Celebrating Chemistry and Art!

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Chemistry & Art–A Great Mix!

Chemistry is a part of everything! Chemistry is the science people use to explore what things are made of and to explain how they change. This year, National Chemistry Week, an annual event sponsored by the American Chemical Society (ACS), has the theme *Celebrating Chemistry and Art*. People all over the United States will be finding out about the connections between chemistry and art.

The word art means different things to different people. To some people, it means the performing arts like theater, music, and dance. To others, art means the visual arts like painting, sculpture, and photography. Chemistry plays an important role in all of the arts. In theater, for example, chemists help produce better kinds of makeup to create exciting special effects. Chemists influence the sound a musical instrument makes by improving the materials the instrument is made from. Ballet dancers now have stronger, longer-lasting pointe shoes because chemists created new materials and glues.

The activities described in this paper are visual art activities. It is because of chemistry that each of these activities turns out the way it does. As you carry out the activities, you will not only be an artist, you will also be a chemist! Before beginning any of these activities, be certain to work with an adult and read the warning labels on all materials being used. It is highly recommended that eye protection be worn during these activities. As indicated, several of the activities require the wearing of chemical safety goggles.

REMEMBER: No materials should ever be placed in the mouth.

Marker Butterflies

Some artists use the way paint moves on a surface to produce interesting shapes and designs. Many artists paint on canvas, a type of fabric that is very absorbent. Before painting on canvas, most artists treat it so it does not absorb as much liquid. The artist Helen Frankenthaler did not prepare her canvas in this way. Frankenthaler used the absorbent property of canvas to create interesting shapes and patterns. To make a painting, she would tack a canvas onto the floor and pour the paint directly onto the surface. She would let the way the paint moved over the canvas help decide what the picture would be.

MATERIALS

- 2 circular white coffee filters
- 1 pipe cleaner
- Water-based markers (various colors)
- Scrap paper (do not use newspaper)
- Paintbrush
- Paper towel
- Cup of rinse water

In this activity, painting with water over marker designs on coffee filters will produce different shapes and beautiful works of art.

PROCEDURE

1. Place the coffee filters on top of a piece of scrap paper. Use several different color markers to create a design or pattern on each coffee filter. Please note that this design will be changed when the directions in Step 3 are carried out.
2. Place both coffee filters on another piece of scrap paper.
3. Dip the paintbrush in the water and paint over the designs with the wet brush. Be certain to rinse the brush in the water several times while you are painting with the water. Watch how the designs change.
4. Fold the pipe cleaner in half. Hold the pipe cleaner about 2 cm from the fold and twist two times. This will leave a small loop.
5. Scrunch one of the coffee filters along an imaginary line down the middle of the filter to produce one set of the butterfly's wings.
6. Place this filter inside the open ends of the pipe cleaner, centering it close to the twisted end.
7. Repeat Step 5 with the other coffee filter. This is the second set of the butterfly's wings. Place it above the first filter, inside the open ends of the pipe cleaner.
8. Twist the two pieces of the pipe cleaner together about 4 cm from the open end of the pipe cleaner. This will hold the two filters in place.
9. Turn down the ends of the pipe cleaner to look like antennas.
10. Thoroughly clean the work area and wash your hands.

WHERE'S THE CHEMISTRY?

The filter is made of a special type of paper that absorbs water easily. Paper towels are made of a similar type of paper. The colors in the markers dissolve, or are soluble in, water. When the water is painted onto the coffee filter, the colors dissolve in the water. As the paper filter absorbs the water, the dissolved colors move with the water and create the resulting color patterns.

Safety First!

ALWAYS

- Work with an adult.
- Read and follow all directions f the activity.
- Read all warning labels on all materials being used.
- Wear eye protection when recommended.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Use all materials carefully, followi the directions given.
- Refrain from eating or drinking while doing science activities.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

For more information on safety and tips on presenting the activities go to chemistry.org/ncw

Universal Indicator Rainbow Trout

The colors people see depend on the chemicals that things are made of. Sometimes the color of a substance helps to identify it. This activity shows how color changes can help identify two kinds of chemicals called acids and bases.

Participants must wear chemical safety goggles to do this activity!

