

INVINCIBLE BALLOON

SAND2013-10507P

Purpose

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

Performing the experiment

1. Inflate a balloon to about $\frac{3}{4}$ 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!



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LOCKHEED MARTIN A stylized blue 'A' logo with a vertical line to its right.

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.



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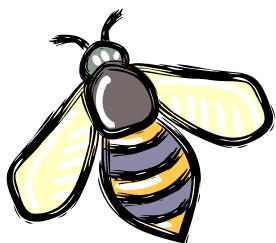
Balancing Bees

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.)



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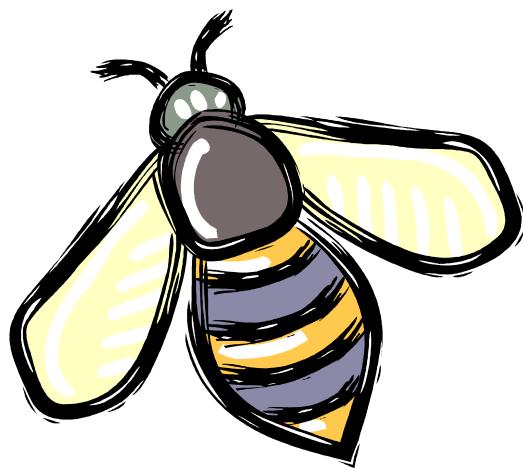
Balancing Bees

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.



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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.



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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.



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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



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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



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Kitchen Chemistry

Water	Vinegar
Orange Juice	Lemon Juice



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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.



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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.



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

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!



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Leaning Tower *of* Pasta

Purpose

Construct structures using creativity and ingenuity.

Performing the Experiment

1. Using spaghetti and marshmallows, 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

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.



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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.



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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.



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Popping Bubbles

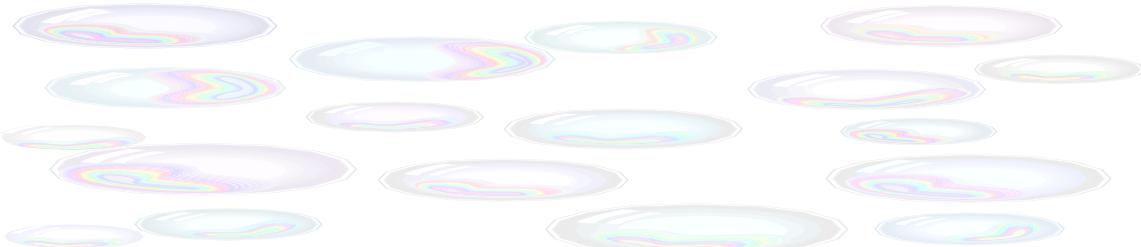
Purpose

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**

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.



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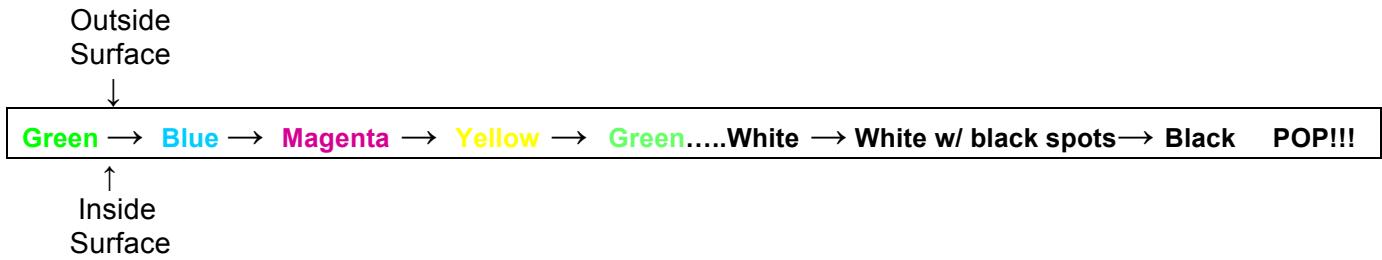
Popping Bubbles

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.



