ITQ ARTS and SCIENCE INTEGRATION
GRADE 3
Dance and Physical Science

Chemical Reactions and Changing States
Lesson 3

CONTENT STANDARDS

Dance

5.1 Explain relationships between dance elements and other subjects (e.g., spatial pathways – maps and grids; geometric shapes – body shapes).

Physical Science

PS1g Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.

I&E5c Use numerical data in describing and comparing objects, events, and results.

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

- How can I show chemical reactions and changing states of matter?
- How do atoms in solids, liquids, and gases move?

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

- Students will explore time, space and energy concepts as they demonstrate two substances: liquid (vinegar), and solid (baking soda) reacting chemically to give off a 3rd different substance, gas (CO2).

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

- **Feedback for Teacher**
  - Student response to inquiry
  - Student performance
  - Observations Record Sheet
- **Feedback for Student**
  - Teacher and peer feedback
  - Performance
  - Observations Record Sheet

WORDS TO KNOW

Dance

- **axial movement** is movement that is anchored to one spot by a body part (e.g. bend, twist, reach, turn, etc.)
- **force/energy:** an element of dance characterized by the release of potential energy into kinetic energy. It utilizes body weight, reveals the effects of gravity on the body, e.g., sustained, percussive, suspended, swinging, and collapsing.
- **locomotor movement is** movement progressing through space from point A to point B. Basic locomotor movements include walking, running, galloping, jumping, hopping, skipping, sliding, leaping
- **space:** an element of dance that refers to the immediate spherical space surrounding the body in all directions. Use of space includes shape, direction, pathway, range, and level of movement. Spatial relationship between dancers describes their proximity or connectedness
- **personal space:** movement around the spherical axis of the body in all directions.
- **time:** an element of dance involving rhythm, phrasing, tempo, accent, and duration

Science

- **carbon dioxide:** a gas .
- **gas:** Matter that is shapeless and expands to fill a closed container.
- **liquid:** Matter that flows and takes the shape of the container it is in.
- **mass:** a quantity of matter.
- **reaction:** an interaction between substances that produces one or more new substances that have different properties than the starting substances.
- **solid:** Matter that has a definite shape.
- **substance:** matter that can be defined by the particles from which it is made.

MATERIALS

- One "Observations: Record Sheet" on overhead or one copy per group
- Large labeled signs to be hung around student's neck or pinned to clothing: six of one color saying "solid", six of a second color saying "liquid".
- Two, two-sided labels. One side labeled "solid" in the same color as above and the reverse side labeled "gas" in the same color above.
- Music Options:
  - Handel's "Water Music" (any selection)
  - "Aquarium" and "Swan" from *Carnival of the Animals*
  - "Flight of the Bumblebee", *Share the Music,* Grade 1, CD 2, track 14, McGraw-Hill
  - "Hall of the Mountain King", *Share the Music,* Grade *2*, CD 5, track 22, McGraw-Hill
  - "Amphibious" from *Music for Creative Movement* by Eric Chappelle
- Post a copy of the chant on chart paper or on overhead
- CD player and Music
- Video Camera and monitor or computer for viewing video

PREPARATION

- Teach *FOSS Kit Grade 3*, "Physical Science, Matter and Energy," Investigation 4: Changing Matter, Part 3
- Teach VAPA Grade 2 dance Lesson #4 "Energy: Characteristics of Movement."
- Copy of "Observations: Record Sheet" posted on overhead
- Prepare labels on three different colored papers for solid, liquid and gas
- Provide ample space to move
- Have video camera ready
- Copy of the chant on chart or for overhead
- Doc Cam or overhead projector
- CD Player and music

RESOURCES

- *FOSS Kit Grade 3*, "Physical Science, Matter and Energy," Investigation 4: Changing Matter, Part 3
- *Music for Creative Movement*, by Eric Chappelle
- *Share the Music,* CD collection

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

(2 minutes)

- Guide students through a physical representation of each state of matter. Chart or project a list of dance vocabulary: **energy** (bound, free, vibrate, float, smooth, bouncing, darting, settling); **axial movement** (bend, stretch, reach, twist)**; locomotor movement** (walk, jump, hop, leap, slide, etc.)**; space** (personal and general space, pathway, levels, size); **time** (fast, slow, stillness or freeze).
  - *Ask: What do we know about atoms?* [They are the tiniest particles of matter]
    - Have students stand and *say*: "All atoms move. They move with a vibrating energy."
  - *Say: vibrate your hands, now your legs, now your shoulders, and now, your whole body. Vibrate*

very quickly.