MATERIALS

- ❑ Universal indicator solution (available from chemical supply houses)
- ❑ Lemon juice
- ❑ Liquid laundry detergent
- ❑ Index card or piece of acid-free cardstock with nonshiny finish
- ❑ Rainbow trout pattern
- ❑ Paintbrush
- ❑ Cotton swabs
- ❑ Water
- ❑ 3 small plastic cups
- ❑ Paper towels
- ❑ Pencil, pen
- ❑ Scissors
- ❑ Teaspoon
- ❑ Chemical safety goggles

PROCEDURE

1. Trace the rainbow trout pattern onto the index card or a piece of the card stock. Cut out the fish and lay it on a paper towel.
2. Use masking tape and a pen to label the 3 plastic cups, each with one of the following names: “lemon juice”, “universal indicator solution”, and “laundry detergent”.
3. Add a small amount of lemon juice to the cup labeled “lemon juice”. In the cup labeled “laundry detergent”, place a small amount of laundry detergent and 1 teaspoon of water.
4. Place about 40 drops of universal indicator solution into the remaining labeled cup. Use a paintbrush to completely color the fish with this green solution. The fish will change color because of the way the solution reacts with the kind of paper you are using. If the paper turns a salmon color, the paper is very acidic. If the paper is closer to a green color, the paper is considered to be acid-free.
5. The fish can be wet or dry to do this step. Dip a cotton swab in lemon juice and paint a few stripes, dots, or other designs on the fish. Do not cover the entire fish with the designs. Observe what happens.
6. Dip a different cotton swab into the detergent solution. Paint more stripes or dots on the fish. Compare what happens with the detergent and what happened when the lemon juice was used to make the designs.
7. Allow the fish to dry and observe what happens to the colors.
8. Thoroughly clean the area and wash your hands.

WHERE’S THE CHEMISTRY?

The reason color changes occur on the fish is because the universal indicator solution was painted onto the fish. The solution is a special type of chemical used to tell if another substance is an acid or a base.

Universal indicator solution is normally green, but acids make it turn yellow, orange, or pink. Bases make it turn blue or purple. Acids are chemicals like tomato juice, lemon juice, and vinegar. Bases are chemicals like soap, laundry detergent, ammonia, and baking soda.

Newspaper Collage

Making a collage involves combining many items and placing them on the same piece of paper to make one picture. Collages can be made by pasting different pictures on a piece of paper. For example, a collage could be made from pictures of animals in the zoo. Other collages may be put together from materials made from different kinds or colors of fabrics.

In this activity, you will create a collage by using vinegar to transfer color pictures from a newspaper onto a piece of white paper. The type of inks that are used for color pictures in the newspaper make it possible to transfer the pictures from the newspaper to other papers. The inks, the vinegar, and the paper are all made of chemicals.

MATERIALS

- ❑ Color pictures from a newspaper
- ❑ White vinegar in a small cup
- ❑ Cotton swabs
- ❑ Metal teaspoon
- ❑ Paper towels
- ❑ Scissors
- ❑ White paper

PROCEDURE

1. Carefully use the scissors to cut out a small (5 cm by 5 cm or smaller) color picture or comic from the newspaper.
2. Dip a cotton swab in the vinegar. Lightly moisten the picture you want to copy by wiping the picture with the vinegar-soaked swab. Make sure to cover every part of the picture with vinegar.
3. Place the picture between two paper towels and press hard for 5 to 10 seconds to dry off any excess vinegar.
4. Place the picture with the side to be copied face down on a piece of white paper.
5. Place another piece of white paper on top and rub hard with the bottom of a teaspoon. Make sure to rub over the entire picture.
6. Remove both the upper paper and the piece of newspaper. There should be a transfer of the picture on the bottom white paper. (If the transfer is too faint, repeat the process with a different picture but rub with the edge of the spoon instead of the bottom.)
7. Choose a different picture and repeat steps 1–6, placing the second picture at a different location on the same piece of white paper when the transfer is made.
8. Repeat Step 7 until the collage has several different pictures transferred onto it.
9. Thoroughly clean up the work area and wash your hands.

