16.5
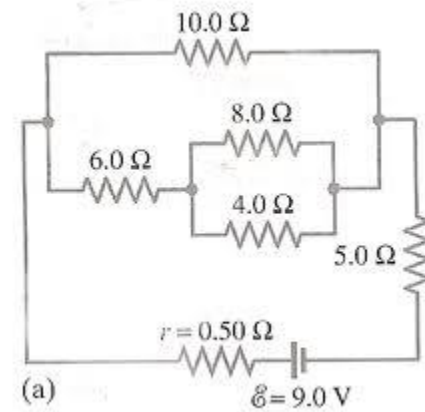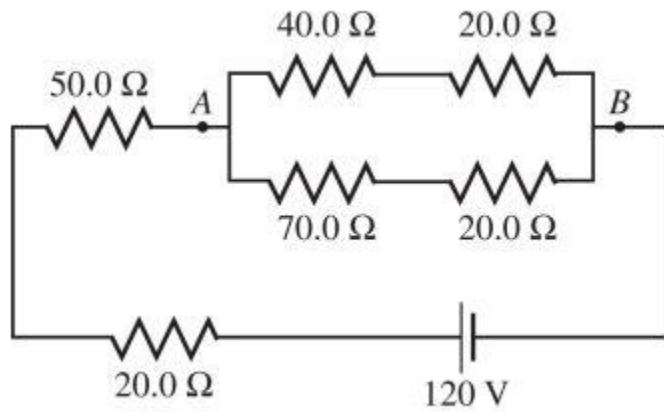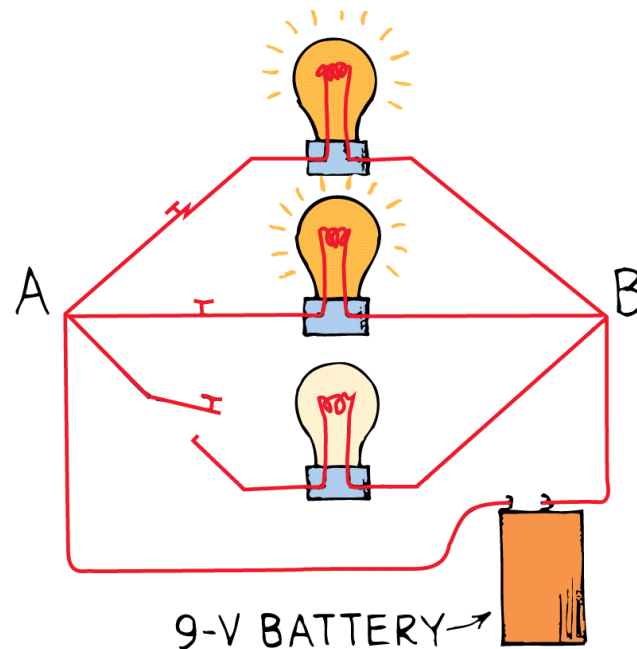# Parallel Circuits

Parallel Circuits

In a **parallel circuit** having three lamps, each electric device has its own path from one terminal of the battery to the other.
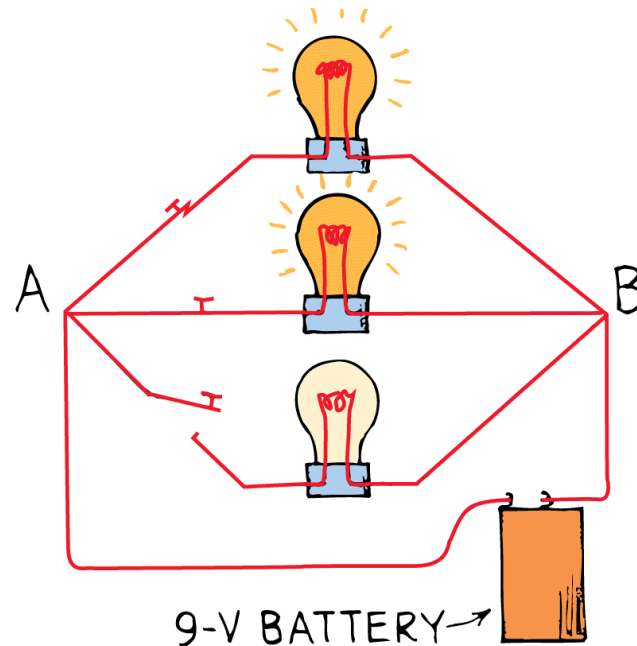
There are **separate pathways** for current, one through each lamp.


