Family Science Night
2008-09 School Year
List of Activities

1. **Invincible Balloon** - Study a property of elastic polymers by passing a skewer through an inflated balloon.
2. **Attractive -** Determine which objects are attracted to a magnet.
3. **Patterns -** Determine patterns of shapes and colors with pattern blocks.
4. **Balancing Bees** - Explore the concepts of Balance and counterweights.
5. **Centripetal Force** - Investigate centripetal force.
6. **Kitchen Chemistry** - Compare the reactivity of different liquids.
7. **Hoopster**- Make an airplane without wings.
8. **Symphony of Sound** - Create a symphony of sounds without ever touching an instrument.
9. **Harry Potter Potion** - Observe a chemical reaction
10. **Jumping Pepper** - Take charge and command the pepper to jump.
11. **Leaning Tower of Pasta** - Construct designs using creativity and ingenuity
12. **GlueP** – Make a gel-like material by changing the physical properties of the polymer polyvinyl alcohol formed from white glue.
13. **Popping Bubbles -** Use the color patterns of bubbles to predict when the bubble is ready to pop.

New Activities:

1. **Can YouWalk Through Paper?** – Make a hole in an ordinary piece of paper to walk though.
2. **The Blooming Flower –** Discover the concepts of capillary action and absorption in plants.
3. **Floating Paper Clips –** Use the properties of water to float a paper clip.
4. **Lumpy Liquid –** Explore the different states of a chemical mixture.
5. **Spinning Balloon –** Make a balloon spin using a bendy straw.

INVINCIBLE BALLOON

Purpose

Study a property of elastic polymers by passing a skewer through an inflated balloon.

Performing the experiment

1. Inflate a balloon to about ¾ of its full size.

2. Tie off the end of the balloon after making certain that the balloon is not longer than the skewer.

3. Dip the tip of the skewer into Vaseline to lubricate it. This requires only a very thin coating of Vaseline!

4. Using a gentle, twisting motion, insert the skewer into the thickest part of the balloon - very close to the tied end. Continue pushing and twisting the skewer until it comes out the other side of the balloon – look for the thickest part of the balloon – usually across from the tied end. Were you able to do this without bursting the balloon?

5. You may keep your balloon and skewer – but BE CAREFUL not to stab anyone!

Sandia National Laboratories

LOCKHEED MARTIN

INVINCIBLE BALLOON

Questions to think about

1. Why can you ride for miles with a thumbtack through your bicycle tire and tube? Why does air leak out of the tire and tube when you remove the thumbtack?

Explanation

Balloons are made of a thin sheet of rubber containing many long intertwined or cross-linked strands of polymer chains. When a balloon is stretched, the polymer network will attempt to regain its original shape, giving an elastic quality to the polymer. Blowing up the balloon stretches these strands of polymer chains. The cross-linked chains of elastic polymers in the balloon are pushed apart or separated when the skewer is inserted. The polymer chains at the nipple end and tie end of the balloon are not stretched as tightly as those at the sides of the balloon, thus allowing the skewer to push the polymer chains apart and enter the balloon without bursting it. When you remove the skewer, you feel the air leaking out through the holes where the strands were pushed apart. Eventually the balloon deflates.

ATTRACTIVE?

Purpose

Determine which objects are attracted to a magnet.

Performing the experiment

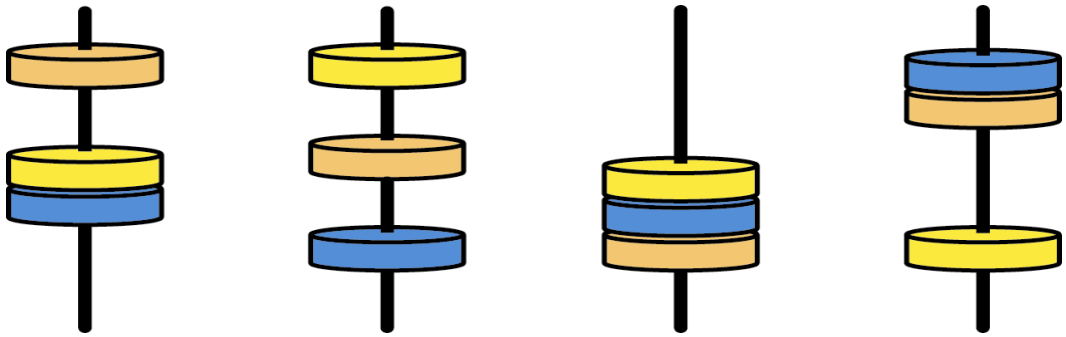
1. Touch the magnet to each object. Which objects or which portions of objects are attracted to the magnet?

