ITQ ARTS AND SCIENCE INTEGRATION
GRADE 4
DANCE AND PHYSICAL SCIENCE

Get Your Motor Running: Circuits and Motors
Lesson 2

CONTENT STANDARDS

Dance

1.4 Explain the principles of variety, contrast, and unity and apply to a dance sequence.

Physical Science

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 into heat, light and motion.

ESSENTIAL QUESTIONS *(Questions that students might ask about the topic)*

- What are open and closed circuits and how do I show the difference between the two using contrasting movement?
- What does a motor do in a circuit and how do I show it through movement?
- How does movement help me understand open and closed circuits?
- How does dance help me understand how a motor changes electrical energy into motion?

OBJECTIVES & STUDENT OUTCOMES *(Students will be able to…..)*

- make movement choices as they explore the flow of electricity through open and closed circuits.

ASSESSMENT *(Various strategies to evaluate effectiveness of instruction and student learning)*

- **Feedback for Teacher**
  - Student response to inquiry
  - Student performance
  - Student schematic diagram of a motor
- **Feedback for Student**
  - Teacher feedback
  - Peer feedback
  - Videotape feedback

WORDS TO KNOW

Dance

- **Contrast:** To set side-by-side to emphasize differences. In dance this could be represented as opposites such as high/low, fast/slow or heavy/light, sharp/smooth, etc.

Science

- **Circuit:** A pathway for the flow of electricity.
- **Closed circuit:** A complete circuit through which electricity flows.
- **Motor:** A component in a circuit that converts electric energy to motion energy.
- **Open circuit:** An incomplete circuit through which electricity will not flow.
- **Switch:** A device used to open and close circuits.

MATERIALS

- Handouts from the *FOSS Teacher Handbook*, “Science Notebook Masters,” pg. 239 (Lighting

Bulbs), pg. 241
- Schematic Diagram Showing a Battery, Switch, and Motor (attached)
- "Making a Motor Run" – Steps (chart to post, included)
- Music – *Music for Creative Dance* by Eric Chappelle
- CD Player
- Video camera and monitor
- Science notebooks (one per student)

RESOURCES

- *FOSS Kit Grade 4*, "Physical Science: Magnetism and Electricity," Investigation 2, Parts 2, 3 and 4.
- *Music for Creative Dance* by Eric Chappelle

PREPARATION

- Have schematic diagram showing a battery, switch, and motor ready.
- Have masters ready and if doing the extension.
- Have "Making a Motor Run" steps sheet ready to display.
- Ample space to rehearse and demonstrate exercises.

WARM UP *(Engage students, access prior learning, review, hook or activity to focus the student for learning)*

(3 minutes)

- Post vocabulary words or chart as they are presented: **contrast, circuit, open circuit, closed circuit, switch, motor**
  - Review the exercise from the guided practice section from Lesson #1: the flow of electricity through a D-cell, the positive and negative poles, and the pathway of electric energy.

MODELING *(Presentation of new material, demonstration of the process, direct instruction)*

(15 minutes)

- Introduce vocabulary.
- Have students define **circuit.**
  - *Say: In the last lesson we said that electric energy flows from point A to point B in a pathway and today we name that pathway. It is called a **circuit.** A **circuit** is a complete pathway through which electricity flows.*
  - *Say: We want to create a **circuit** to light a bulb.*
  - *Ask: What are the parts we will need to create a one-wire **circuit**?* [Energy source, wires, and a light bulb].
- Define **switch.**
  - *Say: A **switch** is used to open and close a **circuit**.*
- Define **open circuit** and **closed circuit**s**.**
  - *Say**:** An **open circuit** is an incomplete circuit. The flow of electricity is stopped because the pathway has been broken. A **closed circuit** is a complete circuit because electricity flows without interruption.*
- Teach gestures and a chant to represent the **switch**, and **open** and **closed circuits.**
  - **Closed Circuit** Chant: **Switch** closed, **circuit** complete, electricity flows.
  - Gesture: clap hands together and hold, clasp fingers, wave the arms and body.
  - Repeat gestures and chant several times.
  - Option: Call and response to practice throughout the week:
    - Teacher says: *When I say closed you say flows. Closed.*
    - Student responds "flows".
    - Teacher repeats *closed*.
    - Student responds "flows".
  - **Open Circuit** Chant: **Switch** open, **circuit** incomplete, electricity stops.