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.



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Popping Bubbles

Observation Table

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



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Popping Bubbles

Observation Table

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



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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 $\frac{1}{2}$ " from the edge of the paper.
2. Turn the paper around and make 6 cuts from this side of the paper also stopping about $\frac{1}{2}$ " from the edge of the paper.
3. Except for the first and last strip of each end, snip $\sim\frac{1}{8}$ " off the folded ends of the strips.
4. Carefully open the paper without tearing the paper



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

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.



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".**



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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

moisture. In our paper plant, water gradually rises up through tiny, tube like holes between the fibers of the paper. The paper swells and the petals open up, just like a real flower.



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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.





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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!



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!



Purpose

What do you always have, but always leave behind?
Your fingerprints! Discover what your fingerprint looks like.

Performing the experiment

1. Take a pencil and scribble on a piece of paper until you have a nice big black mark.
2. Rub your index finger in the mark. Your index finger is the one next to your thumb.
3. Put a piece of tape over your finger, press down, and pull the tape off.
4. Place the tape in the square box on the worksheet.
Now you can see your fingerprint.



Sandia CSI

Questions to think about

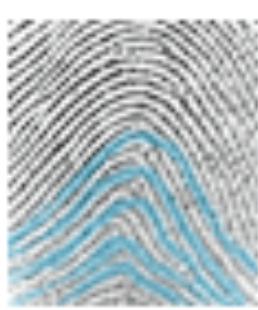
- 1) No two fingerprints are exactly alike. Most people's fingerprints look like a whorl, loop or arch. What does your fingerprint look like?



WHORL



LOOP



ARCH

What are other ways of identifying people?

Explanation

The FBI has many ways of solving crimes and finding criminals. One of them is through fingerprint identification.

Fingerprints are a great way to tell people apart because everyone's fingerprints are unique. This means that no two people in the world have the same fingerprints! Other ways of identifying people (hair color, height, weight, and eye color) may change as a person gets older, but fingerprints stay the same.



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LOCKHEED MARTIN The Lockheed Martin logo, featuring a stylized 'A' shape next to the company name.

NAME: _____

DATE: _____

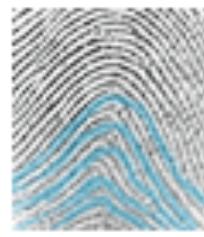
Circle what your
fingerprint looks like:



WHORL



LOOP



ARCH

TAPE FINGERPRINT HERE



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LOCKHEED MARTIN A stylized 'A' logo.

NAME: _____

DATE: _____

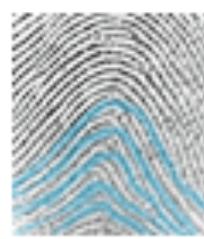
Circle what your
fingerprint looks like:



WHORL



LOOP



ARCH

TAPE FINGERPRINT HERE



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Arrow Illusion

Purpose

Surprise your eyes with this optical illusion!

Performing the experiment

1. Take two pipe cleaners that are the same length and the same color. (IF they aren't the same, the optical illusion won't work.)
2. Cut in half two other pipe cleaners that are a different color. These will be the ends of your arrows.
3. Wrap the end of one long pipe cleaner around the middle of one short pipe cleaner. Then bend the short one in half so it looks like an arrow. Do the same thing with the other end.
4. Then do it again with the other pipe cleaner, but this time, turn the arrows the other way. Move your pipe cleaners apart. Tape the two arrows on a sheet of paper. Now you have an optical illusion!



