ITQ ARTS AND SCIENCE INTEGRATION
GRADE 5
DANCE AND PHYSICAL SCIENCE

I Can't Take Any More!
Saturation and Solubility
Lesson 1

CONTENT STANDARDS

Dance

1.3 Demonstrate a great dynamic range in movement utilizing space, time, and force/energy concepts).

Physical Science

PS1f Students know differences in chemical and physical properties of substances are used to separate mixtures and identify compounds

PS1i Students know the common properties of salts, such as sodium chloride (NaCl).

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

- What is Epsom salts and how do Epsom salts differ from table salt?
- What is saturation and solubility and how do I show those concepts through applying space, relationship and qualities of movement?

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

- Use movement to distinguish between, describe, and explore, saturation and solubility.

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

- **Feedback for Teacher**
  - Chart of Energy Terms
  - Student response to inquiry
  - "Data Sheet – Saturating a Solution"
- **Feedback for Student**
  - Teacher feedback
  - Performance/Rubric
  - "Data Sheet – Saturating a Solution"

WORDS TO KNOW

Dance

- **Quality of movement:** An element of energy in dance. The most recognized qualities of movement are sustained, percussive, suspend, swinging, and collapsing.
- **Level**: an element of vertical space that surrounds the body in a high (standing tall or jumping), medium (crouching, kneeling) or low (sitting or lying on the floor) position.

Science

- **Epsom salts:** An example of a salt other than table salt. Its properties are different than those of table salt. Magnesium Sulfate, ($MgS0_4$), contains one magnesium atom, one sulfur atom and four oxygen atoms
- **Periodic Table of Elements:** An arrangement of the elements that provides information about their properties.
- **Solubility:** The property substances have of dissolving in solvents, such as the solubility of salt in water.

- **Soluble**: Capable of being dissolved. Table salt is soluble in water.
- **Solute:** A substance that dissolves in a solvent to form a solution.
- **Solution:** A special mixture formed when one or more materials dissolves in another.
- **Solvent:** A substance that dissolves a solute to form a solution.

MATERIALS

- Construct and print color coded labels: 20 for salt (white) and 6 water (blue)
- Energy Word Pairs and Descriptions (included)
- Post a copy of the chant on chart paper or overhead
- Record Observations Table
- Performance Rubric
- Video camera
- Hand drum or other percussive instrument
- CD Player and Music
- Science notebooks (one per student)

RESOURCES

- *Music for Creative Dance* by Eric Chappelle; "Contrast Concerto"
- *FOSS California, Grade 5*, "Physical Science: Mixtures and Solutions," Investigation 2, Parts 1 and 2

PREPARATION

- Ample space to move.
- Post **Periodic Table of Elements** (PTE) on overhead.
- Construct and print color coded labels: 20 for salt (white) and 6 water (blue)
- Review Dance and Physical Science, Grade 3, lesson #9, "Chemical Reactions and Changing States of Matter" for group movement for solids, liquids, and gasses.
- Review the element of energy in dance Grade 3, Lesson #1, Force and Energy: Characteristics of Movement

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

(5 minutes)

- Post **Periodic Table of Elements** (PTE) and be prepared to mark Mg, Na, Cl, S, H and O as you work through the lesson.
- *Ask:* (pair share), *What do you know about the Periodic Table of Elements?* [Share answers.]
- *Ask:*
  - *What elements make up table salt (NaCl)?* Identify and mark sodium and chlorine on the PTE.
  - *What are some uses of table salt?* [Salt seasons food. Salt is also used to raise the boiling point of water for cooking pasta or rice.]
  - *What state of matter is table salt?* [Solid] Students have learned that objects are described by their properties (things we can see and feel). [Responses may include: white, powder, piles up, fine-grained, coarse-grained, etc.]
  - *How can we create a grain of salt through dance and what would the movement look like?* [tight, bound movement, vibrating, allow students to arrange themselves into a solid looking formation, 3x3]
  - Arrange class into a tight, shoulder-to shoulder block formation. Have students vibrate very quickly. Reinforce axial movement only.
- *Say: Solids do not travel around the room in general space. They stay tightly bound to each other in a defined shape.*
- *Ask:*
  - *What elements make up water (H_2O)?* Have students identify hydrogen and oxygen and

mark on the PTE.
  - *What state of matter is water?* [liquid]
  - *How can we create water in a container through dance and what would the movement look like?* [water molecules would vibrate and flow past each other in a formation to represent the shape of the container (circle, square, oval, etc.]
  - Teach the double basic step: step together step touch. (The water molecules will use only this step in any direction as they flow and vibrate.)
  - Arrange students in a tight formation (representing a container: round, square, etc.) and perform for 10 seconds, the double basic step to slide past, through and around each other within the confines of the specified shape).

