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EXPERIMENTING WITH SCIENCE KIT

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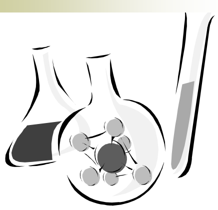

WRITTEN AND EDITED BY

NICOLE OANDASAN

ABOUT THIS 'EXPERIMENTING WITH SCIENCE' KIT

This kit was created to assist you or your group in completing the 'Experimenting With Science Patch Program.'

Kits are books written to specifically meet each requirement in a patch program and help individuals earn the associated patch.

All of the information has been researched for you already and collected into one place.

Included are crafts, experiments, recipes, games, and other educational information.

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Experiment Information

When conducting an experiment, it is important to use the Scientific Method.

First, a scientist must make a *hypothesis*, or a belief, about an experiment.

Then the scientist creates a *purpose* for the experiment, collects the *materials* needed, and then drafts a *procedure* of how the experiment will be executed.

After the experiment is conducted and the results are observed, scientists look at their original hypothesis and compare the results. If their hypothesis was wrong, they change it and then usually perform the experiment again until their hypothesis matches the experiment's results. Scientists are usually wrong in their hypotheses, in fact, they try to prove their hypotheses wrong. When your hypothesis can't be proven wrong, you've succeeded! This means that you need to be very specific in your hypothesis, and perform experiments to prove or disprove it.

Because of this *scientific method,* the experiments included in this book all have a purpose, materials, and procedure. The experiments are also divided into eleven categories: air, magnetism, water, motion, chemistry, electricity, light, heat, physical changes, creating, and cooking. See if you can guess what is going to happen before you conduct the experiment: make a hypothesis!

Remember to always keep safety in mind when performing experiments, and have fun!

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'Air' Experiments

Coming Closer Together

Marbled Balloon

Musical Straw

Snore Time

Straw Strength

Check out the 'No Heat Boiling' experiment on page 32, under 'heat'

Coming Closer Together

Purpose
- to observe the effects of gas as it expands

Materials
- empty 2-liter plastic soda bottle
- timer
- ½ cup tap water
- 1 tablespoon dishwashing liquid
- saucer
- NOTE: *this experiment requires a freezer*

Procedure
- Place the empty soda bottle in a freezer for about 2 minutes.
- While you are waiting for the soda bottle, mix the water and dishwashing liquid together in the saucer.
- Remove the soda bottle from the freezer and dip the open end in the soapy water.
- Stand the bottle on a flat surface and observe what happens.

Results
- A soap bubble forms over the mouth of the bottle.
- NOTE: *If a soap bubble does not form over the mouth, dip the bottle in the soapy water again.*

Why?
- As the temperature of molecules decrease, their motion becomes slower and their *cohesive forces* increase. This pulls the molecules closer together.
- Because the molecules moved closer together, more air was able to go inside the bottle.
- After the bottle was removed from the freezer, the molecules' temperature increased, their motion increases, and their cohesive forces decreased, so the air molecules moved farther apart.
- As the extra air that entered the bottle earlier escapes, it gets caught behind the soapy film that was put across the open mouth of the bottle; this makes a soap bubble.

Marbled Balloon

Purpose
- to show the difference between objects that have the same *mass* but different *density*

Materials
- 1 quart wide-mouthed jar
- tap water
- 2 identical glass marbles
- 2 identical 7-inch round balloons

Procedure
- Fill the jar ¾ full with water
- Place a marble inside each balloon
- In one of the balloons, tie a knot as close to the marble as possible
- Slightly inflate the second balloon with air, and tie a knot as close to the mouth of the balloon as possible.
- Drop both balloons in the jar of water.
- Observe what happens to the balloons.

Results
- The inflated balloon floats on top of the water, but the deflated balloon sinks to the bottom of the jar.

Why?
- *Density* is the measure of how much mass is packed into a given volume.
- Density is calculated by dividing an object's mass by its volume.
- The amount of air in each balloon is about the same, but the balloon with more air in it had more volume than the deflated balloon.
- Since its volume is greater, its density is less.
- Anything that has a density less than water, like the inflated balloon, will float on top of water.

Musical Straw

Purpose
- to determine if the length of a flute affects the pitch of the sound it produces.

Materials
- drinking straw
- ruler
- scissors
- 2 identical 7-inch round balloons

Procedure
- Make a ½ inch cut on each side of the straw's end. This forms the reed part of the flute.
- Place the reed in your mouth.
- Push on the reed with your lips and blow.
- You may have to try several times and change the pressure of your lips in order to produce a sound.
- As you play the straw flute, cut the end of the straw off with the scissors and observe any change in pitch.

Results
- The pitch of the sound gets higher as the length of the straw decreases.

Why?
- The sound produced is due to the vibration of the straw and the air inside it.
- The longer the column of vibrating air inside the tube, the lower is the pitch of the sound.

Snore Time

Purpose
- to determine what makes a person snore

Materials
- wax paper
- ruler
- scissors

Procedure
- Measure and cut a 6-inch square of wax paper.
- Place your hands on the sides of the paper square.
- Hold the paper against your lips.
- Hum your favorite song.
- Hum the same song without the paper

Results
- The song sounds natural without the paper, but when you use the paper, you can hear a vibrating sound
- The wax paper also tickles your lips.

Why?
- Sound is produced by vibrating items.
- Humming causes the wax paper to vibrate.
- Snoring, like all sounds, is nothing more than the vibration of soft tissue inside your mouth.
- As you sleep, gravity pulls your tongue, *uvula* (the hanging piece of skin at the top of your throat), and other soft tissue in the mouth downwards, causing your airway to be partially blocked.
- As you inhale, air moves through the small passage remaining and causes the soft parts of the mouth to vibrate. This vibrating sound is called snoring.

Straw Strength

Purpose
- to demonstrate air pressure

Materials
- plastic drinking straws
- scissors
- tape
- a beverage

Procedure
- Make a *mega-straw* by connecting plastic straws.
- To get an airtight seal, make two ½ inch slits in one end of each straw. Mesh the straws at the slits so they overlap and then tape over the connection.
- Test your *straw strength* by starting out with a two or three piece straw.
- Put your straw into your beverage and try to drink. If you can get normal amounts of liquid through the straw, add another straw onto your mega-straw.
- Keep adding onto your mega-straw until you can't drink normal amounts through it.

Results
- The beverage is transported to the straw until it becomes too hard to suck the beverage all the way through.

Why?
- The liquid is sucked up a straw by lowering the *air pressure* in your mouth.
- The liquid around the straw in being pushed down by the atmosphere, or the air in the room.
- When the air pressure is lowered in your mouth to be less than the pressure on the liquid outside the straw the liquid escapes the pressure outside by going up the straw and into the low pressure area: your mouth.
- The human mouth and lungs has to work hard to lower the air pressure in your mouth, and it has to work harder as the distance you're pulling the liquid increases.
- The most a person could "drink" a liquid is around six feet. What was your record?

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‘Magnetism’ Experiments

What is Magnetism?

What is a magnet?

- a magnet is an object made of a type of material that can create a magnetic field.
- every magnet has at least two different areas, or poles, a north pole and a south pole.
- Similar poles repel (north to north) and opposite poles attract (north to south).
- Magnetic forces only attract magnetic materials.
- Magnetic forces act at a distance.

What are magnets used for?

- Magnets are usually used to hold, separate, control, and lift objects as well as convert *electrical energy* to *mechanical energy* or convert mechanical energy to electrical energy. (electrical energy is a battery making a toy truck run and the mechanical energy is the truck moving. Generators are good examples of electrical to mechanical energy and mechanical to electrical energy)
- Here's a list of things magnets can be used for: headphones, speakers, telephones, microwaves, refrigerator magnets, credit cards, dish washers, motors, fans, ice makers, furnaces, clothes washers and dryers, computers, cell phones, car door locks, and CD players. Can you think of more?

What types of magnets are there?

- There are three main types of magnets: permanent magnets, temporary magnets, and electromagnets.
- *Permanent magnets* are the most common magnets, and can be seen on your refrigerator holding things in place. These magnets are permanent because once they become magnetized, they stay magnetized. Different magnets can have different strengths of magnetism. Permanent magnets can be made into almost any shape you can think of.
- *Temporary magnets* are things that act like magnets when they are around other magnets, but when they are by themselves, they have no magnetism. Some examples of temporary magnets would be paper clips and nails.
- *Electromagnets* are coiled wire that acts like a permanent magnet when it has electricity running through it. The strength and *polarity* (which pole the magnet will be attracted to on other magnets, north or south) of the electromagnet can be changed by the amount of electricity that runs through the wire.

What affects a magnet's magnetism?

- A magnet can be affected by the material it is made of, temperature (being heated up or cooled down), physical impact (hammering or dropping the magnet), and demagnetizing fields (areas of energy that has a particular magnetism that can remove the magnetism from a magnet).

Attraction Action

Purpose

- to determine what materials are attracted to a magnet

Materials

- a magnet (a *wand magnet* is preferable, but whatever strong magnet you have on hand)
- various items, including many metal items, including coins,
- various stones and minerals (you can buy tumbled stones from us)
- iron fortified cereal (look on nutrition labels to find cereals that have a large percentage of RDA iron)

Procedure

- make a chart with spaces for each item you test and its level of attraction to the magnet. Write either "weak, strong, or none" in the magnetism column.
- take the magnet and wave it next to the various items, seeing if the two items become attracted to each other. Make sure to try different directions and angles too.

Results
- Some items are attracted to the magnet and some items are not.
- The wax paper also tickles your lips.

