

**ITQ ARTS AND SCIENCE INTEGRATION
GRADE 5
DANCE AND PHYSICAL SCIENCE**

**The Periodic Table of Elements (PTE): Families Stick Together
Alloys and Compounds
Lesson 3**

Note: this lesson could take up to three class sessions to teach depending upon student's prior knowledge, i.e., one class session for the location and properties of elements on the PTE, one class session for alloys, and one class session for compounds.

CONTENT STANDARDS

Dance

2.2 Invent multiple possibilities to solve a given movement problem and analyze problem-solving strategies and solutions.

Physical Science

PS1c Students know metals have properties in common such as high electrical and thermal conductivity. Some metals, such as aluminum (Al), iron, (Fe), nickel (Ni), copper (Cu), silver (Ag), and gold (Au) are pure elements, others, such as steel and brass, are composed of a combination of elemental metals.

PS1e Students know that each element is made of one kind of atom and that the elements are organized in the periodic table by their chemical properties.

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

- How is the periodic table organized and how do I show the properties of elements through movement?
- What are metals, alloys, and compounds?
- How could I show solutions and compounds through movement?
- How does movement help me to understand the properties of metals?

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

- identify the parts of the periodic table according to elements with similar chemical properties.
- demonstrate understanding of the properties of elements and be able to show how combinations of elements form alloys and compounds.

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

- **Feedback for Teacher**
 - Student response to inquiry
 - Student performance
 - "Alloys and Compounds Worksheet and Instructions" worksheet (included)
 - Color coded Periodic Table of Elements completed by students
- **Feedback for Student**
 - Teacher feedback
 - Performance/Rubric
 - Alloys and Compounds Worksheet and Instructions" worksheet (included)
 - Blank Periodic Table of the Elements which students will color

WORDS TO KNOW

Dance

- **Beat:** Steady and evenly spaced pulse of movement.
- **Contrast:** To set side-by-side to show differences in size, shape, energy, direction, level or design (symmetry, asymmetry, open, closed or in patterns).
- **Dance sequence:** The order in which a series of movements and shapes occurs.
- **Shape:** The positioning of the body in space. Shapes are curved, straight, angular, twisted, symmetrical or asymmetrical.
- **Spatial relationship:** the position of the body in relationship to another body or object (over, under, above, below, between, beside, around through, etc.).
- **Stillness:** ceasing all movement in a frozen shape.
- **Variety:** the quality or range of different things that maintains audience interest. Contrast and repetition provide variety.

Science

- **Alloy:** A combination of two or more metals.
- **Chemical property:** A characteristic that describes how a substance is changed when it reacts with other substances.
- **Chemical reaction:** The process in which two or more substances combine to make one or more new substances that have different properties than the original ones.
- **Compound:** A substance made of two or more elements that are chemically combined.
- **Element:** A fundamental substance that cannot be broken down by simple chemical and physical processes.
- **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.
- **Metal:** Elements that may be shiny, stretched, bent, or hammered into different shapes without breaking; and also conduct heat and electricity well.
- **Periodic Table of Elements:** An arrangement of the elements based on atomic number that provides information about their properties.
- **Property:** A characteristic of an object that can be observed, such as size, color, shape, or texture.
- **Reactivity:** Elements that form compounds easily.
- **Solid:** Matter that has a definitely shape.

MATERIALS

- "Alloys and Compounds Worksheet and Instructions" (included)
- Color coded labels of each the following elements: copper, zinc, sodium, and chlorine (15 of each element for a class of 30 students)
- Blank copies (not colored) of Periodic Table of the Elements
- Colored markers, pencils or crayons
- Video camera
- Hand drum or other percussive instrument
- Science notebooks (one per student)

RESOURCES

- *FOSS Kit Grade 5*, "Physical Science: Mixtures and Solutions", Investigation 4: Elements

PREPARATION

- Discuss with students the characteristics of solids, liquids, and gasses.
- Refer to the Periodic Table of Elements to familiarize students with where the metals, alkali metals and noble gasses are located. Cite a few examples and the properties of each element you select.
- Prior to teaching this lesson, determine which of the two concepts, compounds or alloys your students need the most help.

- Make color coded labels of each the following elements: copper, zinc, sodium, and chlorine (15 of each element for a class of 30 students)
- Post Periodic Table of Elements on overhead.
- Teach lesson #3 from Grade 3 Dance and Physical Science for solid, liquid, and gas movement exercises.
- One copy per pair of students of the “Alloys Worksheet and Instructions” and “Compounds Worksheet and Instructions.”
- One blank copy of the Periodic Table of Elements per student.
- Five different colored markers, pencils or crayons per group of students.