MODELING *(Presentation of new material, demonstration of the process, direct instruction)* (15 minutes)

- Review and post vocabulary words: evaporation, **solute**, **solution**, **solvent**
- Teach the chant:
  - *Salt is a solute* (vibrate hands like a solid)
  - *In water it dissolves* (wavy arms and jazz hands)
  - *When the solution* is saturated (cabbage patch),
  - *Salt just falls* (vibrate hands and drop to a low level, touching the ground)
- Explain to students that in dance we use the word "fall" in science we use the word "settle".
- *Ask:*
  - *In our table salt and water investigation, which is the solute and which is the **solvent**?* [The table salt is the solute and the water is the **solvent**.]
  - *What happens when spoonfuls of table salt (the **solute)** are placed in water (the **solvent**)?* [The grains break up into smaller salt particles and distribute evenly creating a **solution.**]
- Divide the class in half. One half will demonstrate, the other half will observe.
- Arrange one-half of the demonstrators to represent the water in a confined shape.
- Arrange the other half of the demonstrators to represent a large grain salt.
- *Ask:*
  - *How can we show a solid grain of salt being put into the water?* [Allow student suggestions and select one to try.]
  - *How can we show the salt and water being made into a **solution**?* [Accept student answers.]
    - Set up the demonstration: Remind students that liquids flow and can move around but the salt is a solid and can only vibrate. It cannot travel without being moved.
    - Arrange the students representing the salt grain on their knees in a tight shape. The salt grain will stay in one spot and vibrate. The water molecules (liquid) will flow around each other and gently bump into the salt grain breaking it (the individual students) into individual molecules that will be evenly dispersed in the water (liquid).
    - Have students perform this concept for 10 seconds.
    - Switch groups and repeat.

- Introduce **saturation**.
- *Ask* (students are seated)*:*
  - *When we say a **solution** is **saturated**, we mean that a **solvent** is so heavy and full with a **solute** that it can't possibly hold any more. What happens to the **solute** when the **solvent** can't hold any more?* [The **solute** settles to the bottom of the container.]
  - *How could we show **saturation** of table salt in water through movement?* [Allow think time and suggestions. Students who are dancing as salt would fall to the floor.]
- *Say: Let's create a **saturated solution** of table salt and water.*
  - Arrange six students as water molecules in a container.
  - Arrange five groups of four (20 students total) to represent five spoonfuls of salt.
  - The remainder of class will observe. Select one student from the group to be the recorder.

- Post the Solubility Table.
- Say to group three in private: *You will show **saturation** by settling to the floor.*
- Add group one (four students representing the first spoonful of salt) to the **solvent** (water). The student water molecules move freely breaking up the salt.
  - Reinforce for students that as water molecules they are to use flowing, smooth movement that travels over and around each other. They will gently bump and push the salt.
  - Reinforce that salt is a solid, it may only move when bumped or brushed by a water molecule.
- Demonstrate for 10 seconds.
- Add group two (the second spoonful of salt). Demonstrate for 10 seconds. Freeze action.
  - *Ask observers: What do you notice about the **solution**?* [The water is very crowded with salt.]
- Continue demonstration. Add group three spoonful of salt. Allow 10 seconds to demonstrate. Group three should be bumped around and finally settle to the floor. Freeze action.

- *Ask/Say:*
  - *Describe what happened?* [The salt settled to the floor because the **solution** was **saturated**.]
  - *When the water (which is the* **_____** [**solvent**] *cannot hold any more salt* [which is called **solute**] *salt settles to the bottom of the container. We say the **solution** has reached **saturation**.*
  - *Since **table salt** dissolves in water, we say that table salt is* **_____**[**soluble**] in water**.**
  - To the recorders: *What did you notice about the number of water molecules?* [Six]
    - Have the recorder chart that number on the table.
  - *How many spoonfuls of salt did it take to reach **saturation**?* [Three]
    - Have the recorder chart that number on the table.