MODELING *(Presentation of new material, demonstration of the process, direct instruction)* (20 minutes)

- *Ask: What are examples of **solids**?* [ice, coins, rocks, t-shirts, coffee cups, etc.]
  - *Say: How do you describe a **solid**?* [They have a definite shape.]
  - *Atoms in a **solid** are packed so tightly together that all they can do is vibrate in **personal space**.*
    - Arrange students into a tight formation, shoulder-to-shoulder, in several rows to form a **solid** shape (square, rectangle, circle, triangle, etc.).
  - *Ask: Can this **solid** move around freely?* [No]
  - *Say: Show me how a solid moves. Vibrate your whole body very quickly, but stay in one place. You are bound very tightly together. So tight that all you can do is vibrate.*
- *Ask: What are examples of **liquids**?* [water, milk, juice, syrup]
  - *Say: How do you describe a **liquid**?* [They have no shape but can take the shape of their container (glass, carton, bottle)]
  - *Atoms in a **liquid** vibrate but move a little more freely by flowing and sliding past and around each other. These atoms do not have to stay in one place like atoms in a **solid.***
    - Arrange the class into the same tight shape as the **solid.**
    - *Ask/Say: Move like a solid* [students vibrate]. *What happens if you are an ice cube and I apply heat?* (As students are vibrating they respond.) [We melt and turn into a **liquid.**]
    - *Now you are more free to move around in the shape. Your body vibrates but you feel looser and freer as you slide and flow around and past each other. You may bump gently and safely into another atom and change direction. Keep sliding and flowing until I say freeze.*
    - *Look at me but keep moving. What will happen to the flow of this **liquid** if I tip the container this way?* With arms extended to your sides, tip your body to the left. Students should flow to their right. Tip your body to the right. The students should flow to the left. *Freeze!*
- *Ask: What are examples of a **gas?*** [Your breath, wind, oxygen, steam]
  - *How do you describe a **gas**?* [Gas expands and contracts easily, gasses have no shape of their own but can take on the shape of their container.]
    - Have students stay in their **liquid** shape.
  - *Ask/say: Move like a **liquid**.* Students will move while you direct them to respond the following:
  - *If I apply more and more heat, what will happen to the **liquid**?* [The liquid turns into water vapor and then into a gas and evaporates].
  - *Say: Begin to spread out and move more quickly. Move away from the other atoms. Find open space. Vibrate your body all over as you jump, bounce, twist, and safely bump into other atoms in general space. Keep looking for more open and empty space, spreading further and further apart from the other atoms until you disappear!*
  - *Ask/say: How can you show **gas** atoms disappearing? Show me how gas atoms disappear and come to stillness.*
  - *Ask: can you see a **gas** like your breath when you exhale or the air you breathe in?* [no]
  - *Why can't we see a **gas**?* [Accept a variety of student answers].
  - *Say: We can't see a gas because the atoms vibrate and move so fast and are so far apart from each other that we can't see them. Even though **gases** have matter and have **mass**, they look invisible to us!*
- Tell students that they will be demonstrating through movement an experiment showing what happens when baking soda and vinegar combine in a chemical **reaction**.
- Review vocabulary: **reaction** and **substance.**
- Setting Up baking soda (Sodium Bicarbonate):
  - *Say: Baking soda is a **solid**.*
    - *Say: Baking soda is hard and **solid** like a piece of chalk. In our experiment the baking soda crushed has been crushed into a powder.*
    - *Say: when I say "baking soda" you say "**solid"** and move like a **solid**. How do **solids** move?* [In personal space, bound and vibrating]
    - *Let's try it. "Baking soda"* [Students respond **solid** and vibrate in a tight shape].
- Setting Up Vinegar (Acetic Acid):
  - *Say: Vinegar is a **liquid**.*

- *Say: When I say "vinegar" you say "**liquid"** and move like a **liquid**.*
- *Ask: How do **liquids** move?* [In general space, they vibrate, slide and flow around and past each other. They are a more free].
- *Say: Let's try it. "Vinegar"* [Students respond **liquid** and continue to move as a liquid within a confined space.)

- Teach a chant to memorize what happens in the baking soda/vinegar reaction. (Post a copy of the words)
  - *"Baking Soda **solid**, vinegar **liquid**, they **react** and form a gas."*
  - Practice several times.
- The movement:
  - Baking Soda/**solid:** make fists elbows bent, and pull arms down strongly and tightly two times.
  - Vinegar/**liquid:** wave arms and hands in front of body in a horizontal figure-eight pattern.
  - **React:** roll arms
  - **Gas**: bend legs deeply (plie) and jump high into the air. Arms form a circle like a bubble and break apart at the top of the jump.
- *Say* (after chant)*: What kind of **gas** is it?* **[**CO2]. *And what is it called?* [carbon dioxide]. *Where does the **gas** go?* [it escapes and disappears into the air]
- Practice the chant and movement several times with the closing two questions with enthusiasm.