- Gestures: Flip hands up with elbows bent and hold, drop the left hand, then extend right arm. Push flexed hand.
- Option: Call and response to practice throughout the week:
  - Teacher says: *When I say open you say stop. Open.*
  - Students respond "stop".
  - Teacher repeats *open*.
  - Students respond "stop".

- *Ask/Say:*
  - *What do we notice about the words open and closed?* [Open and closed are opposites.]
  - *What conclusion can we make about **open** and **closed circuits?*** [In a **closed circuit** the **circuit** is complete and the electricity flows. In an **open circuit** the **circuit** is incomplete and electricity stops.]
  - *What do we notice about the role of the **switch** in a **circuit**?* [The **switch** closes or opens the **circuit.** It also works in opposition. When the **switch** is closed, the **circuit** is complete, electricity flows. When the **switch** is open the **circuit** is incomplete, electricity stops.]
  - *What do we notice about the gestures we use to show **closed** and **open circuits**?* [The gestures are opposites. The **closed circuit** shape is curved or round and closed and flowing, the **open circuit** shape is broken and straight.]
  - *Say: In dance, we use the word "**contrast**" for movements that look very different from each other.*

- Exercise One: The one-wire **circuit** with bulb. (Post illustration pg. 112 in the *FOSS Teacher Guide.*)
  - *Say: Let's use our bodies to create a model of a one-wire **circuit** to light a bulb.* (Refer to illustration.)
  - *Ask*: *What do we need to create this **circuit**?* [D-cell, one wire, and a light bulb]
  - As a group, ask students to set up the **circuit** using their bodies as the parts (done in lesson #1). Allow 60 seconds for students to think, make suggestions and create.
  - Choose one student to be the light bulb.
    - *Ask: How can you show me with your body, a light bulb that is lit and not lit?*
    - Have student demonstrate.
  - Ask:
    - *Where should we place the light bulb in this **circuit**?* [Place the light bulb at the positive pole of the D-cell.]
    - *What will happen to this light bulb when the **circuit** is closed?* [The bulb will light up.]
  - *Say: I will act as the **switch**, opening and closing the circuit.*
  - Say the **closed circuit** chant. Play music and perform for 15 seconds.
  - Disconnect a few students from the negative end of the D-cell.
  - Say the **open circuit** chant. Music stops and everyone freezes.
  - Repeat the exercise two more times.
    - *Ask: The bulb converted the electric energy into what other form of energy?* [Light and heat energy because light bulbs get hot when they are turned on.]

GUIDED PRACTICE *(Application of knowledge, problem solving, corrective feedback)*
(24 minutes)

- Have students define **motor.**
  - *Say:*
    - *We have already shown you what a single wire circuit looks like. Now you are going to make a circuit with a motor that will convert electricity into motion.* (Refer to diagram on page 118 in the *FOSS Teacher Guide.)*
  - Demonstrate a frozen shape to represent a motor that is not running. Move your body or a body part to represent the motor in motion. Give several examples (swinging an arm, twisting the body, twisting and lifting a leg, tilting, chopping, bending knees or bending at the waist, etc.).

- ➢ *Say* (simultaneously with the demonstration): *When I am still the switch is open and the circuit is incomplete* (hold shape)*. When the switch is closed the circuit is complete, I will move my body.*
- o *Ask: What parts will we need to make our motor operate?* [You will need a battery, two wires, a **switch**, and a **motor.**]

- Setting up the Motor Demonstration:
- Post a copy of the schematic drawing for a motor (pg. 314 in the FOSS Teacher Handbook). Review the parts and how the switch opens and closes the **circuit**.
- *Say:*
  - o *In your groups, you will create this schematic **circuit** with your bodies.*
  - o *Students who are representing the wires will be at a low level.*
  - o *The student as the D-cell will be at a medium level.*
  - o *The student as the **switch** will be higher than the D-cell but lower than the motor.*
  - o *The student as the motor will be standing at a high level.*
  - o *When we use different levels like this in dance we create **contrast**. It makes a dance more interesting.*
    1. Arrange students into groups of ten.
    2. One student will create the D-cell.
    3. One student will create the **motor.**
    4. Seven students will create the wires (two per each short wire, three for the long wire).
    5. One student will be the **switch**.

