

Grade 9 Science

Electricity

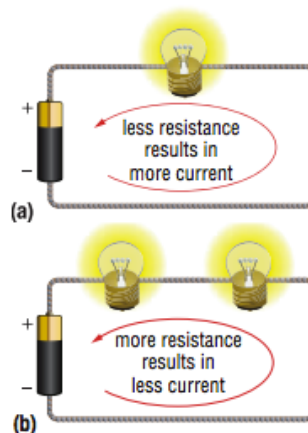
Class 13

Series and Parallel

Series - Current

- If Resistance increases, current decreases
- If Resistance decreases, current increases

$$R = \frac{V}{I}$$





Checkpoint



The same type of lamp is used in two series circuits. The first circuit has two identical lamps and the second circuit has three identical lamps. If each lamp has a resistance of 5Ω and the potential difference across the battery is 10V, calculate the current going through each circuit.

Series – Voltage

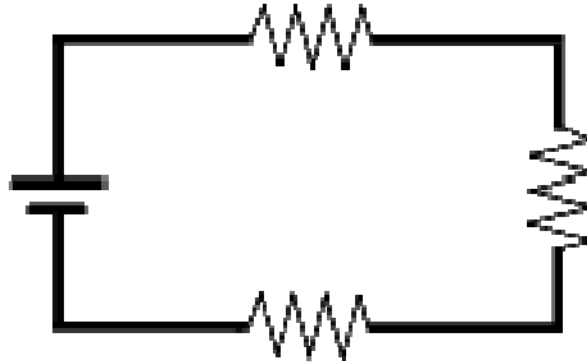
- The brightness of each lamp in a series decreases as you connect more lamps

$$V_{load} = \frac{V_{source}}{\# \text{ of identical loads}}$$

- A series circuit contains three identical lamps. The potential difference is 30V. Calculate the potential difference across each lamp.

Summary of Series

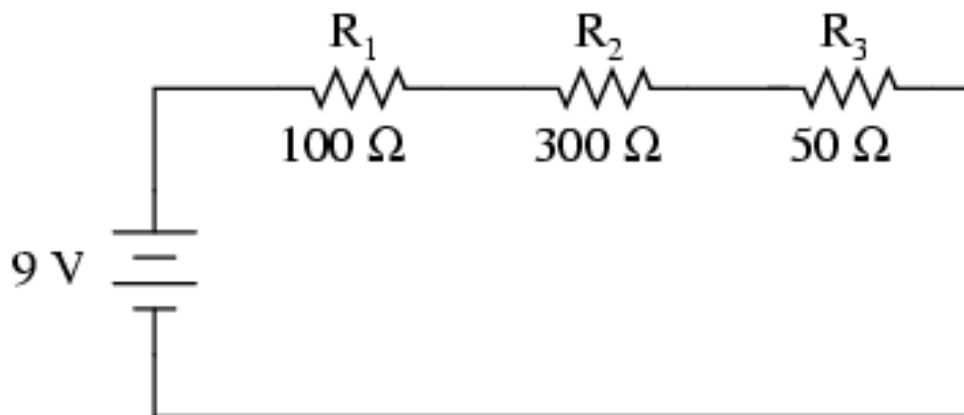
- Current (I) = stays the same
- Voltage (V) = changes
- Total Resistance (R) = $R_1 + R_2 + R_3 + \dots$



Checkpoint

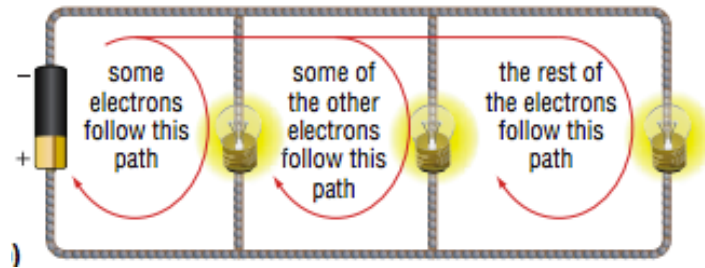


Find the V and I for each resistor.



Parallel – Current

- Current decreases with each branch in the circuit



$$I_{load} = \frac{I_{source}}{\# \text{ of identical loads}}$$

- The total resistance in a parallel circuit is 2Ω . The potential difference is 18V. Calculate the current through each lamp.

