 / (R_1 + R_2)$
$R_{EQ} = 12 \cdot 6 / (12 + 6)$
$R_{EQ} = 4$

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

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

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



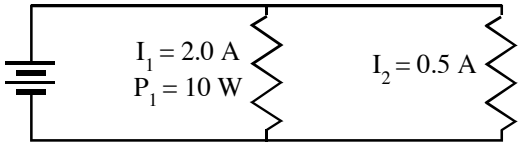
a. $R_{EQ} = R_1R_2 / (R_1 + R_2)$
$R_{EQ} = 16 \cdot 24 / (16 + 24)$
$R_{EQ} = 9.6$

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

c. $P_1 = \varepsilon^2 / R_1$
$P_1 = (12\ V)^2 \cdot 16$
$P_1 = 9$ W

d. $I_2 = \varepsilon / R_2$
$I_2 = 12\ V / 24$
$I_2 = 0.5$ 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. $R_2 = \varepsilon / I_2$
$R_2 = 5.0\ V / 0.5\ A$
$R_2 = 10$

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

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

1.a. 9.6 Ω b. 1.3 A c. 9 W d. 0.5 A 2.a. 5.5 V b. 10 Ω c. 13 W d. 2 Ω

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

$V_2 = V_1 = I_1R_1$
$V_2 = 1.5\ A \cdot 8$
$V_2 = 12\ V$

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

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

5. If ε = 32 V, R_1 = 18 Ω, 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. $I_1 = \varepsilon / R_1 = 32\ V / 18 \quad = 1.8\ A$

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

c. ITOT = I1 + I2 = 1.8A + 1.5 A = 3.3 A

3.12V 4.14W 5.a.1.8A b.1.5A c.3.3A