2. See if you can attract the paper clip to one end of the magnet and then pick up another paper clip, or nail with the paper clip.

3. Rub the paper clip slowly over the magnet in its long direction about fifty times. Now try to pick up a second paper clip with the first paper clip, but without the magnet. What do you observe?

4. Try the maze – place a paper clip on top of the paper. Place a magnet on the underside of the paper. Can you guide the paper clip through the maze?

5. Try to make your donut magnets look like these.



ATTRACTIVE?

Questions to think about

1. Are all metals attracted to magnets?

2. Are other materials beside metals attracted to magnets?

3. Can some materials become magnetic after long contact with a magnet?

Explanation

If an object sticks to a magnet, we say it is magnetic. Most magnetic objects contain iron. Some metals (like copper (pennies) and aluminum (foil)) don't stick to magnets, so we say they are non-magnetic. There is a magnetic field around magnets that makes them affect each other and other objects without touching them. The force causes the paper clip to be attracted to the magnet and hover. When magnets push away from each other, they are "repelling." You are able to feel the force, or magnetic field, between the magnets. When magnets pull towards each other, they are "attracting."

PATTERNS?

Purpose

Determine patterns of shapes and colors with Pattern Blocks.

Performing the experiment

1. Ask your child to take a variety of blocks from the bucket.
2. Work through some of the following questions with your child:

- How many blocks do you have?
- What are the colors? Can you sort them into piles by color?
- How many different colors do you have?
- How many of each color do you have?
- How many different shapes do you have? Can you sort them into piles by shape?
- How many of each shape do you have?
- Do all of the sides of all of the shapes all have the same length?

3. Create different pictures using a variety of shapes.

PATTERNS?

Questions to think about

1. Can you think of other shapes that are different from those on the Pattern Blocks?
2. Can you find examples around the room of these different shapes?
3. Can you find examples in this room of how similar things are organized together?
4. Can you think of how your house is organized?

Explanation

Organization and classification is an important math and science concept. Scientists group living things by their forms and functions. hemists group elements (which make up all matter) into columns on a periodic chart by similar properties. Mathematicians group numbers together such as even and odd or prime numbers. Society also organizes and classifies many products. Food products in a grocery store are organized by type. Media stores classify music by type and then alphabetically by musician. In our homes, we keep grocery and cooking supplies in the kitchen, toiletries in the bathroom, and clothes in the bedroom.

Balancing Bees

Purpose

To explore the concepts of Balance and Counterweights.

Procedure

1. Cut out a bee.

2. Make two separate chains with three paper clips in each chain. Attach one chain to the end of each wing.

3. Take your new pencil with a flat eraser and hold it vertically in one hand (eraser end up). Hold the bee horizontally in the other hand.

4. Place the tip of the bee's nose in the center of the eraser and release the bee. The bee stands on its nose. If it leans to one side, adjust the position of the paper clip chains. This will change the length of the lever arms, the distance the chains are from the fulcrum (the bee's nose.)

Balancing Bees

Questions to think about

1. Can you find other ways to balance your bee?
2. Where do your counterweights (the paper clips) work best – higher or lower?

Explanation

Objects can be balanced in many ways. Counterweights can help balance an object. A stable position is one that is steady; the object is not falling over. The place on which an object balances is called the balance point. Counterweights work best when placed low on an object in relation to the balance point.

Centripetal Force

Purpose

The purpose of this experiment is to investigate centripetal force.

Performing the experiment

1) Slide a penny down the ramp of the Vortx. It might take more than one try to get your penny to spin into the well.
2) If you need more pennies – remove the bottom of the Vortx to retrieve pennies.

1) Put a penny into a balloon – push it all the way in.
2) Blow up the balloon about ½ way and tie the balloon.
3) Hold the balloon with two hands and make a swirling motion.
4) Wow!!!!! Cool, huh?

Centripetal Force

Questions to think about

1) What causes the penny to flip up on its edge?

2) Stop the swirling motion – how long does the penny continue to spin?