Why?
- Iron, steel, nickel, and cobalt are naturally attracted to magnets. They are *temporary magnets* because they act magnetic when they are around magnets, but hold no magnetism themselves.
- Hematite, Magnetite, Lodestone, Franklinite, Chromite, Ilmenite, Pyrrhotite, Cobalite, and Pyrite (fool's gold) are all attracted to the magnet. Chromite, Hematite and Magnetite all have iron in them. Magnetite was actually used in ancient Greece as the first magnet, and started the study of magnetism. Franklinite has zinc in it (which is sometimes magnetic) and Ilmenite has iron and titanium in it, and is actually related to hematite. Pyrrhotite and pyrite both have significant amounts of iron in them as well, leading to their magnetism.
- Cereal that is iron fortified actually has finely powdered iron flakes mixed in with the cereal. When you mix a half serving of cereal with water and stir a magnet that is inside a plastic zipper bag inside the water, the iron flakes will stick to the magnet in the form of small dark specks. If you turn the plastic bag inside out, the magnet stays dry and you've captured some cereal iron!

Donut Magnets

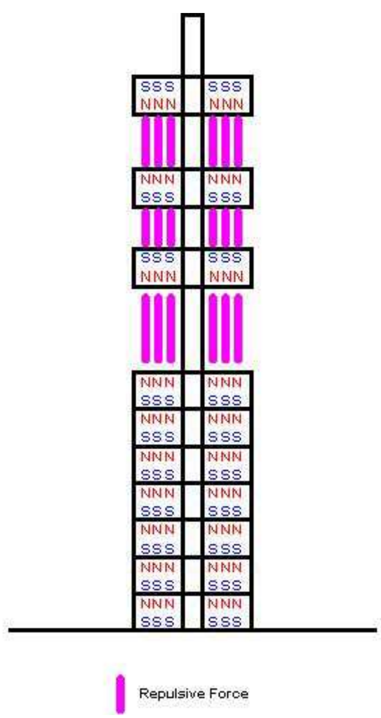
Purpose
- to show the effects of repelling magnetic poles

Materials
- ten donut magnets (circular magnets with holes in the middle)
- a wooden dowel whose width is slightly smaller than the holes in the donut magnets (1/4" should be good)
- a block to put the wooden dowel in to stabilize it.

Procedure
- Secure the wooden dowel into the wooden block to secure it using glue or other material.
- Place seven magnets on the dowel N (north pole) to S (south pole) so that they attracted to each other.
- Now place three magnets on the dowel N to N, S to S and N to N.

Results
- The top three magnets will float, not touching the other magnets.
- The seven bottom magnets are stuck together.

Why?
- The top three magnets are repelled from each other because their poles are the same.
- Because they are repelled, they do not attract each other and leave a space in-between them.
- They are held at that space because it is the point where the two forces of repulsion against the top and bottom magnets are equal due to distance.
- The bottom seven donut magnets are attracted to each other because they have opposite magnetic poles.



Fishing for Fun

Purpose
- to demonstrate magnetism for certain materials

Materials
- cutouts (included on the next page)
- paper clips
- magnet
- string
- pencil or stick
- shoe box (optional)

Procedure
- cut out and decorate the cutouts.
- attach a paper clip to each cutout
- place the cutouts in a box, shoebox size.
- attach the magnet to a length of string (this would be easier to do with a magnet that has a hole through it).
- attach the other end to the end of the pencil or stick.
- try to pick up the cutouts with the magnet, like a fishing pole.
- you can either try to pick up the trash to clean up the pond or try to pick up the fish to go fishing!

Results
- the magnet is attracted to the paperclip, and can go through the paper.

Why?
- Magnets pull *on* magnetic materials such as metal, but pull *through* non-magnetic materials such as paper.

Paper Clip Adventures

Purpose
- to demonstrate magnetism for certain materials (three experiments in one!)

Materials
- water
- paper clips
- magnet
- clear glass
- a piece of cardboard
- plastic or wooden ruler

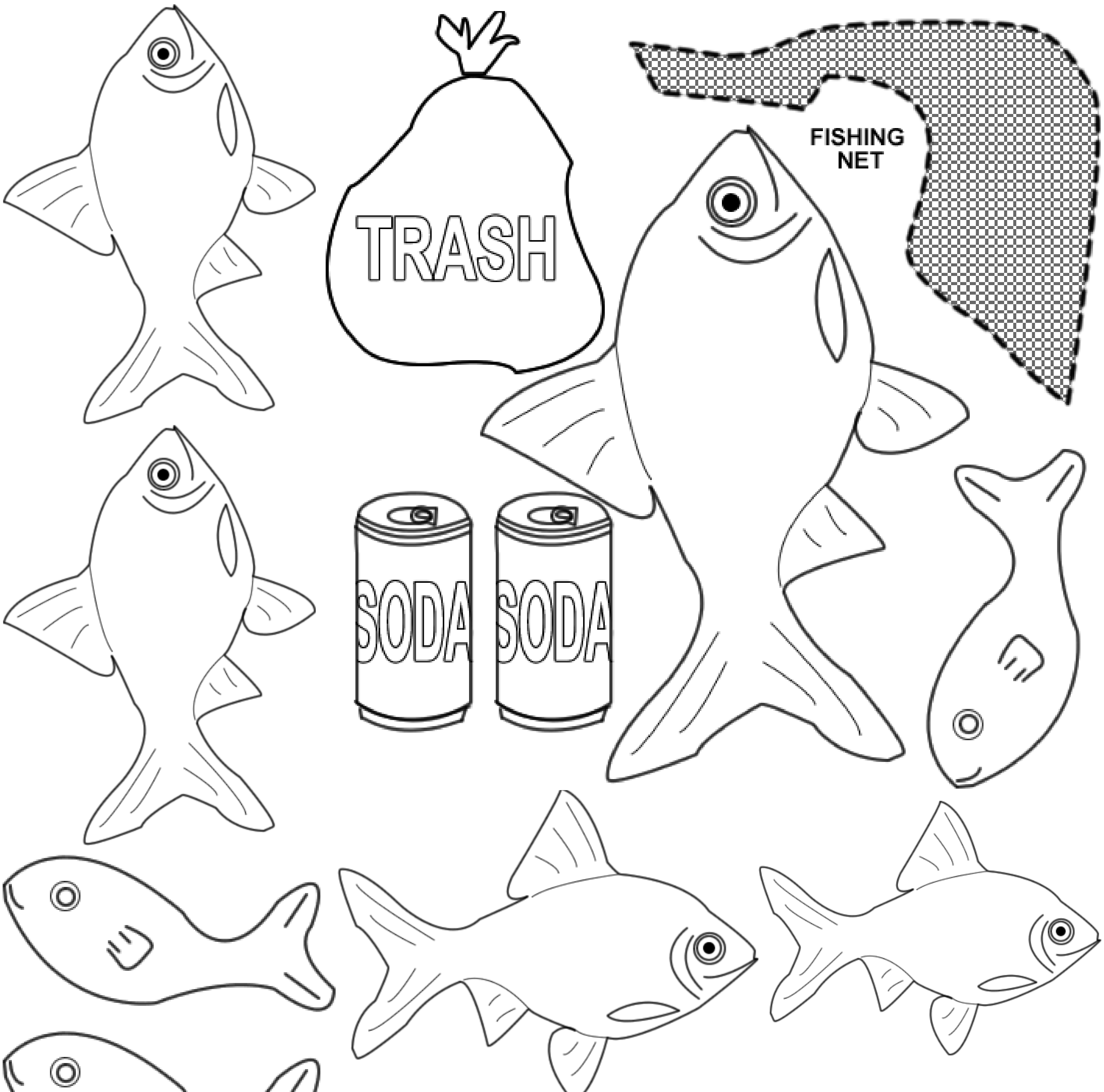
Procedure
- Draw a maze on the piece of cardboard. Place the paperclip on the top of the cardboard with the maze facing up and place the magnet under your cardboard where the paperclip is resting on top. Now move your magnet around and see what happens.
- Fill the glass with water and drop the paperclip inside the glass. Take the magnet and place it on the out-side of the glass close to the magnet and see if you can pull the paper-clip to the side of the glass and up to the top (without getting wet).
- Hold your ruler so that one end is resting on a flat surface and hold the other end up at a angle. Place the magnet underneath the ruler (the end that is resting on the flat surface) and then place the paperclip on the top of the ruler above the magnet. Move the magnet to go up to the top end of the ruler.

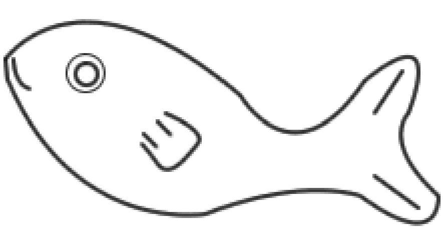
Results

- The magnet is attracted to the paperclip, but nothing else.
- The magnet attracts the paperclip and can maneuver it through the maze through the cardboard, attract the paperclip through the glass and water, and through the ruler.

Why?

- Magnets pull *on* magnetic materials such as metal, but pull *through* non-magnetic materials such as cardboard, wood, plastic, glass, and even water!





Fishing for Fun Game Cutouts

You may want to print this sheet twice

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‘Water’ Experiments

A Penny for Your Thoughts

Colorful Raindrops

Eggs that Float

More ‘water’ experiments can be found under ‘air’ , ‘magnetism’, ‘physical changes’, and ‘heat’

A Penny for Your Thoughts

Purpose
- to demonstrate surface tension

Materials
- cup and saucer
- pennies
- tap water

Procedure
- Place the cup on the saucer.
- Fill the cup to the brim with water.
- Drop one penny into the water at a time until the water spills over the top of the cup.
- After each penny is added to the cup, look at the water's surface from the side.
- Record how many pennies it took to get the water to spill.

Results
- The water rises above the rim of the cup.
- After each penny is added, the water rises a little bit until the water spills over the edge of the cup.

