Why Chemistry Matters

A Closer Look at Chemistry

The world is filled with matter and substances that come in different forms and act and react in different ways. Consequently, students are curious about how chemistry plays a role in their daily lives. The *Why Chemistry Matters* Teachers' Guide serves to fuel further exploration of chemistry. By using this guide, you have an opportunity to tap into high student interest while exposing students to broader scientific issues.

Participation in these lessons will lead students to make global connections and understand higher-level concepts, such as states of matter, atoms, and chemical reactions. Students will become aware of some of the issues involved in atomic composition and the common uses of acids and bases.

The lesson plans in this guide are tailored for grades 5-7 and address various subjects, such as science, language arts, and mathematics. Each lesson plan is designed to stand alone. As such, they do not need to be presented in sequential order. Helpful reproducible worksheets and rubrics appear at the end of the guide. The book titles referenced in this guide include:

Acids and Bases

Atoms and Molecules

Chemical Changes

Elements and Compounds

Mixtures and Solutions

States of Matter

As students investigate the topics addressed in the guide and become more aware of substances and matter, they will sharpen their critical thinking skills to work toward creative solutions to worldwide problems. We invite you to jump in and ask questions with your class as you have fun learning more about chemistry.

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National Standards Correlation

Lesson Plan Title	Correlation to National Standards
What's The Matter?	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop the abilities necessary to do scientific inquiry. Students should develop an understanding about scientific inquiry. Students should develop an understanding of properties of objects and materials.
The Atomic World	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop an understanding of properties of objects and materials.
Find The Solution!	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop the abilities necessary to do scientific inquiry. Students should develop an understanding about scientific inquiry Students should develop an understanding of properties of objects and materials.
Mix It Up!	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop an understanding of properties of objects and materials.

Lesson Plan Title	Correlation to National Standards
Healthy Acids	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop an understanding of properties of objects and materials.
Acid or Base? It's All in the pH!	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Science** Students should develop abilities necessary to do scientific inquiry. Students should develop an understanding about scientific inquiry. Students should develop an understanding of properties of objects and materials.
Watch The Temperature	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. **Mathematics** Students should select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles. **Science** Students should develop the abilities necessary to do scientific inquiry. Students should develop an understanding about scientific inquiry. Students should develop an understanding of properties of objects and materials.
It's Elemental!	**Language Arts** Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information) **Science** Students should develop an understanding of the properties of objects and materials.

For state specific educational standards, please visit www.crabtreebooks.com/.

Overview and Scope of Lesson Plan Activities

Lesson Plan Title	Subject Areas	Major Concepts
What's The Matter?	Language Arts Science	• states of matter • properties of states of matter
The Atomic World	Language Arts Science	• atoms • subatomic particles • elements • periodic table
Find The Solution!	Language Arts Science	• mixtures • solutions
Mix It Up!	Language Arts Science	• types of mixtures • characteristics of different mixtures
Healthy Acids	Language Arts Science	• properties of acids • acids used in our bodies
Acid or Base? It's All in the pH!	Language Arts Science	• properties of acids • properties of bases • pH testing
Watch The Temperature	Language Arts Math Science	• chemical changes • exothermic reactions • indicators of reactions
It's Elemental!	Language Arts Science	• groups of elements • periodic table

Pacing Chart and Vocabulary

One class period is approximately 40 minutes.

Lesson Plan Title	Pacing	Vocabulary	Assessment
What's The Matter?	1 class period	gas liquid particles solid	Evaluate student reproducibles for understanding of major concepts.
The Atomic World	1–2 class periods	electrons neutrons nucleus protons subatomic particles	Evaluate student models for accuracy.
Find The Solution!	1 class period	mixture properties solution	Evaluate student reproducibles for understanding of major concepts.
Mix It Up!	2–3 class periods	heterogeneous homogeneous suspension	Evaluate student reproducibles and presentations for accuracy and understanding of major concepts.
Healthy Acids	2 class periods	buffer corrode	Evaluate student posters and reproducibles for creativity and understanding of major concepts.
Acid or Base? It's All in the pH!	2 class periods	acid base indicator neutral	Monitor student participation during the activity and evaluate student reproducibles for understanding of major concepts.
Watch The Temperature	1 class period	chemical change exothermic reaction indicator oxidizing precipitate	Monitor student groups for participation and evaluate student reproducibles for understanding of major concepts.
It's Elemental!	2–3 class periods	element periodic table	Evaluate student reproducibles, posters, and infomercials for creativity, participation, and understanding of major concepts.

What's The Matter?

A Lesson on States of Matter

Content

Students will learn about states of matter by observing the properties of materials in solid, liquid, and gas form.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop the abilities necessary to do scientific inquiry.

Students should develop an understanding about scientific inquiry.

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

 Bodily-Kinesthetic

 Linguistic

 Visual-Spatial

Prerequisites

Have students read the book *States of Matter* before starting the lesson.

Materials

- *States of Matter* books
- marbles
- plastic shoebox
- chalkboard and chalk or whiteboard and markers
- student copies of the *What's The Matter?* reproducible
- small paper cups filled with water (1 per group)
- small plastic zip-top bags (3 per group)
- ice cubes

Instructional Procedure

Anticipatory Set

Tell students that matter is made of *particles* and that particles act differently in different states of matter. Fill the bottom of the plastic shoebox with enough marbles so that they do not have room to move around in the box. Tell students that the marbles represent particles in a solid. Show students the box and gently shake it. Ask them to describe how the marbles move. (They barely move and are packed close together.). Remove some marbles, and tell students that now, the particles represent a liquid. Shake the box, and ask students to describe how the marbles move. (They have more room to move and can swirl around in the box.) Remove more marbles, and tell students that it represents gas. Shake the box again and ask students to describe how the marbles move. (They have a lot of space to move and they can move faster in a larger area.)

Class Discussion

Write *solid*, *liquid*, and *gas* on the board. Ask students to review pages 8–13 of their books. Then have students name some properties of solids. (Solids hold their own shape; they have a fixed volume.) Remind students to think about the marble demonstrations. Ask: *How do the particles help a solid keep its shape?* (They stay close together and are arranged in a repeating pattern, which helps hold the material in one shape.) Ask students to name some properties of liquids. (Liquids do not have a set shape; liquids change shape; liquids take on the shape of containers.) Discuss how the particles act in a liquid and how this helps form a liquid's shape. (The particles have more space between them, allowing the liquid to flow and adopt the shape of its container.) Ask students to name some properties of gases.

