Mix It Up
Teacher's
Resource Guide

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Class Activities:

Here are activities for you to do with the class—before and after the workshop—to reinforce the concepts and terms in the lesson with an emphasis on the subjects of Science, Technology, Engineering, and Math (STEM).

Additional Resources

This teacher's guide includes a cross-curricular activity section, a book list, vocabulary words and a themed assessment questionnaire.

Science: Sorting Out Solutions

Students separate colored mixtures into chromatograms.

Materials

- Food coloring or watercolor paint (red, yellow and blue)
- Straws (1 per group)
- Ice cube tray with six wells (2 per group)
- Cotton swabs (6 per group)
- Coffee filter paper (1 per student)
- Spray bottle

Procedure

1. Before class begins, fill a well in each egg carton with red, yellow or blue watercolor paint respectively. Cut the straws into three equal parts. Put one straw into each paint well. Fill the spray bottle with water.
2. Divide the class into groups of three students. Give each group a prepared plastic egg carton.

3. Demonstrate how to transfer paint into the empty wells with the straw. Cover the open end of the straw with your finger while the tip of the straw is in the paint. Lift up the straw without removing your finger and put it into an empty well. Remove your finger to allow the paint to flow into the well.
4. Have the groups create three new colors by mixing the primary colors in the remaining egg carton wells.
5. Hand each student one coffee filter. Hand each group six cotton swabs. Tell the groups to keep the paint separate by assigning one cotton swab to one color in their egg carton. Have the students draw dots or lines on their coffee filters with the paints. Each colored dot or line should be separate from the other colors.
6. Walk around the class and wet each student's coffee filter with one spray of water. Have the students compare the colors as they separate out.

Explanation

The paints get their colors from dye pigments. These colored dyes separate when dissolved in a liquid like water. This process is called chromatography. Different dye mixtures make different paint colors, and chromatography can help you identify the colors. Adding water to the filter paper dissolves the dyes in the paint. The dissolved dyes move through the filter paper. Smaller dyes travel farther from the initial spot. This forms a color pattern specific to that paint mixture. Compare the filters from the various groups. You can use the chromatography test results to find matching paint mixtures.

Technology: Mixtures in Motion

Create a mini lava lamp of immiscible liquids and differing densities.

Materials

- Cooking oil
- Food coloring or watercolor paint
- Water
- Marker
- Clear, leak proof bottles (1 per group)
- Effervescent tablets (e.g. Alka-seltzer tablets)
- Flashlights (1 per group)

*Note: The amount of cooking oil depends on the size of bottles you use. Change this activity into a demonstration to reduce the amount of oil needed.

Procedure

1. Before class begins, mark a line about 2.5 cm (1 in.) below the bottle's mouth.
2. Divide the class into groups of 5. Hand each group a clear, leak proof bottle and a funnel. Have the groups fit the funnel spout in the bottle's mouth.

3. Have each group choose a color to add to their bottle. Allow them to add about 10 drops of food coloring or a spoonful of paint to their bottle via the funnel.
4. Fill each group's bottle 1/3 full of water. Fill each group's bottle with cooking oil up to the marked line.
5. Have the groups cap their bottle. Verify that each group's bottle is properly capped. Ask the students to hypothesize what will happen when they shake the bottles and then have them shake their bottle. The water will become colored and the oil will separate and float on top of the water layer.
6. Hand each group a flashlight. Ask the students to hypothesize what will happen when they add an effervescent tablet to their bottles. Have them uncap their bottles and give each group an effervescent tablet. They may need to break the tablet into smaller pieces so that it fits through the bottle's neck. Allow time for the tablet to completely dissolve before capping them.
7. Have the students recap their bottles (verify they are properly capped) and then have the students shine the flashlight through the bottom of the bottle. This should create a lava lamp effect.