Why?
- Water is made of *water molecules* that are attracted to each other.
- The attraction between each molecule is strong enough to hold the surface of the water together as it rises above the rim of the cup.
- When the molecules aren't strong enough to hold together against the forces pulling them apart, the water spills over the edge.

Colorful Raindrops

Purpose
- to demonstrate *solutes* and *solvents*

Materials
- clear drinking glass
- water
- flat toothpick
- powdered fruit drink (dark colors like cherry, grape, or raspberry)

Procedure
- Fill the glass with water.
- Use the wide end of a flat toothpick to pick up some of the powdered drink.
- Gently shake the powder of the glass of water so that the powder goes into the water.
- Once the powder is in the water and off the toothpick, observe the water from the side of the glass.
- Continue to add powder until the water is completely colored.

Results
- Colorful stripes of water appear in the water.

Why?
- When the powdered drink meets the water, the crystals *dissolve*.
- Dissolving means that a material, the *solute*, breaks apart into smaller and smaller pieces and then spreads evenly through the *solvent*, or the material that it is dissolving *in.*
- The solute dissolves into the solvent, making a *solution.*

- If the solution is even, it is *homogeneous*. If the solute does not dissolve evenly, it is *heterogenous*.
- There is no chemical change in this experiment. The solute just becomes so small that you cannot see it, but it is still there!

Eggs That Float

Purpose
- to prove that an egg can float when put into a solution

Materials
- 2 clear, plastic cups
- water
- ¼ teaspoon milk
- 3 tablespoons table salt
- spoon
- 2 small eggs

Procedure
- Fill both cups ¾ full with water
- Add the milk to one cup of water
- Add and stir in the salt to the second cup of water. This is your “special” solution.
- Place an egg in each cup

Results
- One egg floats in the “special” solution, but the other egg sinks.
- Note: if the egg does not float in the magic solution, add more salt to the water.

Why?
- The milk was added only to give the water a cloudy appearance like the “special” salt water.
- The egg floats because it is not as *dense* as the salty water.
- The dense salt water is able to hold the egg up.
- The egg in the milky water is denser than the water, so it sinks.

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‘Motion’ Experiments

Blast Off Balloon

Daddy Penguin

Kite Tail

Round and Round

Two of a Kind

Vanilla Balloon

Vibrating Sounds

Blast Off Balloon

Purpose
- to demonstrate motion as a result of unbalanced forces

Materials
- yardstick
- drinking straw
- scissors
- string
- 2 chairs
- 9-inches of masking tape
- balloon

Procedure
- Measure and cut a 4-inch piece from the drinking straw.
- Cut about 3½ feet of string.
- Thread the end of the string trough the straw piece
- Position the chairs about 4 feet apart.
- Tie the string to the backs of the chairs. Make the string as tight as possible.
- Inflate the balloon and twist the open end.
- Move the straw to one end of the string.
- Tape the inflated balloon to the straw.
- Release the balloon.

Results
- The straw with the attached balloon jets across the string. The movement stops at the end of the string or when the balloon totally deflates.

Why?
- *Newton's Law of Action and Reaction* states that when an object is pushed, it pushes back.
- When the balloon was opened, the walls of the balloon pushed the air out.
- When the balloon pushed against the air, the air pushed back and the balloon moved forward, dragging the straw with it.
- The string and the straw keep the balloon rocket on a straight course.

Daddy Penguin

Purpose
- to show how emperor penguins carry their eggs

Materials
- 1 cup dry rice
- sock

Procedure
- Pour the rice into the sock.
- Tie a knot in the sock.
- Stand with your feet together.
- Place the sock of rice on top of your feet.
- Try to walk without dropping the sock off your feet.

Results
- The sock stays on your feet only if you move short distances at a time.

Why?
- Female emperor penguins lay 1 egg, which the male rolls on top of his feet.
- The egg stays in this position until it hatches, about 2 months later.
- To move around without dropping the egg, the penguin must do a slow shuffle like the shuffle you did with the sock of rice.
- But emperor penguins do have a little extra help from a flap of skin that folds down over the egg.
- This skin helps to keep the egg in place and also keeps it warm.
- Staying warm is difficult since emperor penguins hatch their eggs during the Antarctic winter, where winds at times blow in excess of 100 miles per hour and the temperature can drop to -80ºF.
- After the egg hatches, the male and female take turns carrying their baby chick around on their feet for about another 2 months.
- This keeps the chick from freezing until its fat layer and protective feathers develop.

Kite Tail

Purpose
- to demonstrate the purpose of a kite's tail

Materials
- 1 sheet of notebook paper
- scissors
- cellophane
- tape
- string
- ruler

Procedure
- Measure and cut a 2-inch by 12-inch strip from the sheet of paper
- Use tape to attach an 18-inch length of string to one end of the strip.
- Hold the free end of the string and whip the paper back and forth in front of you
- Cut 1 ¼-inch by 12-inch strip from the paper and attach it with tape to the free end of the wider strip
- Again move the strip back and forth in front of you

Results
- The paper twirls around, but when the small strip is attached, the movement is smoother.

Why?
- The paper moves forward at an angle, causing the air to flow faster over the top-side.
- Fast-moving air has a lower pressure around the moving "tail", so the kite tail is lifted underneath.
- The angle of the paper is not constant, so the pressure of the air on the kite is erratic. These changes in pressure make the strip twist and rotate.
- The paper tail makes the angle of the kite is more constant, so the air moves smoother and with less twisting.

Round and Round

Purpose
- to demonstrate the effects of spinning on the body

Materials
- yourself

Procedure
- Stand outdoors or in an open area
- Turn around rapidly five times
- Sit on the ground

Results
- You will feel dizzy after you stop turning.

Why?
- The liquid in the canals of your ears move as the body turns.
- When you stop moving, the liquid continues to turn.
- This motion is interpreted by the brain that the body is still moving, so you feel dizzy.

Two of a Kind

Purpose
- to test your power of concentration

Materials
- yourself
- a helper

Procedure
- Ask your helper to pat the top of his or her head with one hand and to pat his or her stomach with the other hand.
- Have him or her to continue patting the head, but to start rubbing their stomach in a circular motion.
- Reverse the movements and have your helper rub his or her head while patting his stomach.

Results
- It's easy for the hands to perform the same pattern of movement, but you have to concentrate really hard to move your hands simultaneously in two different patterns.

Why?
- Through repetition of motion, you become proficient at moving your hands in the same pattern. Your brain is programmed to do this.
- Back-and-forth motions or circular motions are easily done, but only one pattern at a time.
- Both types of motion are in the brain's functions, many programs, but it takes much effort to do both actions at the same time.

Vanilla Balloon

Purpose
- to demonstrate osmosis and diffusion *solutes* and *solvents*

Materials
- eye dropper
- small-sized balloon
- shoe box
- vanilla extract

Procedure
- Place 15 drops of vanilla extract inside the deflated balloon.

- Inflate the balloon to a size that will comfortably fit inside the shoe box and tie the open end.
- Place the balloon in the empty shoe box.
- Leave the balloon in the closed box for one hour.
- Open the box and smell the air inside.

Results
- The air smells like vanilla.

Why?
- The balloon appears to be solid, but it actually has very small invisible holes all over its surface.
- The liquid vanilla molecules are too large to fit through the holes, but the *vapor,* or gas, molecules are smaller than the balloon holes and can pass through.
- The movement of the vapor through the rubber membrane is called *osmosis*.
- The escaped vanilla vapor, which holds the vanilla scent, moves throughout the air in the shoe box and, one the box is opened, through the air in the room.
- This movement of molecules from one place to another is called *diffusion*.
- If you wait long enough, the diffusion will result in a uniform *mixture* of the vanilla vapors and the air, and the vanilla smell will go away.

Vibrating Sounds

Purpose
- to demonstrate how *frequency* affects the *pitch* of sound

Materials
- water
- 6 small-mouth bottles of similar sizes
- metal spoon

Procedure
- Pour different amounts of water in each bottle
- Gently tap each bottle with the metal spoon
- Note the difference in the pitch produced

Results
- The bottle with the most water has the lowest pitch.

Why?
- Sounds are made by *vibrating* objects.
- The number of times the object vibrates—moves back and forth—is called the *frequency* of the sound.
- As the frequency increases, the *pitch* of the sound gets higher.
- Tapping on the bottle causes the bottle and the water to vibrate.
- As the height of the water column increases, the sound the bottle makes gets lower.

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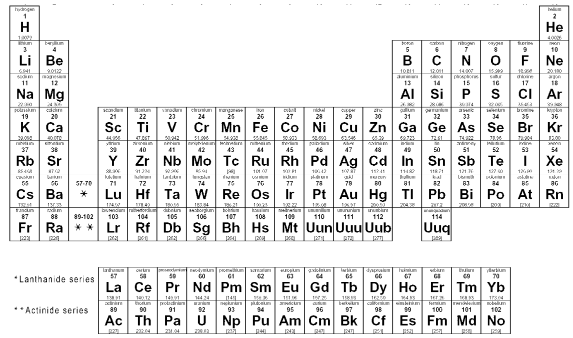
‘Chemistry’ Experiments

More ‘chemistry’ experiments can be found under ‘cooking’, ’create’, ‘heat’, and ‘physical changes’

What is Chemistry?



What is chemistry?
- Chemistry comes from the Egyptian word kēme, meaning “earth”, and studies the transformations and reactions that occur with every thing on Earth.
- This includes energy, fire, plants, chemical reactions, cooking, eating food, growing things, making soap and washing things, clothes, vitamins, medicine, electricity, electricity, magnets, and much more.
- Chemistry uses microscopes, beakers, flasks, Bunsen burners, test tubes, the Periodic Table of Elements (all the different substances that make up *every* thing), and other materials you would find in a laboratory.