GOING A STEP BEYOND

1. Repeat the above activity except this time, transfer something with words on it.
2. Observe how the appearance of this transfer compares to the transfer of the picture.
3. To make the words easier to read, turn the paper over and use a cotton swab to rub a little baby oil on the back of the paper.
4. Observe what happens.

WHERE'S THE CHEMISTRY?

The ink used on the newspaper does not mix well with water. In other words, the ink does not dissolve easily in water. This is good because the ink is less likely to smudge when the newspaper gets water on it, even from the moisture on fingers. The ink does dissolve a bit better if certain kinds of chemicals are added to the water. Vinegar is a solution of water and a weak acid called acetic acid. (Check the label of the vinegar bottle.) When the vinegar is wiped over the color picture, some of the ink dissolves and the picture can be transferred more easily to another piece of paper.

Look at the two transfers. When words were transferred, it was easy to notice that they were reversed, just as the pictures were. When you apply baby oil to the back of the paper, the oil makes the paper "translucent" so that light can shine more easily through the paper, and because of it, the image or words can be seen as well.

You Can Be a Chemist!

Chemistry is the science that helps us learn about the world around us. Everything is made of chemicals—our bodies, our pets, our houses, the toys we play with, the medicines we take, the food we eat, and the books we read. Chemicals are the ingredients that make up all living and nonliving things.

Chemists are scientists. Many of them work in laboratories to solve problems and make new materials. Laboratory chemists are often inventors. They mix chemicals in ways that no one else has done before. Chemists have discovered the adhesive used on Post-it® notes, artificial sweeteners, Teflon® and Nylon®, new medicines, and many different kinds of plastics. Some chemists are teachers. They help students learn about the world around them. Some chemists work in art museums restoring and preserving works of art. Other chemists are lawyers or writers for newspapers and magazines. Because chemistry is part of everything, chemists work in many different fields and have a wide variety of jobs.

If you want to learn more about chemistry, watch your newspaper for notices about programs for K–12 students. Local colleges frequently sponsor programs for students with an interest in science. Your school guidance counselor or science teacher can also talk to you about these programs as well as some possible careers in chemistry.

The work of chemists will never be over. As long as we need new products, better ways to protect the environment, and more information about the world and the way it works, there will be a need for chemists. For articles and other information about chemistry, check the ACS website, chemistry.org.

Chemistry Puts Us "In the Limelight"

When people notice something you have done and make you the center of attention, they say you are "in the limelight". Where did this expression come from? Of course, it is chemistry that provides the answer!

When actors appear on a stage, there are lights in a row along the front of the stage that shine on the actors and make the actors easier for the audience to see. These lights are called footlights. Before electric lights were invented, the light for footlights and spotlights was produced by using a chemical called calcium oxide. The common name for calcium oxide is lime. This lime is not the fruit, lime, but a white, solid substance sometimes found in powder form. When the lime was burned in an oil or gas flame, a greenish light was produced that shined on the actors who were on stage. Thus, someone on stage was in the limelight! When you are the center of attention, it is as if you are on the stage and "in the limelight".

Chemists Make Good Music

Chemists, like people in all professions, have many talents. Some chemists have made important contributions to the world of music as well as to the science of chemistry.

Every spring, when thousands of students march down the aisle at graduation to the sound of *Pomp and Circumstance*, they have an amateur chemist to thank for the music. Sir Edward William Elgar was born in England in 1857. He wrote the *Pomp and Circumstance* march along with several other compositions while enjoying chemistry as a hobby. He seems to have been more of a composer than a chemist, however, since he broke an important rule of working in the laboratory. One day while he was carrying out an activity in his lab, he had an idea about a composition. He promptly forgot about the experiment and, as the story goes, just as he was writing the horn and trumpet sections, a sudden and unexpected crash shook the room. Sir Edward Elgar learned the important lesson that leaving an experiment unattended can result in a potential disaster.

During the 19th century, a very famous composer earned a degree in chemistry as well. The composer was Alexander Borodin, who was born in Russia in 1833 and died in 1887. Like many composers at the time, he did not make his primary living composing. He was a professor of chemistry at the St. Petersburg Military Academy in Russia where he taught and did research. Borodin wrote many compositions including three symphonies and the music for the opera *Prince Igor*. Some of this music was used in the Broadway show *Kismet.* The best example of his orchestral music is *In the Steppes of Central Asia*. Borodin also composed music for the piano and strings.