Explanation

When coins go down the ramp of the Vortx, they begin to spin tangent to the curved surface, traveling in a circular motion. Centriputal force is the inward force on a body that causes it to move in a circular path. As the coins get closer to the well, their rotational velocity increases – it spins even faster.

When an object spins, a force is created which pulls the object inward to make them move in a circular orbit, just like the coins in the Vortx. As the penny spins, it pushes against the side of the balloon. At the same time, the balloon pushes back. This causes the penny to spin and move in a circular path. Have you ever seen a motorcycle guy at the circus? It is a lot like that. After the coin is nicely spinning, stop moving the balloon. The coin tries to keep moving in a circular orbit. This is like a gyroscope (or a spinning top) where the spinning mass resists any effort to tip it over.

Kitchen Chemistry

Purpose

We will compare the reactivity of different liquids.

Performing the experiment

1. Place a piece of the wax paper on top of the paper with the boxes having the names Water, Vinegar, Orange Juice, and Lemon Juice.

2. Inside each of the four boxes, put about 1/2 of a teaspoon of baking soda on top of the wax paper.

3. In the box named Water, drop two or three drops of water on the baking soda.

4. Observe what happens very closely.

5. Do the same thing for the other three liquids.

6. On the piece of paper provided, write down what happened.

7. Throw away the wax paper and baking soda.

Kitchen Chemistry

Questions to think about

1. Did all the liquids give the same reaction when added to the baking soda?

2. Which liquid gave no reaction? Which liquid gave the most reaction?

Explanation

In a chemical reaction, chemicals are mixed together to produce some new chemicals. Many times, we can observe a change that has occurred when the chemicals are mixed. Baking soda reacts with acids to produce carbon dioxide gas. That's the fizzing you see. Stronger acids produce more gas so you should see more fizzing or bubbles when you add the liquid to the baking soda. The gas produced from this chemical reaction, carbon dioxide - CO_2, is the same gas we exhale when we breathe. It is also the gas plants need to grow.

Kitchen Chemistry

Fill out the chart below. Use the letters **W** for water, **V** for Vinegar, **L** for Lemon Juice and **O** for Orange Juice.

Biggest Reaction	More Reaction	Less Reaction	No Reaction

Sandia National Laboratories

LOCKHEED MARTIN

Kitchen Chemistry

Fill out the chart below. Use the letters **W** for water, **V** for Vinegar, **L** for Lemon Juice and **O** for Orange Juice.

Biggest Reaction	More Reaction	Less Reaction	No Reaction

Sandia National Laboratories

LOCKHEED MARTIN

Kitchen Chemistry

Water	Vinegar
Orange Juice	Lemon Juice

Sandia National Laboratories

LOCKHEED MARTIN

HOOPSTER

Purpose

Make an airplane without wings.

Performing the experiment

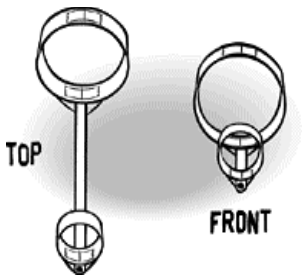
1) Cut a file card the long way into three equal strips.

2) Put a piece of tape on the end of one strip. Curl the paper into a little hoop and tape the ends together.

3) Put the other two strips end to end, so they overlap a little. Tape them together to make one long strip, and put another piece of tape on one end. Curl the strip into a hoop and tape the ends together.

4) Put one end of a straw onto the middle of a strip of tape. Put the big hoop on top of the straw and fold the tape up the sides of the hoop.

5) This part can be a little tricky. Put another strip of tape at the other end of the straw. Press the small hoop very gently onto the tape. Move it around until it lines up with the big hoop, and then press the tape down firmly. Your Hoopster should look like the picture.



HOOPSTER

6) Now comes the fun! Hold the Hoopster in the middle of the straw, with the little hoop in front. Throw it like a spear. It may take a little practice, but once you get the hang of it, your Hoopster will really fly!

Questions to think about

1. Does the Hoopster fly better if you have the smaller or larger hoop in the front?

Explanation

Aerodynamics is the science that studies what happens when air (or any gas) is moving. Air may be moving against an object (wind) or an object may be moving through the air (airplane). A principle that is necessary for aerodynamics is known as Bernoulli's principle. Bernoulli's principle is used in the design of airplane wings and helicopter blades. The wings are designed so that air moves faster above the wing. This means that the pressure is less there and so there is a force that is pushing the wing upward. This force is called lift and it offsets the downward force of gravity allowing the plane to fly.

