LESSON 4

LIGHTING A PARK IN MEDIANA CITY (PART 1)

Next Generation Science Standards

Physical Sciences

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.

PURPOSE

IN LIGHTING A PARK, STUDENTS WILL:

- Use D-cells, wires, and switches to operate light bulbs and/or motors.
- Observe that the electrical energy in a D-cell can be converted into heat, light, and/or motion energy.
- Identify the essential components of an electrical circuit.
- Draw pictures and schematic diagrams to represent electric circuits and communicate understanding
- Engineering Design Process: Design a lighting system for their Mediana Park project.

BACKGROUND FOR THE TEACHER

Electric Current

When electrons are moving from a place with an electron excess to a place with an electron deficit, we call the flow electric current. Whenever matter is in motion (and electrons are matter), the kinetic motion of the moving matter can be put to do work. The source of electric current in this activity is the **D-Cell**.

Electric Circuit

Electricity flows when it is provided with a pathway that connects the two terminals of the D-Cell. When there is a complete pathway of electricity flow through the components (wires, switches, light bulbs, or motors) it is a **closed circuit** and the light bulb will light. If the pathway is broken in any location, the electricity does not flow through the resulting **open circuit**, and the light will turn off. A **switch** is a circuit breaker – a component used to open and close circuits.

Series Circuit

A **series circuit** has two or more components connected to a source where the electricity flows through each component, one at a time, if one component is disconnected, all the components will turn off.

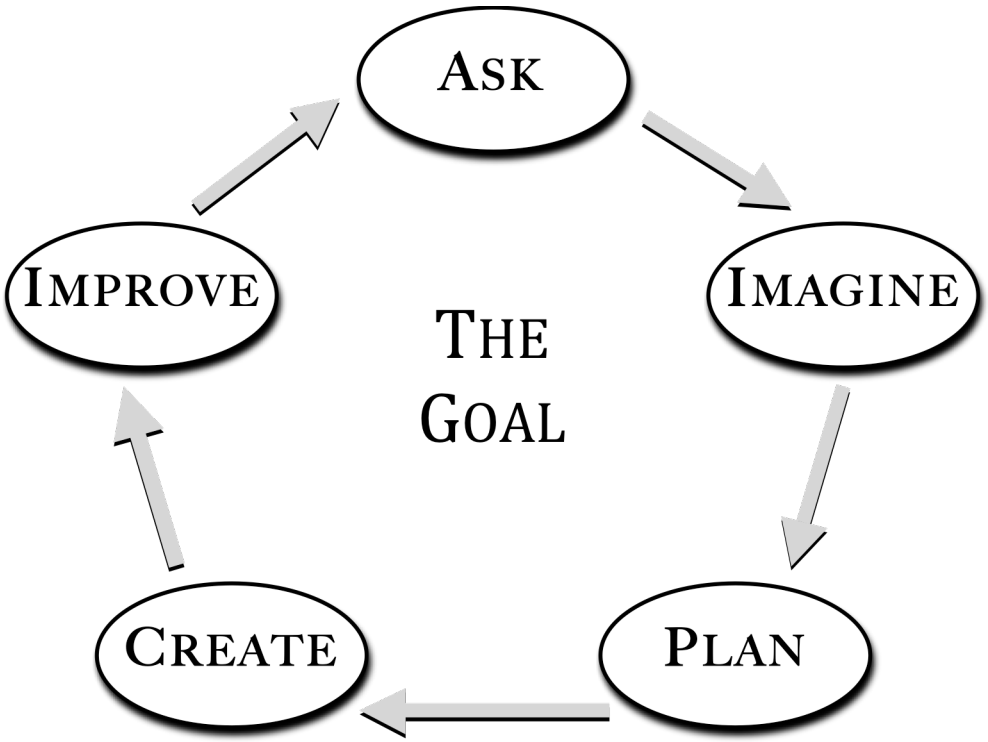
Parallel Circuit

A **parallel circuit** has two or more components connected to a source where the electricity flows to each component, at the same time, if one component is disconnected, the other components will stay on.

Schematic Diagrams

Schematic diagrams are symbols that electricians and electrical engineers use. See Schematic Chart. For detail information and diagrams on all of the above concepts, see the Magnetism and Electricity Teacher's Guide from the Full Option Science Systems (FOSS) curriculum.

Engineering Design Process (EDP)



1. **ASK:** WHAT IS THE PROBLEM?
   WHAT ARE THE CONSTRAINTS?
   WHAT HAVE OTHER'S DONE?

2. **IMAGINE:** WHAT ARE POSSIBLE SOLUTIONS?
   BRAINSTORM IDEAS.
   SELECT THE BEST ONES.

3. **PLAN:** DRAW A DIAGRAM.
   MAKE A LIST OF NEEDED MATERIALS.

4. **CREATE:** FOLLOW YOUR PLAN AND CREATE IT.
   TEST IT!

5. **IMPROVE:** MAKE YOUR DESIGN EVEN BETTER.
   TEST IT!

MATERIALS

LESSON 4: LIGHTING A PARK

FOR EACH STUDENT

- 1 *Schematic* Handout
- 1 Science notebook or science journal

FOR EACH GROUP

- 1 D-Cells
- 1 D-Cell holders
- 1 Light bulbs in holder
- 1 Switch
- 3 Red wires from Magnetism and Electricity Module

FOR THE LESSON

- Chart paper for Vocabulary and Concepts
- Markers
- LCD Projector (If needed)

GETTING READY

LESSON 4: LIGHTING A PARK (SCIENCE)

1. **Schedule The Investigation / Engineering Sessions**

   The lesson will take about 45 - 60 minutes each session.

