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Print Match

What you need:
- Washable marker
- Plastic cup
- Family members
- Sheet of paper

What you do:
Label a sheet of paper “Fingerprint Database.” Write the name and/or draw a picture of each family member on the sheet.

Have your family members colour their right index finger with the washable marker, and then press it next to their name on the Fingerprint Database sheet.

Gather your family members. Tell them that after you leave, one of them will colour their index finger with the marker, and then press it onto the plastic cup.

Leave the area. Make sure you are far enough so that you cannot hear or see who makes the fingerprint.

Return and examine the cup. Try and match the fingerprint on the glass with one from the Fingerprint Database sheet to discover which family member made the fingerprint!

What’s going on?
You just used a fingerprint to identify a person! Fingerprints have been collected, studied, and tested as a way to identify individuals for over a hundred years. Small ridges form on a person’s fingertips before they are born, and they do not change for a lifespan. The oil on our fingertips is what leaves ridge impressions on objects. No two people share the same prints on their fingers, or even their toes.

Memory Compositions

What you need:
- Old magazine
- Pencil
- File folder or large book
- 2 sheets of paper
- Adult helper

What you do:
Ask your adult helper for permission to select and tear out a picture of a person from an old magazine. Don’t let your helper see the picture you selected!

Study the picture for 20-30 seconds.

Turn it over. Ask your helper to prepare the blank paper and pencil on a file folder to be ready to draw.

Describe the person to your helper. Try to describe the forehead, eyes, nose, and mouth separately and slowly so that your helper has time to draw.

Compare the original picture with the drawing. Do they look the same? Trade places with your helper, and use a new picture to try it again!

What’s going on?
You just used your memory to recreate a picture! Your long-term episodic memory organizes information around events in your life. To recall certain information, we try to picture the related event in our mind to help out. It is our long-term episodic memory that allows us to remember last year’s class field trip and yesterday’s lunch. However, our memory of an event is not always reliable since it can change over time.

Fun Facts!
A dog’s nose print is as unique as a fingerprint!

Even identical twins have differences in their fingerprints!

Fingerprints that are invisible to the naked eye are called latent and are uncovered through a process using superglue.

Lack of sleep affects the neurons in the brain that control your memory. This can cause you to become forgetful!

The hippocampus, a part of the brain, plays a big part in making our long-term memory work.
Magnification on the Spot

**What you need:**
- Sheet of waxed paper
- Scissors
- Drinking straw
- Small cup of water
- Newspaper or magazine

**What you do:**
Have your helper cut out a 7.5cm x 7.5cm square of waxed paper. Place the square of waxed paper on top of an article in a newspaper or magazine. Dip your straw in the cup of water. Cover the end of the straw with your finger, and lift the straw out of the water (there will be water inside the straw). Place the straw over a letter on the waxed paper. Remove your finger to let a drop of water run out of the straw. Look through the drop. Does the letter look different? Add more water until the drop fits over a few letters. Do the letters look bigger or smaller than before?

**What’s going on?**
You just used water to magnify, or enlarge, letters and words! The water acts as a lens, a clear material with a smooth, curved surface that bends light. Our drop of water is a convex lens because it makes the light bend outwards. As the light bends out, the image you see appears larger. The smaller the drop of water, the more curved its shape is, and the more it magnifies. A bigger drop of water allows you to see more letters, while a tiny drop makes the letter too big to see the whole word.

Contact Confirmation

**What you need:**
- 2 sheets of construction paper (different colours)
- White glue
- Pad of paper
- Pen
- Pencil
- Helper

**What you do:**
**Part 1**
Glue together two different colours of construction paper. Press the papers firmly together. Wait until the glue dries, and then pull them apart. What do you see?

**Part 2**
Take out a pad of paper, pen, and pencil. Have a helper write a short message on the pad of paper with the pen. Flip over to the second sheet and rub the pencil over the imprint on the blank page. What do you see?

**What’s going on?**
Dr. Edmond Locard believed that when two objects have contact, there is always a transfer of material from each object onto the other. When you pull apart the glued construction papers, you may notice a bit of each coloured paper sticks to the other. When you rub the pencil over the seemingly blank page, you are able to tell what your helper wrote on the previous page. Locard’s principle is useful for police officers and forensic scientists since it can help link a suspect to a crime.