Objectives

The student will be able to…

- understand the properties of each state of matter
- identify materials in different states of matter
- work in a small group to categorize materials according to their states of matter

(Gases can fill any container; gases do not have a specific size or shape.) Ask: *How do some gases inflate balloons and make them rise?* (The particles can move around freely, allowing gases to be light and spread upward. If the gas is lighter than air, the balloon will rise.)

Activity

Divide students into groups of three or four. Distribute the *What's The Matter?* reproducible, three plastic bags, an ice cube, and a cup of water to each group. Tell students to follow these directions:

1. Put the ice cube in a bag and seal it.
2. Pour the water in the second bag and seal it.
3. Blow air inside the third bag and seal it.

Explain that each bag contains matter in different states. Ask students to observe the qualities of the matter and record their observations on the reproducible. Then ask students to complete the rest of the reproducible using the bags of matter and their *States of Matter* books as references.

Accommodations and Extensions

Have students observe the bags of matter in groups, and then complete the reproducible as an entire class.

As an extension, ask students to investigate the ways temperature can affect states of matter. Tell students to use their books to create a list of facts about the way temperature affects each state of matter. Then have students draw a diagram showing how temperature affects one state of matter.

Closure

As a class, review students' responses on their reproducibles. Have volunteers share their answers and particle drawings for each state of matter. Then have students give examples of ways they encounter the three different states of matter in their daily lives. (Examples: oxygen is a gas that we breathe; we drink liquids; we eat solid food.) Write student answers on the board under the categories of solids, liquids, and gases. Discuss whether some materials can fall into more than one category while they are being used. (For example, ice can melt into a liquid as it is cooling a drink)

Assessment

Evaluate student reproducibles for understanding of major concepts.

The Atomic World

A Lesson on Subatomic Particles, Atoms, and Molecules

Content

Students will learn about the subatomic particles in an atom by creating a model of an atom.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Bodily-Kinesthetic
- Linguistic
- Visual-Spatial

Prerequisites

Have students read the book *Atoms and Molecules* before starting the lesson. Students should be familiar with the concepts of matter and elements.

Materials

- *Atoms and Molecules* books
- small piece of concrete
- scoop of sand
- chalkboard and chalk or whiteboard and markers
- large poster of the periodic table
- beads of 3 colors (red, green, and blue)
- glue
- scissors
- paper plates (1 per student)
- pencil crayons or markers
- student copies of *The Atomic World* reproducible

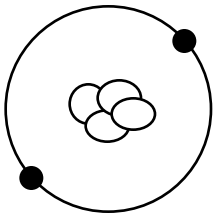
Instructional Procedure

Anticipatory Set

Show students a piece of concrete, and ask them to describe what they think concrete is made of if you break it down into smaller parts. (Answers may include rocks, water, sand, and chemicals.) Tell students that if you broke down concrete into smaller parts, sand is one thing you would see. Show students a scoop of sand and ask them if they think sand can be broken down into smaller parts. (Students may say yes, or they may say no, explaining that sand is already tiny and cannot be further broken down.) Then explain that even though grains of sand are tiny, they can be broken down into smaller parts too tiny to see. Tell students that these smaller parts are *atoms* and that everything on Earth is made up of these tiny parts.

Class Discussion

Draw the following diagram on the board and label it "atom."



Objectives

The student will be able to…

- identify and understand subatomic particles
- understand the reasoning behind atomic numbers of elements
- create a model of an atom

Tell students that even atoms can be broken down into smaller parts. Ask students to name the parts of the atom, using their *Atoms and Molecules* books as a reference. Label each part on the diagram as it is named. (*protons*, *neutrons*, *nucleus*, *electrons*) Tell students that protons, neutrons, and electrons are called *subatomic particles*. Have students describe the properties of subatomic particles. (Protons and electrons have electrical charges; protons have a positive charge; electrons have a negative charge; neutrons have no electrical charge and are neutral.)

Show students the periodic table and ask them to look at page 13 of their books as well. Explain that the periodic table shows information about the atoms in each element. Point out the parts that make up each element on the chart. Explain that the top number in each square is the atomic mass of the element, which tells how light or heavy an element is. Point out that the bottom number is the atomic number, which represents the number of protons in the element. Tell students that usually, the number of protons is the same as the number of electrons. Then tell students that to find the number of neutrons in an atom, they need to subtract the atomic number from the atomic mass.

Activity

Distribute the beads, glue, scissors, crayons or markers, paper plates, and *The Atomic World* reproducibles to each student. Tell students that they will be creating models of atoms. Assign each student one of the following elements:

- Hydrogen
- Helium
- Lithium
- Beryllium
- Boron
- Carbon
- Nitrogen
- Oxygen

Explain that the red beads are protons, the green beads are neutrons, and the blue beads are electrons. Ask students to determine the number of protons, neutrons, and electrons in their element by using the periodic table on page 13 of their books as a reference. Tell students to cut out the circle from the reproducible, glue it to their plates, and use it as a guide to create their atom. Students must create the nucleus for their element by gluing the correct number of green and red beads onto the center of the paper plate, and then add the electrons by gluing the blue beads in the rings around the nucleus. Remind students to label the parts of the model.

Accommodations and Extensions

List the number of protons, neutrons, and electrons for each element assigned. Provide the list for students to use during the activity.

As an extension, ask students to research their element and write a paragraph describing its properties.

Closure

Have students present their models to the class, explaining how they determined the number of protons, neutrons, and electrons to include. Discuss how models help people understand things that are too small to see, such as atoms.

Assessment

Evaluate student models for accuracy.

Find The Solution!

A Lesson on Mixtures and Solutions

Content

Students will learn about mixtures and solutions by observing their properties.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop the abilities necessary to do scientific inquiry.

Students should develop an understanding about scientific inquiry

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

 Bodily-Kinesthetic

 Linguistic

 Logical-Mathematical

 Visual-Spatial

Prerequisites

Have students read the book *Mixtures and Solutions* before starting the lesson.