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

(3 minutes)

- Post Vocabulary as it occurs during the lesson: **alloy, compound, element, gas, liquid, Periodic Table of the Elements, property, reactivity, solid**
- Review with students the groups, periods and transition **elements** on **The Periodic Table of the Elements**.
- *Ask: How is The **Period Table of Elements** is arranged? [in groups and periods]*
- *Say: The transition metals are a family of **elements** that have **properties** in common which we will explore through movement.*
- Review the **dance sequence** from lesson #2.
- Divide the class into three equal groups. Group one will represent a **solid property**, group two a **liquid property**, and group three a **gas property**.

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

(17 minutes)

Properties of elements (solids, liquids, gasses): Note: if students are familiar with the PTE and know where the solids, liquids and gasses are located on the table, this portion of the lesson may be omitted.

- Have students locate groups 17 and 18, i.e., the column under fluorine (F) and the column under helium (He).
 - *Say: Group 18 on the **Periodic Table of the Elements** is composed of **gasses**. These are very stable **gases** called the noble **gases** and very rarely form **compounds** while group 17 are very **reactive elements** and form **compounds** easily. We call group 17 the **halogens**.*
- Have students in group one find personal space in the room.
- *Say: **Gas** atoms move freely, vibrating, quickly, skipping, bouncing and jumping, gently bumping into one another in general space. Have group one move like a **gas** for 10 seconds.*
 - *Ask:*
 - *How would the two groups of **elements** in groups 17 and 18 (the halogens and the noble **gases**) move differently? [Allow think time and various student responses]*
 - *Divide group one into two smaller groups.*
 - *Say/Ask: Think about how you would solve this movement problem. How can you show the difference between the **gases** in group 18 that rarely form **compounds** from the very **reactive elements** in group 17 that form **compounds** easily?*
 - *Give 30 seconds think time and 10 seconds to perform. Freeze.*
 - *What was the difference between how the two **elements** moved? [Accept student responses.]*
- *Say/ask: Only two **elements** on the **periodic table** exist as **liquids** at standard temperature and pressure. They are **liquid metals**.*
 - *Ask:*
 - *Locate Mercury (Hg) and Bromine (Br) on the **periodic table**?*
 - ***Liquid** atoms vibrate, slide, brush against each other, and flow smoothly around and past each other in general space within the confines of their container.*

- Arrange students in group two into rows in a geometric shape (circle, square or rectangle) and have them move and flow as a **liquid** for 10 seconds. Freeze.
 - *Watch me closely. How would your movement change if I tipped the container to the left and then to the right? Tilt your body left and right. [Think and perform 10 seconds]*
 - *Can you describe how the movements are different between a **gas** and a **liquid**?*
- Have students Identify Groups 1-12 and the two bottom rows (numbers 57-102).
 - *Say: These are the **metal elements**.*
 - *Ask: What do we notice about the number of **metal elements** compared to the **gas** and **liquid elements**? [There are many more metals than **gasses** or **liquids**.]*
 - *Say: **Metals are solids** and their atoms are packed tightly together. Their physical **properties** are shiny, greyish - silver colored, and hard. Metals are good conductors of heat and electricity. Metals can be easily, bent, pulled and stretched into wires or pounded into sheets. **Metals form compounds** easily with other **elements**.*
- Identify Group 1's **elements**.
 - *Say: With the exception of hydrogen, which is a **gas**, all these **elements** are **metals**, are **solids** and very **reactive**. They are called the **alkali metals**. They form **compounds** with other **elements** easily. Group 2 are also **metals** called **earth metals**. And these **metals**, although not as **reactive** as group 1, will still form **compounds** easily.*
 - Arrange group three into a tightly compacted shape.
 - *Say: Your muscles are very tight. Vibrate your whole body in personal space in the shape. Perform for five seconds.*
 - *Ask:*
 - *How can you show being pulled and stretched into coiled wire? [Think and perform 15 seconds]*
 - *How can you show being pounded into a sheet? [think and perform 15 seconds]*
- Locate Groups 13-16 on the **Periodic Table of the Elements**.
 - *Say/Ask: These **elements** are **semi-metals** or **non-metals**. Carbon (C) is a **non-metal** and Boron (B) is a **semi-metal**. In your groups discuss what you think these substances would look like through movement. Note: If necessary, prompt students thinking by saying, if we know the **properties** of **metals**, then **non-metals** imply opposition. What predictions can we make about the **properties** of **non-metals**? [Allow student responses. Generally these **metals** are poor conductors of heat and electricity, brittle, and do not have a metallic shine.]*
 - *Say: Most **non-metals** have the ability to form a wide range of **compounds** because of their **chemical properties** and **reactivity**.*