In the 20th century, a chemist was the first person to compose music with a computer. Lejaren Hiller studied chemistry at Princeton University, NJ, where he received his Ph.D. in 1947. He worked first at DuPont, a chemical research company, and later moved to the University of Illinois where his work with computers led him to experiment with music. He created *ILLIAC Suite* for string quartet in 1957. Hiller was the founding director of the Experimental Music Studio at the University of Illinois in 1958. Not all of his musical works make use of computers. He wrote many pieces for piano and strings and was an expert in the form of music known as sonata. Hiller died in 1994 at the age of 70.

CHEMISTRY & ART WORD SEARCH PUZZLE

Find the following words in the puzzle. Words may be forwards, backwards, or diagonal.

ABSORBENT
ACID
ART
CANVAS
CHEMISTRY
CLAY
COLLAGE
COLOR
COMPOSER
CRYSTAL
DISSOLVE
EASEL
FRESCO
LIMELIGHT
MOLECULES
PLASTER
SAFETY
SCULPTOR
STENCIL
THEATER

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

The puzzle solution is on the back page.

Green grass, Green beans, Green thumb, but Green chemistry???

What is green chemistry? You might think green chemistry is the chemistry of green things. Maybe it refers to photosynthesis—the process that only green plants carry out. Maybe it means mixing green liquids together. Or perhaps it means using chemistry to make green things—green paint, green paper, green jelly beans, etc…

Actually, green chemistry is the movement within the chemical industry to make chemicals in a safer and more environmentally friendly way. To accomplish this, chemists are inventing new chemicals that are safer but have the same beneficial properties as existing chemicals. For example, chemists have developed new insecticides that kill some insects, yet are safe for plants, other insects, and other animals including human beings.

Sometimes, however, the process used to make a chemical also makes some other chemicals or "byproducts" that may be dangerous. Another way that chemists use green chemistry is to change the way a chemical is made. They use some different "ingredients" so that harmful chemicals are not made. Water, for example, is used in place of other chemicals whenever possible. In some cases, the whole "recipe" for making a chemical may be changed. This way, both the ingredients and the step-by-step process make safer chemicals and fewer byproducts. For example, ibuprofen, the drug in some painkillers like Advil or Motrin, was first made using a difficult process that gave scientists large amounts of byproducts. Now, chemists make ibuprofen in a new way that results in fewer byproducts.

These changes in how chemicals are made is a new way to protect human beings and the environment. It is better not to make harmful substances in the first place than it is to treat or clean up these substances and the problems they create. This is what green chemistry is all about.

How Many Materials Can You Find in Your Athletic Shoes?

When you jump, run, and play, your feet can experience 3–6 times the force they do when you are standing or walking slowly. So, athletic shoes must be

- cushioned to absorb the shock, and sturdy to support your ankles;
- made of sturdy materials so they are long-lasting (since you wear them almost every day);
- lightweight, to make it easy to move in them; and
- flexible, to make it easy to jump and run.

Chemists and chemical engineers have worked with shoe designers to develop and manufacture materials that give support and are lightweight, flexible, and durable.

Many of these materials are called polymers. A polymer is a chemical made up of repeating little chemical units hooked together in a very long chain.

Nylon is a very strong, lightweight fiber polymer that is sometimes used in the upper part of athletic shoes.

The soles of athletic shoes need to be durable and provide traction. Rubber, a somewhat sticky type of chemical polymer, is most often used for the outer soles of athletic shoes. By controlling how rubber is made, chemists can change how it feels. For example, a harder type of rubber may be used to cover the toe of the shoe than is used for the cushioning in the sole.

Some shoes contain different types of polymers or gels that chemists have made specifically for their shock-absorbing characteristics. These materials may be heavier, but they are placed in areas of the shoe where the foot needs extra cushioning such as the heel and ball.

Some shoes have bands that are made of polymers called plastics. Plastic materials can be made very strong, lightweight, and somewhat flexible so they make good materials for adding support to an athletic shoe.

How Many Elements Do You Know?

Everything is made of substances we call elements. Take this quiz to see how many of the elements you know about. Draw a line connecting the question on the left to the correct element from the list on the right.

