

SciTech Activities: Jack-O-Lantern Circuitry

Time: 4 hours (broken down into 4-1 hour classes)

Standards:

4th Grade Science Content Standards:

PS1a. Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.

PS1g. Students know electrical energy can be converted to heat, light and motion.

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

5th Grade Science Content Standards:

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

Topical Objectives:

- Students will investigate the various components of electricity and circuits.
- Students experiment on circuits and circuit design.
- Students will explore the differences between a series circuit and parallel circuit.
- Students design and construct a pumpkin to showcase their circuit design.

Safety Rules:

Students should be reminded that bare wires will get **HOT**. Students should use the battery holders (or electrical tape) whenever possible to reduce the exposure to burns. Students should not hold bare wire while circuit is complete. Have the students place the circuit inside the pumpkin only when it is dry. Students should be advised **not** to place lit candles inside the pumpkin while the circuit is present.

Material:

(per group of 3-4 students):
2- 4 med-length pieces of 20 gauge copper wire
1-2 light bulbs (#46)
1-2 light bulb sockets
2 D cell batteries
2 D cell battery holders
Set of indoor/outdoor string lights
Electrical tape, if necessary

1 wire stripper/cutter (for teacher's use only)
Set of pumpkin carving kit
Markers
Newspaper
Spoons

(each student should receive):
1 small pumpkin

Day 1

Exploring circuits

Preparation:

1. Locate 20 gauge copper wire and precut into lengths of about 20 cm. Strip both ends to about 3 cm.
2. Gather light bulbs, light bulb sockets, batteries and battery holder.
3. Keep wire cutters handy.

Procedure:

1. Before starting this activity, review what the students' know about Electricity Where does it come from? What are some things that use electricity? What are Circuits (series/parallel).
2. Explain that everything in this universe is made out of Matter. Matter is anything that has mass and takes up space. For example, your hair, the chair, the ocean and even the air we breathe is made of matter. Matter is made up of tiny building blocks, called Atoms. Atoms are composed of 3 sub particles. Atoms have a nucleus or center. Inside the nucleus there are protons (positively charged) and a neutron (neutral or no charge). Each atom has electrons (negatively charged) particle spinning around the nucleus. Draw a diagram showing the parts of an atom on a white board.
3. Explain that a circuit is a path for electricity to travel through.
4. Challenge the students to come up with a way to make the light bulb light up.
5. Review the names of each material in today's experiment (battery-power source, wire-conductors, light-load)
6. Pass out materials to build a circuit. Let the students experiment with the materials for a few minutes before you offer assistance.
7. Show the students how to connect the wires and answer any questions the students might have.
8. Review that the movement of electrons cause electricity (electrons = electricity) and that electrons move from one atom to another. The circuit that the students made is a path for these electrons to follow.
9. Draw a circuit on the board and label the 3 parts: Battery (energy source-where electrons come from), wires (conductors-path electrons flow through), and light bulb (load- somewhere for electrons to go).

Science Notebook Ideas:

Students should draw and label a diagram of an atom and the flow chart for Matter (Matter-Atoms-nucleus-neutrons-protons-electrons). Students should draw and label their series circuit. Questions about circuits or Electricity should be written down.

Day 2

Exploring Circuits II

Preparation

1. Bag of marbles and 2 clear cups (one marked + positive and – negative)
2. String of lights
3. Each group of 2-3 students should receive 2 additional wires and 1 additional light.
4. Keep wire cutters handy.