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

- Divide the class in half (one half will be **alloys** and one half will be **compounds**) and have students form pairs. Distribute an “**Alloys**: Worksheet and Instructions” handout to each pair of the **alloy** group and one “**Compounds**: Worksheet and Instructions” to each pair in the **compounds** group. Ask students to take notes so they can solve the movement problems later in this section.
- Introduce **alloys** and **compounds**.
 - *Say: Sometimes **elements** combine to form **compounds** with completely different **chemical properties** of the original **elements**. In this next exercise we are going to show how **elements** exist and combine to form **alloys** and **compounds**.*
 - Define **alloy** [a mixture of two or more **metals**]
 - *Say: Two **metals** can combine in a mixture to form a **solid** solution. Most pure **metals** are either too soft, brittle or chemically **reactive** for practical use. Combining different ratios of **metals** as **alloys** modifies the properties of pure **metals** to produce desirable characteristics. The aim of making **alloys** is generally to make them less brittle, harder, resistant to corrosion, or have a more desirable color and luster.*
 - *Ask/Say: How can we show that brass is an **alloy**? What do we need to know?*
 1. Brass is not an **element**. It is an **alloy**; a **solid** mixture composed of which two

- elements?** [copper (Cu) and zinc (Zn)]
2. *Locate copper (Cu) and zinc (Zn) on the PTE. In which group are these **elements** found?* [Cu: group 11, period 4; Zn: group 12, period 4]. *What do we notice about the location of Cu and Zn?* [They are next to each other on the PTE and both transition **metals**.]
 3. *What are the **properties** of Cu and Zn?* [Accept student responses.] *Both are **solids**. Cu is a soft transition **metal** that can be bent, pulled, stretched or pounded into shape and it conducts electricity, Zn is a hard, brittle transition **metal** that does not conduct electricity.*
 4. *How is brass made?* [Accept student responses.] *The two **metals**, Cu and Zn are melted together(heat is added) to form a **liquid** mixture and then hardened (heat is removed) to form a **solid** mixture called brass.*
- *Ask: How can we show brass is an **alloy**?* Solve the problem:
 - Create a distinct shape hold for 8 beats.
 - Create movement to represent each **element** (Cu and Zn) and its property (refer to #3 above) for 8 beats.
 - Show the process of combining the **elements** by melting into a **liquid** and mixing for 16 beats.
 - Students will reform and harden to show the new substance, brass. (The shape for brass must show a combined shape but with evidence of the original **elements** of Cu and Zn remaining in the shape.)
 - E.g. the student representing Cu may have their right arm in a curve in both the beginning and ending shape. The student as Zn might have a hard, angular bend in the left knee in both the beginning and ending shape. Those two parts of the shape will remain the same while the rest of the shape merges to look different as the mixture is formed.) Hold that combined shape.
 - Use the double basic dance sequence from lesson #2. Omit the group and period ending and replace it with the **alloy** sequence as the ending for the dance.
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- Review **compound** [a substance made of two or more **elements** that are bonded together].
 - *Say: In a **compound** a new substance with completely different properties is formed, e.g., Table salt is a **compound**.*
 - *Ask: What do we need to know?*
 1. *Table salt is not an **element** it is a **compound** formed when the **elements** [sodium (Na) and chlorine (Cl)] bond with each other.*
 2. *Locate Na and Cl on the PTE. In which group and period are these **elements** found?* [Na: Group 1, period 3; Cl: group 17, period 3] *What do we notice about the location of Na and Cl?* [both are in the same period]
 3. *What are the **properties** of Na and Cl? Sodium is a soft, light-weight alkali **metal** that can conduct electricity. It is very **reactive** and can be explosive and is so dangerous that it has to be stored in kerosene. Chlorine is a green, poisonous halide **gas** that is also very **reactive**. Na and Cl have opposite charges: Na is positive and Cl is negative. Ask, what do we know about opposite charges?* [They attract]. *Sodium (Na+) and chlorine (Cl-) form a stable, brittle white **solid compound** that all living*

things need in small amounts to stay alive. NaCl does not have the properties of the original elements.