Explanation

Certain liquids mix easily with each other. They are miscible. Water and watercolor paint are miscible. Others will not mix at all. Oil and water are immiscible. Oil is less dense than water so it floats in a layer over the water. The effervescent tablet produces carbon dioxide gas in the water. Carbon dioxide gas is less dense than oil or water. It floats up to the top and escapes into the air. When it floats up, it takes some water with it. The gas and water together are buoyant in the oil. When the gas escapes, the water sinks back down to the bottom. The rise and fall of the water and gas creates a lava lamp effect. Electric lava lamps use energy to create a difference in buoyancy. Technicians mix several substances to create a wax compound that is denser than the clear liquid in the globe. An incandescent 40 watt bulb shines through the bottom of the globe and warms up the wax. The wax softens as it warms up, and its buoyancy changes. The softened wax rises to the top where it cools. The cooled wax is denser so it sinks. The technicians need to adjust the wax compound with the liquid in each individual globe to have this effect!

Engineering: Cleaning Crew

Purify dirty water with mechanical filters.

Materials

- Bowls (2 per group)
- Filter paper (1 per group)

- Sieves (1 per group)
- Cheesecloth (1 per group)
- Funnels (1 per group)
- Spoons (1 per student)
- Forks (1 per group)
- Plates (1 per group)
- Bottles (1 per group)
- Aquarium filter pouch (containing activated carbon)
- Hole-punched paper bits (1 handful per group)
- Cooking oil
- Mustard
- Confetti
- Sand

Procedure

1. Before class begins, label five bowls "sewage materials". Fill each bowl with one of the following: diluted cooking oil, diluted mustard, wet confetti, wet sand or hole-punched paper bits.
2. Ask the class to describe sewage. Tell them sewage is the collection of liquids and waste materials collected from sinks, showers, toilets and maybe even storm drains. Ask the class how they think sewage gets treated, as in separating out the waste and processing the water for reuse. Tell the class they will create a test sewage and then will be sewage processing plants. The challenge is to figure out how to treat the sewage mixture.
3. Divide the class into groups of five. Hand each group one bottle, one plate, one funnel, one sieve, one spoon, one fork, one piece of filter paper, one piece of cheesecloth, a paper and a pencil. Show the groups the five bowls of sewage waste material. Give the groups time to write down the type of waste and their ideas of which tools to use to clean the waste from the sewage. Encourage the groups to create a blueprint of their sewage processing plant.
4. Give the groups time to set up their sewage processing plant.
5. Hand each group a bowl. Tell the groups each member can add one spoonful of each pretend waste to make their sewage. Allow the groups time to create their sewage.
6. Tell the groups to give their bowl of sewage to another group. Set a time limit and challenge each group to use their tools to clean their given bowl of sewage. They need to remove the solid waste to put into a trash can, and then filter the solution to clarify the water as much as possible.
7. After the time has passed, discuss how each group's sewage processing plant worked or didn't work.

8. The group's treated water should be yellow from the mustard. Pour one group's treated water through the aquarium filter to remove the color. Discuss what the yellow color could represent and then introduce the idea of using chemical filters to treat the organic part of sewage.

Explanation

Sewage can contain a mixture of solid and liquid waste materials. Sewage passes through many stages during treatment. Each stage separates a type of waste. Parallel bars rake through the sewage to remove large trash such as leaves, plastic, cans and sticks. In this case, the confetti and hole-punched paper represent solid trash. The next stage is to remove particles and grease. Grit, sand and broken glass settle at the bottom of the tank. Rotating bars skim off floating grease and oil. The cooking oil represents the grease and the sand represents the settled material. Most processing plants use bacteria to treat the organic component of sewage. This can be human waste, food waste, soaps and detergent. The mustard represents organic sewage. The aquarium filter contains activated carbon. This removes color from the water, but would not remove organic waste. Sewage treatment plants bubble oxygen through sewage to grow bacteria that consume the waste. Some sewage treatment plants recreate wetlands to treat the material. Wetlands are natural water treatment centers!

Math: Heated Solutions

Students measure how temperature affects solubility.

Materials

- Thermometers (1 per group)
- Timers (1 per group)
- Paper (1 per group)
- Pencils (1 per group)
- Stirring rods (2 per group)
- Beakers (2 per group)
- Spoon
- Epsom salts
- Very cold water
- Very warm water

Procedure

1. Divide the class into groups of five students. Give each group a beaker of cold water, a beaker of warm water, a pencil and paper.
2. Tell the students they will compare the temperature difference and time needed to dissolve Epsom salts in the warm and cold water. Have them create a chart on

their papers. They will need to mark down the initial and final temperatures, and the time taken to dissolve a spoonful of Epsom salts in the warm and cold water.