9-V BATTERY→

Parallel Circuits

In contrast to a series circuit, the parallel circuit is completed whether all, two, or only one lamp is lit.

A break in any one path does not interrupt the flow of charge in the other paths.

Parallel Circuits

In this parallel circuit, a 9-volt battery provides 9 volts across each activated lamp. (Note the open switch in the lower branch.)
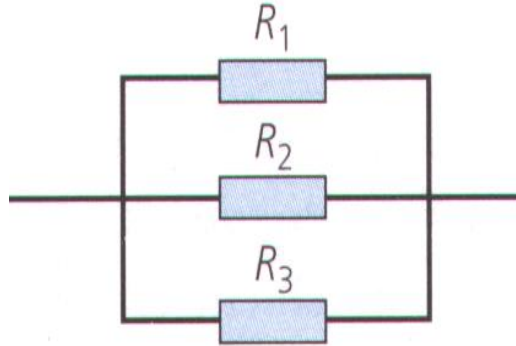

A   B

9-V BATTERY→
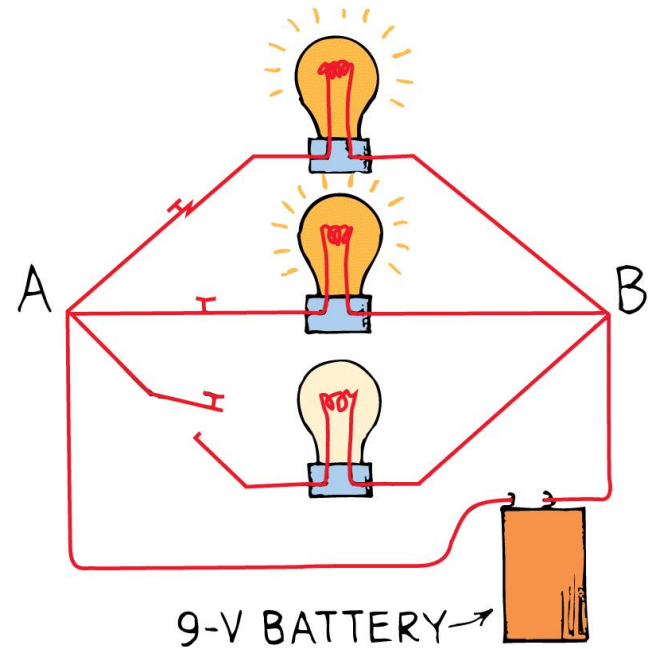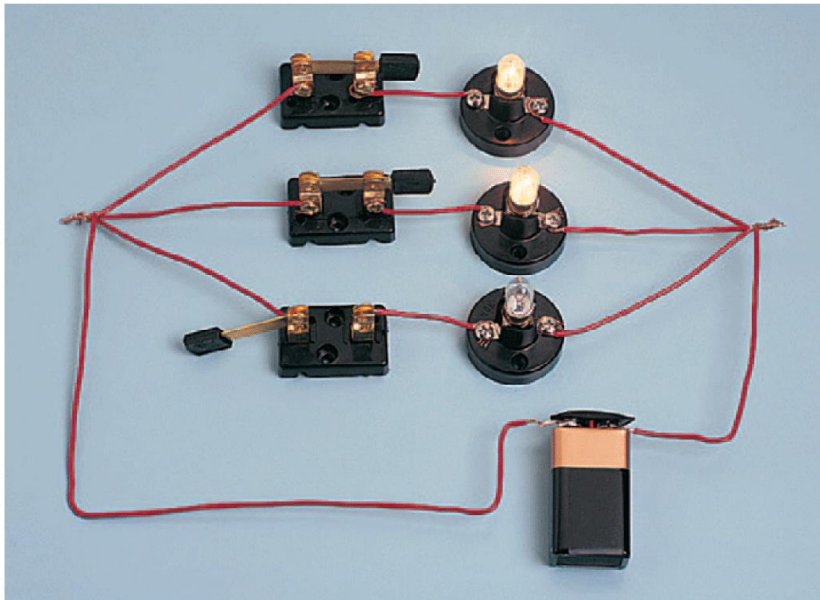
Parallel Circuits