- **How can we show table salt is a *compound*?** Solve the problem:
 - A pair of students will represent the properties of Na⁺ and Cl⁻ by selecting one **element** and creating a unique shape and movement for that **element**.
 - Each student will move like the properties of that **element** for 8 beats (Na⁺ will move using bound, axial movement in an agitated, reactive way and Cl⁻ will move using lively locomotor movement).
 - Encourage expression on face and in the body to show that these **elements** are dangerous, explosive, reactive, volatile.
 - Pairs will show attraction and bonding for 8 beats.
 - Students will create a unique, combined shape to represent the new substance (**compound**) that shows no resemblance to the original two **elements**. Hold this new shape for 8 beats.
 - Use the double basic dance sequence from lesson #2. Omit the group and period ending and replace it with the **compound** sequence as the ending for the dance.

- Allow 5 minutes to explore and 15 seconds to perform. Videotape the performances.
- Have the entire **alloy** group perform two or three times while the **compound** group observes and determines which pair strongly solves the **alloy** problem.
- Switch groups and have the **compound** group perform while the **alloy** group observes to determine which pair strongly represents the formation of a **compound**.
- Videotape the performances.

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

- Exit Questions:
 - *What did you learn about the **properties of elements**? Give two examples of each. [They exist in **solid**, **liquid** or **gas** form. Some are highly **reactive** or **reactive** enough to form **compounds** very easily, or they don't react at all existing as independent **elements**.]*
 - *What did you learn about **metals**? [The metal groups form 75% of all substances, is the largest family and has common characteristics: they are **solids**, shiny, conduct electricity, very **reactive** and form **compounds** easily, they participate in chemical reactions, they can form **alloys** such as brass and steel, they are malleable, and ductile (can be stretched into wires or flattened into sheets)]*
 - *Record and answer the following questions in your science notebooks:*
 - *Complete the **Alloys and Compounds Worksheet** and add to your notebook.*
 - *What did you learn about **alloys and compounds**? [**Alloys** are **solid** solutions, a mixture of two metals. **Compounds** are made from a chemical reaction of two or more **elements** to form a new substance with completely different **properties**]*
 - *How do **compounds and alloys** show contrast in dance? How are they similar and different?*

➤ *How does dance help me to understand how alloys and compounds form?*

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.)*

- View videotape and have students assess their demonstration. Discuss success and challenges.
- Demonstrate **alloys**: steel-iron (Fe) and carbon (C); or bronze-copper(Cu) and tin (Sn) using the process above.
- Demonstrate **compounds**: water-hydrogen (H) and oxygen (O), sugar-carbon (C), hydrogen (H), and oxygen (O), or carbon dioxide-carbon (C) and oxygen (O)

Alloys: Worksheet and Instructions

Students' Names _____

ALLOY: A mixture of two metals.

1. What are the two **elements** that when combined make brass?

The two elements that make brass are:

_____ and _____

2. What are the properties of each element?

The properties of copper are: _____

The properties of zinc are: _____

3. What are the properties of brass?

The properties of brass are: _____

Creating the Movement for an Alloy

1. Create a distinct shape and movement to represent each **element** and its property. Hold that shape for 8 beats.
2. Show the process of combining the **elements** (melting mixing into a solution). Melt slowly for 8 beats.
3. Show the new, hardened substance (brass must show a combined shape but with evidence of the original **elements** (remember, brass is a mixture not a compound). Move your shape into a combined shape for 8 beats and freeze. Hold the shape for 8 beats.
4. Add this new part to your double basic dance sequence from the last lesson.

Describe how you made your movement choices.

Compounds Worksheet and Instructions

Students' Names _____

COMPOUNDS: A substance made of two or more elements that combine.

1. What are the two **elements** that when combined make table salt? The two elements that make brass are:

_____ and _____

2. What are the properties of each element?

The properties of sodium are: _____

The properties of chlorine are: _____

3. What are the properties of table salt?

The properties of table salt are: _____

Creating the Movement for a Compound

1. Create a distinct shape and movement to represent each element and its property. Hold for 8 beats.
2. Show the attraction and the chemical reaction of the elements. Do this for 8 beats.
3. Show the new substance (a combined, single, new shape). Freeze in a totally new and unique shape. Hold for 8 beats.
4. Add this new part to your double basic dance sequence from the last lesson.

Describe how you made your movement choices.