Materials

- *Mixtures and Solutions* books
- spoonful of baking soda
- small glass of vinegar
- chalkboard and chalk or whiteboard and markers
- student copies of the *Find The Solution!* reproducible
- tape
- paper
- black marker
- 5 mixtures and 5 solutions (see activity)
- beakers (10)
- labels

Instructional Procedure

Anticipatory Set

Show students a spoonful of baking soda and ask them to describe it. (It is a solid; it is white; it is a powder; it's made of tiny grains; it smells clean.) Then show students a glass of vinegar, and ask them to describe the vinegar (It is a liquid; it is clear; it smells strong.) Tell students they just listed the physical *properties* of each of the materials. Then stir the baking soda into the vinegar and ask students to describe what they see. (It creates fizzing air bubbles; it turns into a cloudy liquid.) Explain that this change is a chemical reaction, which is a chemical property.

Class Discussion

Tell students that both physical and chemical properties are important when identifying *mixtures* and *solutions*. Ask students to explain what a mixture is, referring to their *Mixtures and Solutions* books for help. (a combination of several substances that are not chemically combined) Write their responses on the board under the word "mixture." Then ask students to describe how combining the substances affects the properties of the materials in the mixture. (The substances are put together but they each keep their own properties; the substances can be physically separated.)

Have students refer to their books to help them describe what a solution is. (a homogeneous mixture made of two or more substances; a mixture whose molecules are too hard to see; a mixture in which one substance dissolves into the other).

Objectives

The student will be able to…

- define and identify *mixtures* and *solutions*
- describe properties of mixtures and solutions

Write their responses on the board under the word "solution." Ask students to explain how the properties of the two substances are affected in a solution. (The physical properties change because one of the substances dissolves and can no longer be seen; one substance may seem to disappear completely.) Then ask students if all mixtures are solutions. (No, only most homogeneous mixtures are solutions.)

Activity

Part I: Setting Up the Stations

Before class begins, set up five stations around the classroom. Label each station with its station number. Put a pair of beakers at each station. Fill one with a mixture and one with a solution. Label the beakers with what they contain, and label one "A" and the other "B." Examples of materials that you can put in the beakers include the following:

Mixtures: mud, vinaigrette, spaghetti sauce, toothpaste, sandy water, concrete

Solutions: vinegar, sugar water, salt water, drink made from powdered mix, soda

Record a "key" of the mixtures and solutions you put at each station. You will use the key to evaluate student reproducibles.

Part II: The Activity

Tell students that they need to identify the solution at each station. Distribute the *Find The Solution!* reproducible. Ask students to visit each station and describe the properties of each beaker's contents in the spaces on their reproducible. Remind students that they can use sight and smell to observe the properties of the materials, but they should not touch or taste them. Then ask students to decide which of the two is the solution, and
circle it on their reproducible.

Accommodations and Extensions

Have students work in pairs to complete the activity.

As an extension, put three beakers at each station, and tell students that there could be any combination of mixtures and solutions (3 mixtures and 0 solutions, 2 solutions and 1 mixture, etc.). Then challenge students to identify the contents of all three beakers per station.

Closure

As a class, review the mixtures and solutions at each station. Have student volunteers share which one they chose as the solution and explain how they made their choices. If students incorrectly identified the contents of any of the beakers, explain to them the properties that make it either a mixture or solution.

Assessment

Evaluate student reproducibles for understanding of major concepts.

Mix It Up!

A Lesson on Mixtures and their Characteristics

Content

Students will learn about different types of mixtures and their characteristics by creating simple mixture "recipes" and presenting them to the class.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

 Bodily-Kinesthetic

 Linguistic

 Visual-Spatial

Prerequisites

Have students read the book *Mixtures and Solutions* before starting the lesson. Students should understand that a mixture is a combination of two or more materials.

Materials

- *Mixtures and Solutions* books
- glass of water
- glass of lemonade (pulp-free)
- chalkboard and chalk or whiteboard and markers
- student copies of the *Mix It Up!* reproducible
- materials for mixtures: sugar, salt, sand, cornstarch, flour, powdered drink mix, small pasta pieces, vegetable oil, water
- containers for materials (4 per material)
- label stickers
- tablespoon measuring scoop (4 per material)
- paper towels
- small clear containers (3 per group)
- spoons

Instructional Procedure

Anticipatory Set

Show students a glass of lemonade. Ask: *Is this lemonade a mixture?* (yes) Ask students how lemonade is made. (by mixing lemon juice, water, and sugar) Then ask students if they can see the three ingredients in the glass of lemonade. (No, the sugar dissolved into the combined liquids.) Explain that because the sugar dissolved in the lemonade, it is an example of a *homogeneous* mixture.

Class Discussion

Write *homogeneous*, *heterogeneous*, and *suspension* on the board. Ask students to use their books to help them define a homogeneous mixture. (a mixture that has the same uniform appearance and composition throughout) Ask: *Can you see the parts that make up a homogeneous mixture?* (No, they dissolve and blend together to make the mixture.) Ask students for some examples of a homogeneous mixture and write their responses on the board. (lemonade, brewed tea or coffee, etc.)

Ask students to define a heterogeneous mixture. (a mixture that has visibly larger parts that keep their own properties) Ask: *Can you see the parts that make up a heterogeneous mixture?* (Yes, the parts stay separate within the mixture.) Have students give some

Objectives

The student will be able to…

- define *homogeneous*, *heterogeneous*, and *suspension* mixtures
- make mixtures out of various materials
- create recipes for mixtures and present them to the class

examples of heterogeneous mixtures, and write their answers on the board. (concrete, pile of rocks, trail mix, drink with ice cubes in it, etc.)

Ask students what a suspension mixture is. (a liquid that has solid parts that separate over time) Ask: *Can you see the parts that make up a suspension mixture?* (At first you can't because the mixture is cloudy, but later you can see the parts because the mixture separates.) Discuss some examples of suspension mixtures and write them on the board. (mixed paint, sandy water, muddy water, tomato juice, etc.)

Activity

Part I: Creating Mixture Recipes

Before class begins, set up four materials stations for the mixtures in four different areas of the classroom. Divide each material into 4 containers, label each with the material's name, and lay a scoop by the container. Then put one container of each material at each station around the room, ensuring that each station has all the materials. Line each station's surface with paper towels in case of spills.

Divide the class into small groups, and assign each group to a station. Distribute the *Mix It Up!* reproducible, clear containers (3 per group), and spoons to each group. Tell students that they are going to create a homogeneous, heterogeneous, and suspension mixture. Explain that the ingredients for their mixtures are in the labeled containers, and that each scoop equals one tablespoon. Tell students that they should think about the characteristics of each type of mixture and then examine the ingredients to decide which ones they should combine to make each mixture. Tell students that they should use only 2–3 ingredients per mixture. Students should put the ingredients for each mixture in the clear containers, stir the ingredients in their mixtures, and then write the results on their reproducible. Students should also create names for their mixtures.

