ITQ ARTS AND SCIENCE INTEGRATION
GRADE 3
DANCE AND PHYSICAL SCIENCE

Energy on the Move: Forms of Energy
Lesson 1

CONTENT STANDARDS

Dance

1.3 Perform short movement problems, emphasizing the element of force/energy (e.g., swing, melt, explode, quiver).

Physical Science

PS1b Students know that sources of stored energy take many forms, such as food, fuel and batteries.

PS1c Students know machines and living things convert stored energy to motion and heat.

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

- Where does energy come from and what does it do?
- What is the difference between stored energy and working energy?
- How is energy in dance like energy in science?

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

- Students will explore through movement how energy is converted from one form to another and its role in creating heat and motion.
- Students will identify the various forms of stored and working energy.

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

- **Feedback for Teacher**
  - Student response to inquiry
  - Student performance
  - "Observation: Machine" worksheet
- **Feedback for Student**
  - Teacher feedback
  - Performance
  - "Observation: Machine" worksheet

WORDS TO KNOW

- **convert (conversion):** To change the nature, form or function of something.
- **energy:** The ability to make things happen. Energy can take a number of forms and can be converted from one form to another.
- **energy source:** A place where energy comes from, such as batteries, food, fuels, and the Sun.
- **force/energy (effort in dance):** The release of potential energy into kinetic energy. It utilizes body weight. Qualities of movement most recognized are: sustained, percussive, suspended, swinging, and collapsing.
- **motion:** A form of energy.
- **stored energy:** Energy available for use.

MATERIALS

- *FOSS Kit Grade 3*, "Physical Science: Matter and Energy," Investigation 1: Energy

- "Demonstration: Machine" procedure and worksheet
- "Steps to Creating a Machine" handout
- "Machine Assignments" flashcards
- CD Player and Music
- Video camera (optional)

RESOURCES

- *Music for Creative Dance* by Eric Chappelle; "Contrast Concerto"
- *FOSS Kit Grade 3*, "Physical Science: Matter and Energy," Investigation 1: Energy

PREPARATION

- Make copies of "Demonstration: Machines" worksheet, one per group of five students
- Make copies of "Steps to Creating a Machine" handout, one per group of five students
- CD Player and music
- Video camera

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

(5 minutes)

- *Ask: What do you think of when you hear the word **energy**?* [Accept student responses.]
- *Say: **Energy** is the ability to make things happen. **Energy** is the ability to do work.*
- *Ask:*
  - *What do people use **energy** for?* [To move, work, and play.]
  - *What other places do we see **energy** at work?* [machines such as cars and busses that take us to school, light bulbs shining so we can see, fans move to keep us cool]

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

(10 minutes)

- *Say: **Energy** makes things happen. It makes the body move. We use **energy** to start, stop, and change movement (**motion**).*
  - Teach gesture for the word **motion**. Clap hands and shoot one arm forward. Every time you use the word **motion** do the gesture.
- *In dance, using different amounts of **force** and **effort** determines how we do a **motion**. Let's do a movement exercise so you can feel how the body uses different amounts of **energy** or **effort** to move.*
- *Say/Ask:*
  - *Lie still on the floor. This takes no **effort**.*
  - *Wiggle your toes and fingers then open and close your fingers sharply and flex and point your feet. Which of these two movements needs the most energy?*
  - *Bend your arms and legs in smooth, flowing motion. This takes a little **effort**.*
  - *Come to sitting position, moving your arms in smooth flowing motion, then move them in stiff, sharp slicing motion and quick chopping motion. Which of these two movements takes the most energy? [stiff, sharp, quick] This is moderate **effort.***
  - *Come to a standing position. Reach, stretch, and bend your body. Now shake your arms and legs. Push a heavy imaginary object for 10 seconds. Now pull that same heavy object for another 10 seconds with all your might. This is an example of strong **effort**.*
  - *Jump in place, jump side-to-side, forward and back for about 30 seconds, then squat down to the ground and jump up for 30 seconds. This takes a large amount of **effort**. Freeze.*
  - *How does your body feel*? [warm or hot]
- Talk about how the body becomes warmer as movement and expending energy increases. Ask students to identify which of the warm up movements needed the most amount of **effort** and **energy** and created the most heat.
- *Say: When we do exercise, we use **stored energy** in our muscles and **convert** it into **motion** and heat. Our bodies move and we get warm.*