Banana Power

Purpose
- to demonstrate oxidation and its effects

Materials
- dinner knife
- banana
- 2 saucers
- 2 sheets of computer paper
- pen
- 3 vitamin C tablets (100mg tablets work well)
- cutting board
- rolling pin
- timer

Procedure
- Peel the banana, then slice it into 8 pieces
- Place 4 slices of banana on each saucer
- Set each saucer on a piece of paper.
- Label one of the papers “Without Vitamin C” and the other “With Vitamin C”.
- Place the vitamin C tablets on the cutting board and crush them with the rolling pin.
- Using the dinner knife to scoop up the vitamin C powder, sprinkle the powder over the cut surface of the banana slices in the saucer labeled “With Vitamin C”.
- Every 30 minutes for 2 hours or more, observe the color of each sample’s surface.

Results
- The untreated banana slices slowly turn brown, but those covered with vitamin C are unchanged.

Why?
- Bananas and other fruit, such as apples and pears, discolor when bruised, peeled, or exposed to air.
- This discoloration is caused by changes that occur when the fruit’s *cells* are broken.
- The chemicals released by the broken cells are *oxidized* (combined with oxygen), which causes the changes in appearance. This process is called *oxidation.*
- Vitamin C is an *antioxidant*, a material that *inhibits* (decreases or stops) oxidation.
- When you cover the banana with Vitamin C, the discoloration is less.

Slime

Purpose
▪ to create *slime*, a *non-Newtonian fluid*, through a chemical reaction

Materials
▪ spoon
▪ 1 teaspoon liquid starch
▪ 1 teaspoon white school glue
▪ food coloring
▪ 12-inch square sheet of waxed paper
▪ timer

Procedure
▪ Using the spoon, mix the starch, glue, and 1 drop of food coloring in the center of the waxed paper.
▪ Continue to stir the materials until the mixture begins to separate from the paper.
▪ Allow the substance to stand on the paper for 3 to 4 minutes.
▪ Then, with your fingers, roll the mixture into a ball and knead it with your hands for about 1 minute.
▪ You've made slime!
▪ Try these experiments, observing what happens to the slime each time.
+ Roll the slime into a ball and bounce it on a smooth surface
+ Hold it in your hands and quickly pull the ends in opposite directions.
+ Hold it in your hands and slowly pull the ends in opposite directions.

Results
▪ The material you made bounces a little when dropped, breaks apart if pulled quickly, and stretches if pulled slowly.

Why?
▪ A *fluid* is a substance, like a *liquid* or *gas*, that can flow.
▪ A *non-Newtonian fluid* is a special substance that has properties of both *solids* and liquids.
▪ This type of fluid acts like a solid and breaks when its pulled apart quickly, but when left alone, it acts like a liquid and takes the shape of its container.
▪ The slower the *flow* the higher is its *viscosity* (measure of how fast a fluid moves).

Soda Bubbles

Purpose
▪ to demonstrate *effervescence*

Materials
▪ small baby-food jar
▪ soda or any carbonated beverage
▪ 1 teaspoon table salt

Procedure
▪ Fill the jar one-half full with soda
▪ Add one teaspoon of salt to the soda

Results
▪ Bubbles form in the liquid, then foam appears on top of the soda.

Why?
- Each bubble in the soda represents a pocket of carbon dioxide gas
- Salt and carbon dioxide are both examples of *matter* and matter takes up space.
- When the salt is added to the beverage, bubbles of carbon dioxide stick to salt crystals.
- Larger bubbles form and rise to the top, bringing small amounts of soda with them.
- This movement of the gas forms the foam on top of the liquid, and the process is called effervescence.

Soda Fun

Purpose
- to compare the *density* of materials that have equal *volume*

Materials
- cooking pot or bucket 8 inches deep or deeper
- water
- ruler
- can of regular soda
- can of diet soda (must be the same brand and flavor as regular soda)

Procedure
- Fill the pot with water to a depth of 6 inches
- Place the cans of soda in the water
- Observe the positions of the cans in the water

Results
- The diet soda floats in the water, but the regular soda does not float.

Why?
- The diet soda floats, so the *density* of the diet soda must be less than that of the regular soda.
- Since the *volume* of the two sodas is the same, the *mass* (weight) of the diet soda must be less than that of the regular soda.

Vitamin 'See'

Purpose
- to write a message that magically appears

Materials
- soup bowl
- cup
- tincture of iodine
- eyedropper
- lemon
- notebook paper
- art brush

Procedure
- Pour ½ cup water into a soup bowl
- Add 10 drops of tincture of iodine to the water and stir
- Squeeze the juice of the lemon into the cup.
- Cut a section from the notebook paper.
- The paper must fit inside the bowl.

- Dip the art brush into the lemon juice and write a message on the piece of paper.
- Allow the juice to dry on the paper.
- Submerse the paper in the iodine solution in the bowl.

Results
- The paper turns a blue-purple except where the message was written.
- The words are outlined by the dark background.

Why?
- The starch in the paper combines with the iodine to form iodine-starch *molecules*.
- These molecules are blue-purple in color.
- Vitamin C combines with iodine to form a colorless molecule.
- The area covered with lemon juice remains unchanged because the paper is coated with vitamin C from the lemon.

What's Growing?

Purpose
- to change the chemical environment of bread and 'make' something new

Materials
- plastic zipper bag
- eyedropper
- water
- bread slice

Procedure
- Place the bread in the plastic bag.
- Put 10 drops of water inside the bag.
- Close the bag.
- Keep the bag in a dark, warm place for 3 to 5 days.
- Observe the bread through the plastic.
- Discard the bag and its contents after your observation.

Results
- Something black and hairy-looking is growing on the bread.

Why?
- Mold is a form of *fungus*, it can grow and reproduce very quickly.
- Mold produces very tiny cells with hard coverings called *spores*.
- Spores are smaller than dust particles and float through the air.
- The slice of bread already had spores on it when it was put in the plastic bag, but the water, warmth, and darkness made a good environment for the mold to grow.
- Molds have good and bad effects. Some forms of mold make food smell and taste bad, but there are foods that depend on mold for their good taste. Many cheeses are moldy and taste good.
- This greenish mold that forms on bread and oranges is used to make a medicine called *penicillin*.

‘Electricity’ Experiments

What is Electricity?

How a light bulb works

Static Electricity

More ‘electricity’ experiments can be found under ‘magnetism’

What is Electricity?

What is a electricity?

▪ The word *electricity* comes from a word that means "amber".
▪ Electricity is responsible for lightning, electromagnetic fields, and electric currents, and is used in industrial machines in the form of electronics and electric power.

What are some terms related to electricity?

▪ These terms might help you understand electricity a little better: electric charge, electric field, electric potential, electric current, electric energy, electrons, and electric power.
▪ *Electric Charge* - the charge of an *atom*, or small building block of a chemical, which determines how the chemical will interact with other chemicals in reactions, or *electromagnetic interactions*.
▪ *Electric Field* - electric fields affect objects that are close to them because of their electric charge.
▪ *Electric Potential* - the ability of an electric field to do work or produce energy; this is measured in *volts*.
▪ *Electric Current* - the movement of particles that have an electrical charge; measured in *amperes*.
▪ *Electric Energy* - as an electrical charge flows through an electrical conductor, electric energy is produced.
▪ *Electrons* - are parts of atoms that give the atom an electric charge
▪ *Electric Power* - the rate, or speed, that electric energy is converted to another type of energy, such as light, heat, or mechanical energy (moving things).

How does electricity occur in nature?

▪ Electricity occurs in nature in the form of: electrons within atoms that hold molecules together, lightning, the earth's magnetic field, power surges, piezoelectricity (crystals that can create voltage), triboelectricity (electricity as a response of *friction* between two materials), bioelectricity (electricity within living organisms such as electric eels and sharks), and neurons (electricity within nerves). Can you think of other forms of electricity?

How does a light bulb work?

Purpose

▪ to discover how a light bulb works

Materials

▪ 1 light bulb of any kind
▪ a matching lamp

Procedure

▪ Look at the light bulb and discuss the different parts. What do you think each part does?
▪ Put the light bulb into the lamp and look at it now. How is it different?

Results

▪ The light bulb lights up and gets hot.

Why?

▪ A light bulb has a small metal wire called a *filament* that glows when it is heated. Usually the metal is *tungsten*, a metal that can stay solid until very hot temperatures. Otherwise, the metal would melt!
▪ A light bulb is also encased in glass, which allows the wire to be kept away from the air. If the wire was exposed directly to the air, it would burn up instantly.
▪ When a light bulb "burns out", it is because the filament has been burned away.
▪ Electricity flows through the filament and heats it up and as a result, the wire glows.
▪ The wire heats up because of *resistance*. When electricity passes through something, the substance it is passing through tries to hold on to the *electrons*, so the electrons have to be forced through.

- Some of this force is absorbed by the metal and given off as heat.
- As the filament heats up as a result of the friction, it pushes the *electrons* farther away from the *nucleus*, or center, of the atom.
- When the electrons move back to their original position when the friction decreases, they give off *photons*, or light energy.
- Light bulbs always make sure that the energy enters and leaves from different places.
- Light Bulb Facts
  + Thomas Edison invented the first light bulb in 1879 by doing two important things: putting the filament in a glass bulb and removing the air from inside the bulb. Removing the oxygen slows down the *combustion*, or burning, of the wire.
  + Thomas Edison tested more than 1,600 materials to find the right filament, including coconut fiber, fishing line, and even hairs from a friend's beard.

Static Electricity

Purpose
- to demonstrate static electricity

Materials
- scissors
- tissue paper
- ruler
- comb

Procedure
- Measure and cut a strip of tissue paper about 3 inches by 10 inches.
- Cut long, thin strips in the paper, leaving one end uncut.
- Quickly move the comb through your hair several times. Your hair must be clean, dry, and oil-free.
- Hold the teeth of the comb near, but not touching, the cut end of the paper strips.