Part II: The Mixture Lab

Tell students that they are starring in a segment of "The Mixture Lab" show. Ask each group to present one of their mixture recipes to the class. Have students stand in front of one of the materials stations, and give each group a clean container and spoon to use for their recipe demonstration. Each group should tell the class the name of their mixture and the ingredients used. Groups should then demonstrate making their mixture to the class and finish by revealing the type of mixture the recipe created.

Accommodations and Extensions

Ask each group to create only one mixture.

As an extension, ask students to create a cookbook of mixture recipes that is divided into three sections: homogeneous, heterogeneous, and suspension. Tell students that they should think about materials they might have at home or at school that they could use to create their mixtures. Students should define the type of mixture at the beginning of each section and then write 3 recipes for each mixture. Encourage students to create unique names for their recipes.

Closure

Remind students that mixtures don't have to be made in a "lab." Have students give examples of some naturally-occurring mixtures on Earth, and write their responses on the board. (sea water, air, dirt, sand, clouds, nest of eggs, fossil fuels, agate rocks, etc.) Then ask students to classify each of their answers as homogeneous, heterogeneous, or suspension mixtures.

Assessment

Evaluate student reproducibles and presentations for accuracy and understanding of major concepts.

Healthy Acids

A Lesson on the Acids in our Bodies

Content

Students will learn about the healthy acids that people consume and that already exist in their bodies.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

 Bodily-Kinesthetic

 Linguistic

 Visual-Spatial

Prerequisites

Have students read the book *Acids and Bases* before starting the lesson. Students should have a basic understanding of the properties of acids.

Materials

- *Acids and Bases* books
- battery
- bottle of toilet bowl cleaner or other cleaning product
- lemon
- can or bottle of soda
- broccoli
- egg
- chalkboard and chalk or whiteboard and markers
- student copies of the *Healthy Acids* reproducible
- books or articles about a variety of acids found in the body and in foods
- pencil crayons or markers
- poster board
- scissors
- food- or health-related magazines
- glue sticks

Instructional Procedure

Anticipatory Set

At the front of the classroom, display the battery, toilet bowl cleaner, lemon, soda, broccoli, and egg. Point to the battery and toilet bowl cleaner, and have students describe these items. Then do the same with the lemon and soda, and the broccoli and egg. Ask students what all of these items might have in common. Then explain that they all contain acids. The first pair of items have acids that are harmful to your body, the second pair contain acids that neither harm nor help your body, and the third pair contain acids that are very helpful to your body.

Class Discussion

Ask students to list the properties of acids, referring to their *Acids and Bases* books for help. (Acids release a hydrogen atom into a solution with water; acids react with bases; acids can *corrode* metals; acids can hurt skin and membranes in the nose and throat; acids taste sour.) Explain that even though many of these characteristics seem harmful to the body, there are also properties of acids that help our bodies. Ask students to describe some of the positive things acids can do in our bodies. (They

Objectives

The student will be able to…

- understand that some acids are useful in the body
- work in small groups to research an acid and create a poster

provide essential nutrients and perform specific functions.) Then tell students to look at pages 14–15 in their books. Explain that to make sure you don't have too much acid in your body, *buffers* help maintain a good chemical balance. Have students describe what a buffer is. (a solution that resists changes in pH) Then discuss how buffers help the body function. (They keep the pH at a certain level and balanced in the body; they stop a chemical reaction from going forward or backward; they protect every cell in the body.)

Activity

Part I: Researching Acids

Tell students that they are going to research a healthy acid that is used in the body. Distribute the *Healthy Acids* reproducible. Divide the class into five groups. Assign each group one of the following topics:

- Folic acid
- Nucleic acid
- Amino acid
- Gastric acid
- Lactic acid

Give each group the articles or books you've gathered about each of their topics. Tell students to read these resources and record the information they find on their reproducible.

Part II: Making Posters

Distribute crayons or markers and poster board to each group. Have glue sticks, scissors, and magazines available in a common area of the classroom. Tell students to create a poster that displays information about their topic. Tell students that their posters must include an image related to their topic, which can be drawn or cut and pasted from a magazine. Around the image, students must include five to ten facts about their topic. Encourage students to be creative; ideas for types of posters they can make may include a movie poster, an advertisement, a billboard, or a magazine cover. Tell students to come up with catchy titles for their posters. When students are finished, display the posters in the classroom.

Accommodations and Extensions

Provide students with a list of facts about each acid, and have them use these lists to create their posters.

As an extension, ask students to write a paragraph describing the process of how your body uses the acid they are studying, following each step from the time of ingestion (if applicable) to the final result of its function in the body.

Closure

Ask student volunteers to present their posters. Then discuss how nutrition affects the levels of these healthy acids in their bodies. Discuss the importance of eating a balanced diet that provides nutrients the body needs.

Assessment

Evaluate student posters and reproducibles for creativity and understanding of major concepts.

Acid or Base? It's All in the pH!

A Lesson on pH Levels

Content

Students will learn about the pH of different materials by testing them with a cabbage juice indicator.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop abilities necessary to do scientific inquiry.

Students should develop an understanding about scientific inquiry.

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:


Bodily-Kinesthetic


Logical-Mathematical


Visual-Spatial

Prerequisites

Have students read the book *Acids and Bases* before starting the lesson, paying special attention to pages 6–9.

Materials

- *Acids and Bases* books
- lemons cut into small slices (1 slice per student)
- chalkboard and chalk or whiteboard and markers
- red cabbage (2 cups, chopped)
- boiling water
- blender
- mesh strainer
- bowl
- small paper cups (6 per student)
- acidic and basic materials to be tested (examples: orange juice, vinegar, aspirin [crushed], antacid [crushed], salt, baking soda, milk, soda)
- labels
- coffee filters
- scissors
- straws (cut into 2-inch lengths, 6 pieces per student)
- paper plates (1 per student)
- markers
- student copies of the *Acid or Base? It's All in the pH!* reproducible
- paper towels

Instructional Procedure

Anticipatory Set

Give each student a lemon slice. Ask them to taste the lemon and describe its taste. (sour, tangy, tart, pungent) Write their responses on the board. Tell students that lemons are acidic and that acidic foods often have a sour taste. Explain that taste is one way to test whether something is acidic, basic, or *neutral*. Then explain that taste-testing is a very unsafe and often unreliable way to test materials, so there are lots of other ways to discover whether something is an *acid* or *base*.