Parallel – Voltage

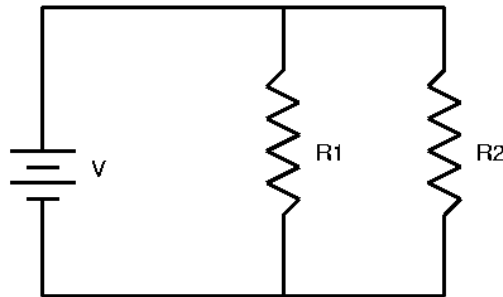
- Voltage does not change with new branches
- Brightness of each light bulb will not change in a parallel circuit

Table 1 The Relationships of Loads in Series and Parallel Circuits

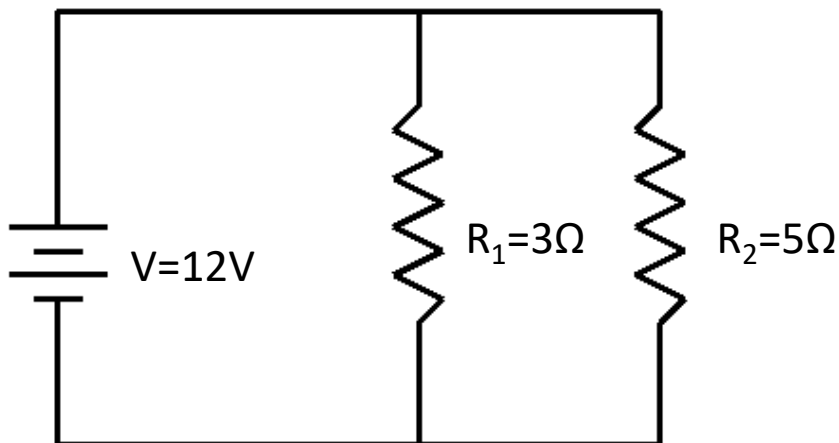
Quantity	Series circuits	Parallel circuits
total resistance of circuit (R_T)	increases	decreases
current through loads (I_{load})	I_{source} decreases as more loads are added	I_{source} splits among loads based on the number of branches in parallel
voltage across loads (V_{load})	V_{source} splits based on the number of loads	voltage of each parallel branch is the same as V_{source}

Summary of Parallel

- Current (I) = changes
- Voltage (V) = stays the same
- Resistance (R) =
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

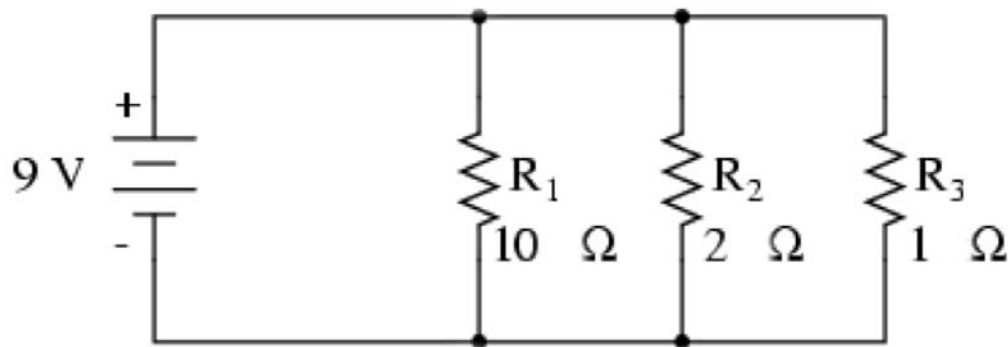


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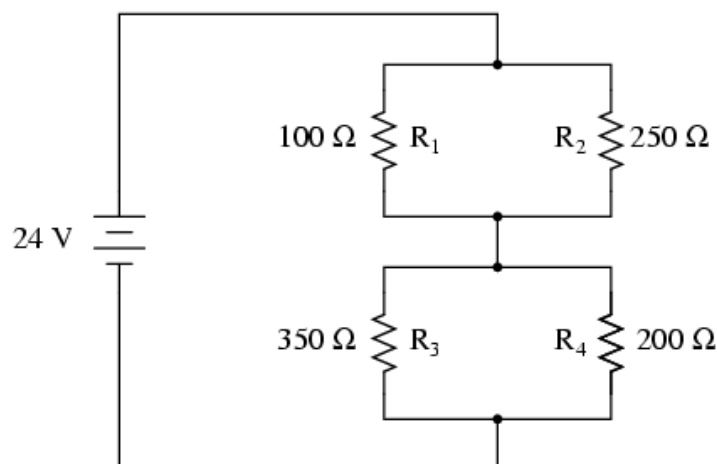