Results
- The paper strips move toward the comb.

Why?
- *Static* means stationary.
- *Static electricity* is the buildup of negative charges, which are called *electrons*.
- Matter is made up of atoms, which have electrons spinning around a positive center called the *nucleus*.
- Moving the comb through your hair rubs electrons off the hair and onto the comb.
- The side of the comb that touched your hair is now charged with electrons, so it is now negatively charged.
- The paper strips are also made atoms and holding the negatively-charged comb close to the paper causes the positive part of the atoms in the paper to be attracted to the negative parts of the comb (similar to the attraction with north and south poles in *magnets)*.
- This attraction between negative and positive charges is strong enough to lift individual strands of paper.

PATCHWORK DESIGNS, INC

‘Light’ Experiments

Bending to the Light

Candy Flashes

Dark Depths

More ‘light’ experiments can be found under ‘heat’ and ‘electricitry’

Bending to the Light

Purpose
- to determine if plants follow light

Materials
- houseplant

Procedure
- Place the plant next to a window for 3 days.
- Rotate the plant 180º and allow it to stand for another 3 days.

Results
- The leaves of the plant turn toward the window.
- Rotating the plant changes the direction of the leaves, but within three days, they turn back toward the light.

Why?
- Plants contain a chemical called *auxin* that makes plant cells grow longer.
- Auxin builds up on the dark side of plants and the extra auxin causes the plant cells on the dark side of the plant to grow longer and these longer parts bend towards the light to try to make the auxin more even.
- This movement toward the light is called *phototropism*. Photo means light and tropism means movement.

Candy Flashes

Purpose
- to demonstrate crystal light

Materials
- wintergreen candy
- plastic sandwich bag
- wooden block
- hammer
- this experiment must be performed in a dark room. A closed closet works well

Procedure
- Place one wintergreen candy in the plastic bag
- Place the bag on the wooden block
- Position the hammer above the candy.
- Look directly at the candy piece as you smash it with the hammer.

Results
- A quick bluish-green flash of light is given off at the moment the candy crushes.

Why?
- Crystals broken by pressure give off light.
- This light is an example of *triboluminescence*.
- Crystals such as sugar and quartz give off light flashes when crushed.

Dark Depths

Purpose
- to demonstrate why green plants don't live below 300 feet in the ocean

Materials
- 2 small green plotted plants of the same variety

Procedure
- Place one of the plants in a sunny area, and the other plant in a dark closet or cabinet, water them the same amount.
- Leave the plants for 7 days.
- Compare the color of the plants.

Results
- The plant in the closet will be lighter in color and wilted.

Why?
- Plants need sunlight to perform a reaction called *photosynthesis* which gives them energy.
- *Chlorophyll* is a green pigment necessary in the photosynthesis reaction.
- Without the sunlight, the chlorophyll molecules are used up and not replenished, and this causes the plant to look pale.
- Eventually, the plant will die without sunlight.
- Green plants grow in the ocean to a depth of about 300 feet.
- They are more abundant near the surface and decrease with an increase in depth.
- The concentration of sunlight is greatest at the surface and totally disappears below 300 feet.
- Green plants cannot live below 300 feet because there is no sunlight there.

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‘Heat’ Experiments

No-Heat Boiling

Sunny Tea

Time Machine Paper

More ‘heat’ experiments can be found under ‘light’ and ‘electricitry’

No Heat Boiling

Purpose
▪ to demonstrate boiling water without heat

Materials
▪ cotton handkerchief
▪ clear drinking glass with straight smooth sides
▪ rubber band

Procedure
▪ Wet the handkerchief with water. Squeeze out any excess water
▪ Fill the glass to the top with water
▪ Drape the wet cloth over the mouth of the glass
▪ Place the rubber band over the cloth in the middle of the glass to hold the cloth close to the glass.
▪ Use your fingers to push the cloth down about 1 inch below the water level.
▪ Pick the glass up, hold the bottom with one hand, and turn it upside down.
▪ There will be some spillage, so do this over a sink.
▪ Place the other hand under the hanging cloth and hold the glass.
▪ At this point, one hand is holding the cloth next to the glass with the free end of the cloth draped over the other hand.
▪ With the free hand, push down on the bottom of the glass.
▪ Allow the glass to slowly slip down into the cloth.

Results
▪ The water doesn’t fall out of the glass, and it looks like its boiling.

Why?
▪ Every material has a melting point and a boiling point. A boiling point is the temperature that a material, like water, will boil and change through *evaporation* from water to *water vapor*, the gas form of water.
▪ This water does not actually boil, it just looks like it because there are air bubbles inside the water.
▪ At first, the water does not flow out of the cloth because the tiny holes in the cloth are filled with water.
▪ Water molecules have a strong attraction to each other that draws them close together.
▪ This causes the water to behave as if a thin skin were covering each hole in the cloth, preventing water in the glass from falling out.
▪ Pushing the glass down causes the cloth to be pulled out of the glass. This outward movement creates a vacuum inside and the air outside is pushed through the cloth.
▪ Small bubbles of air form inside the water, giving an appearance of boiling water.

Sunny Tea

Purpose
▪ to determine how temperature affects how quickly a reaction occurs

Materials
▪ two 1-quart jars or pitchers with lids
▪ cold water
▪ 4 tea bags
▪ timer

Procedure
▪ Fill the jars with water.
▪ Add 2 tea bags to each of the jars. Secure the lids on both jars.
▪ At or near noon on a sunny day, set one jar outside in direct sunlight.

▪ Set the remaining jar in the refrigerator.
▪ Every 30 minutes for 2 hours, compare the color of the liquid in each jar.

Results
▪ The tea in the ‘outside’ jar is darker than the ‘inside’ jar.

Why?
▪ As the temperature increases, a reaction, like brewing tea, goes faster.
▪ Heat from the Sun caused an increase in the temperature of the water in the ‘outdoor’ jar while the temperature of the ‘inside’ jar was decreased by the refrigerator.
▪ So, the hot tea brewed faster than the cold tea because it had more energy to start, complete, and finish the reaction.

Time Machine Paper

Purpose
▪ to demonstrate heat’s effect on paper

Materials
▪ newspaper
▪ an automobile or sunny, stable spot that can trap heat.

Procedure
▪ Lay a piece of newspaper in an automobile so that the sun’s rays hit it
▪ Leave the paper in the car for 5 days

Results
▪ The newspaper looks as if it has aged several years in just a few days, and is now yellow instead of white.

Why?
▪ This is another example of temperature affecting the speed of a reaction.
▪ This particular reaction is actually the opposite of most reactions having to do with oxygen.
▪ Usually when you add oxygen to a reaction involving color, the color becomes lighter because the color is *oxidized,* removed.
▪ In the case of newspaper, the paper is originally yellow and turned white by removing oxygen.
▪ Placing the paper in the car allowed the sunlight to heat up the air and the paper, causing oxygen to combine with the paper.
▪ Adding the oxygen back to the newspaper makes it revert back to yellow, its original color.
▪ All newspaper turns yellow after time, but the sun’s light just sped it up!

PATCHWORK DESIGNS, INC

‘Physical Changes’ Experiments

Big Bear

Ice Cube Stack

Ice Pops and Ice

Make Your Own Crystals

Quicksand

More ‘physical changes’ experiments can be found under ‘water’, ‘heat’, ‘create’, and ‘cooking’

Big Bear

Purpose
▪ to demonstrate *absorption*

Materials
▪ two 10-ounce clear plastic drinking glasses
▪ 2 gummi bears (or other gummi candy)
▪ timer

Procedure
▪ Fill one of the glasses about ¾ full with water and leave the other glass empty.
▪ Place a gummi bear in each glass.
▪ Place the glasses where they won't be moved, but you can still see them.
▪ Check on the glasses every hour for 6 or more hours.
▪ After the experiment is completed, discard the candy.

Results
▪ The bear in the empty glass is the same, but the bear inside the water is swollen.

Why?
▪ When one substance takes in another, such as a sponge soaking up water, it is called *absorption*.
▪ An increase in the *volume* of a substance is a good characteristic of absorption.
▪ The bear in the glass with water became bigger because of *osmosis*. Water moved from outside of the bear to inside the bear in order to make the amount of water inside everything more equal.
▪ You can learn more about osmosis in the 'Vanilla Balloon experiment on pages 18-19.

Ice Cube Stack

Purpose
▪ to demonstrate how the physical changes of water can be observed and controlled

Materials
▪ ice cubes
▪ a plate
▪ table salt

Procedure
▪ Try to make a tower out of ice cubes.
▪ Now try to make a tower a different way by using the following steps.
▪ Before you try stacking the ice cubes, let them sit on a plate at room temperature for two or three minutes.
▪ Now sprinkle a good amount of salt on the top surface of each ice cube before you stack another one on top of it.

Results
▪ You can stack more ice cubes when you use salt and let them melt a little bit than before.

Why?
▪ The salt you added onto the ice cubes lowers the *freezing point* of water, meaning that the ice will melt quicker and that the temperature needs to be much lower to keep the ice cubes frozen.
▪ As each salt crystal dissolves, the ice melts around it. This causes the ice to melt unevenly and the surface is not smooth so the ice cubes are not as slippery.
▪ This is why salt is used to melt ice on roads and walkways.
▪ The newly melted water freezes again and joins the stacked ice cubes together.

▪ This happens because the insides of the ice cubes are much colder than the freezing point of water, and are cold enough to remove the remaining heat from the melted water, so it refreezes.