Class Discussion

Write the word *indicator* on the board. Using page 8 of their *Acids and Bases* books as a reference, ask students to define *indicate*. (to be a sign of something) Then ask students to explain

Objectives

The student will be able to…

- understand qualities of acids and bases
- measure the pH levels of different materials using an indicator
- use pH levels to determine whether materials are acidic, neutral, or basic

what a pH indicator does. (shows a range of pH values; shows whether a solution is an acid, neutral, or base; changes colors as a solution is placed on it)

Draw the following diagram on the board:

pH level:	2	4	6	7	8	10	12	14
	Acid --------- Neutral ---------- Base							

Discuss with students what the diagram shows. (It shows how acidic or basic a solution is based on its pH level.) Ask students how an indicator shows if a solution is an acid, neutral, or base. (It changes color, which can be matched to a pH level, and then the pH level shows if the solution is an acid, neutral, or base.) Leave the diagram on the board for students' use during the activity.

Activity

Part I: Preparation Before Class

Make the cabbage juice by putting the chopped cabbage into a blender. Cover the cabbage with boiling water and blend. Strain the juice from the cabbage using a mesh strainer over a bowl. Let it sit until the cabbage juice is cool. Fill small paper cups halfway with cabbage juice. Make a cup for each student in the class. Then prepare the materials to be tested by putting each material into a labeled paper cup (1 cup of each material per student). Add some water to the powdered materials (crushed aspirin, baking soda, crushed antacid).

Part II: Making Indicators

Note: This step should be done at least 30 minutes before Part III. Distribute a coffee filter, paper plate, scissors, straw, and small cup of cabbage juice to each student. Explain that students are going to make indicators that will be used in the activity. Ask students to cut five small (about 1"x 3") strips from the coffee filter and lay them on the paper plate. Tell students to stick the straw into the cabbage juice and then hold one end to pull some juice into the straw. Then tell students to put a few drops of cabbage juice on each strip. Remind students to be careful, because cabbage juice can stain things. Have students set the indicators aside to dry.

Part III: Testing pH

Distribute straws, markers, and the *Acid or Base? It's All in the pH!* reproducible to each student. Then, distribute the five cups of materials that students will test in the activity. Ask students to test the materials with their pH indicators by putting the straw into the liquid, holding one end to pull some liquid into the straw, and then dropping a few drops of the liquid onto the indicator. Tell students to use a new straw and indicator for each material. Students should put a drop of the material on the indicator and observe the color change. Tell students to record their observations on their reproducible.

Accommodations and Extensions

Divide students into groups and have them work together to conduct the pH tests.

As an extension, ask students to use their books to list the common properties of acids and bases. Tell students to provide examples of products that contain acids or bases that are used around the house. (for example: baking soda, ammonia, vinegar, antacids) Have students explain how each product is used and why it works.

Closure

Review the results of the pH tests as a class. Ask students if they were surprised by any of the results. Then have students discuss what each material is used for and how its acidic or basic properties might cause it to be used in certain ways.

Assessment

Monitor student participation during the activity and evaluate student reproducibles for understanding of major concepts.

Watch the Temperature

A Lesson on Exothermic Reactions

Content

Students will learn about the chemical change of an exothermic reaction by measuring the temperature change as steel wool reacts with vinegar.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Mathematics

Students should select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.

Science

Students should develop the abilities necessary to do scientific inquiry.

Students should develop an understanding about scientific inquiry.

Students should develop an understanding of properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Bodily-Kinesthetic
- Linguistic
- Logical-Mathematical
- Visual-Spatial

Prerequisites

Students should read the book *Chemical Changes* before starting the lesson, paying particular attention to pages 20–21.

Materials

- *Chemical Changes* books
- one raw egg and one hardboiled egg
- glass bowl
- knife
- chalkboard and chalk or whiteboard and markers
- student copies of the *Watch the Temperature* reproducible
- glass jars with lids (jars must be tall enough to contain a thermometer) (1 per group)
- thermometers (1 per group)
- steel wool (1 piece per group)
- protective gloves (1 pair per group)
- bowls (1 per group)
- vinegar

Instructional Procedure

Anticipatory Set

Hold up the raw and hardboiled eggs for the class to see. Tell students that these are both eggs, but that one is cooked and one is not cooked. Break the raw egg into the bowl and ask students to describe what it looks like. (It is wet; it is slimy; it does not have a specific shape; the egg white is clear.) Peel the shell from the hardboiled egg and cut the egg in half. Show the halves to students and ask them to describe what they see. (The egg has an oval shape; the yolk and white are solid; the white has a white color.) Ask: *Could you change the hardboiled egg back to make it look like the raw egg?* (no) Explain that this means the egg has gone through a chemical change.

Class Discussion

Have students refer to their *Chemical Changes* books to describe what happens during a *chemical change*. (Something new is created; a reaction makes something happen; two or more ions, atoms, or molecules touch; what is created cannot be changed back to its original form.) Ask students to name as many chemical changes as they can think of, and write their answers on the board. (Examples: rust, burning leaves, cooking an egg, food decomposing, an apple *oxidizing* when cut, fireworks, baking) Then write *indicator* on the board. Explain that an indicator shows a sign of a reaction.

Objectives

The student will be able to…

- define *chemical change*, *exothermic reaction*, and *indicator*
- observe and record temperature changes in a table
- work in small groups to conduct an exothermic reaction

Have students review page 6 in their books and ask them to give examples of indicators that show that a chemical change has occurred. (light; heat [released or absorbed]; gas; *precipitate*; change in color) Explain that reactions that always have certain indicators sometimes have special names. Write *exothermic reaction* on the board and explain that this is a chemical reaction that produces heat.