Symphony of Sounds

Try these fun "instruments"

Percusion Bottles - Tap the sides of the bottles gently with a spoon. Vary the order of the bottles to change the sound.

Thunder Tube - Grasp the Thunder Tube in the middle with one hand and let the spring hang down. Make the spring dance by shaking your wrist and the air comes to life with sound! The tube works like a drum played by the spring -- sound waves are created in a column and resonate back and forth against the sides of the tube.

Palm Pipes - Pound your chosen pipe into the center of your hand to create an amazing tone! When you pound the pipe into the palm of your hand, it disturbs the air molecules inside the tube. The action of these molecules creates the vibration that becomes the note you hear.

Sound Hose – Caution: Watch out for your neighbors – swing away from the table. Twirl the hose over your head at different speeds and make at least five different tones, depending on how fast you can twirl! Twirling the tube makes the air molecules inside bump against each other and vibrates, creating sound waves that you can hear. The faster you move the Sound Hose, the higher the pitch.

Explanation

Sound is caused by vibration, creating sound waves that you can hear. The molecules create the vibration and that becomes the notes you hear.

Sandia National Laboratories

LOCKHEED MARTIN

Harry Potter Potion

Purpose

The purpose of this activity is to observe a chemical reaction.

Performing the experiment

1) Fill the baggie with about 2 tablespoons of water.

2) Gently squeeze out the air and reseal the baggie leaving only a small slot.

3) Slip an effervescent tablet into the baggie and quickly reseal it.

4) Shake the bag gently, lay bag flat on the table and watch as gas fills the baggie.

Sandia National Laboratories

LOCKHEED MARTIN

Harry Potter Potion

Questions to think about

1) What causes the bubbles to form?

2) Can you name the gas that is being formed?

3) Name some other chemical reactions that take place around us.

Explanation

Effervescent tables contain an acid, similar to lemon juice, and a base, similar to baking soda. When the acid and base are dry like they are in the tablet, they do not react. When they dissolve in the water, they react to produce carbon dioxide gas. This is known as a chemical reaction. A **chemical reaction** is when two molecules come together and undergo chemical change to form a new substance with new properties. When a chemical reaction takes place, you might see a color change or bubbles form. Other signs of chemical reactions are when you see light or feel heat after the chemicals are mixed together. Chemical reactions occur all around us!

Sandia National Laboratories

LOCKHEED MARTIN

Jumping Pepper

Purpose

Take charge and command the pepper to jump.

Performing the experiment

1. Pour equal amounts of salt and pepper on the lid of the bin. Mix them together into a pile.

2. Inflate a balloon. Rub the balloon vigorously on the piece of wool.

3. Hold the balloon a few inches above the pile of salt and pepper. The pepper will jump up to the balloon. (If not, rub the balloon again and hold it closer to the pepper.)

4. Notice that the pepper doesn't jump until the balloon gets close. If you get really close, you should be able to get a little salt jumping, too.

5. Brush off the salt & pepper back into the bin lid. Leave the balloon.

Sandia National Laboratories

LOCKHEED MARTIN

Jumping Pepper

Questions to think about

1. Why does the pepper jump?

Explanation

Every bit of matter is made of atoms. Atoms are made of even tinier particles called protons, electrons, and neutrons. Protons have a positive electrical charge and electrons have a negative charge. Neutrons have no electrical charge. Positive charges attract negative charges and vice versa. Negative charges push away negative charges and positive charges repel positive charges. The attraction between positively charged protons and negatively charged electrons keep atoms together. When you rub the balloon on the wool, free electrons jumped to the balloon. The balloon now has a negative charge. The balloon attracts the protons in the pepper. The same thing is happening with the salt, but the salt is heavier and it takes a larger electrical force to make the salt jump. But, if you rub the balloon really hard for a long time and get really close to the salt, it will also jump.

Leaning Tower of Pasta

Purpose

Construct structures using creativity and ingenuity.

Performing the Experiment

1. Using spaghetti and marhsmallows, create a spaghetti structure that will support a ping pong ball.
2. There is no wrong way to construct your structure – construct it as you see fit.
3. You may break the spaghetti into whatever length is desired.

Questions to think about

1. How tall is your creation?
2. What could you do to build a higher structure?
3. How many different designs did you come up with?
4. What other building materials might work well?