Procedure:

1. Review that electricity is produced by the flow of electrons and that electrons move from one atom to another. The series circuit we made is a path for these electrons to flow.
2. Explain to the students that we will perform a circuit simulation. Have students form a large circle around the room and stand facing the center of the room with their palms up.
3. Students will hold an electron in their right hand and will move it to their left hand. (Left hand does not move! Students can not pass electrons to someone who already has an electron in their hand!) Choose a couple of students to help you demonstrate the process.
4. Teacher is the battery and holds the cup of electron (marbles) and passes one out at a time.
5. Have students practice passing electrons. If the students drop an electron, they should just let it go. (Chasing after it wastes too much time.)
6. Once the students have the hang of it, choose one student to be the light bulb. The light bulb is the load – it slows down the flow of the electrons. Repeat the activity, but have the student who is the light bulb walk around a chair before passing her electron.
7. Ask the students what each part of the demonstration represents (marbles=electrons, students=conductors and battery is the cup of marbles). Ask the students what happens if we run out of electrons in our battery? What happens if we remove the light bulb? What happens when someone drops a marble?

8. Pass out extra material and challenge the students to build a circuit that the electrons will have more than one path to flow.
9. Draw and Label a series/parallel circuit on the board for comparison. Underline Series circuit/Parallel circuit and ask the students how they are different. In a series circuit the light bulbs are dim. If you remove one bulb, the other bulb will go out. There is only one path for the electrons to flow. In a parallel circuit the light bulbs are bright. If you remove one bulb, the other bulb will stay lit. There are at least 2 paths for the electrons to flow.

Science Notebook Ideas:

Students draw and label a parallel circuit. Write the differences between a parallel circuit and a series circuit. What are the advantages/disadvantages of a series/parallel circuit? What kind of circuit is best for their Jack-O-Lantern Pumpkins? Why?

Day 3:

Designing Pumpkins

Preparation:

1. Use pictures/laptops to show students different pumpkin faces.
2. Provide markers to design Jack-O-Lanterns in student notebooks.
3. Pumpkin carving kits (enough for 2-3 students)
4. Large metal spoons/scrapers
5. Trays to put pumpkin seeds on
6. Newspaper/paper towels handy
7. Permanent markers to draw faces on pumpkins
8. Pumpkins! (1 for each student)

Procedure:

** Don't forget to take pictures of the students in action!**

1. Have students design pumpkin faces in their notebooks.
2. Pass out permanent markers to students but remind them that they are for the pumpkins only! They should not use them in their notebooks or themselves!
3. Remind the students that they will need to make a hole big enough on the top of the pumpkin to fit their hand in and scoop out the seeds.
4. After the students have carved the top, they can start to carve the face of their pumpkin. Helpful Hint: The more detailed the face the harder it is to carve.
5. Have students wipe off their pumpkins and check the inside for any seeds or pulp.
6. Student will place their names on the bottom on their pumpkins and place on a shelf away from the sun.

Science Notebook Ideas:

Students will sketch their pumpkin faces into their notebooks before they start to carve their pumpkins. Students will predict which circuits they will use to light up their pumpkin and how they will assemble it.

Day 4:

Assembling Jack-O-Lanterns

Preparations:

1. Provide each student 2 AA batteries, 2 outdoor Halloween lights-ends striped to about 1 cm. 4 strips of electrical tape-5 cm long and 3-15 cm 20 gauge wire with ends striped to about 1-1/2 cm.
2. Provide extra tape and scissors.
3. Keep the wire cutters handy!

Procedure:

** Don't forget to take pictures of the students in action!**

1. Review the materials for completing a circuit. Show the differences between the materials used for making a series/parallel circuit and today's activity.
 - Wires/conductors will be the same
 - Light bulbs have changed a little-they are now orange and do not have the light bulb socket
 - The connection between the wires will change-students will be wrapping the wires together for the lights and conductors. They will exchange battery holders for electrical tape.
 - **Caution!** Remind the students about electrical safety
2. Pass out materials for each student.
3. Circulate around the tables and trouble shoot any problems the students might encounter.
4. Remind students to take pumpkins home today!

Science Notebook Ideas:

If students could design another pumpkin what would it look like? Have the students write down any suggestions or questions they have encountered during this activity.

Extensions:

- If pumpkins are not available, students can use gourds or any hollow object (plastic items would not be recommended).
- Challenge students to decorate an energy efficient house using series/parallel lights.