Ice Pops and Ice

Purpose
▪ to show the differences in frozen crystals

Materials
▪ 1 quart jar
▪ water
▪ 2-quart pitcher
▪ 0.15 ounce package of unsweetened flavored powdered drink mix
▪ 1 ½ cups granulated sugar
▪ spoon
▪ two 3-ounce paper cups
▪ plate
▪ 2 craft sticks
▪ freezer

Procedure
▪ Pour 1 quart of water into the pitcher.
▪ Add the drink mix and the sugar to the water and stir.
▪ Place the paper cups on the plate
▪ Fill one of the cups with tap water and the other cup with the drink
▪ Stand a craft stick in each cup (covering with cling wrap and then poking the stick through might help keep the stick straight).
▪ Set the plate in the freezer
▪ The next day, remove the plate from the freezer
▪ Peel the paper cup away from the frozen liquids
▪ Holding the craft sticks, carefully try to bite into the ice pop (the frozen drink) and the ice (frozen water)
▪ You can use the remaining drink mixture, cups, and sticks to make extra ice pops to share!

Results
▪ The liquid drink and water both changed to solids, but the ice pop is not as hard as the ice.
▪ It is easier to bite into the ice pop than the ice.

Why?
▪ The water molecules in each liquid combined to form ice crystals that joined together into a solid shape.
▪ The ice pop crystals are separated in some places by sugar molecules and other ingredients from the drink mix so the ice crystals are smaller.
▪ These smaller ice crystals make the ice pops easier to eat than the frozen water, which has larger ice crystals and less separation in-between the crystals.

Make Your Own Crystals

Purpose
▪ to demonstrate evaporation

Materials
▪ 1 small baby-food jar
▪ water

- 2 tablespoons of Epsom salts
- construction paper
- scissors

Procedure
- Fill the jar ½ full with water
- Add the Epsom salts to the water.
- Stir.
- Cut a circle from the construction paper to fit the inside the jar.
- Pour a thin layer of the salt solution over the paper. Try not to pour out the un-dissolved salt.
- Place the jar in a warm place and wait several days.

Results
- Long, slender, needle-shaped crystals form on the paper

Why?
- Epsom salt crystals are long and slender.
- The particles in the box have been crushed for packaging and do not have a slender shape.
- As the water *evaporates* from*,* leaves, the solution, small salt crystals start to stack together.
- Eventually, the crystals build long, needle-shaped crystals.

Quicksand

Purpose
- to demonstrate how a material can physically, but not chemically, change when mixed with other materials

Materials
- measuring spoons
- water
- 2quart bowl
- 1 cup cornstarch
- spoon

Procedure
- Pour 8 tablespoons of water into the bowl and slowly add the cornstarch, stirring well after each addition.
- The mixture should be so thick that it is very hard to stir.
- Add a few drops of water if all of the starch will not dissolve or a little starch if the mixture looks thin.
- Place your hand on the surface of the mixture in the bowl and very gently push downward.
- When your hand has sunk into the mixture try to lift your hand out of the bowl.

Results
- Your hand easily sinks into the mixture, but cannot be pulled out easily.
- The bowl rises as you lift your hand.

Why?
- Like the slime (p 22) this quicksand is a *non-Newtonian fluid,* and its *viscosity* (thickness) increases when pressure is applied to it.
- Pushing or pulling on the mixture makes it so thick and firm that it is difficult to pull your hand out.

PATCHWORK DESIGNS, INC

‘Create’ Experiments

Bubbles

Mind Games

Watch Me Grow

More ‘create’ experiments can be found under ‘chemistry’, ‘physical changes’, and ‘cooking’

Bubbles

Purpose
- to make a solution and use it

Materials
- liquid dish soap
- cup
- 8-inch piece of 20 gauge wire (any thin, bendable wire will work)

Procedure
- Fill the cup ½ full with the dish soap.
- Add enough water to fill the cup. Stir.
- Make a 2-inch loop in one end of the wire.
- Dip the loop into the soapy solution.
- Hold the loop, with the thin layer of soap stretched across it, about four inches from your mouth.
- Gently blow through the film of soap.

Results
- Bubbles of soap appear after you blow air through the soap film stretched over the water.
- If the soap film breaks, try blowing more gently.
- Add 1 tablespoon of soap to the solution if the bubbles continue to break.
- More soap should be added until bubbles are produced.

Why?
- The soap and water molecules link together and form a zig-zag pattern.
- This irregular pattern allows the thin soap film to stretch outward when blown into.

Mind Games

Purpose
- to demonstrate the overlapping of images in your mind

Materials
- white poster board
- marker
- scissors
- paper hole punch
- ruler
- string

Procedure
- Draw and cut a circle with a 4 inch diameter from the poster board.
- Use the hole punch to make two holes on each side of the paper circle.
- Measure and cut two 24-inch pieces of string
- Thread the string through the holes.
- Use the marker to draw a large empty fishbowl on one side of the paper and a small fish on the other side.
- Hold the strings and twirl the paper disk around in a circle about 25 times to twist the strings.
- Pull the strings straight out with your fingers.
- Observe the spinning paper disk.

Results
- The fish looks like it is inside the fish bowl instead of on the other side of the paper.

Why?
- You see each picture as it passes in front of your eyes.
- Your mind retains the image of each picture for about 1/16 of a second.
- The image of the bowl is still being held in your memory when the fish image is seen.
- This causes an overlapping of the pictures in your mind so the fish appears to be inside the bowl.

Watch Me Grow

Purpose
- to demonstrate how a new plant can grow from a cutting of an old plant

Materials
- house plant such as ivy
- scissors
- small jar
- water

Procedure
- Cut off a stem with leaves from the plant.
- Place the cut end of the stem in the jar filled with water.
- Observe the bottom of the stem for several days.

Results
- Tiny roots start to grow

Why?
- Many house plants, especially ivy, will easily form roots from cut stems.
- This is one way that plants make new plants instead of using seeds.
- To keep the plant growing, plant it in soil or add nutrients to the water.

Zany Tye Dye

Purpose
- to create different colored and designed fabric

Materials
- white cotton clothing that has been washed at least once
- soda ash mixture
- dye
- rubber gloves
- rubber bands
- table with plastic cover or a sheet of plastic or tarp
- squeeze or spray bottles and/or turkey baster
- bowl and container to mix the dye
- old clothes to wear while dyeing

Caution: Don't work with dyes in or around where food is prepared, or mix dyes with a container or spoon used for eating.

Procedure
- Start with your white fabric and dip it in a soda ash mixture prior to dyeing. Using these guidelines, the article of clothing dyed will come out more vibrant.
- There are several ways to make designs.
    + Take a dowel rod and place it in the middle of a shirt. Twist the rod ever so slightly until the shirt is turned into a complete circle of swirls. Do the same to the sleeves or create another design.

Rubber band the circle of the shirt and rubber band the sleeves. Apply the dye as directed on the container.

+ Tie rubber bands in different areas of the shirt. Keep in mind the bands must be tight to ensure that the dye doesn't seep through to areas that you would like to stay white. Using a fine string instead of rubber bands will give you finer lined white areas and more color areas. Apply dye as directed.
+ Twist, turn and bind the shirt in different areas and designs. Apply dye as directed on the container. For a variety of colors on your shirt, use the squeeze or spray bottle method. Mix your dye as directed in a bucket and pour it in a container as described above.

- Saturate the area where you would like that color and continue this method with other colors.
- Place item in a gallon plastic zipper bag for at least 24 hours.
- Rinse thoroughly in cold water until all colors run clear.
- Twist it dry. Throw it in a dryer to set the colors.
- After the shirt is dry, wash the shirt in cold water.
- Dry and wear your cool design.

Results

- The fabric is dyed where you applied dye, but is white where the rubber bands or string were.

Why?

- The dye can adhere to the *polymers,* strings, of the fabric and permanently change the color, but it cannot bond with the rubber bands.

PATCHWORK DESIGNS, INC

‘Cooking’ Experiments

What does cooking have to do with science?

Inside-Out Marshmallow

Ice Cream Float recipe

Magic Bars recipe

Chocolate Fun-due recipe

More ‘cooking’ experiments can be found under ‘chemistry’, ‘physical changes’, and ‘create’

What does cooking have to do with science?

- Cooking is all about experimenting and reactions; your kitchen is a laboratory!
- Not only do you have many ingredients in your kitchen like chocolate, butter, flour, sugar, milk, vinegar, baking powder, and eggs, but you also have sources of heat and electricity (oven, stove, microwave, refrigerator, freezer), friction (rolling pin), chemistry (mixing ingredients), motion (mixing and microwaves), and physical changes (mixing, baking, and molding).
- Just like in science, you measure materials out, make hypotheses, and have a procedure you follow called a recipe.
- Cooking also has many different parts, just like science. When you make bread, you use yeast, which is actually alive! In cooking, you heat things up, change colors, melt them, freeze them, cut them, mold them, cool them down, make them thicker, thinner, colder, harder, and softer.
- A good example is when you put cake batter into the oven that it comes back out looking, and tasting, totally different, or popping popcorn.
- Have you ever experimented in the kitchen? What tools do you have? What types of science do you use?

Inside-Out Marshmallow

Purpose
- to demonstrate how a microwave works

Materials
- marshmallow
- paper plate
- microwave

Procedure
- Put a marshmallow on a paper plate and place it in the microwave for about a minute and thirty seconds.
- Observe the marshmallow.
- Once the time is up, take the plate out of the microwave, letting the marshmallow cool before you touch it.
- Observe the marshmallow as it cools.
- Break the marshmallow open.
- Look at the inside of the marshmallow.
- You can eat it now!

Results
- As the *micro*-waves (small and invisible waves) inside the microwave react with the marshmallow, the marshmallow grows, moves, and sways.
- As the marshmallow cools, it slowly shrinks and shrivels.
- The outside of the marshmallow is white and looks normal, but when you break it open you see that the inside of the marshmallow is brown and crispy.