- Teach a gesture for heat by rubbing the hands together.
- *Ask:*
  - *How do we get **stored energy** into our muscles?* [Allow for think time and guide students to realize we get **stored energy** from the food we eat.]
  - *What is **energy** called when it is resting and waiting to work?* [**Stored energy**]
- *Say: Our muscles **convert stored energy** into **motion**. Every morning when we eat breakfast our bodies **convert** that food into **stored** energy. When we move our muscles and our bodies with **effort**, the **stored energy** is **converted** to heat and **motion.** That's why we get hot when we dance.*
- *Ask: Where is the **energy** stored in your body?* [Guide students to point to their muscles in their arms, legs, shoulders, etc.]

GUIDED PRACTICE *(Application of knowledge, problem solving, corrective feedback)* (30 minutes)

- *Say: Like our bodies, machines also create **motion** and heat. Machines can also create light as in a lamp.* (Teach the gesture for light by opening and closing fingers).
- *Machines are powered by either electricity from wall outlets or batteries, or fuel such as gasoline.*
- *Ask: Where can we find stored electricity?* [In batteries or in wall outlets] *What form of **energy** is found in batteries?* [chemical energy]
- Tell students they will be creating a machine with their bodies that will show motion.
- *Say: The machine you create must run on an **energy source:** battery (if electrical) or fuel (if gas). It must be clear to the observers which energy source the machine will use when it is "turned on."*
  - *Let's think of several machines with motors that use fuel: car, airplane, train, boat.*
  - *Let's think of several machines objects that use electricity as their source (or battery): flashlight, cell phone, toaster, fan.*
- Model with four students a machine (we will use an oscillating fan in this demonstration).
  1. Name the parts of the fan (cord, stand with the buttons, the body with blade).
  2. One person will turn on the machine.
  3. Identify the energy source (electricity).
  4. Identify the motor.
  5. *Ask: What do you have to do to get the energy source to the fan?* [Plug the fan into a wall outlet.]
  6. *Say "How can you show the cord of the fan plugged into the wall?"* [The person as the cord could extend a leg to touch the wall, of they could lie down on the floor and touch the wall, etc.]
  7. *How can you show the stand with the buttons?* [Make sure the cord is connected to the stand and the on/off switch is on the stand.]
  8. *How can you show the motor?* [The motor is connected to the stand.]
  9. *How can you show where the blades are and how they will move?* [The blades are connected to the motor and will show rotating movement.]
  10. *How can you show me a fan that oscillates (twist from side to side)?* [Have the blades twist from side to side.]
  11. The person who operates the fan will plug it in and push the start button.
  12. The fan begins to move.
  13. As an option, talk about the speeds (slow, medium and fast) that the fan can do and have students change speeds.
- Arrange students into groups of six. Distribute "Steps to Creating a Machine" handout to each group or post on overhead.
- Procedure
  1. *Say: Five of you will create the parts of the machine. All parts must work together and show the action of the machine. (E.g., if you are creating a can opener, the clamp holds the can, the gear turns the can, the blade cuts the lid and the magnet attracts the metal of the lid which opens the can). I will give you a machine to create. Your job is to make it clear to the*

observers what the machine is, its motion and its action.