3. Give each group a timer and demonstrate how to use them. Give each group a thermometer and have them record the temperature of the warm and cold water.
4. Have the groups start the timer once you add a spoonful of Epsom salts to their beaker of warm water. Have the groups record the final temperature and dissolving time.
5. Repeat the experiment with a spoonful of Epsom salts in the cold water.
6. Compare the temperature change and the time required to dissolve the salts. Is there a noticeable difference? Have the groups calculate the average temperatures and dissolving times.
7. Have the groups add more Epsom salts, one spoonful at a time. Have them chart the time it takes for each addition of Epsom salts to dissolve, and compare the amount of salt dissolved in the two beakers.

Explanation

Matter that dissolves is a solute. Matter that does the dissolving is a solvent. A mixture of dissolved solute and solvent is a solution. Solute and solvent molecules rest in contact with one another without forming new molecules. Temperature and concentration are factors that affect how a solute dissolves in a solvent. Adding heat gives the molecules more energy. They can move around and come into contact faster with each other. Solute dissolves easier in warm solvent. Adding more solute makes a higher concentration in the solution. A higher concentration lowers the amount of solvent available to interact with the solute. Solute dissolves slower in solvent that already contains dissolved solute.

The state of matter also affects how solutes dissolve. Heat makes solid solute molecules dissolve faster in liquid solvents. Molecules in gases dissolve slower when warmed up. They need to lose energy by cooling down in order to dissolve more easily!

MORE TO DO

Language Arts

- Have the students create poetry about mixtures and solutions.
- Have each student write up their favorite mixture in recipe form. Put them together to create a class recipe book.
- Have the class create adjective-heavy advertising posters promoting the ingredients of various food and drinks.
- Create mixture stories –have each student write a five-sentence story based on a main theme. Each sentence should be numbered and written on a separate line. Have the students cut out the sentences and put them in the appropriate numbered bags (sentence 1 through 5). Have each student pull one sentence out of each of the five bags and read their mixed-up five-sentence story.

Art

- Have the students write down five facts they learned from the workshop. Have them draw a picture or symbol to represent each fact.
- Have students research and then draw a diagram of how a mechanical sorting machine would sort recycled materials.
- Purchase a soap-making kit from a craft store and have the class create soaps to use at the school sinks or at home. Add a field trip to the local garden to pick flowers or herbs to add to the soaps.

Math

- Have the students convert a cooking recipe into metric units and then prepare it.
- Challenge the students to come up with pictorial equations to describe various types of mixtures and solutions. For instance, in the equation x + y = z, substitute the x for a picture of water, the y with a picture of a scoop of dirt and the z with the words "liquid-solid mixture".
- Have the students compare how well various food-based solutes dissolve. Some possible examples include hot chocolate powder, iced tea powder, Jell-O powder, sugar, pepper, and salt. Tell the students to graph their results.

Social Studies

- Have students research how a recycling plant separates materials and then have the students create information sheets for how families should recycle.
- Have the students research how drinking water is treated. Ask your local water treatment plant for sample materials to test the drinking water in your school.

- Have the students research and present how milk is processed. Some types of milk include skim, 2% and whole milk. Some processes include pasteurization, ultrapasterization and homogenization.

Field Trip Suggestions

- Ask a local donation organization if your class can visit (and help out) their sorting facility.
- Visit a water treatment plant.
- Visit a cheese-making factory or a chocolate-making shop.

BOOKS

Title: Bartholomew and the Oobleck
Author: Dr. Seuss
Publisher: Random House Books for Young Readers
ISBN#: N/A
Description: This classic Seuss tale describes how the words "I'm sorry" have a magic to themselves. A young page boy named Bartholomew tries to help his king after the proud monarch orders his magicians to concoct oobleck, a slimy mixture that falls from the sky and gums up the kingdom. This book is suitable for kindergarten to 2nd grade.