Explanation

Engineers use a variety of materials and designs to build buildings. Materials and design depend on the purpose of the buildings, required stability, foundation, outward appearance and many other factors.

Sandia National Laboratories

LOCKHEED MARTIN

GlueP

Purpose

Make a gel-like material by changing the physical properties of the polymer polyvinyl alcohol formed from white glue.

Performing the experiment

1. Fill the measuring cup to the top line with the glue mixture (this is about 30 ml or 2 tablespoons or 1 fl oz).

2. Pour the glue mixture into your paper cup.

3. Measure 10ml (about 1/3 of the measuring cup) of borax solution. Pour into the glue mixture and stir well.

4. Continue to stir until most of the liquid is gone.

5. Remove the material from the cup and knead it thoroughly in your hands.

6. Throw away the cup and stirrer. Put your GlueP in a plastic bag to take home.

Problems?
Too runny or stringy – add a few drops of glue.
Too sticky – add a few drop of borax solution.

Sandia National Laboratories

LOCKHEED MARTIN

GlueP

Questions to think about

1. Does it keep its shape? Is GlueP a solid or a liquid?

2. Will a ball of GlueP bounce? Does it stretch or does it break? What other experiments can you come up with?

Explanation

Glue contains millions of individual chains of a polymer called polyvinyl acetate. We mixed the glue with water and formed polyvinyl alcohol. Before you added the borax, these chains were able to slip and slide freely over one another like spaghetti. Although they could slip around, the chains are so long they don't interfere with each other, so glue stays thick and pours more slowly than water. When you add the borax polymer,
you cause the polyvinyl alcohol chains to be attracted to the borax chains by forces known as hydrogen bonding. The mixture forms many bridges between the polymers, forming net-like structures that trap the water molecules and stiffen the materials into a thick gel.

Popping Bubbles

Purpose

Use the color patterns of bubbles to predict when the bubble is ready to pop.

Performing the experiment

1. Select a clean straw and remove it from the wrapper.

2. Lower the straw into one of the puddles of soap solution in the styrofoam tray. Blow **GENTLY** through the straw to form a large bubble dome.

3. Observe the swirling of the soap film and the changing colors in the bubble until the bubble pops.

4. Repeat steps 2 & 3 several more times.

5. Record your observations in the Observation Table.

Sandia National Laboratories

LOCKHEED MARTIN

Popping Bubbles

Questions to think about

1. What color do you think indicates that the bubble is ready to pop?

Explanation

The bubbly domes had air in the middle and a thin soap-film wall. The bubble dome remains intact as long as the walls are strong enough to hold the air in. However; over time, the wall becomes thinner and thinner. This because the soap film that makes it up gradually flows away from the top of the bubble due to gravity. Eventually the wall becomes so thin that the bubble pops.

Outside Surface ↓

Green → Blue → Magenta → Yellow → Green.....White → White w/ black spots→ Black POP!!!

↑ Inside Surface

The pattern you see may be slightly different, because air currents may cause the bubble to grow thin too quickly or pop early, disrupting the pattern.

Sandia National Laboratories

LOCKHEED MARTIN

Popping Bubbles

Observation Table

Trial #	Colors observed (in order if possible)	Color immediately before popping
1	_____	_____
2	_____	_____
3.	_____	_____

Sandia National Laboratories

LOCKHEED MARTIN

Popping Bubbles

Observation Table

Trial #	Colors observed (in order if possible)	Color immediately before popping
1	_____	_____
2	_____	_____
3.	_____	_____

Sandia National Laboratories

LOCKHEED MARTIN

Can You Walk Through Paper?

Purpose

Challenge: Can you cut a hole in a sheet of paper large enough to walk through? Is this a physical or chemical change?

Performing the experiment

1. Fold the paper in half crosswise. Make 7 straight cuts from the folded side about 1" apart and stopping about ½" from the edge of the paper.

2. Turn the paper around and make 6 cuts from this side of the paper also stopping about ½" from the edge of the paper.

3. Except for the first and last strip of each end, snip ~1/8" off the folded ends of the strips.

4. Carefully open the paper without tearing the paper and walk through the hole! See solution in envelope!

Sandia National Laboratories

LOCKHEED MARTIN

Can You Walk Through Paper?