Why?
- Microwave ovens cook by making water molecules in the food vibrate.
- The faster molecules vibrate, the hotter food gets.
- When the water gets hot enough, it transforms to steam, the gas form of water and this causes the tiny air spaces in the marshmallow to expand.
- A campfire cooks from the outside in, but a microwave penetrate the marshmallow and cook it all at once.
- The inside temperature of the marshmallow gets high enough so that it is cooked, but the outside of the marshmallow stays white because it is cooled by the steam when it leaves the marshmallow.
- *Evaporation* always cools and doesn't heat because it is a *endothermic* reaction, meaning it *takes* heat away from the reaction. Reactions that *produce* heat are called *exothermic*.
- The marshmallow will become brown and burn after all the steam has escaped, so be careful to turn off the microwave oven as soon as the puffing has stopped.

Chocolate Fun-due

Purpose
- to demonstrate how a substance can be melted and cooled and undergo *physical* changes

Materials
- 1 package of chocolate melts
- forks or kabob sticks to use for dipping
- dipping materials (pretzels, marshmallows, cut fruit, cookies, small pieces of cake, etc)
- wax paper
- paper plates
- pot or bowl to melt chocolates in

Procedure
- Melt the chocolate according to the directions on the package.
- Dip your materials into the chocolate, one at a time.
- Shake off excess chocolate.
- Place each item on the wax paper (which is on top of the plate) after it has been dipped.
- Items do not have to be completely submerged in the chocolate.
- Items can be eaten immediately or frozen/refrigerated for later eating.

Results
- The chocolate melts when it is heated up and cools when it is placed in the refrigerator or freezer.

Why?
- By applying heat, the chocolate is heated to its *melting point* and it turns from a solid to a liquid.
- Once it is no longer hot enough to stay melted, it returns back to its solid state.

Ice Cream Float

Purpose
- to demonstrate how a substance can float on another

Materials
- any carbonated beverage (root bear or cream soda is the traditional choice)
- 2 scoops of vanilla ice cream
- cup that is big enough to hold ice cream and beverage
- spoon or straw

Procedure
- Place two scoops of vanilla ice cream inside the glass.
- Slowly pour the soda over top of the ice cream.
- This will create a frothy cream effect.
- Add the spoon or straw and enjoy.

Results
- The ice cream floats on top of the soda and the beverage foams.

Why?
- The ice cream, though dense, is large, flat, and cold. The *carbonation,* bubbles, from the beverage are constantly trying to escape into the air, so they lift the ice cream up.
- The ice cream also lowers the temperature of the beverage, causing more bubbles to form (ice cubes do this as well, but not as much). Some of the ice cream also melts into the beverage and takes up room, causing even *more* bubbles to form.

Magic Bars

Purpose
- to demonstrate how substances change when affected by heat

Materials
- 1/2 cup butter
- 1 1/2 cups graham cracker crumbs
- 1 cup chopped walnuts
- 1 cup semisweet chocolate chips
- 1 1/3 cups flaked coconut
- 1 (14 ounce) can sweetened condensed milk

Procedure
- Preheat oven to 350 degrees F (180 degrees C).
- While the oven is preheating place the stick of butter (1/2 cup) into bottom of the 9 x1 3 pan and place inside the oven to melt.
- Gather the remaining ingredients.
- Remove the pan from the oven and sprinkle crumbs evenly over the melted butter.
- Pat the crumbs down to absorb the butter and create a crust.
- Pour the condensed milk over the crust and spread it evenly with a spatula.
- Top with chocolate chips, sprinkling evenly over the milk layer.
- Next, add the coconut.
- Make sure the nuts are chopped into small pieces and sprinkle them over the coconut.
- Bake for 25 minutes or until lightly browned on top.
- Cool 15 minutes before cutting into yummy bars.

Results
- The ingredients melt together, and when cooled, hold in the shape of the container.

Why?
- The ingredients, when introduced to the heat, lost their solid form and were transformed into liquids.
- As a liquid, they joined with other materials and took the shape of their container.
- When they cooled, the molecules were held in the shape of the container because they were solid again.

Other additions or substitutions to this ‘experiment’:

Peanut butter chips
Pecans instead of walnuts
Butterscotch chips
M & M’s , mini or actual size
Marshmallows
Chopped up cookies
Chopped up candy bars
Peppermint candies crushed and added for decorations

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Teach Me

Here is a list of science museums worldwide.
Feel free to make your own list or visit facilities that are not found here.

Africa

- Durban, South Africa - KwaZuzulwazi Science Centre
- South Africa - Assoc. of Science and Technology Cen-

Asia

- Kuala Lumpur, Malaysia - National Science Centre
- Manila, Philippines - Philippine Science Centrum
- Nagoya, Japan - Nagoya Science Museum
- Seoul, Korea - National Science Museum
- Singapore - Singapore Science Centre
- Taipei, Taiwan - National Natural Science Museum
- Tokyo, Japan - National Science Museum
- Yokohama, Japan - Yokohama Science Center

Australia

- Adelaide, South Australia - Investigator Science & Tech
- Brisbane, Queensland - Queensland Sciencentre
- Canberra, Australian Capital Territory - Questacon - The National Science & Technology Centre
- Launceston, Tasmania - Launceston Science Centre
- Melbourne, Victoria - Scienceworks Museum
- Perth, Western Australia - Scitech Discovery Centre
- Sydney, New South Wales - The Australian Museum
- Sydney, New South Wales - The Powerhouse Museum
- Wollongong, New South Wales - Science Centre

Europe

- Aberdeen, Scotland - Satrosphere Hands-on Dicovery Centre
- Amsterdam, Netherlands - Nemo Science & Technology Center
- Armagh, Northern Ireland - Armagh Planetarium & Science Centre
- Bristol, England - At Bristol
- Cardiff Bay, Wales, UK - TechniQuest
- Copenhagen, Denmark - The Experimentarium
- Coruña, Spain - Casa de las Ciencias (House of Science)
- Flanders, Belgium - Technopolis
- Florence, Italy - History of Science Museum
- Glasgow, Scotland - Glasgow Science Center
- Guildford, England - Guildford Discovery
- Haifa, Israel - Israel National Museum of Science
- Halifax, England - Eureka Children's Museum
- Jerusalem, Israel - Bloomfield Science Museum
- Leicester, UK - National Space Science Centre
- London, England - The Science Museum
- Luleå, Sweden - Teknikens Hus (House of Technology)
- Manchester, England - Museum of Science and Industry
- Mannheim, Germany - Landesmuseum für Technik und Arbeit
- Munich, Germany - Deutsches Museum
- Boras, Sweden - Navet
- Norwich, England - Inspire
- Oulu, Finland - Tietomaa Science Center
- Paris, France - Musée des arts et métiers
- Paris, France - Palais de la découverte
- Paris, France - Cité de Sciences
- Poitiers, France - Futurescope
- Södertälje, Sweden - Tom Tits Experiment
- Stockholm, Sweden - Cosmo Nova
- Stockholm, Sweden - Museum of Science and Technology
- Trondheim, Norway - Vitensenteret
- Vantaa, Finland - Heureka
- Vaxjo, Sweden - Xperiment Huset
- Winterthur, Switzerland - Technorama (German only)

South America

- Buenos Aires, Argentina - Museo Participativo de Ciencias

North America

USA

- Acton, MA - Discovery Museums
- Akron, OH - Inventure Place
- Albuquerque, NM - New Mexico Museum of Natural History and Science
- Atlanta, GA - SciTrek
- Augusta, GA - Fort Discovery
- Aurora, IL - SciTech
- Aurora, NE - Edgerton Educational Center
- Baltimore, MD - Maryland Science Center
- Bellingham, WA - Mindport Exhibits
- Bemidji, MN - Headwaters Science Center
- Berkeley, CA - Lawrence Hall of Science
- Berkeley, CA - University of CA Museum of Paleontology
- Boston, MA - Computer Clubhouse
- Boston, MA - Boston Museum of Science
- Buffalo, NY - Buffalo Museum of Science
- Cedar Rapids, IA - The Science Station
- Champaign, IL - Franklin Science Center
- Charlotte, NC - Discovery Place
- Chicago, IL - Chicago Academy of Sciences
- Chicago, IL - Museum of Science and Industry
- Chicago, IL - Science Education Center
- Colorado Springs, CO - Nikola Tesla Museum of Science and Industry
- Columbus, OH - Ohio Center of Science and Industry
- Dallas, TX - Science Place
- Davis, CA - Explorit Science Center
- Detroit, MI - Detroit Science Center
- Durham, NC - NC Museum of Life & Science
- Eugene, OR - Willamette Science & Technology Center
- Flushing, NY - NY Hall of Science
- Fort Collins, CO - Discovery Center Science Museum
- Fort Lauderdale, FL - Museum of Discovery and Science
- Fort Wayne, IN - Science Central
- Fort Worth, TX - Fort Worth Museum of Science and History
- Garden City, NY - Long Island Children's Museum
- Grand Junction, CO - Western Colorado Science Center
- Hampton, VA - Virginia Air and Space Center
- Hot Springs, AK - Mid America Science Museum
- Houston, TX - Houston Museum of Natural Science
- Houston, TX - Nature Discovery Center
- Huntsville, AL - Space and Rocket Center
- Ithaca, NY - The Sciencenter
- Jackson, MI - Michigan Space and Science Center
- Jersey City, NJ - Liberty Science Center
- Lafayette, IN - Imagination Station
- Lansing, MI - Impression 5 Science Museum
- Leesburg, VA - The Naturalist Center
- Little Rock, AR - AR Museum of Science and History
- Louisville, KY - Louisville Science Center
- Los Angeles, CA - CA Museum of Science and Industry
- Miami, FL - The Miami Museum of Science
- Milwaukee, WI - Discovery World Museum
- Nashville, TN - Cumberland Science Museum
- New Hyde Park, NY - Goudreau Museum
- New York, NY - Children's Museum of Manhattan
- New York, NY - Sony Wonder Technology Lab
- Norwich, VT - Montshire Museum of Science
- Oak Ridge, TN - American Museum of Science & Energy
- Oklahoma City, OK - Omniplex Science Museum
- Olympia, WA - Hands On Children's Museum
- Oneonta, NY - Science Discovery Center
- Orlando, FL - Orlando Science Center
- Philadelphia, PA - The Franklin Institute
- Phoenix, Arizona - AZ Science Center
- Pittsburgh, PA - Carnegie Science Center
- Portland, OR- Oregon Museum of Science and industry
- Provo, UT - BYU Earth Science Museum
- Richmond, VA - Science Museum of Virginia
- Salisbury, MD - ExceL Interactive Science Museum
- San Diego, CA - Reuben H. Fleet Science Center
- San Francisco, CA - Exploratorium
- San Jose, CA - Children's Discovery Museum
- San Jose, CA - Tech Museum of Innovation
- Santa Ana, CA - Discovery Science Center
- Santa Barbara, CA - Santa Barbara Museum
- Seattle, WA - Pacific Science Center
- Sioux Falls, SD - Kirby Science Discovery Center
- St. Louis, MO - St. Louis Science Center
- St. Paul, MN - Science Museum of Minnesota
- St. Petersburg, FL - Great Explorations
- Tampa, FL - Museum of Science and Industry
- Tulsa, OK - Harmon Science Center
- Wailuku, HI - Hawai'i Nature Center
- Washington, DC - Capital Children's Museum
- Washington, DC - National Air and Space Museum
- West Palm Beach, FL - South Florida Science Museum
- Worcester, MA - EcoTarium