Activity

Divide the students into small groups. Distribute the *Watch the Temperature* reproducible, steel wool, glass jars, thermometers, protective gloves, and bowls. Fill each bowl with vinegar. Explain to students that they are going to create an exothermic reaction and measure the temperature change. Before the activity begins, ask students to write their predictions on their reproducibles. Then direct students to follow these instructions:

1. Put the thermometer inside the empty glass jar and close the lid. Wait one minute and record the temperature. Then remove the thermometer from the jar.
2. Put on the protective gloves and place the steel wool in the bowl of vinegar. Wait one minute as the steel wool soaks.
3. Squeeze the vinegar out of the steel wool. Wrap the wool around the thermometer bulb and put the steel wool and thermometer inside the glass jar. Close the lid.
4. Record the temperature after one, two, three, four, and five minutes.
5. Remove the thermometer and steel wool from the jar. Look at the steel wool.
6. Complete the reproducible with your observations of the experiment.

Accommodations and Extensions

Perform the experiment as a class. Set up the steel wool in the jar at the front of the classroom and have student volunteers come up to read the thermometer aloud after each minute.

As an extension, ask students to refer to page 20 of their books to write a paragraph about how and why the temperature change in their experiment occurred.

Closure

As a class, discuss the results of the experiment. Then ask students to name some common exothermic reactions. (striking a match; using a hot pack or cold pack; a fire in the fireplace; charcoal burning in the grill; fireworks) Discuss the ways that exothermic reactions are helpful to our daily lives. (Examples: they help us cook food; they allow us to heat our homes)

Assessment

Monitor student groups for participation and evaluate student reproducibles for understanding of major concepts.

It's Elemental!

A Lesson on Elements and the Periodic Table

Content

Students will learn about the properties of element groups in the periodic table by creating a poster and performing an infomercial about the properties of an element group.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

Science

Students should develop an understanding of the properties of objects and materials.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

 Bodily-Kinesthetic

 Linguistic

 Visual-Spatial

Prerequisites

Have students read the book *Elements and Compounds* before starting the lesson.

Materials

- *Elements and Compounds* books
- tube of toothpaste
- salt shaker
- chalkboard and chalk or whiteboard and markers
- a poster of the periodic table
- student copies of the *It's Elemental!* reproducible
- crayons or markers
- poster board (1 per group)
- scissors
- copies of a periodic table (1 per group)
- old magazines
- glue

Instructional Procedure

Anticipatory Set

Show students a tube of toothpaste and a shaker of salt. Ask students if these two objects have anything in common. (Student responses will vary, but the correct answer is yes.) Explain that even though they are very different, both objects contain *elements* that belong to the same group on the *periodic table*. Tell students that the toothpaste contains fluorine and the salt contains chlorine, and that those two elements belong to the group of Halogens and Noble Gases.

Classroom Discussion

Display the periodic table in front of the class, and ask students to turn to page 7 in their books. Ask students what the periodic table is. (a grid or chart that lists the elements) Ask students to describe some ways that the table is arranged. (in number order using atomic number; in groups of colors) Ask: *Why do you think the periodic table is separated in different colors?* (to show different groups of elements) Explain that even though each element is different, certain elements have similar qualities. Tell students that there are different groups of elements that are made up of elements with similar qualities. Have students refer to their books to list some of the qualities that elements in the same group can share. (how *reactive* the elements are; the kind of light they can produce when burned; their strength; their rarity; their

Objectives

The student will be able to…

- identify the characteristics of different groups of elements
- create a poster that displays information about a group of elements
- work in small groups to perform an infomercial

instability or stability; their state at room temperature; their smell; their color or appearance) Explain that while elements in a group may share certain qualities, they may produce very different products, such as the toothpaste and the table salt.

Activity

Part I: Research and Posters

Tell students that they are going to make posters describing the properties of a group of elements. Divide the class into five groups and distribute the *It's Elemental!* reproducible, crayons or markers, scissors, glue, copies of the periodic table, and poster board. Assign each group one of the following groups of elements:

- hydrogen
- alkali and alkaline metals
- transition elements (metals)
- metals and nonmetals (alloy and metalloids)
- halogens and noble gases

Ask students to research their elemental group using their *Elements and Compounds* books. Explain that they should complete their reproducibles as they research. Once students have completed their reproducibles, ask them to use these facts to create their posters with the poster board and crayons or markers. Have magazines available to the class. Tell students that they should find images related to their element groups to glue onto their posters.

Part II: Infomercials

Tell students they are going to present their posters to the class in the form of an infomercial. Explain that an infomercial is a television advertisement that presents facts about a product. Tell students that they will work as a group to make a short infomercial that presents facts from their posters about their group of elements. Encourage students to be creative with their presentations. Tell students that they must present all of the information on their posters clearly and creatively, and that each group member should participate. Give groups time to practice their infomercials, and then have each group perform their infomercial in front of the class.

Accommodations and Extensions

Have students use their reproducibles as an outline for their infomercial, and have them present the facts about their element group in the infomercial without creating posters.

As an extension, ask students to research one element from their group in detail. Students may use the Internet or library books to research the element. Ask them to make a mini-poster about the element, including its name, some products that contain it, and five facts about the element. Have students present their mini-posters in a short commercial.

Closure

Discuss the kinds of products and qualities that belong to each elemental group. Ask students to describe how the products and qualities of the elements in a group may be similar or different. (Some elements within a group are very similar — for example, most noble gases are light sources. But some are very different. For example, within the metals and nonmetals group, a pencil and a diamond are both made from carbon, and computer chips are made from silicon.)

Assessment

Evaluate student reproducibles, posters, and infomercials for creativity, participation, and understanding of major concepts.

Name ______________________ Date ____________

What's the Matter?

Directions: Answer the questions for each bag of matter.

What is in the bag? ______________________
Name the state of matter: ______________________
Describe the shape of the matter: ______________________
____
Describe the particle activity in this type of matter: ______________________
____
Draw a picture of how the particles are arranged in this state of matter:
Name three other materials that exist in this state of matter: ______________________
____

