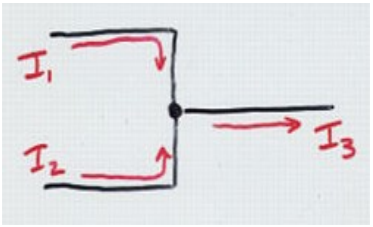
Kirchoff's Laws for Circuit Analysis

SPH4C

At any junction point in an electrical circuit,

the _____ the junction equals the

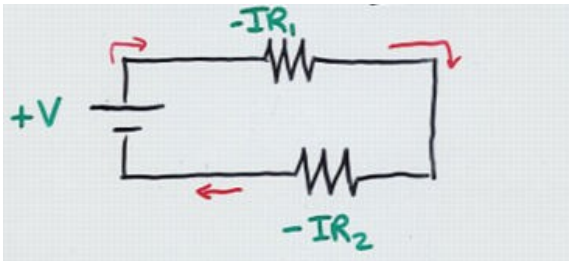
_____ the junction.



In any complete path in an electrical circuit,

the _____ equals the

_____.



The Laws for a Series Circuit

The current is _____ at all points in the circuit:

The total voltage supplied to the circuit is equal to the sum of the voltage drops across the individual loads:

$$V_T = V_1 + V_2 + \ldots$$

Given this, from Ohm's Law, $V = IR$

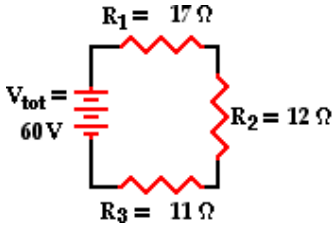
$$I_T R_T = I_1 R_1 + I_2 R_2 + \ldots$$

Since $I_T = I_1 = I_2 = \ldots = I$,

$$I R_T = I R_1 + I R_2 + \ldots$$

Divide all terms by I and the equivalent resistance is the _____:

Example:



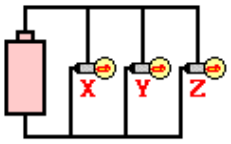
R_{eq} = _____ Ω I_{tot} = _____ A

I_1 = _____ A V_1 = _____ V

I_2 = _____ A V_2 = _____ V

I_3 = _____ A V_3 = _____ V

The Laws for a Parallel Circuit



At a junction:

$$I_T = I_1 + I_2 = \ldots$$

But the total voltage across each of the branches is _____:

Given $I_T = I_1 + I_2 + \ldots$

From Ohm's Law, $V = IR$ *or* $I = V/R$

$$V_T/R_T = V_1/R_1 + V_2/R_2 + \ldots$$

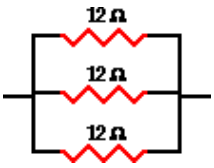
Since $V_T = V_1 = V_2 = \ldots = V$

$$V/R_T = V/R_1 + V/R_2 + \ldots$$

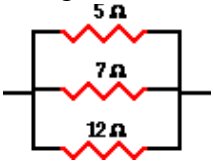
Divide all terms by V and the _____ of equivalent resistance is the sum of the

_____ of the individual resistances:

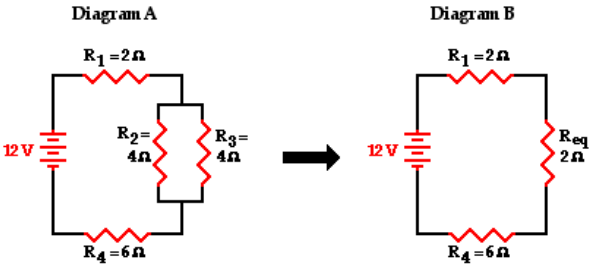
Example: Find the equivalent resistance of



Example: Find the equivalent resistant of



What do we do if a circuit has both series and parallel loads? Find the equivalent resistance of the loads in parallel and continue the analysis.



More Practice

Match each of the configurations of resistors on the left to their equivalent resistance on the right.

_____ two 12Ω resistors in series	A. 2Ω
_____ two 12Ω resistors in parallel	B. 4Ω
_____ a 12Ω resistor and 6Ω resistor in series	C. 6Ω
_____ a 12Ω resistor and 6Ω resistor in parallel	D. 18Ω
_____ 12Ω, 6Ω, and 4Ω resistors in series	E. 22Ω
_____ 12Ω, 6Ω, and 4Ω resistors in parallel	F. 24Ω

1. 60 V is supplied to a circuit with a 10-Ω resistor and a 20-Ω resistor in parallel. The voltage drop across the resistors is:

   A. 10 V across the 10-Ω resistor and 20 V across the 20-Ω resistor
   B. 20 V across the 10-Ω resistor and 40 V across the 20-Ω resistor
   C. 30 V across each resistor
   D. 60 V across each resistor

2. In the previous question, if I_{10} is the current across the 10-Ω resistor and I_{20} is the current across the 20-Ω resistor, which of the following is true?

   A. $I_{10} < I_{20}$ B. $I_{10} > I_{20}$ C. $I_{10} = I_{20}$ D. It cannot be determined.

3. 60 V is supplied to a circuit with a 10-Ω resistor and a 20-Ω resistor in series. The voltage drop across the resistors is:

   A. 10 V across the 10-Ω resistor and 20 V across the 20-Ω resistor
   B. 20 V across the 10-Ω resistor and 40 V across the 20-Ω resistor
   C. 30 V across each resistor
   D. 60 V across each resistor

4. In the previous question, if I_{10} is the current across the 10-Ω resistor and I_{20} is the current across the 20-Ω resistor, which of the following is true?

   A. $I_{10} < I_{20}$ B. $I_{10} > I_{20}$ C. $I_{10} = I_{20}$ D. It cannot be determined.

5. Is the total current around the circuit greater in Question 1 or in Question 3?

   A. Question 1 B. Question 3 C. It's the same. D. It cannot be determined.