What element...

1. ... has the same name as a U.S. coin?	OXYGEN
2. ... is a metal and is found in blood?	HELIUM
3. ... is an important mineral found in milk?	PLATINUM
4. ... is needed in order for something to burn?	ALUMINUM
5. ... is used in glowing signs?	CALCIUM
6. ... makes balloons float?	NEON
7. ... is found in toothpaste to help prevent cavities?	CHLORINE
8. ... is used to make airplanes?	FLUORINE
9. ... helps to purify water in swimming pools?	IRON
10. ... is used to make jewelry?	NICKEL

Correct answers: 1. Nickel 2. Iron 3. Calcium 4. Oxygen 5. Neon 6. Helium 7. Fluorine 8. Aluminum 9. Chlorine 10. Platinum

Crystal Stencil Stars

When a small amount of table salt is added to a glass of water, the table salt "disappears" because it dissolves in the water. We know the table salt is still there because the water will now taste salty. The chemical name for table salt is sodium chloride. In this activity, another kind of salt called Epsom salt will be dissolved in water. The resulting solution will be used to create a work of art.

MATERIALS

- ❑ Epsom salt
- ❑ Water
- ❑ Small bowl
- ❑ Sponge
- ❑ Black construction paper
- ❑ Card stock (approximately 8 cm by 8 cm)
- ❑ Scissors
- ❑ Plastic cup (8–10 oz)
- ❑ Tablespoon measure
- ❑ Stirrer

PROCEDURE

1. From a piece of heavy card stock, use the scissors to cut out a star. Do not cut into the paper from the edge to the center. Instead, fold the card to start the cut or carefully poke a hole near the center of the card and then begin to cut. The card with the star removed is the stencil.
2. Pour 3 tablespoons of very warm water into the plastic cup.
3. Add 1 tablespoon of Epsom salt to the warm water and stir. Continue adding Epsom salt, one tablespoon at a time, and stir until no more dissolves.
4. Place the stencil flat on the black paper.
5. Pour the Epsom salt solution into a small bowl. Dip the sponge in the solution and dab the solution onto the stencil.
6. Carefully lift the stencil and move it to a different location on the same piece of black paper.
7. Dip the sponge into the solution and dab the stencil again making another star.
8. Repeat Steps 6 and 7 to produce a number of stars.
9. Wait about 15 minutes. Observe the crystal patterns that appear.
10. Pour the excess Epsom salt solution down the drain and rinse the cup and bowl with water.
11. Thoroughly clean the work area and wash your hands.

WHERE'S THE CHEMISTRY?

For most substances that dissolve in water, using hotter water means more of the substance will dissolve. When a liquid has as much dissolved substance in it as it can possibly hold, it is called a saturated solution. When the water from the solution evaporates, the crystals of Epsom salt will reform on the paper. The crystals may not look the same as they did before they were dissolved because of the temperature in the room and how quickly the water evaporates. The process of making rock candy is very similar. Sugar is added to very hot water until no more will dissolve. A string or stick is placed into the solution. The solution is allowed to stand for a period of time without being disturbed. As the water from the solution evaporates, sugar crystals grow on the string or stick.

Stained Glass Glue

Colored translucent material such as colored glass has been used for centuries to make beautiful stained glass artwork. Glass makers use different chemicals in various combinations to produce the many different colors of glass for stained glass artwork. The combination of the design, the colors, and the effect of the light passing through the translucent material can create wonderful works of art. This activity uses glue instead of glass to create a work of art that you can hang in your window.

MATERIALS

- ❑ White, clear-drying glue
- ❑ Food coloring
- ❑ Water
- ❑ Craft stick
- ❑ Small plastic circular lid or styrofoam bowl
- ❑ 2 small plastic cups
- ❑ Liquid dish detergent
- ❑ Toothpicks
- ❑ Measuring spoons

PROCEDURE

1. Place a small amount of liquid dish detergent in one small cup.
2. Place about 1 teaspoon of the glue in the other small plastic cup. Add about 1/4 teaspoon of water. Mix with the craft stick.
3. Pour the glue and water mixture into the lid or small styrofoam bowl. Tilt the lid or bowl until the glue solution completely covers the bottom surface.
4. Place one drop of food coloring on the glue solution.
5. Repeat Step 4 two times, using a different color each time. Be certain to place the three drops in three different locations on the glue.
6. Dip the end of the toothpick into the detergent to obtain a small amount on the end of the toothpick.
7. Very quickly touch the center of each food coloring drop with the detergent on the end of the toothpick. Do not stir.
8. Observe the changes.
9. Thoroughly clean the work area and wash your hands.
10. Allow the glue to dry overnight. Remove the dried glue from the container. Hold your "stained glass" up to the light and enjoy!

