Electricity and Magnetism: 4.F.1

Simple Circuits

Grade Level	4
Sessions	1 – 55 minutes each
Seasonality	N/A
Instructional Mode(s)	Small Group Activity
Team Size	2 – 4 students
WPS Benchmarks	04.SC.IS.03 04.SC.IS.06 04.SC.PS.05 04.SC.TE.02 04.SC.TE.04 04.SC.TE.05
MA Frameworks	3-5.IS.3 3-5.IS.6 3-5.PS.4 3-5.TE.1.2 3-5.TE.2.1 3-5.TE.2.2
Key Words	Electricity, Circuit, Circuit design

Summary

The students will learn about electrical circuits through investigation. The students will then practice what they have learned by completing a worksheet and building circuits. Then apply what they have learned while working on a design problem.

Learning Objectives

2002 Worcester Public Schools (WPS) Benchmarks for Grade 4

04.SC.IS.03 Keep accurate records while conducting simple investigations or experiments.

04.SC.IS.06 Record data and communicate findings to others using graphs, charts, maps, models, and oral and written reports.

04.SC.PS.05 Recognize that electricity in circuits requires a complete loop through which an electrical current can pass, and that electricity can produce light, heat and sound.

04.SC.TE.02 Identify and explain the appropriate materials and tools (e.g., hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) to construct a given prototype safely.
04.SC.TE.04 Identify a problem that reflects the need for shelter, storage, or convenience.
04.SC.TE.05 Describe different ways in which a problem can be represented (e.g., sketches, diagrams, graphic organizers, and lists).

Additional Learning Objectives

1. 3-5.IS.03 Keep accurate records while conducting simple investigations or experiments.
2. 3-5.IS.06 Record data and communicate findings to others using graphs, charts, maps, models, and oral and written reports.
3. 3-5.PS.4 Recognize that electricity in circuits requires a complete loop through which an electrical current can pass, and that electricity can produce light, heat and sound.
4. 3-5.TE.1.2 Identify and explain the appropriate materials and tools (e.g., hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) to construct a given prototype safely.
5. 3-5.TE.2.1 Identify a problem that reflects the need for shelter, storage, or convenience.
6. 3-5.TE.2.2 Describe different ways in which a problem can be represented (e.g., sketches, diagrams, graphic organizers, and lists).
7. Understand how to built an electrical circuit.

Required Background Knowledge

None

Essential Questions

1. What is a circuit?
2. What is electricity?

3. What is the different between an open circuit and a closed circuit?

Introduction / Motivation

* **This introduction requires an electrical device that only works when it is plugged in (electric pencil sharpener, radio, lamp, etc.).**

Ask the students what they know about electricity? Ask the students to point to something in the classroom that uses electricity. Demonstrate with an appliance that is plugged into an outlet. Unplug the appliance and ask the students if it'll work. Test the appliance. Based on that short experiment, what does that tell you about electricity? Tell the students that there is something flowing through the wire (and that electricity needs a complete circuit to flow, but that'll be covered later in the lesson).

Procedure

The instructor will:

1. Draw a picture of a simple circuit on the blackboard or display ***Electrical Circuit*** on the overhead. Ask if there are any questions. If not, ask one of the students to explain the drawing on the blackboard or the overhead. (5 minutes)
2. Ask the class if there is a difference between circuits built with batteries and circuits created when you plug something into a wall outlet. Draw a picture on the board of what the electrical path looks like for a simple appliance like a lamp to emphasize that there is a complete circuit for the electricity to flow. (5 minutes)
3. Pass out ***Will it work?*** for students to work on either in class or as a homework assignment. Go over the solutions to the worksheet if the students have completed it in class. (10 minutes)
4. Pass out ***Building Circuits*** for students to think through how each of the circuits will work before building. After the students have completed the worksheets discuss the answers as a class. (10 minutes)
5. Divide the students into groups and distribute materials. Have the students build each of the circuits on ***Building Circuits***. (10 minutes)

6. Tell the students that they will be working on a design problem to wire the lights in a home. Pass out the ***Home Lighting Design Challenge***. Have the students share their designs with other students. (15 minutes)

Materials List

Materials per group/student	Amount	Location
Battery	2	Electronics Store
Wires	4	Electronics Store
Light bulbs	2	Electronics Store

Vocabulary with Definitions

1. *Electricity* – The flow of electrons in a circuit.
2. *Electromagnets* – A magnetic field created by the flow of electricity.
3. *Magnet* – An object that attracts iron and steel and produces a magnetic field.