Questions to think about

1. How did your first idea differ from the solution? Why?

2. What is the difference between a physical change and chemical change?

3. How else could you make a physical change in the paper?

4. How could you make a chemical change in the paper?

Explanation

There are two types of changes - chemical and physical. They are based on studying chemical reactions and states of matter. Matter undergoes chemical change when the composition of the substances changes by having one or more substances combine or break apart to form new substances. Physical changes occur when objects undergo a change that does not change their chemical nature. It involves a change in physical properties. Examples of physical properties include: texture, shape, size, color, odor, volume, mass, weight, and density.

The Blooming Flower

Purpose

Discover the concepts of capillary action and absorption in plants.

Performing the experiment

1. Cut out the flower.

2. Fold the five sides of the flower up and place in the bowl of water.

3. Observe the flower as it "blooms".

Sandia National Laboratories

LOCKHEED MARTIN

The Blooming Flower

Questions to think about

1) What did you observe when you placed the flower in the water?

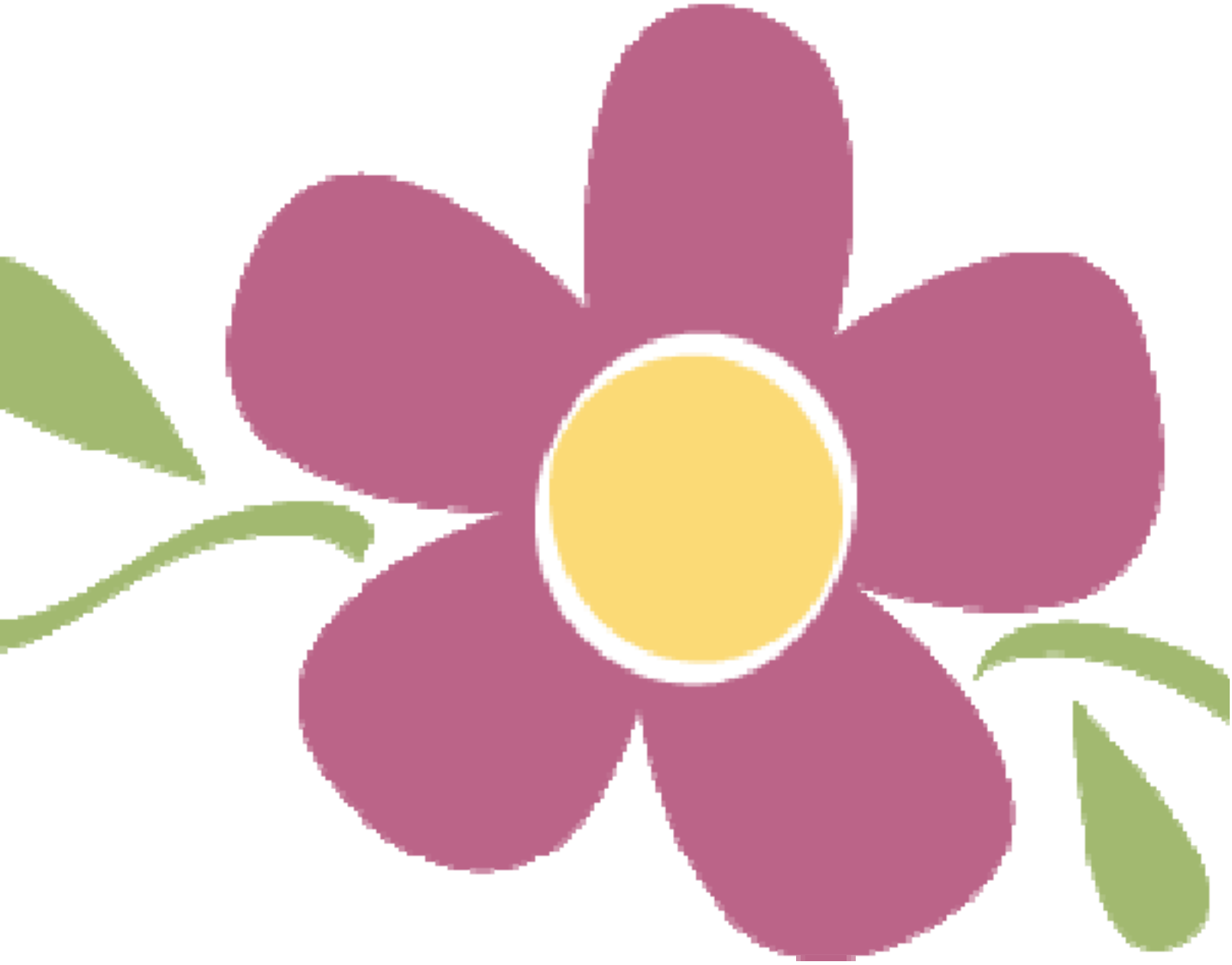
2) Why do you think this occurred?