Canada

- Calgary, Alberta - Calgary Science Centre
- Halifax, Nova Scotia - Discovery Centre
- Ottawa, Ontario - National Museum of Science & Technology
- Sudbury, Ontario - Science North
- Toronto, Ontario - Ontario Science Centre
- Vancouver, British Columbia - Science World
- Edmonton, Alberta - Edmonton Science Centre

Science Programs

Traveling Science Programs, World-Wide!

Visit this site: http://van.physics.uiuc.edu/van/links-Shows.htm

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Careers with Science

Here are some careers that use science. Choose one to learn more about! Can you think of some jobs that aren't listed on here?

Doctor	Psychologist
Scientist	Baker
Artist	Oceanographer
Biologist	Chemist
Physicist	Engineer
Computer Programmer	Electrician
Astronomer	Geographer
Geologist	Volconologist
Anthropologist	Archeologist
Astronaut	Botanist
Dentist	Veterinarian
Inventor	Science Teacher
Cartographer	Pharmacist
Nutritionist	Chef

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Extra! Extra!

Learn how to relate science to every day life, complete one requirement from one of our other kits. You may have already completed this requirement if you performed certain experiments. Kit requirements are available here: http://www.patchworkdesigns.net/patchprograms.htm

Culinary Creations
+ complete a 'cooking' experiment

Groovy Scouting/Fabulous Fifties
+ tye dye (under the 'create' section)
+ make an ice cream float ('cooking')

Discovering Nature
+ perform an experiment involving plants.

Planet Protection/Games
+ play the 'Fishing for Fun' game ('magnetism')
+ compete in 'ice cube stack', 'straw strength', or 'paper clip adventures'

Colonial Days, Historically Speaking Native Americans, Girls of the Past, Medieval Merriment
+ use 'Time Machine Paper' to make something from the past

Music
+ complete 'vibrating sounds', 'snore time', or 'musical straw'

Geology
+ learn about rocks and magnetism in 'Attraction Action'

Emergency Ready
+ learn about lightning and natural electricity in 'What is electricity?'

I Solved the Mystery!/Magical Fairy Adventure
+ create a hidden message or perform a magic trick like 'no-heat boiling' or 'inside-out marshmallow'

Pirate Adventure
+ use what you learned about density ('water') and make your own pirate ship that will float!

Disco Diva
+ learn about light and things that can make light in the dark (light' and 'electricity')

RESOURCES

Books

- 201 Awesome, Magical, Bizarre, & Incredible Experiments by Janice VanCleave
- 202 Oozing, Bubbling, Dripping, and Bouncing Experiments by Janice VanCleave
- 203 Icy, Freezing, Frosty, Cool, and Wild Experiments by Janice VanCleave
- YOU GOTTA TRY THIS! Absolutely Irresistible Science by Vicki Cobb and Kathy Darling

Internet

- Magnet Man--http://www.coolmagnetman.com
- Magnet Experiments--http://www.kids-science-experiments.com/
- Wikipedia--http://www.wikipedia.org
- Suzy's World--http://www.suzy.co.nz/
- Worldwide Science Centers--http://www.cs.cmu.edu/~mwm/sci.html

The following requirements should be chosen according to the age level of the participant.
The requirements can be worked on as a group or individually. Each requirement can be completed at home, in school, or with specific groups.

The idea is to show participants that we complete science activities daily without even realizing it and to asssit them in learning something new about science. Science is fun for everyone of all ages !

YOU HAVE ONE OF TWO OPTIONS TO COMPLETE THIS PROGRAM.
OPTION ONE: Choose any THREE science activities to complete according to your age level.
OPTION TWO: Choose 3 of the following requirements to earn this patch.

1. AIR-Conduct an experiment that you use air to perform. Examples are using wind socks, balloons, paper airplanes, lifting things with air, find out what air can move, blow bubbles, calculating the speed of wind, measuring the distance of air according to the object.

2. MAGNETISM- Conduct an experiment that you magnets to perform. Examples are attracting metals, comparing magnet strengths, magic tricks, make your own magnet, use a compass, use a Magna Doodle for drawing, and using a magnet to find out what is magnetic.

3. WATER-- Conduct an experiment that you use water to complete it and name 3 things we use water for. Water has a surface tension, this means that some items can float on it. Examples of water experiments are: seeing if items float, evaporation, freezing, rain gauge, creating music with water glasses, creating a water cycle, moving things with water, and creating a tornado with water bottles.

4. MOTION- Conduct an experiment that you motion to perform. You can calculate how high a bounces when you throw it from the same distance. What happens if you choose a larger ball or throw it harder? Some other examples racing cars, bouncing balls, dropping objects and measuring the time, push and pull items, pulleys, playing Jenga or any other stacking or motion game, and working with simple machines.

5. CHEMISTRY- Conduct an experiment that you conduct chemistry experiments or learn more about 3 elements on the Periodic Table. A periodic table is a special table of elements that can help people better understand atomic chemistry. Investigate the study of matter or use products to create a chemical reaction. Examples include: creating soap,

6. ELECTRICITY--- Conduct an experiment that you use electricity to perform it. Electricity makes many things work. The currents follows a path called circuits. Therefore, when a light bulb is unscrewed or burns out the circuit is broken and the bulbs goes out. Examples include: static electricity, complete a circuit, or learn how a light bulb works.

7. LIGHT--- Conduct an experiment that you use light to perform it. Our main sources of light is from sun and electricity. Did you know that we need light to see a reflection in a mirror? Examples include: creating shadows, making rainbows, create reflections, flashlights, or learn how a light bulb works.

8. HEAT- Conduct an experiment that you use heat to perform. Heat can move in different ways suchas through as space using energy waves, through a solid object when you are cooking, and through gases or liquids. Examples include: how hot is the sun on darker objects, sun painting or fading, cooking, or make sun tea, and learning how to read a thermometer.

9. PHYSICAL CHANGES- Conduct an experiment that makes something physically change. This means that the object you are using in the experiment changes into a different form after the experiment and can not be turned back into it's physical state without doing something to it. For instance, changing water to ice. You would have to apply heat to the ice to get it back to it's natural state of water. Therefore you created a physical change. Other examples: thawing, dissolving, blending, freezing, rusting, and melting.

10. CREATE- Did you know that you create things on a daily basis that conducts an experiment. Create one thing using your own ideas that is conducting an experiment. Examples include: Making lip gloss, creating chocolate in molds, making candy, creating a message phone with cups and string, cooking, and tye-dye.

11. TEACH ME- Attend an event, science museum, or conduct experiments at school. You may be able to accomplish all three requirements if you conduct experiments or learn about science activities at these facilities.

12. COOKING- Conduct an experiment that you use cooking to create it. Have a taste test of items in the kitchen blind-folded and holding your nose. How many items did you get correct? OR Emphasize on a particular ingredient or supply that makes the item come out the way it does. For instance, why do things rise in the oven? Why don't they rise if we only mix flour and water? Examples of items include homemade bread, yeast; cakes and cookies, baking soda; candy, candy thermometer; cut up apples, lemon juice (they will turn brown without the lemon juice)

13. CAREERS- Learn about careers in science and pick which one you would like to do. This includes science teacher, chemist, culinary arts, oceanographer, astronomer, astronaut, computer programmer or engineer.

14. EXTRA ! EXTRA! - Complete one of our kits to enhance your knowledge about science. Complete one extra requirement to cover this requirement. Our science books include Culinary Creations, Discovering Nature, Geology, Astronomy, Rainforest, and Marine Life.

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Requirements Designed By:
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6-8	$12.75
10-12	$15.75
13-20	$22.25
21-23	$24.00
Over 24	Contact us for pricing

Kits and manuals range from 30 to 62 pages in length (except the Patch Program Book, that is over 100). Therefore if you are ordering more than 2 kits or manuals, please use the above shipping chart. Patches, bracelet kits, and stamps can be added to any order falling within that price range. Otherwise, use the highest shipping amount on the chart according to the items ordered.