Assessment / Evaluation of Students

The instructor may assess the students in any/all of the following manners:
Check worksheets: ensure that students have a good understanding of electrical circuits.

Lesson Extensions

1. The instructor may want to discuss why the circuits on ***Building Circuits*** are connected to the bottom and side of light bulb bases (see ***How do light bulbs work?****).*
2. The instructor may want to talk about how electricity is created and travels to you school and home (see ***How does electricity get to your house?)***
3. The instructor may want to concentrate on having the students differentiate between a series and parallel circuit (see ***Types of Circuits***).

Attachments

1. **Electrical Circuit**
2. **How does electricity get to your house?**

3. **Will it work?**
4. **Building Circuits**
5. **Home Lighting Design Challenge**
6. **How do light bulbs work?**

Troubleshooting Tips

If there is no difference in the brightness of the light bulbs with each of the circuits, check the

Safety Issues

None

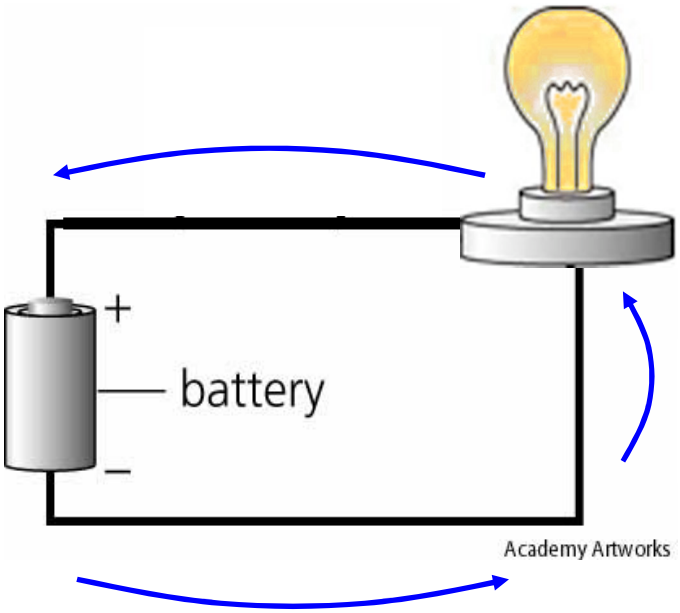
Additional Resources

None

Key Words

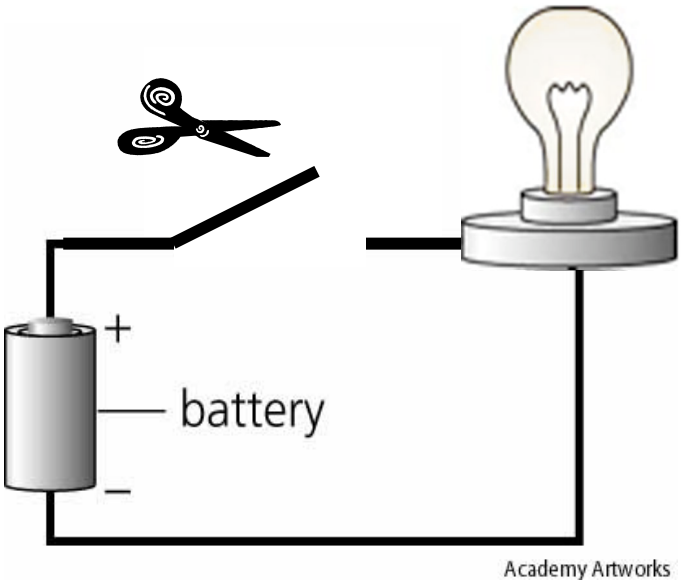
Electricity, Circuit, Circuit design

Electrical Circuit



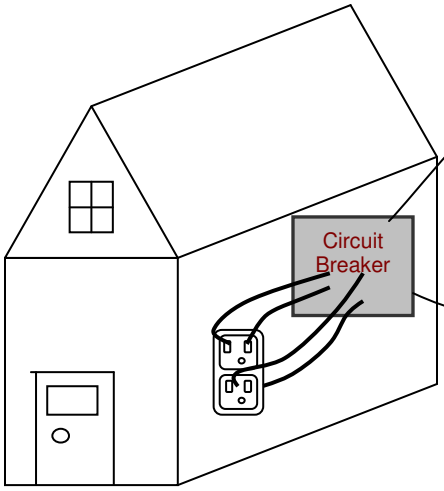
direction of flow of electrons

photo from: www.science-projects-for-kids.com



Why didn't the light bulb light in the second picture?

Answer: Electricity needs a complete circuit to flow. There isn't a complete circuit, so the electricity never made it to the light bulb.



How does electricity get to your house?

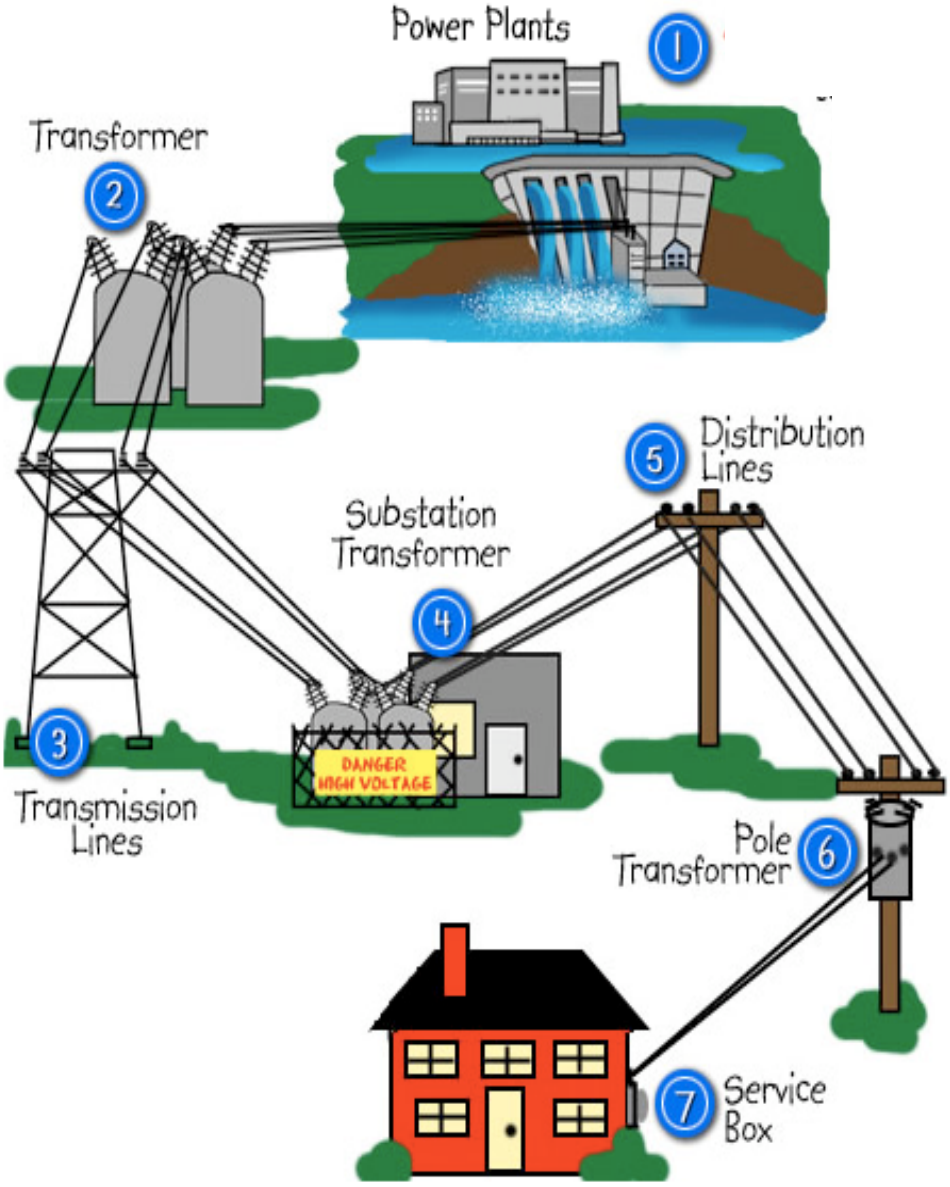


photo from: http://www.usgaselectric.com/id34.html

How does electricity get to your house?