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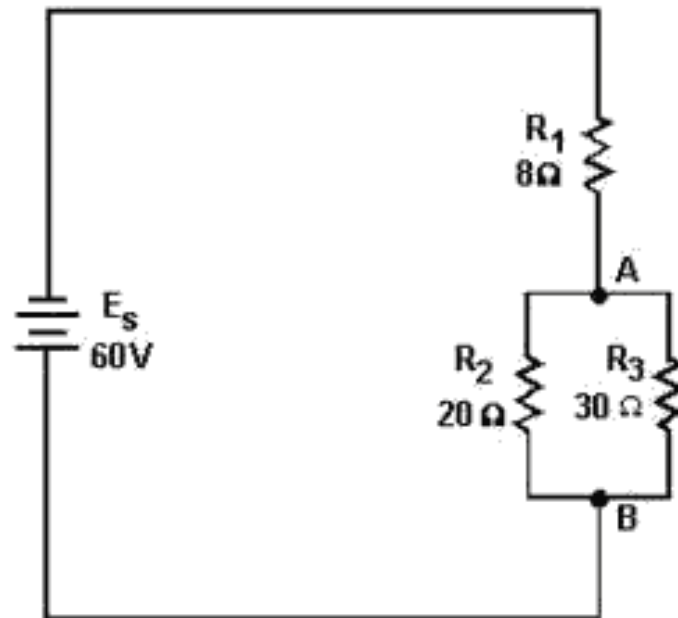
How do you calculate both?

- Calculate the parallel circuit first
- Calculate the series circuit second

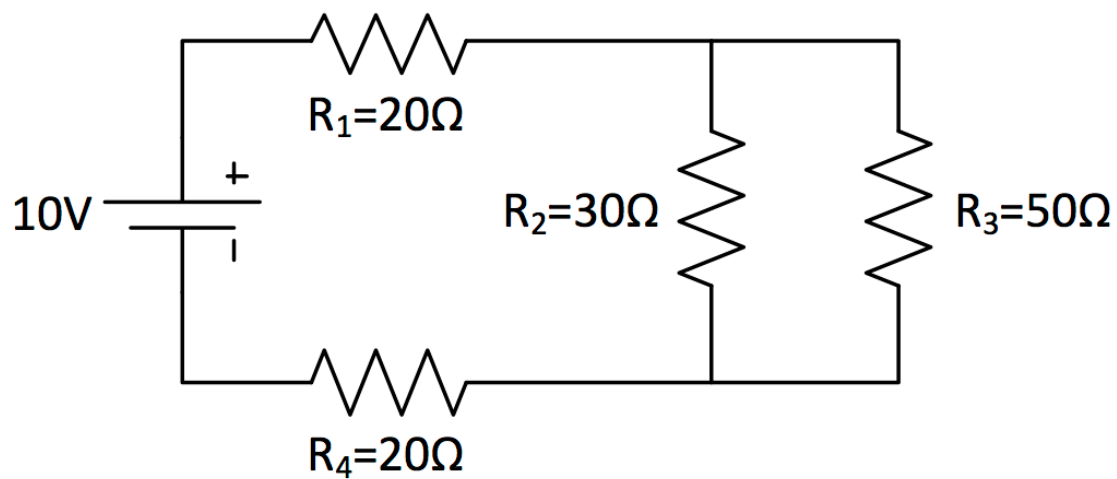




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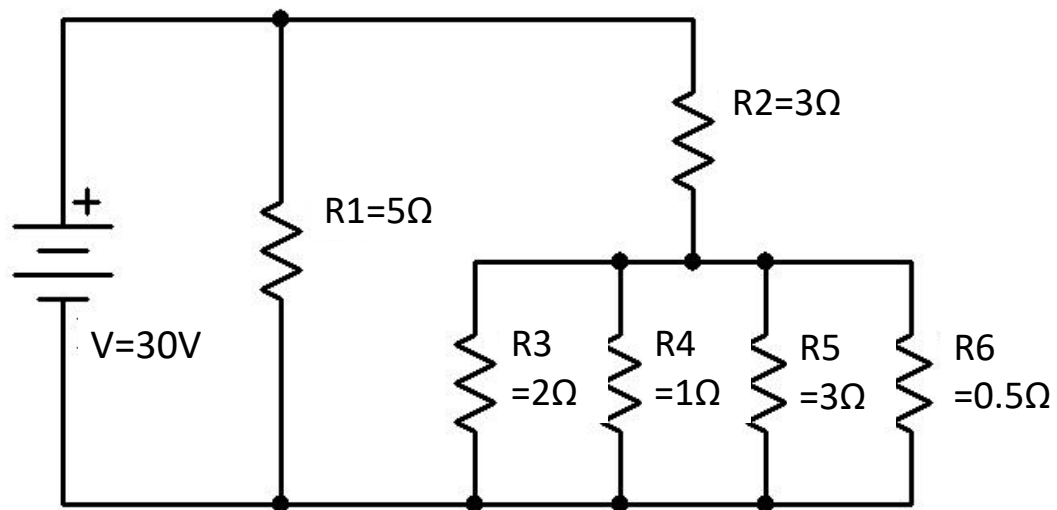