WHERE'S THE CHEMISTRY?

Food coloring is made from water and color molecules called pigments. The white glue also has water in it plus a chemical called polyvinyl acetate that is made of much longer and more flexible molecules than water is made of. The water molecules and the polyvinyl acetate molecules mix so much that the long flexible molecules of polyvinyl acetate move around like strands of spaghetti in a pot of boiling water. When the food coloring drops are added to the glue and water mixture, they can't spread out much because they are blocked by the combination of water and polyvinyl acetate molecules. When the detergent is added, the detergent molecules grab onto the pigment molecules and drag them along and the color spreads over the surface of the glue.

Visual Arts–Products of Chemistry

Every time a sculptor, painter, or photographer creates a work of art, chemistry helps make it happen! Sculptures can be made of wood, metal, plaster, clay, marble, plastic, glass, or many other materials. Each material will act in a certain way that depends on the chemicals that make up the material. The chemicals control how the material can be carved, bent, chipped, or smoothed.

The paper or canvas an artist uses is made of chemicals. Pictures can be drawn with crayons, paints, pencils, or chalk. Each one of these is made from different kinds of chemicals and gives different effects an artist might want to create. Crayons are made mostly of wax that is produced from the chemicals in petroleum. Paints are made from either water or oil with added chemicals called pigments. Different kinds of pigments cause paints to have different colors. Although pencils are referred to as "lead" pencils, there is no lead in them. Instead, the material used for writing is a combination of clay and a chemical called graphite, which is made of the element carbon. Chalk contains a chemical called calcium carbonate, which is found in nature in a mineral called limestone.

Photography is the art of "painting with light". Certain chemicals are sensitive to light. The amount of light that strikes the chemical will influence how dark the chemical turns. Photographs are produced when different amounts of light strike a surface covered with these kinds of chemicals.

No matter what kind of visual art is produced, it can be created because of chemistry. The next time you see a picture, sculpture, or photograph, remember that chemistry made it all possible!

Paint a Fresco

Fresco means "fresh" in Italian. Paintings done on wet plaster are called frescoes because the plaster is fresh; this means that the plaster was still wet when the artist painted on it. One of the most famous frescoes ever painted was finished in 1512 by the artist Michelangelo Buonarroti. This fresco was painted almost 70 feet above the ground on the ceiling of the Sistine Chapel in Rome, Italy. Michelangelo and his helpers spent four years painting this fresco masterpiece. While lying on his back, he mixed small amounts of plaster, smoothed it on the ceiling, and painted it while it was still wet.

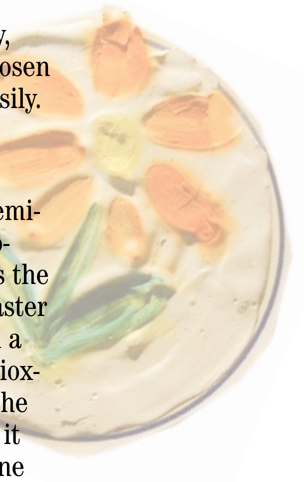
Painting on plaster is different than painting on paper. Experiment with the interesting designs that can be made as the paint and paintbrush are dragged through wet plaster. What happens to the surface of the plaster as it begins to harden? Does it become more difficult to paint?