2. **Obtain D-Cells and Light Bulbs**

   Check D-cells and bulbs to see if they are operable.

3. **Prepare Vocabulary Chart And Concept Chart**

   Have charts ready for new vocabulary and concepts concerning the series and parallel circuits.

4. **Have A Materials Station Set Up**

   Have a central materials station where designated students can retrieve and return needed materials.

5. **Copy Worksheets**

   Have worksheets ready for each student.

6. **Engineering Design Process Poster**

   If you have a poster maker at school, make an EDP poster.

   If not, enlarge each section of the EDP and create one.

GUIDING THE LESSON

LESSON 4: LIGHTING A PARK

1. **Access Prior Knowledge**

    - Ask students "What do you know about open and closed circuits?" Record student answers on the board or on chart paper.
    - The use of Thinking Maps is very helpful for visual learners. The Circle Map for each circuit is preferred when accessing prior knowledge.
    - Many students will answer this question quite easily since they will have had vast experience through the Magnetism and Electricity Module from FOSS.
    - This will move the lesson very quickly or skip this part, thus giving more time to the engineering part of Lighting a Park.

2. **Focus Question: What Are Open and Closed Circuits?**

    - The focus question guides the students in making their observations and understanding of series and parallel circuits.
    - Posing the focus question into a Language Objective is extremely beneficial for students in organizing their thoughts and recording their observations.
    - Again, using Thinking Maps is very helpful. The Double Bubble Map or Venn Diagram is best used when comparing and contrasting Critical Competitors.

3. **Arrange Students Into Groups of 2 or by Their Project Groups**

    Having small groups helps students to collaborate, think together, Discourse (Talk Moves), share observations, and practice 21st century skills. They can help each other when connecting wires onto components.

4. **Have Groups Get Necessary Equipment From The Materials Station**

Each group should designate a materials manager to get the equipment for their investigations. See materials needed from the Materials list for each group.

5. **Distribute Worksheets and Have Student Science Journals Ready**

The worksheet and science journal is where students can record their observations and collect data. This is another opportunity for the teacher to bring out new vocabulary while students are making and recording their investigations.

6. **Lighting Challenge**

If students have prior experience with building a closed circuit, then go to the engineering part. For review, assign *Lighting a Series Circuit* and *Lighting a Parallel Circuit* worksheets for homework.

7. **If Students Have No Experience**

Have students explore and connect the components to create a closed circuit and light up one light bulb with one D-Cell and one switch, and wires. Let them explore, and don't give them the answer. Someone will figure it out. Share out explorations and discoveries.

- **NOTE: DON'T LET STUDENTS TWIST WIRES TOGETHER.** They must properly connect the components (switch, light bulb holder, etc.). Also, they will ask if all the components are needed. Again, don't give them the answer let them figure it out. Someone might ask if they will get shocked. They won't. If a wire gets hot, the student is creating a short circuit.
- After a student figures out how to light the one light bulb, draw a schematic drawing on the board. (See *Schematic Chart*) Discuss with class and explain the flow of energy from the D-Cell to the light bulb. Also, how the energy is transferred from the D-Cell to light and heat energy in the light bulb.

- Have students copy the schematic drawing in their journals.
- Review and chart vocabulary/concepts

VOCABULARY *The following key science terms are developed in this investigation:*

Closed Circuit
Open Circuit
D-Cell
Battery
Electricity Source
Energy
Electricity Converter
Current Electricity
Circuit
Short Circuit
Components
Conductor
Insulator
Series Circuit
Parallel Circuit

CONCEPTS: *The following are key concepts:*

- *A circuit is a pathway on which electric current flows.*
- *A D-cell is a source of electric energy.*
- *Light bulbs convert electric energy into heat and light energy.*
- *Two or more components can be operated at the same time by putting them in series.*
- *Light bulbs in a series circuit share the electric energy from the energy source (D-cell).*
- *Two or more components can be operated at the same time by putting them in parallel.*
- *Light bulbs in a parallel circuit do not share the electric energy from the energy source (D-cell). They have their own pathway to the energy source (D-cell).*

Name: _____ **Date:** _____

LIGHTING A PARALLEL CIRCUIT

1. Draw a diagram of a parallel circuit that will light two light bulbs.

2. Why do you think the two lights are bright when they are in parallel?

_____

_____

_____

3. Why do you think two light bulbs are bright when two D-cells are used in a series?

_____

_____

_____

4. Draw and label a schematic diagram of another parallel circuit that made two light bulbs shine brightly.

Name: _____ **Date:** _____

LIGHTING A SERIES CIRCUIT

1. Draw a diagram of a series circuit that will light two light bulbs.

2. Why do you think the two lights are dim when they are in series?

_____

_____

_____

3. Why do you think two light bulbs are bright when two D-cells are used in a series?

_____

_____

_____

4. Draw and label a schematic diagram of your series circuit that made two light bulbs glow brightly.

Name: _____ Date: _____

SCHEMATIC DIAGRAM

KEY TO SYMBOLS FOR SCHEMATIC DIAGRAMS	
D-CELL	
WIRES	
SWITCH	
LIGHT BULB