Title: Pinkalicious and the Pink Drink
Author: Victoria Kann
Publisher: Harper
ISBN#: 9780061927324
Description: A little girl by the name of Pinkalicious sets up a pink lemonade stand to earn money to buy pink bubble gum balls. This pleasant story follows her attempts at mixing up pink lemonade to sell to her neighbors. Pink's mother helps out at the end to create a tasty strawberry-pink lemonade success. This book is suitable for kindergarten to 2nd grade.

Reference Books

Title: Oobleck, slime & dancing spaghetti: twenty terrific at-home science experiments inspired by favorite children's books
Author: Jennifer Williams.
Publisher: Bright Sky Press
ISBN#: 1933979348
Description: This resource book combines classic children's literature with fun kitchen science experiments. Each chapter presents a new story, includes an experiment, facts and suggestions for more science exploration. This book is suitable for kindergarten to 4th grade.

Title: Super Science Concoctions: 50 Mysterious Mixtures for Fabulous Fun
Author: Jill Frankel Hauser
Publisher: Williamson Publishing Company
ISBN#: 1885593023

Description: This fun book provides children with recipes to concoct amazing mixtures. There are over 75 simple, safe, and easily reproducible experiments with color illustrations to be tried out! This book is suitable for 2nd to 5th grade.

Title: Amazing Kitchen Chemistry Projects You Can Build Yourself
Author: Cynthia L. Brown
Publisher: Nomad Press
ISBN#: N/A
Description: The basics of chemistry are covered in this activity book. Children learn about atoms and molecules, states of matter, chemical reactions and the properties of water among other key chemistry concepts. The simple experiments use common household materials and range from wacky, unusual to yummy cooking projects. This book is suitable for 3rd to 6th grade.

Title: Mixtures and Solutions
Author: Molly Aloian
Publisher: Crabtree Publishing
ISBN#: 0778742504
Description: This straight-forward book explains the basics of mixtures and solutions. Common examples of mixtures emphasize how our lives are full of chemistry. This book is suitable for 3rd to 6th grade.

Title: Chemistry (DK Eyewitness Books)
Author: Ann Newmark
Publisher: DK CHILDREN
ISBN#: 075661385X
Description: This book offers a history lesson in chemistry. It describes our first experiments with fire to our modern-day use of chemicals. The full-color images provide lessons about how scientists study and apply chemical knowledge. This book is suitable for 3rd to 6th grade.

Title: Chemistry for Every Kid
Author: Janice VanCleave
Publisher: John Wiley & Sons
ISBN#: 0471620858
Description: This resource book provides fun experiments and clear explanations for a series of simple chemistry concepts. Children explore the structure of matter, the workings of acids, gases, and solutions among other subjects. This book is suitable for 3rd to 6th grade.

VOCABULARY

Colloid: a liquid containing more than one substance in which one of the parts are large particles big enough to reflect light but small enough to remain suspended by the solvent

Compound: a substance made up of two or more types of matter and that has certain properites

Dissolve: to mix completely with another substance to form a solution

Filter: an object that traps certain substances and allows others to pass through

Heterogeneous mixture: a mixture of visibly different substances or states of matter

Homogeneous mixture: a mixture that has an overall uniform appearance and composition

Matter: what all things are made of

Mixture: two or more substances that are mixed together physically but whose molecules are not bonded together

Solute: the substance that is dissolved to form a solution

Solution: a liquid containing two or more substances mixed at the molecular level such that they look like one single substance

Solvent: the substance in which a solute is dissolved to form a solution

Substance: a single type of matter that has certain properties

Suspension: a liquid containing more than one substance in which one of the parts are large particles big enough to reflect light and heavy enough to settle out of the solvent

ASSESSMENT QUESTIONNAIRE

The next page contains a series of questions designed to help assess students' understanding of the concepts in the workshop. It is in a pop quiz format that can be photocopied and given to children to complete after the workshop.

Answer Key to "Mix It Up" Questions:

1. B
2. A
3. B
4. C
5. C
6. C

Mix It Up Questions

Circle the correct answer for each question.