MATERIALS

- ❑ Small disposable plastic dessert plate
- ❑ Small disposable plastic cup
- ❑ Craft stick
- ❑ Plaster of Paris
- ❑ Water
- ❑ Acrylic paints or poster paints
- ❑ Tablespoon
- ❑ Paintbrush
- ❑ Cup of rinse water

PROCEDURE

1. Place 2 tablespoons of plaster of Paris in a small cup. Add 1 tablespoon of water and stir with the craft stick until the mixture is smooth.
2. Pour the wet plaster onto the plastic plate.
3. Smooth the plaster out with the craft stick until it covers the bottom of the plate.
4. Dip the brush into one color of paint and begin to paint the plaster right away. Before the brush is dipped into the paint a second time, rinse the paintbrush well. Rinse the brush even if the same color of paint is used. If the brush is not rinsed before being dipped into the paint each time, plaster will get into the paint.
5. When you have completed your painting, thoroughly clean the work area and wash your hands.
6. When the fresco is completely dry, twist the plate gently. This will loosen the fresco so that it comes out easily.



WHERE'S THE CHEMISTRY?

Plaster and paint are made of chemicals, and a chemical change happens as the fresco is being created. As the fresco dries, a chemical in the wet plaster called calcium hydrate combines with a chemical from the air called carbon dioxide. When these chemicals combine, the paint gets stuck in the plaster so that it won't peel, chip, or wash off. This is one reason that frescoes can last a very long time. If your newly made fresco is kept safe, it will last a very long time, too.

Note: Frescoes can be moved when they are wet as long as they are kept flat and in the plastic plate.

Make Your Own Sculpture Dough

Sculptures can be made from many different kinds of substances or combinations of substances. One of these materials is clay. Clay can be made to have different qualities by changing the ingredients. It can be harder or softer and can have different colors. This is a recipe for one type of material that can be molded easily that is similar to the clay artists use for their work.

MATERIALS

- ❑ Flour
- ❑ Salt
- ❑ Cornstarch
- ❑ Vegetable oil
- ❑ Food coloring
- ❑ Water
- ❑ 2 plastic cups
- ❑ Spoon
- ❑ Measuring spoons
- ❑ Plastic bag (for storage)

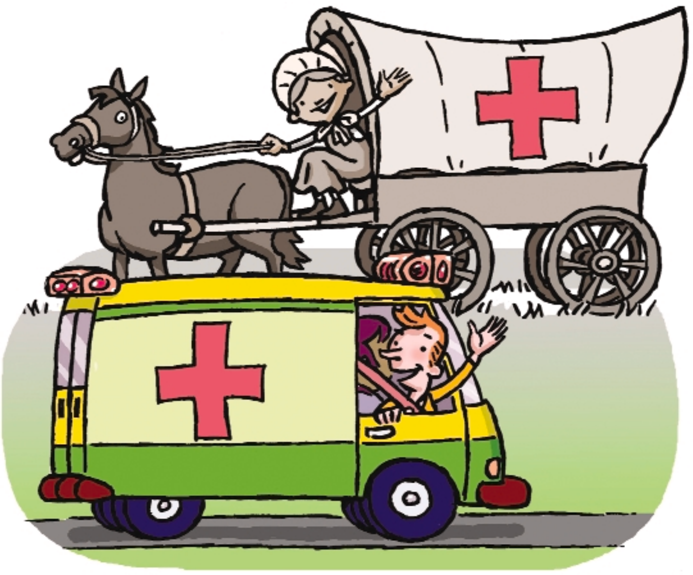
PROCEDURE

1. Place 4 teaspoons of water in a small cup. Add 4 drops of food coloring and 2 teaspoons of salt and mix well with the spoon until as much salt dissolves as possible.
2. Place 4 tablespoons of flour in a different small plastic cup. Add 1 teaspoon cornstarch and 2 teaspoons of vegetable oil.
3. Add the colored salt water from Step 1 to the materials in the cup from Step 2 and mix well with the spoon.
4. Take the material out of the cup and knead it back and forth between your hands until it is smooth and pliable. (It may be a little oily, but this will keep it moist when stored in a plastic bag.)
5. Shape and sculpt the clay.
6. Clean up the work area and thoroughly wash your hands.

WHERE'S THE CHEMISTRY?

When materials are mixed together, the combination that is produced sometimes acts differently than the individual ingredients do. Even though the identities of the ingredients used to make the sculpture dough have not changed, the mixture of the materials behaves in a new way.