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

- Post the Solubility Table (attached)
- Review and/or define **soluble** and **solubility**.
- *Say: We already saw the **solubility** of table salt in the previous exercise. Table salt is **soluble** in water because it dissolves. Let's compare that with the **solubility** of **Epsom salts**.*
- Discuss with students the uses for **Epsom salts** (bathing sore muscles, feet, cleaning skin, etc.).
- Show students the molecular structure of **Epsom salt** ($MgS0_4$).
  - *Ask/Say: How many elements do you see in **Epsom salts** and what are they?* [There are three elements; magnesium, sulfur and oxygen.]
  - Select a student or several students to locate these elements on the PTE. [Students point to or use a dry erase pen to highlight (if laminated) on the PTE]
  - *Ask: how many atoms do you see in Epsom Salt (Magnesium Sulfate* $MgSO_4$) [There are six atoms; one magnesium atom, one sulfur atom, four oxygen atoms.]
  - *Ask: Do you think **Epsom salts** will be more or less **soluble** (dissolves easier than or not as easy as) than table salt?*
  - *Say: Put thumbs up if you think **Epsom salts** is more **soluble**, and thumbs down if less **soluble**.*
- Follow the same procedure for the table salt demonstration.
  - Select six students to be the water in a defined space.
  - Select 20 students to represent the spoonfuls of **Epsom salts** (five groups of four students).
  - *Say* (to the fifth spoonful in private): *You will be the spoonful that settles to the bottom. You will vibrate, get bumped and brushed by the water but eventually you will all settle slowly to a low level. Make sure to do this slowly.*
  - The remainder of class will observe. Select one student from the group to be the

recorder.
    - Post the Solubility Table: *Ask the recorders*: *What do you notice about the number of water molecules in the previous exercise and in this exercise?* [The numbers are the same, six.] *Record that number on your Data Sheet.*
- Procedure:
    - The recorders will observe and record what they see, identify when **saturation** occurs then report findings at the end of the exercise.
        1. Add one spoonful of **Epsom salts** to the **solvent**. Students representing the water should move easily and appropriately for 10 seconds breaking up the **Epsom salts** (who will only break apart when bumped or brushed by a water molecule.) Observe.
        2. Add the second spoonful of **Epsom salt**. Move for 10 seconds and observe.
        3. Add the third spoonful of **Epsom salt**. Move for 10 seconds and observe.
        4. Add the fourth spoonful of **Epsom salt**. Move for 10 seconds and observe.
        5. Add the fifth spoonful of **Epsom salt** (that will slowly settle to a low level). Move for 10 seconds and observe.
- Videotape the exercise.

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

- If time permits, watch the videotape. This will give the observers/recorders a chance to compile their data and present findings to the class.
- *Ask:*
    - To the recorders: *What did you notice about the number of water molecules?* [Six]
        - Have the recorder chart that number on the table.
    - *How many spoonfuls of salt did it take to reach **saturation**?* [Five]
        - Have the recorder chart that number on the table.
    - *Can you describe the **saturation** of **Epsom salts** in water?* [It took four spoons of **Epsom salt** for the water to reach **saturation**. The **Epsom salt** settled on the bottom on the 5th spoonful.]
    - *How can you describe the difference in **solubility** between the two salts -- **Epsom salt** and table salt?* [The water was able to hold more **Epsom salts** than table salt**.**]
    - *Which of the two substances, table salt or **Epsom salt** is more **soluble**?* [Epsom salt]
    - *What dance elements and skills did we use in our exercises?* [qualities of movement: vibrating, flowing, bumping, brushing, flowing, tight; space: level]
- Record in your science notebook:
    - What can you conclude about the **solubility** of **Epsom salts** compared to table salt? How does dancing about this topic help you understand solubility?
- Option:
    - If time permits, discuss what happens to the table salt solution when it is heated and the water evaporates. Have students demonstrate the salt crystals left behind by making group square shapes on a low level. Some shapes may contain the “X” shape.
    - Repeat for **Epsom salts.** The shapes are more connected and “snowflake like” arranged in an array.

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.)*

- Have students explore the effect temperature has on the **solubility** and **saturation** of substances. Apply the dance elements of time, space and energy to explore.