CONCEPT CHECK: **What happens if one device in a parallel circuit fails?**

A break in any one path does not interrupt the flow of current in the other paths.
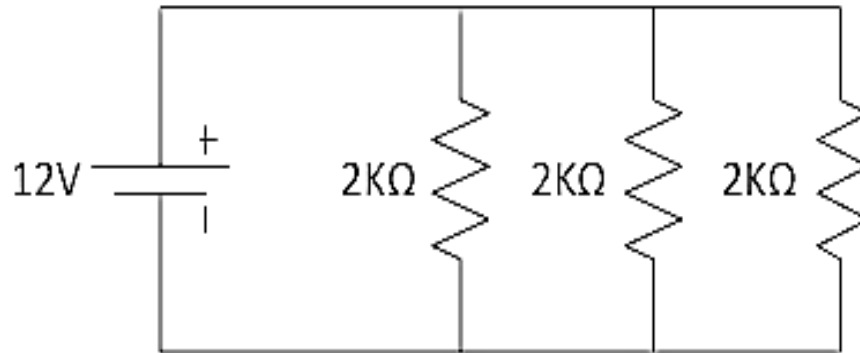
Resistance in a Parallel Circuit

The reciprocal of the total resistance is equal to the sum of the reciprocals of individual resistance.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$
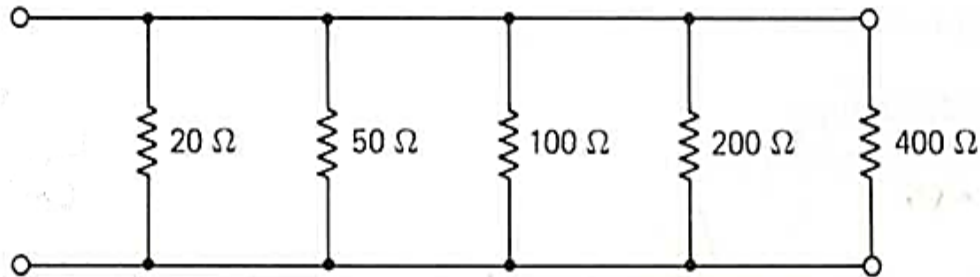
Resistance in a Parallel Circuit

Example #1

What is the equivalent resistance of the following circuit?

Resistance in a Parallel Circuit
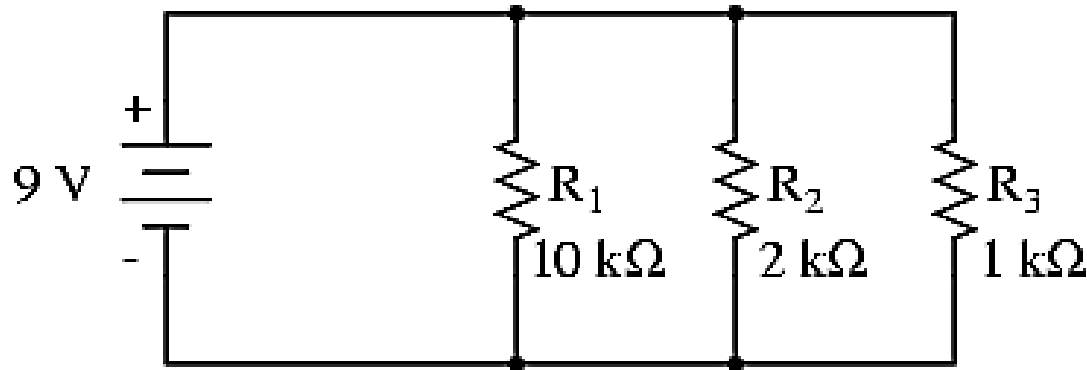
<u>**Example #2:**</u>

What is the equivalent resistance of the following:
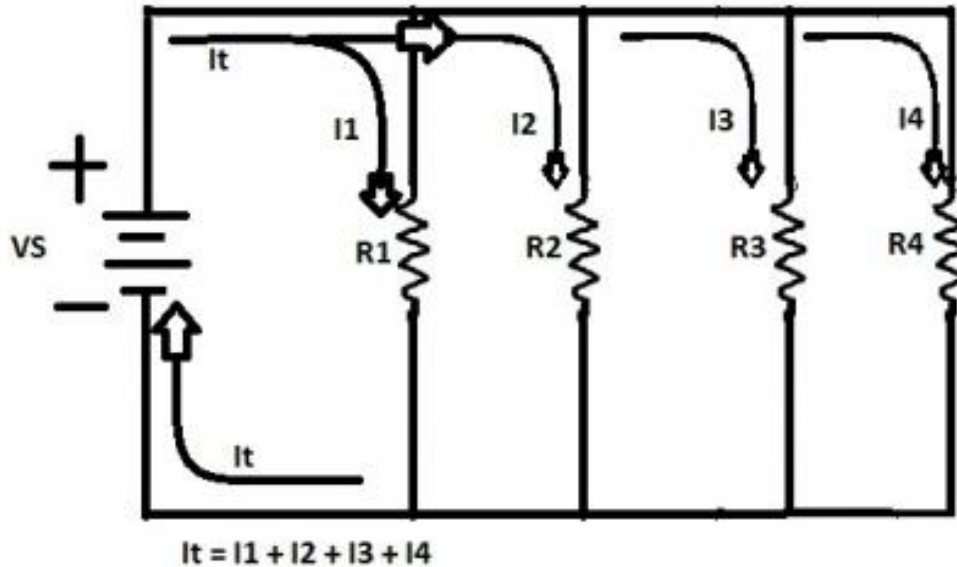
Voltage in a Parallel Circuit