3) What real world applications would involve capillary action?

Explanation

Capillary action is the ability of a substance to draw another substance into it. This is the process by which a flower gets moisture. In our paper plant, water gradually rises up though tiny, tube like holes between the fibers of the paper. The paper swells and the petals open up, just like a real flower.

Flower Pattern



Floating Paper Clips

Purpose

Use the properties of water to float a paper clip.

Performing the experiment

1. Try to make a paper clip float in the bowl of water. Did you have any luck? Remove the paper clip from the water, dry it off and set it aside.

2. Tear off a piece of tissue paper about half the size of a dollar bill and gently place it on the surface of the still water.

1. Carefully place your dry paper clip on the floating tissue paper.

2. Use the eraser of a pencil to carefully poke the tissue paper (not the paper clip) until the tissue sinks.

3. The paper clip should now be floating without the tissue!

4. Remove your paper clip and throw the tissue paper in the trash.

Floating Paper Clips

Questions to think about

1) What is causing the paper clip to float?

2) Why is the tissue paper needed?

Explanation

Water particles are attracted to each other in all directions, making them ”stick” together. However, because there are no water particles above them, the water particles at the surface “stick” only to particles next to and below them. This makes the surface act as if it has a thin “skin”. This is called surface tension. If the conditions are right, they can hold tight enough to support your paper clip. Many insects, such as water striders, use this "skin" to walk across the surface of a stream.

Lumpy Liquid

Purpose

Explore the different states of a chemical mixture.

Performing the experiment

1. Using a spoon, pour a scoop of cornstarch into a cup.
2. Squeeze 1 full dropper of water into the cup.
3. Using a popsicle stick, SLOWLY stir the mixture.
4. Add small amounts of water as needed to wet all the powder.
5. The mixture should act like a liquid when stirred slowly and is hard when you tap on it with your finger. Add more water if it is too hard and more cornstarch if there is too much liquid.

Do not put your mixture down a drain, it will plug it.

Throw it away in the cup.

Sandia National Laboratories

LOCKHEED MARTIN

Lumpy Liquid

Questions to think about

1) What causes the change in the mixtures state?

Explanation

Think of a busy sidewalk. The easiest way to get through a crowd of people is to move slowly and find a path between people. If you took a running start and headed straight for the crowd of people, you would quickly slam into someone and wouldn't get very far. This is similar to what happens in the cornstarch mixture.

We use the term “viscosity” to describe the resistance of a liquid to flow. Water, which has a low viscosity, flows easily. Honey, at room temperature, has a higher viscosity and flows more slowly than water. But if you warm honey up, its viscosity drops, and it flows more easily. Most fluids behave like water and honey, in that their viscosity depends only on temperature. We call such fluids “Newtonian,” since their behavior was first described by Isaac Newton. The cornstarch mixture you made is called “non-Newtonian” since its viscosity also depends on the force applied to the liquid or how fast an object is moving through the liquid.

Other examples of non-Newtonian fluids include ketchup, silly putty, and quicksand. Quicksand is like the cornstarch mixture and ketchup is the opposite, its viscosity decreases under pressure.

Spinning Balloon

Purpose

Make a balloon spin using a bendy straw

Performing the experiment

1. Cut about 2” off the bottom of the bendy straw.

2. Blow up a balloon. Put the opening of the balloon around the bottom of the straw. Hold onto the balloon and straw so that you don’t let any air out.

3. While holding the balloon and straw, tape the balloon onto the straw so that it stays in place.

4. Then, bend the top of the straw, put the balloon on the table, let it go, and watch what happens!

Sandia National Laboratories

LOCKHEED MARTIN

Spinning Balloon

Questions to think about

1) What do you think will happen if you change the direction that the straw points?

2) What would happen if you cut more than 2” off the bottom of the straw?

Explanation

In order for the air to get out of the balloon, the air has to turn the corner in the bendy straw. When the air turns the corner, it pushes on the straw and the straw pushes back on the air. The straw then pushes on the balloon and look what happens to the balloon!

Sandia National Laboratories

LOCKHEED MARTIN