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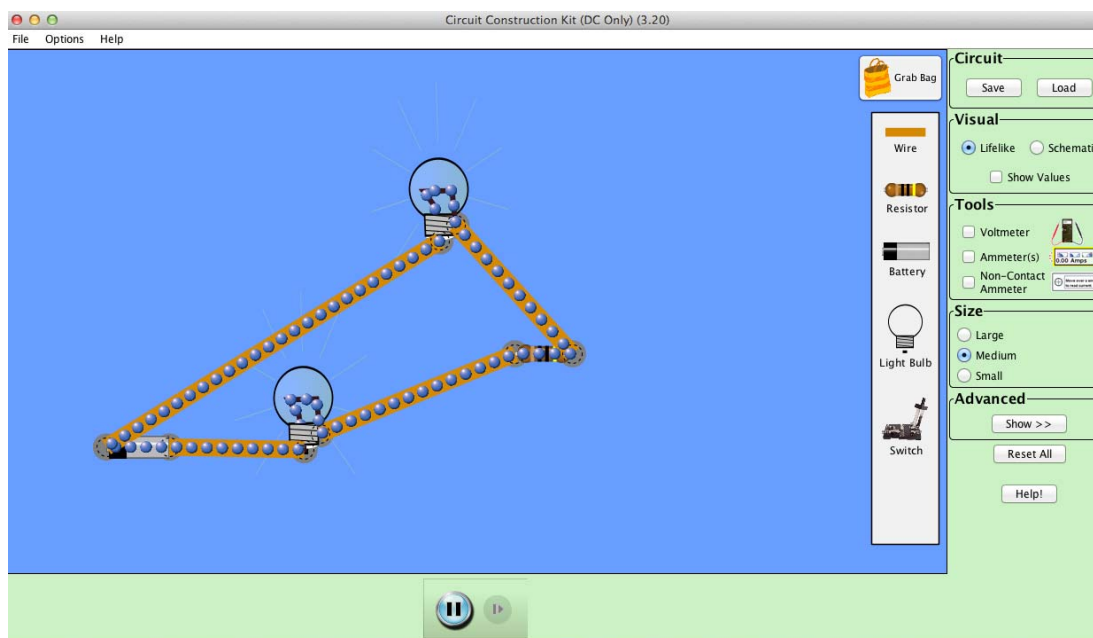


Checkpoint



PhET – Electric Circuit Online Simulator

<http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc>



Review

- 1) Draw diagrams to show how an object can be charged:
- Positively by temporary induction
 - Negatively by conduction
 - Neutral by grounding

Review

- 2) Determine the charge that each of these materials would receive:

- a) Polyester rubbed with nylon
- b) Wool rubbed with acetate
- c) Silk rubbed with glass
- d) Cotton rubbed with cotton

Table 1 Electrostatic Series

Material	Charge tendency
human skin	+ (weaker tendency to gain electrons)
rabbit fur	
acetate	
glass	
human hair	
nylon	
wool	
cat fur	
silk	
paper	
cotton	- (stronger tendency to gain electrons)
wood	
amber	
rubber balloon	
vinyl	
polyester	
ebonite	

Review

- 3) Calculate the percent efficiency of a motor that produces 4500J of mechanical energy while using 6500J of electrical energy.
- 3) Calculate the total annual cost of operating the electrical appliances below if the cost of electricity is \$0.11/kW•h
 - Stove (Power = 12000W; 300h/year)
 - Microwave (Power = 1000W; 12h/year)

Review

- 5) What are the advantages and disadvantages of using fossil-fuel generating stations?
- 6) Draw a circuit diagram for the following scenario:
 - A two-cell battery with three light bulbs in series and a switch
 - A two-cell battery with three light bulbs in parallel with a switch to control the first two lights only

Review

7) Draw a parallel circuit with a correctly placed ammeter, voltmeter and ohmmeter.

8) A microwave oven has a current of 5.0A going through it. It is plugged into a wall outlet with a voltage of 120V. Calculate the resistance of the oven.