Guide for schematic:

1. Electricity is created at power plants. This picture shows a power plant creating electricity from water power. Other examples of power plants are: Wind Power Plants, Solar Power Plants, Nuclear Power Plants, Coal Burning Power Plants.

2. The electricity then goes to a transformer which converts the electricity from a low voltage to a very high voltage to prepare it for the long journey to your home. (110000 and higher volts)

3. The electricity then begins it's long journey along transmission lines. You probably see these along most roads.

4. The next stop for the electricity is the substation transformer which steps the voltage of the electricity down in preparation for being used in your home.

5. From the substation transformer the electricity goes back to the transmission line to complete the journey to your house.

6. Before the electricity gets to your house there is one final stop the pole transformer.

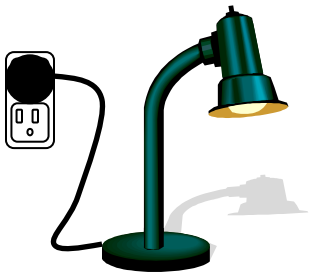
7. The electricity goes to the service box outside your house before reaching your outlets.

Name: _____ Date: _____

Will it work?

Directions: Below each picture fill in the black with “Will work” or “Will not work”.

1.



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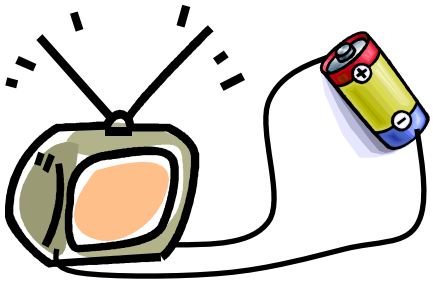
2.



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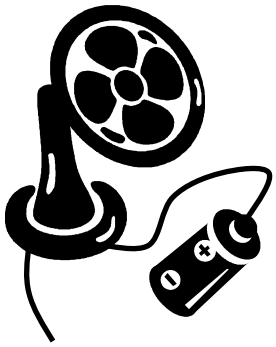
3.



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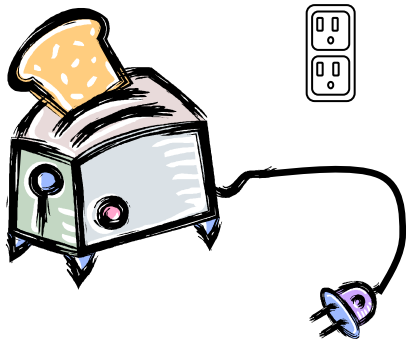
4.



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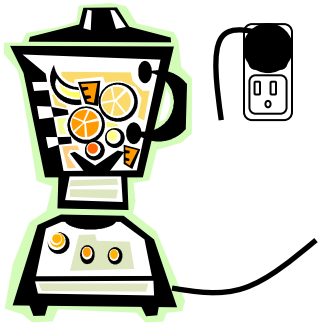
4.



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6.

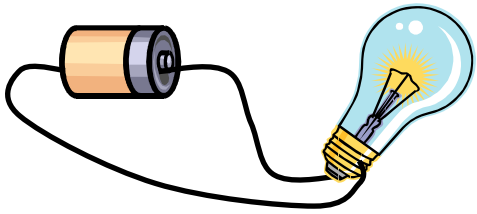
_____

Name: _____ Date: _____

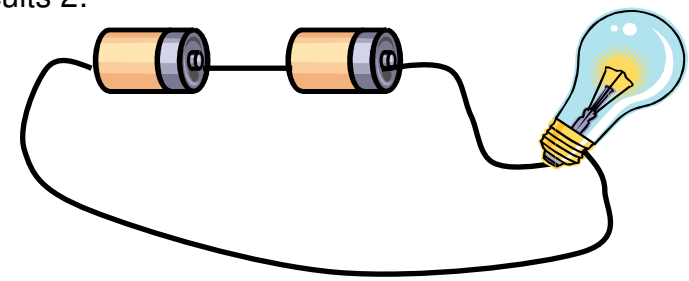
Building Circuits

Directions: Look at each circuit below and answer the questions.