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Arrow Illusion

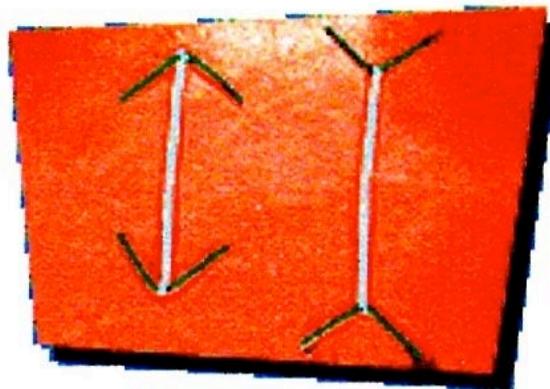
Questions to think about

1. Can you make two different sized pipe cleaners look the same?
2. Do you know of any other optical illusions you could experiment with?

Explanation

Even though the two long pipe cleaners are the same length, one of them should look shorter than the other.

Optical illusions fascinate us, challenging our notion that what we see is real. An illusion is something that deceives or misleads. Most effects have their basis in the visual pathway, not in the optics of the eye.



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Catch a Rainbow

Purpose

Add a clear coating to black paper and get a rainbow of amazing iridescent colors!

Performing the experiment

1. Cut a 3" X 3" piece of black construction paper and place it into the bowl of water. Press it down with your fingers until it's completely wet.
2. Pull the brush out of the bottle of clear nail polish. Touch the very tip of the brush to the water. You should see a film floating on the water. If you don't see any film, add one more drop of nail polish.
3. Make sure the film is floating on top of the paper. Then very carefully and slowly, lift the piece of paper out of the water to "catch a rainbow". Tilt it a little so that water runs off. Gently lay it onto a paper towel to dry a little.
4. Place the paper in a sandwich baggie and allow it to dry. When your print is completely dry, hold it under a bright light or out in the sun. Tilt the paper until you see the brightest colors.



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Catch a Rainbow

Questions to think about

1. Where else can you see colors like these?
2. Why does clear nail polish on dark-colored paper reflect colors? What happens if you use white paper?

Explanation

The very thin layer of nail polish on the dark-colored paper can reveal the hidden colors of white light. Some of this light is reflecting from the top surface, where the nail polish meets the air. Some is reflecting from the bottom surface, where the nail polish meets the paper. The light waves reflecting from these two surfaces overlap. The colors that you see are the ones that are left over when some colors are subtracted from white light.



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Mirror Messages

Mirror Messages

Purpose

Write a secret message.

Performing the experiment

2. Think of a secret message you'd like to send and write it on a piece of paper. Your message should contain no more than three words. Print using large letters.
3. Next, hold a mirror up to your message. Place the mirror on its edge on the paper right next to your message.
4. Now look in the mirror and copy what you see onto a new piece of paper. This will be your secret message.
4. Give your message to a friend and see if they can figure out what it says. To read your secret message, they'll have to hold it up to a mirror and then look in the mirror. Your message will appear!



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Mirror Messages

Mirror Messages

Questions to think about

3. What other surface could you use besides a mirror?
4. Where have you seen mirror writing?
Hint: On ambulances. Lots of times, the word “ambulance” is written so that drivers can see the word the right way when they look in their rear view mirrors.
5. Leonardo da Vinci was quirky enough to write notebook entries in mirror (backwards) script, a trick which kept many of his observations from being widely known until decades after his death. Try writing a message backwards in cursive.

Explanation

Mirror writing makes a great secret code because the message looks really different in the mirror than it does in real life. Most letters look like they got flipped inside out – but some letters, like “O”, look exactly the same as their mirror images. There are more left-handed mirror writers than right-handed ones. Research to find out why this occurs.



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EGG CARTON NUMBERS

Why: To understand numbers

Tools: egg carton
beans

How:

- Give your child the beans and ask him/her to count them into the sections of the carton, according to the numbers. There should be one bean in the section marked “1,” two beans in the section marked “2,” and so on.
- How many beans were used altogether? Can you explain why?
- Older children can look for patterns. It takes 78 beans or 6×13 to fill the egg carton. How many beans would be needed to fill two egg cartons with numbers from 1 to 24?