- Demonstration: Making a Motor Run (Post the list of steps and review them before starting the dance.)
  1. Everyone begins in an opening shape in stillness. (Start videotaping)
  2. The observers and the **switch** start the exercise by performing the chant.
  3. The **switch** must create a movement to close the **circuit**.
  4. The wires show the movement of electricity by bumping beginning at the negative end of the D-cell through the wires, to the motor and back to the D-cell.
  5. The **motor** creates and performs movement. (Note: Steps 4 and 5 happen almost simultaneously.)
  6. Demonstrate to music for 15 seconds.
  7. Stop the music. The observers and student **switch** perform the chant to open the **circuit.** The **switch** creates a **contrasting** movement to open the **circuit**. The electricity and **motor** stops (ends in stillness).
  8. Repeat exercise two or three more times to music.

DEBRIEF AND EVALUATE *(Identify problems encountered, ask and answer questions, discuss solutions and learning that took place. Did students meet expected outcomes?)*
(8 minutes)

- View videotape and discuss.
- *Ask:*
  - o *What is causing the motor to move?* [The motor is put into action by the flow of electricity through the complete circuit.]
  - o *What does a **motor** do in a **circuit**?* [A **motor** converts electric energy into motion.]
  - o *What is the role of the **switch**?* [A **switch** controls the flow of electricity by opening (making the circuit incomplete) or closing (completing) the **circuit**.]
  - o *How did we show **contrast** in the **motor** demonstration?* [**Contrasting** body movements, levels, sizes, and shapes for wires, D-cell, switch and motor.]
- Have students respond to the following exit questions in their science notebooks: **(**Students may work independently, in pairs or small groups.)
  - o *Draw a schematic of a D-cell and a motor.*
  - o What did you learn about **circuits?**
  - o What did you learn about **motors**? [**Motors** need electrical energy, hooked to D-cell by

wires, a **switch** closes the **circuit** which starts the flow of electricity. The **motor** converts electrical energy into motion. The **switch** opens the **circuit** and everything stops.]
    - How did movement help you understand open and closed circuits?
    - How did dance help you understand how a motor changes electrical energy into motion?

EXTENSION *(Expectations created by the teacher that encourages students to participate in further research, make connections and apply understanding and skills previously learned to personal experiences.)*

- *Ask:*
    - *What do you think will happen if the wires in our **circuits** are replaced by a piece of plastic like a straw or a rubber band?* [The electricity won't flow because plastic and rubber are not made of metal.]
    - *If the electricity will not flow, what kind of a **circuit** would we have?* [**open circuit**]
    - *What can we conclude about plastic and rubber as **conductors** of electricity?* [Plastic and rubber will not conduct electricity.]
- *Say: Plastic and rubber are called **insulators.** Electricity does not flow through **insulators**.*
- *Ask:*
    - *How are objects that conduct electricity and objects that stick to magnets alike?* [All metals are **conductors**. Only iron sticks to a magnet.]
- Have students complete handouts from the *FOSS*, "Science Notebook Masters," pg. 239 (Lighting Bulbs), pg. 241 (Response Sheet "Making Connections"), and pg. 242 (Conductors and Insulators).

MAKING A MOTOR RUN
Steps

1. Begin in still opening shape

2. Perform chant. Switch closed (perform a shape), circuit complete

3. Electricity flows (pass the bump) and the motor moves

4. Music stops, Perform the chant. Switch open (create a contrasting shape), circuit incomplete, electricity stops

5. All motion ceases