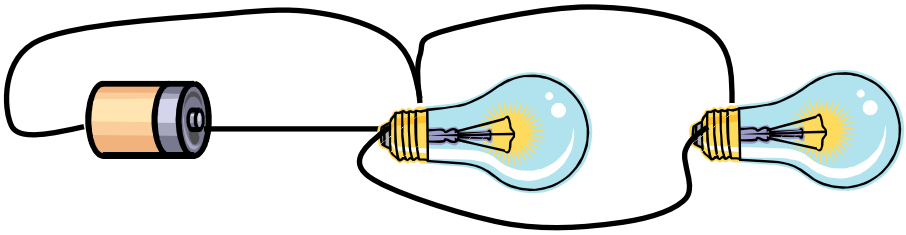
Circuit 1:



Circuits 2:



Circuit 3:



1. Will all of the light bulbs light? Why?

_____

_____

_____

2. Which circuit will produce the brightest light bulb?

_____

_____

_____

3. How could you make the light bulbs even brighter?

_____

_____

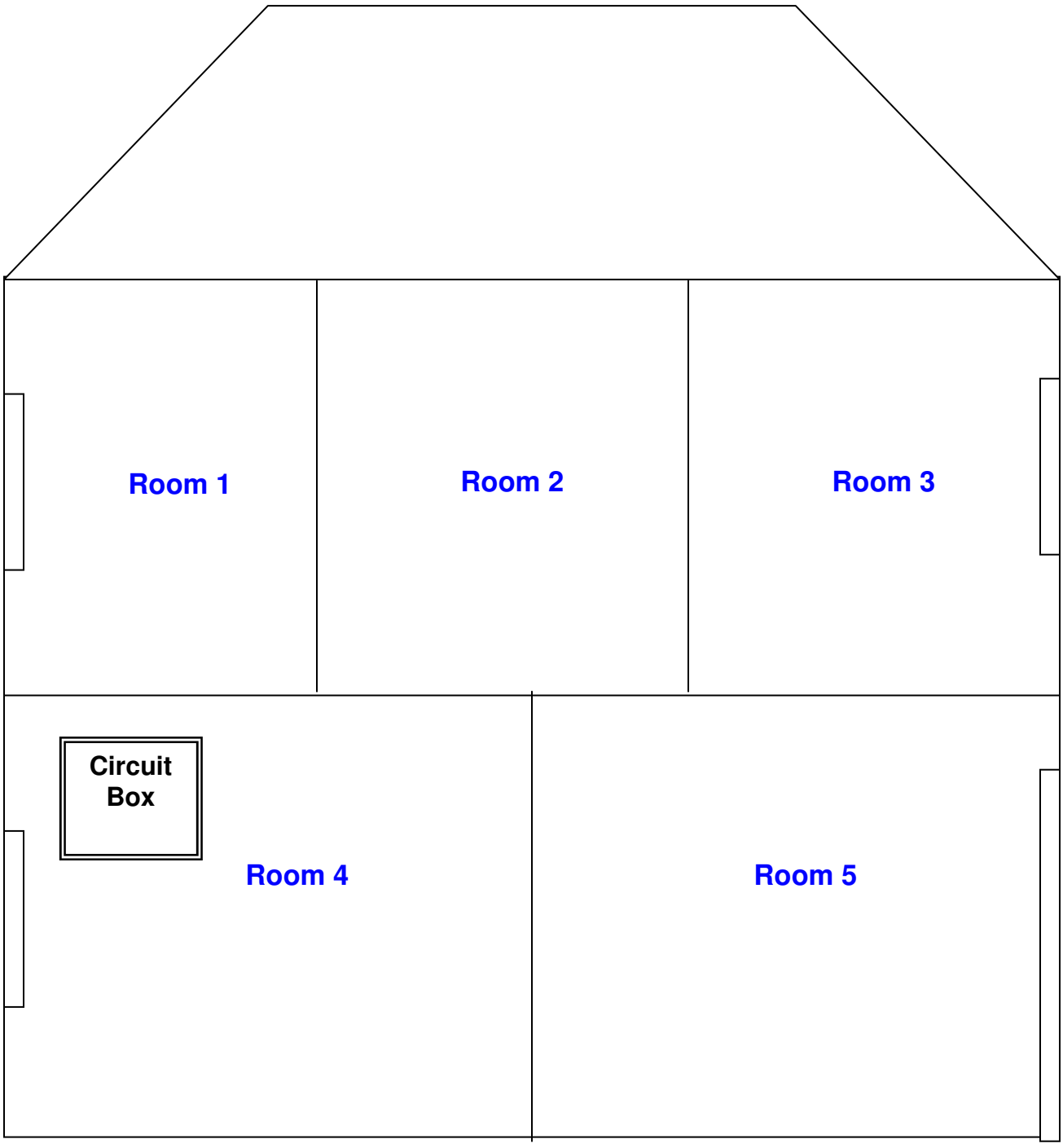