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

- *Say/Ask: In our experiment we mix baking soda and vinegar together in a cup. What do you think might happen?* [Students make predictions and chart responses] *Something will happen? There will be a chemical reaction and something will be given off.*
- Option: Show a mixture of vinegar and baking soda to the class.
- Describe **mass** to students. **Mass** has weight and takes up space. **Mass** is the measurement of how much matter a substance or object has.
- Set up the Chemical Reaction Dance. After these instructions allow three to five minutes to create.
  1. Select six students and ask them to arrange themselves to represent *baking soda*. *Say: Remember what state of matter is baking soda and how do you show it?* Note: Have students as the solid baking soda move at a low level.
  2. Select six students to represent *vinegar*. *Say: Remember what state of matter is vinegar is and how do you show it?*
  3. In private, coach *two* students from the baking soda **substance**. *Say: you two will be the **carbon dioxide gas** bubbles that will form, escape and disappear: When I say **reaction,** you will slowly rise and lower your body while creating a round shape with your arms. When I say **reaction** for a second time, you will show the **gas** bubbles moving very rapidly. Make sure you move safely. When I say **reaction** for the third time you will leave the **substance** and disappear.*
  4. Post the "Observations Record Sheet" on the overhead and have the rest of the class say the chant and observe.
     - Note: The observers should not hear the instructions given to the two students who will dance the **carbon dioxide gas** given off in the experiment.
     - Observers will record what they see: starting and ending number of students left in the **substance**, and the type of movement they see happening.
  5. Place the baking soda students in the center of the space and the vinegar students next to them in their confined space and *say watch for my cue to start.*
  6. Perform the chant. *Say: I will pour the vinegar into the baking soda.*
     - Tip your body to make the vinegar flow into the baking soda. The vinegar flows into the baking soda.
     - *Say: The vinegar atoms will move between and around the baking soda breaking them apart. Remember, the baking soda does not travel but must stay in one spot and will only leave that spot when bumped by a vinegar atom. Allow approximately 40 seconds to explore with or without music or accompaniment.*
  7. *Say:* **"*reaction"*** and give the student gas bubbles five seconds to move.

8. *Say: "**reaction**"* for a second time, give five seconds to move.
9. *Say: "**reaction**"* for a third time, allow five seconds to move.

- Videotape the performance and have performers observe the dance if time permits in the next section or as an extension.

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

- Select one student observer to report their observations (you may also show the video as part of the report).
- *Ask:*
  - *What did you notice about the number of dancers before the chemical **reaction** and after the chemical **reaction**?* [The numbers were equal before the **reaction** and less after the **reaction**.]
  - *If we drew a parallel regarding **mass** to the number of people, what could we infer about the **mass** of the substances **before and after** the chemical **reaction**?* [The mass of both substances were equal before the **reaction** and their combined **mass** was less after the chemical **reaction.**]
  - *Why do you think there was a change in **mass**?* [there was something lost or taken away in the reaction] (refer to pg 195 in *FOSS Kit Grade 3, Physical Science* Handbook)
  - *What do you think chemically happened after we poured the vinegar into the baking soda?* [The baking soda and vinegar caused **carbon dioxide** gas bubbles to form that rose into the air and disappeared which made the two substances weigh less.]
  - *What can we conclude about our Chemical **Reaction** Experiment?* [When two substances combine (solid, liquid) they give off a different substance with its own unique properties (gas).]
  - *Using your dance words, describe how atoms move in a **solid**, a **liquid**, and a **gas.***
  - Have students respond to the following prompt in their science notebooks:
    - *What can we conclude about our chemical **reaction** experiment?* (When these two substances combine (solid, liquid), a new substance with its own unique properties (gas), is formed. The mass of the original substances after the experiment is less because some of the mass of the original substances was used to form the new substance.]

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.)*

- Write a summary and draw illustrations for the experiment using both dance and science language.
- Conduct an experiment that will break water into hydrogen and oxygen atoms. See http://www.energyquest.ca.gov/projects/split_h2o.html for materials and procedure
  - You and your friends reach the playground and run in many directions and speeds.
- Create a poem or story for your chemical reaction dance. Perform the dance to music as it is narrated. For ideas go to http://millergrade2.homestead.com/matter_poetry.htm

PROCEDURE FOR CREATING THE CHEMICAL REACTION DANCE

BAKING SODA

1. What is the property of baking soda (*circle one)* ***SOLID*** ***LIQUID*** ***GAS***

2. In what shape will we arrange ourselves? _____

3. How will we show our property and what will our movement look like? _____

_____

VINEGAR

1. What is the property of vinegar (*circle one)* ***SOLID*** ***LIQUID*** ***GAS***

2. In what shape will we arrange ourselves? _____

3. How will we show our property and what will our movement look like? _____

_____

CARBON DIOXIDE BUBBLES

1. What is the property of carbon dioxide (*circle one)* ***SOLID*** ***LIQUID*** ***GAS***

2. How will we show the reaction to begin forming bubbles? (slowly, rising, circle arm shape)

3. How will we show the bubbles moving quickly popping in the solution? _____

_____

4. How do we show leaving the solution and disappearing? _____

_____