Each device connects the same two points A and B of the circuit. The voltage is therefore the same across each device.
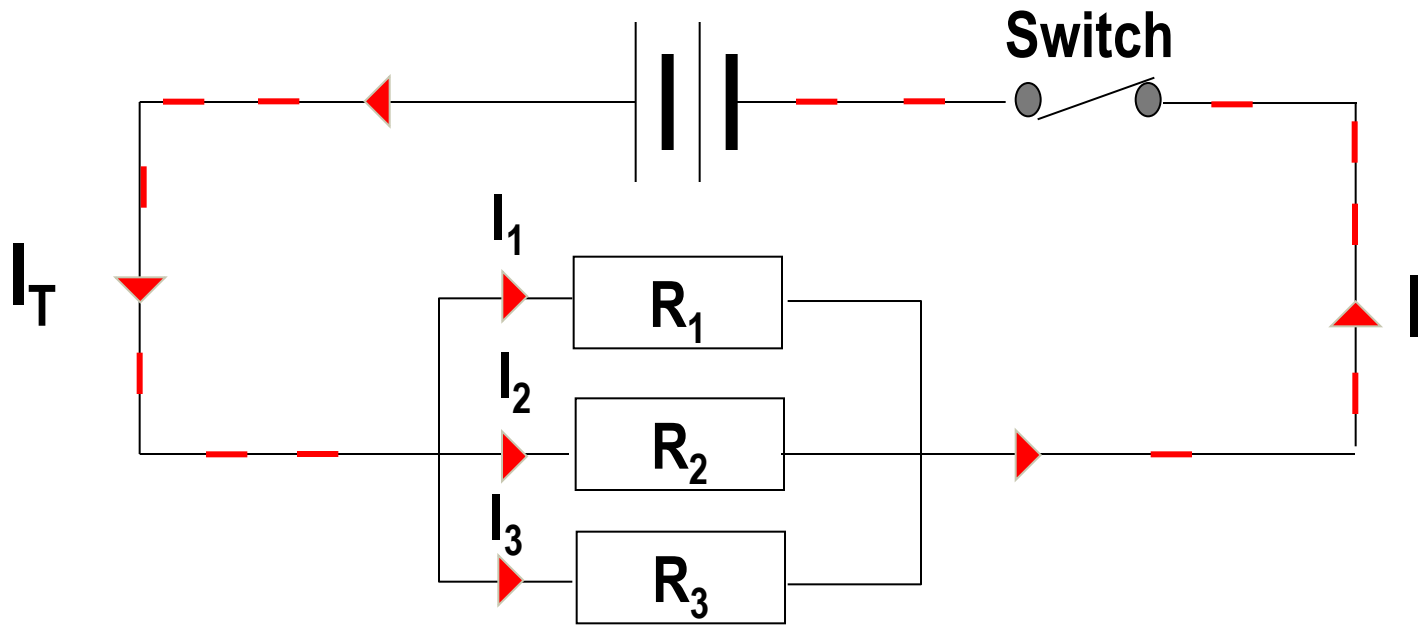
($V_T = V_1 = V_2 = V_3$)

Current in a Parallel Circuit

- The total current divides among the parallel branches

- The total current is the sum of the currents in its branches.