_____

Name: _____ Date: _____

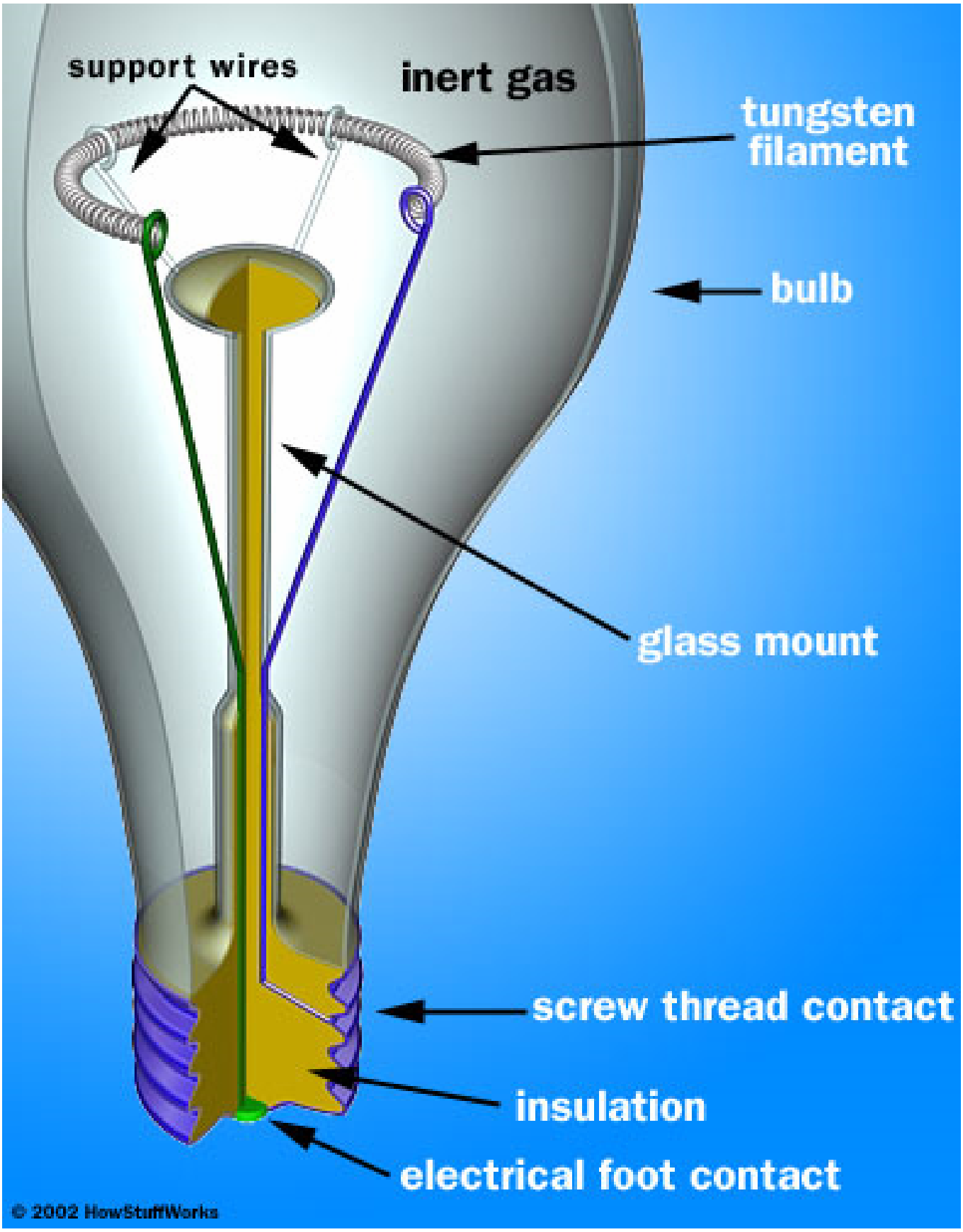
Home Lighting Design Challenge

Directions: Below is a side view of a new home. None of the rooms have lights or wiring for lights. The wires for each light need to start at the circuit box. Draw the lights and wires in on the picture.