Then + Now: How Chemistry Has Improved Our Health in the Past 125 years



Scientists using chemistry have discovered many of the medical breakthroughs and technologies that allow us to live longer, happier, and healthier lives. Here are some of their significant contributions to health and medicine from 1876 to today.

THEN

In 1876, when people became sick or injured, doctors could do little more than comfort them and keep them clean.

The idea that medicine is a science—something that we take for granted today—was new to most people. Few people knew how to stay healthy before they got sick. If you did become sick or injured, you would need a strong body and plenty of luck to survive. Though doctors and scientists knew that germs cause disease, they did not completely understand how they were spread or how to destroy them until the French scientist Louis Pasteur made some important discoveries that led to changes in how hospitals and doctors practiced medicine.

1905: German chemists Felix Hoffman and Hermann Dreser synthesized Aspirin, which is still used today to fight pain and swelling.

1909: German scientist Paul Ehrlich developed the first drug, named Salvarsan, to cure a specific illness by killing the germ that had invaded the body.

1915: American doctor Joseph Goldberger noticed that not getting enough vitamins and nutrients in food can cause a person to get sick.

1922: Canadian doctors Frederick Banting and Charles Best found out that diabetes can be managed by giving insulin to people whose bodies cannot make it. Before this discovery, there was nothing that doctors could do to treat diabetes.

1935: German biochemist Gerhard Domagk discovered a drug named Prontosil to cure previously deadly streptococcal infections.

1942–1945: A potent substance that could kill bacteria was studied in the laboratory by the English physician Alexander Fleming in 1928. A drug based on this discovery, called Penicillin, was created and used throughout World War II to fight infection. We now call this type of drug an antibiotic because it fights bacteria. Unfortunately, the new Penicillin was expensive and only available in certain areas, so many chemists continued their hard work over these years looking for a better way to make the drug.

1950: Chemists Gertrude Elion and George Hitchings created an anticancer drug when Elion discovered a chemical that prevents new leukemia cells (one type of cancer) from being formed in the body.

1952: Microbiologist Jonas Salk created a vaccine against polio by studying the flu vaccine and working with many other scientists to stop the spread of this deadly childhood disease.

1978: Work by scientists in nearly every country meant that the last cases of smallpox in the world occurred in 1978. Smallpox is the first—and so far the only—disease removed by medical science.

1980–present: Medicine was challenged by a new deadly disease called Acquired Immune Deficiency Syndrome (AIDS). In 1987, Zidovudine (also called AZT) was made to treat AIDS, and scientists continue to create better drugs and search for a vaccine and a cure.

NOW

2001: Doctors heal patients by using many medicines and techniques to cure diseases and repair injuries, but some diseases are still incurable. People are living much longer lives and know how to stay healthy, but being poor and living in an unclean environment still makes many people sick around the world.

Antibiotics are important tools to fight illness, but some bacteria change, so new and better drugs are needed to kill them. The medicines and options that doctors use to treat or cure sickness do help thousands of people each year, but it costs a great deal of money to treat everyone who needs it. Reducing the costs of medicine and fighting new diseases continue to challenge scientists. Many chemists continue their everyday work to make medical breakthroughs and technologies that allow us to live longer, happier, and healthier lives.

—Excerpted from the ACS Technology Milestones Project, which is being prepared as an interactive website to debut in 2002. More information about the project can be found at chemistry.org/milestones.

CHEMISTRY & ART WORD SEARCH PUZZLE SOLUTION

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

What is the American Chemical Society?

This year, the American Chemical Society (ACS), the world's largest scientific organization, celebrates its 125th anniversary. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. ACS has more than 163,000 members. The majority of ACS members live in the United States, but others live in different countries all around the world. Members of ACS share ideas with each other and learn about important discoveries in chemistry during meetings that ACS holds around the United States several times a year and through the use of the ACS website and journals it publishes.

The members of ACS carry out many programs that help the public learn about chemistry. The largest of these outreach programs is National Chemistry Week (NCW). NCW is held every year in the fall. Members of ACS celebrate NCW by holding events in schools, shopping malls, libraries, science museums, and even train stations! The activities at these events include, among other things, carrying out chemistry investigations and participating in contests and games. If you would like to know more about how you can participate in National Chemistry Week, please contact us!

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