$$It = I1 + I2 + I3 + I4$$

Current in a Parallel Circuit

The main current is equal to the sum of the sub-currents

$$I_T = I_1 + I_2 + I_3$$
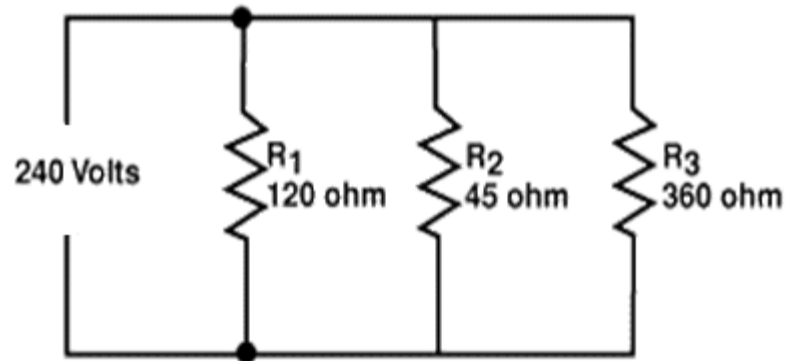
Parallel Circuits

CONCEPT CHECK

How are voltage, current and resistance calculated in a parallel circuit?

- *The voltage is the same across each device.*
- *The total current divides among the parallel branches.*
- *The total current is the sum of the currents in its branches.*
- *The reciprocal of the total resistance is equal to the sum of the reciprocals of individual resistance.*
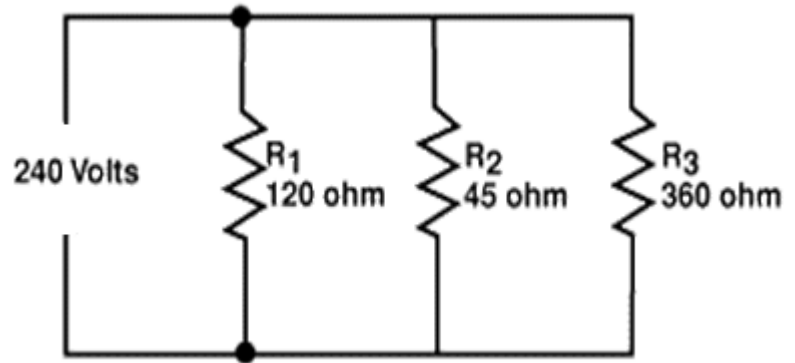
Parallel Circuits Assessment Questions

Example #3:

Use a VIRP table to calculate the values for the circuit below.

240 Volts

R₁ 120 ohm   R₂ 45 ohm   R₃ 360 ohm

Parallel Circuits Assessment Questions

Example #3

240 Volts, R_1 120 ohm, R_2 45 ohm, R_3 360 ohm

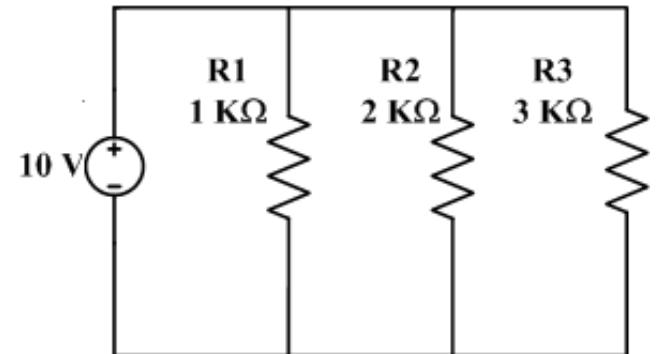| VIRP Table				
	V	I	R	P
R1				
R2				
R3				
Total				

Parallel Circuits Assessment Questions
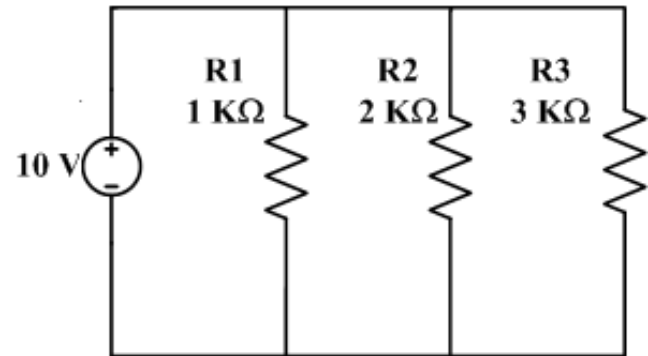
Example #4:

A 10-volt supply is supplied to three resistors of that are connected in parallel. Calculate:

a. The combined resistance
b. The total current flowing in circuit
c. The current in the 2-kΩ resistor
d. The power in the 3-kΩ resistor

Parallel Circuits Assessment Questions

Example #4:

VIRP Table				
	V	I	R	P
R1				
R2				
R3				
Total				