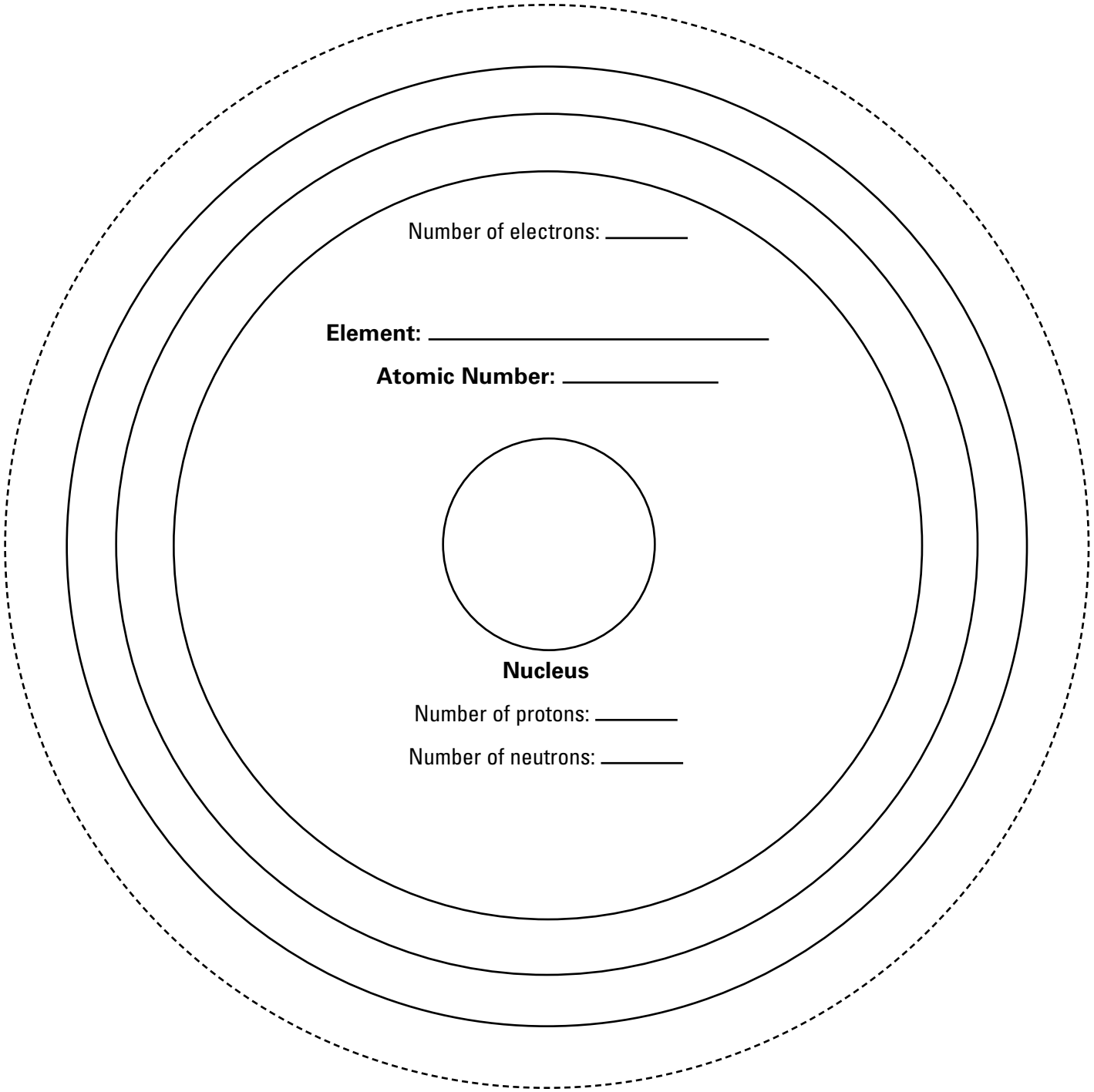
What is in the bag? ______________________
Name the state of matter: ______________________
Describe the shape of the matter: ______________________
____
Describe the particle activity in this type of matter: ______________________
____
Draw a picture of how the particles are arranged in this state of matter:
Name three other materials that exist in this state of matter: ______________________
____

What is in the bag? ______________________
Name the state of matter: ______________________
Describe the shape of the matter: ______________________
____
Describe the particle activity in this type of matter: ______________________
____
Draw a picture of how the particles are arranged in this state of matter:
Name three other materials that exist in this state of matter: ______________________
____

Name _____ **Date** _____

The Atomic World

Directions: Cut out the circle below and glue it onto your paper plate. Glue the correct number of protons (red beads) and neutrons (green beads) onto the nucleus. Then glue the correct number of electrons (blue beads) onto the rings around the nucleus. Be sure to label each part of your atom.

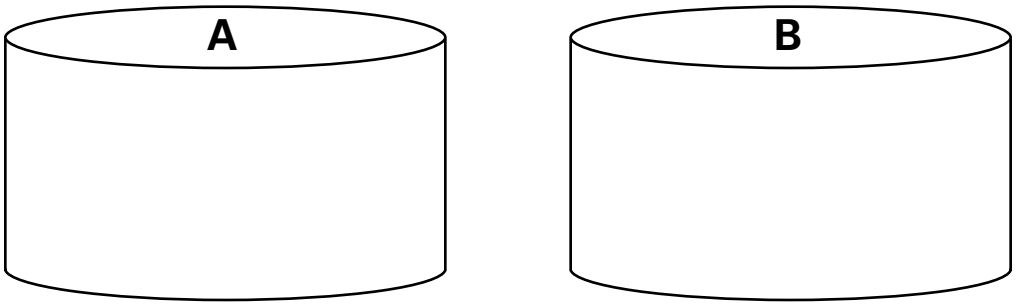


Name _____ Date _____

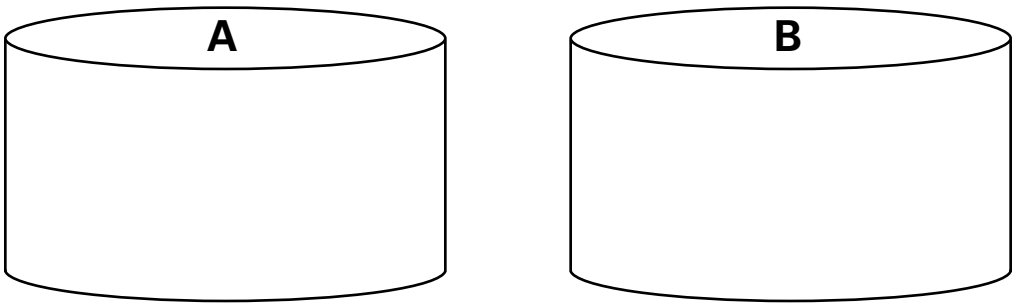
Find the Solution!

Directions: Write the name of the mixture or solution in each beaker. Then describe the properties of each beaker's contents inside the matching beakers below. Decide which beaker in each pair contains a solution, and circle the drawing of that beaker.