1. The ocean contains salt dissolved in water. This makes it a:
   a) mixture
   b) solution
   c) suspension

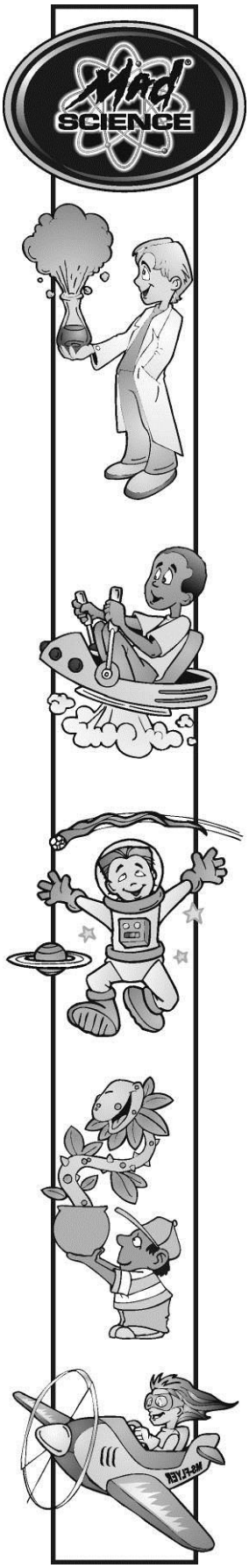
2. Which sentence is true?
   a) Solutes dissolve in solvents.
   b) Solvents dissolve in solutes.
   c) Solutes are the same as solvents.

3. A bowl of cereal containing milk, flakes and fruit is:
   a) a compound
   b) a mixture
   c) a solution

4. What device would sort sand from pebbles?
   a) a beaker
   b) a phone
   c) a filter

5. What does water do to iced tea powder?
   a) it colors the powder
   b) it melts the powder
   c) it dissolves the powder

6. Iced tea make from powder is a:
   a) suspension
   b) solvent
   c) solution



Paper Activities

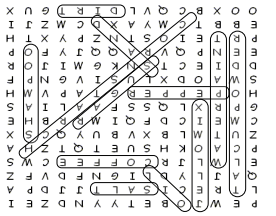
Word Search

The words in the list are hidden in the grid below. Circle all the words that you can find.

P	E	W	J	O	B	E	T	Y	Y	N	D	Z	E	I
L	T	R	E	C	I	S	A	L	T	J	J	D	P	A
Q	A	J	L	Y	D	L	I	G	N	F	D	V	F	Z
E	L	W	L	J	R	C	O	F	F	E	E	C	W	S
P	C	A	O	K	H	S	U	E	T	Q	T	Z	H	A
Z	U	T	M	L	B	X	V	B	U	Y	Q	C	S	X
C	M	E	I	C	D	F	Q	I	M	R	R	B	H	E
G	P	R	X	L	Q	S	S	F	A	A	L	I	A	S
H	O	P	E	P	P	E	R	G	T	A	P	V	M	H
S	W	A	O	D	X	L	U	S	I	V	G	N	P	F
D	D	I	E	C	T	S	N	K	G	M	I	J	O	R
E	E	N	P	Q	V	R	A	Q	Q	J	Y	F	O	P
P	R	T	E	I	O	S	T	N	Z	P	Y	X	T	H
E	B	B	T	C	M	Y	A	X	D	C	M	Z	J	I
O	O	X	B	C	Q	V	L	D	I	R	T	G	U	X

Word List

coffee
dirt
jellomix
oil
pepper
salt
sand
shampoo
sugar
cornstarch
talcumpowder
waterpaint



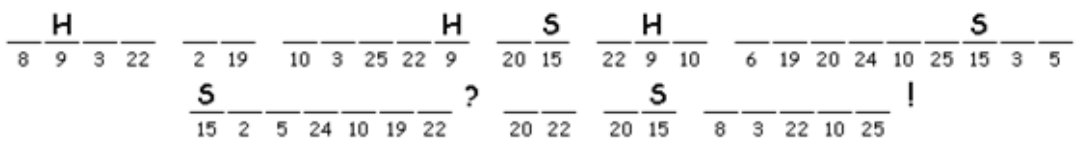
Word Search Solution:

Cryptogram

Assign a number to each letter through trial-and-error. Fill in the spaces below by writing each letter above its corresponding number.

The letters H and S have been done for you.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
							9											15							



Cryptogram solution: What on Earth is the universal solvent? It is water!