You can also decide what each room will be used for and label them.

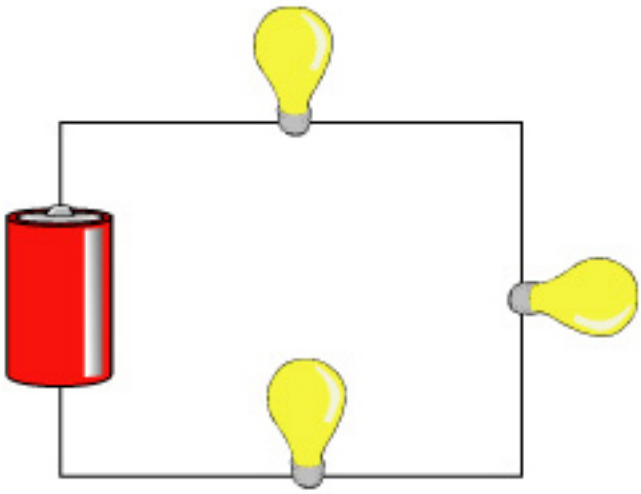


How do light bulbs work?

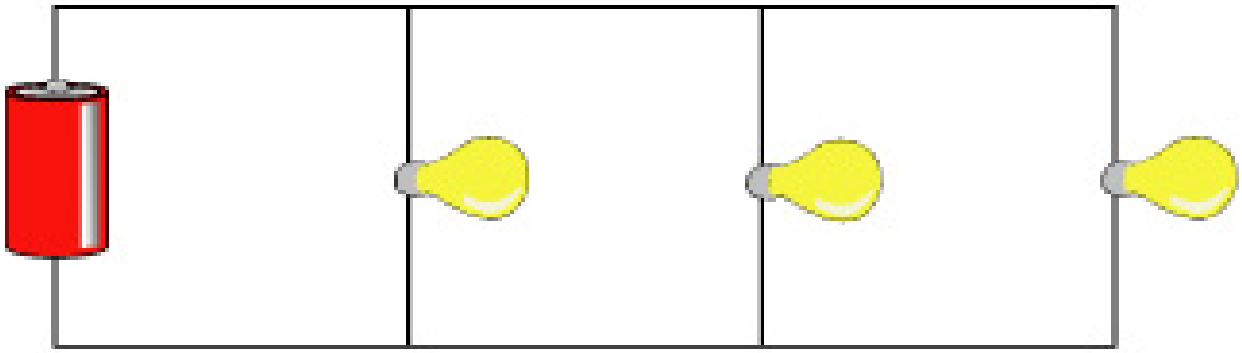


Types of Circuits

Series Circuit



Parallel Circuit



Photos from: http://iss.cet.edu/electricity/pages/a14.xml