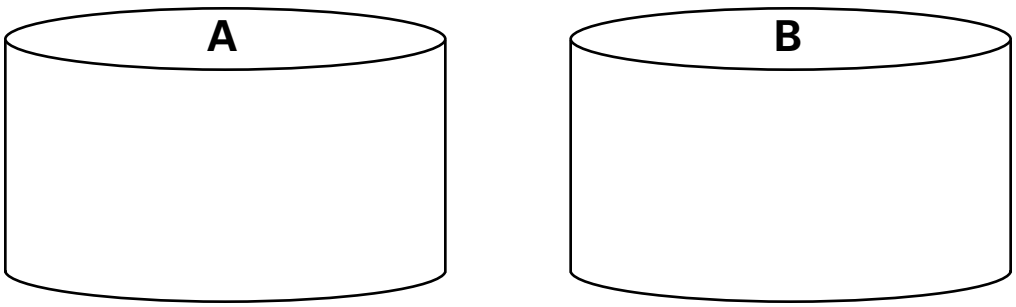
Station 1:



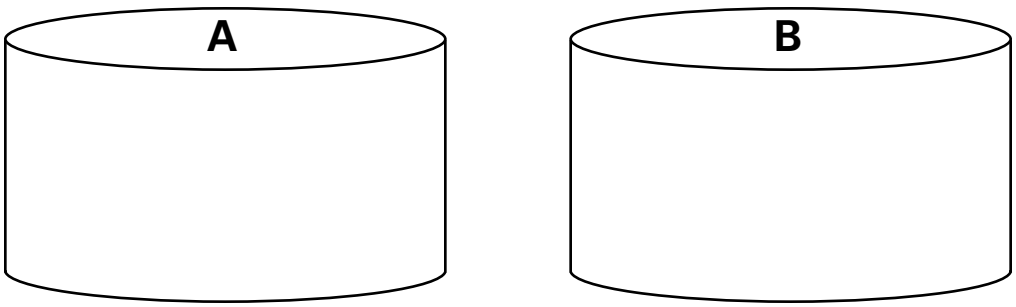
Station 2:



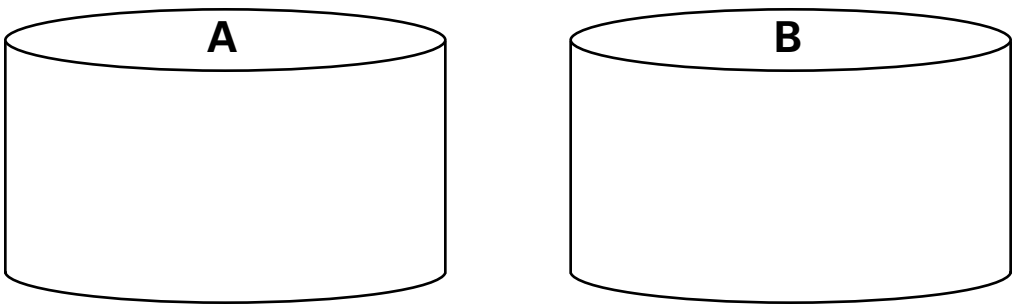
Station 3:



Station 4:



Station 5:



Name _____ Date _____

Mix It Up!

Directions: Create your mixture recipes using the materials in the classroom. You must make one homogeneous, one heterogeneous, and one suspension mixture. Record the materials you used. Write the directions for making each mixture. Then label the type of mixtures you made and come up with a creative name for each recipe.

_____

Recipe Name

Ingredients: _____

_____

_____

Directions: _____

_____

Type of Mixture: _____

_____

Recipe Name

Ingredients: _____

_____

_____

Directions: _____

_____

Type of Mixture: _____

_____

Recipe Name

Ingredients: _____

_____

_____

Directions: _____

_____

Type of Mixture: _____

Name _____ **Date** _____

Healthy Acids

Directions: As you research, answer the questions below. Then use the answers to create your poster.

Topic: _____

Is it a strong or weak acid? What is the pH level?

_____

_____

Is this acid found in food? If so, list the foods that contain this acid.

_____

_____

Is this acid found in the body? If so, describe where it is found.

_____

_____

_____

What is the function of this acid?

_____

_____

_____

How does this acid help the body?

_____

_____

_____

Additional interesting facts about this acid:

_____

_____

_____

_____

Name _____ Date _____

Acid or Base? It's All in the pH!

Directions: Write the name of each material you are testing in the left column of the table. After you conduct and observe each test, mark an X in the column for the color that the indicator shows for each material. Then complete the statements below the table.

Material Tested	Red pH: 2	Purple pH: 4	Violet pH: 6	Blue pH: 8	Blue-Green pH: 10	Green-Yellow pH: 12
_____						
_____						
_____						
_____						
_____						

1. The pH of _____ is _____ . It is an acid / base / neutral.
[name of material] [pH number] [circle one]

2. The pH of _____ is _____ . It is an acid / base / neutral.
[name of material] [pH number] [circle one]

3. The pH of _____ is _____ . It is an acid / base / neutral.
[name of material] [pH number] [circle one]

4. The pH of _____ is _____ . It is an acid / base / neutral.
[name of material] [pH number] [circle one]

5. The pH of _____ is _____ . It is an acid / base / neutral.
[name of material] [pH number] [circle one]

Name _____ Date _____

Watch the Temperature

Directions: Write your predictions before you start the experiment. Then record your temperature observations in the table. Once you have finished the experiment, write a paragraph describing the results.

Experiment Predictions:

Experiment Observations

Item:	Empty Jar	Steel Wool and Vinegar: 1 minute	Steel Wool and Vinegar: 2 minutes	Steel Wool and Vinegar: 3 minutes	Steel Wool and Vinegar: 4 minutes	Steel Wool and Vinegar: 5 minutes
Temperature:						

Experiment Results:

Name _____ **Date** _____

It's Elemental!

Directions: Answer the questions below. Use the information you find to help you make your poster.

1. What is the name of your group of elements?

_____

Write this at the top of your poster.

2. What are some products made from the elements in your group?

_____

_____

_____

_____

Find or draw a picture of one of these products and put it on your poster.

List the other products in a box on the poster.

3. What are five facts about your group of elements?

_____

_____

_____

_____

_____

Write these facts around the picture on your poster.

4. What are the names of the elements that belong to your element group?

_____

_____

_____

_____

Cut out the group of elements from the periodic table, and glue it near the bottom of the poster.