2. *One person must show the energy source for the machine: electricity, battery power or fuel. You must show starting the machine by providing or connecting the source of energy (e.g., plugging it in, connecting the battery, adding fuel (e.g., gas).*
3. Note: If students are creative enough to use wind or solar energy, give them that option.
4. *The machine must cease motion. There are several ways to do that. It might run out of fuel or other source of energy or the person who connected the machine can disconnect it. You can also come up with another idea.*

- Distribute "Observation: Machines" procedure and worksheet, one per group or post on overhead for all to use.
- Group one will record observations for group two, group two will record observations to group three, group three will record observations for group four, group four will record for group five, group five will record for group one. (Numbers of groups will change according to the size of the class.)
  - Have each group perform, one group records observations on the "Demonstration: Machine" worksheet the rest of the class observes.
  - Videotape each group.

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

- After each group performs ask the observers to report observations from their worksheet (or do this as a whole group):
  - *What machine did the group demonstrate? How did you know?*
  - *Describe the motion of this machine*. *What action did you observe*? [Students should use dance vocabulary: pathway, speed, movement in personal space (twisting and turning as in a washing machine, flashing as in a flashlight; general space (rolling, traveling at a certain speed as in a car or airplane, what kind of body energy (vibrating, wiggling, shooting, etc.]
  - What was the **energy source**? [students respond battery or electricity, or fuel (gas)]
  - *The **stored energy** was **converted** into what kind of energy?* [motion, heat, light]
- *What do motors and the human body have in common?* [They both need fuel for **energy** to do work, they both create **motion** and heat.]
- If time permits, show videotape to class so that each group has a chance to reflect on their work.
- Have students respond to the following prompts in their science notebooks:
  - How can energy from a source be converted into motion?
  - How did creating machines help you understand how energy is stored and can be changed 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.)*

- Show videotape to class so that each group has a chance to reflect on their work. Determine if the criteria were met and what could be done to improve the performance.
- Have students to explore the movement potential of a runner.
  - *Where is the **stored energy** of a runner on the starting line?* [in muscles of arms, legs and body which is tense and bound in stillness]
  - *What effort is necessary to put the runner into **motion**?* [pushes against the ground strongly with legs, propelling the body forward]
  - *How is the **stored energy** in the muscles **converted**?* [forward motion that is fast and powerful]
- Have students explore the problem of overwork and overheating on the body and machines.
  - *What happens when the human body, an object, or a motor moves for a very long period of time?* [gets very hot, over heated, stops, breaks down, etc.]
  - *What could happen to the body or the machine if it doesn't have some rest time?* [the body

could get injured or sick, a machine could break down, fall apart - both will not function well]
- *What would have to happen in order to get the body or the machine to return to its best working state?* [turn off motor, repair broken or worn out parts, people should rest, drink fluids, eat healthy food]

OBSERVATION: MACHINES

Name_____ Date _____

- What machine did you observe?

  _____

- What action did you observe? (Describe with movement vocabulary)

  _____

  _____

  _____

- What was the energy source?

  _____

- Where was the energy stored?

  _____

- What was the stored energy converted into?

  _____

Fill in the blank

- The energy in the _____

was converted into _____ energy.

STEPS FOR CREATING A MACHINE

Group No. _____

Names of people in the group: _____

_____

1.

- *Five people will create the parts of the machine. All parts must work together and show the motion of the machine.*
- *Create the machine you were given. It must be clear to the observers what the machine is, its source of energy, and what is its motion.*

- What machine will you create?_____

2.

- *One person will show the energy source for the machine: You must start the machine by providing or connecting the source of energy.*

- What is the source of energy for the machine? _____

- Into what was the stored energy converted? _____

3.

- *The machine must cease motion (stop). There are several ways to do that. It might run out of fuel or other source of energy, or the person who connected the machine can disconnect it or turn it off. Do you have another idea?*

4.

- How will the machine stop? _____

5.

- List the types of movements you will do to show how the machine works.

CAR 

AIRPLANE 

TRAIN 

WASHING

MACHINE

FLASHLIGHT 

TOASTER 

PENCIL

SHARPENER 

VENDING

MACHINE 

TELEVISION