Fun Facts!
Convex lenses are used in microscopes!

Crime science investigators use tools like magnifying glasses to uncover small pieces of evidence at a crime scene.

In 1784, John Toms was convicted of a serious crime because a scrap of paper found in his pocket matched the newspaper used to pack gunpowder into his pistol!
**Climbing Turtle**

**What you need:**
- Crayons or markers
- Tape
- Large paper plate
- Small paper plate
- Scissors
- Drinking straw
- Kite string or cotton twine
- Paper towel tube
- 2 craft or pony beads

**What you do:**
Use the small paper plate as a stencil to draw a circle in the centre of the large paper plate. Draw a turtle head, paws, and tail on the large paper plate so they stick outside the circle. Use scissors to cut out the drawing. Tape the small paper plate over the drawing, and decorate the plate to look like a turtle's shell.

Use scissors to cut two 3cm pieces from the straw. Tape one piece to each foreleg so that the straws are parallel to each other along the side of the turtle. Fold each foreleg over the straw and tape in place on the edge of the paper plate.

Cut two 1m lengths of string. Tie the strings to either end of the paper towel tube.

Cut one 20cm length of string. Tie the string around the middle of the paper towel tube and in place so that you can hang it from a doorknob.

Thread the string ends through the straw pieces of the turtle. Tie a bead to the end of each string. Your turtle should hang from its paws at the bottom of the strings.

Hold one bead in each hand to pull the strings tightly. Pull one string gently so that the tube tilts to the side to make the turtle climb. Pull the other string to make the tube tilt to the other side. Continue pulling the strings gently, alternating from side-to-side, and the turtle will climb to the top! Loosen the strings and the turtle slides back down.

**What's going on?**
You're making friction work! Friction is the force between two objects rubbing together. The straws on your turtle's paws rub and slide along the string as you tug. Pulling a string makes the straw slide up. The string's friction on the straw makes the opposite side stay in place. Loosening the strings in your hand releases the friction, and the turtle slides down the string from gravitational force.

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**Electric Message Machine**

**What you need:**
- 9V battery
- Scissors
- 3 alligator clips or other long wires
- (from an electronics store like The Source)
- A miniature light bulb with two leads
- (from an electronics store like The Source)
- 2 paper clips
- Electrical tape

**What you do:**
Check that you can see the metal in the wires come out of the light bulb. Have an adult help you peel back the plastic coating to expose the metal in the wires.

Place the battery, one paper clip and light bulb on a table to form a triangle's three points. Place one alligator clip wire between each two points to form the triangle's sides.

Use the scissors to cut six 3cm strips of electric tape.

Connect and tape the alligator clips to the battery’s metal ends, the alligator clips to the light bulb's leads, and the alligator clips to the paper clips.

When you touch the two paper clips together, the light bulb turns on. Separating the paper clips turns off the light.

**What's going on?**
You made an electric circuit! Electricity moves in a circle around the triangle's points through the alligator clip wires. This electric movement is called an electric circuit. Touching the paper clips together completes the circuit. If the circuit is open or incomplete, the light bulb does not light up. Electricity moves only through the circuit's metal parts. Electrical tape protects your fingers from the electricity. All electric devices work when the electric circuit is complete. This is why electric devices have plugs with at least two prongs. When you plug the prongs into a wall socket, electricity moves into one prong through the electric device, out the other prong, and back into the socket to complete the circuit. Some plugs have a third prong to protect the device from powerful electric surges that sometimes travel in an electric circuit.

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**Fun Facts!**

- **Your bicycle brakes create friction between the pads on the brakes and the sides of the bicycle wheels. Your brakes won't work so well in the rain because water reduces friction!**

- **Electric Message Machine**

- **Circuit breakers and fuses stop electricity from completing an electric circuit to protect devices. Fuses are made of wire that melts if too much electricity surges through it. Circuit breakers pop open if too much electricity surges through them and must be reset to complete the circuit again.**
**Air Pressure**

**What you need:**
- Drinking cup
- Piece of cardboard large enough to cover the mouth of the drinking cup
- Water
- Sink or tub

**What you do:**
1. Fill a drinking cup to the brim with water.
2. Place a piece of cardboard over the cup.
3. Place your hand firmly against the cardboard and flip the cup upside-down over a sink or tub. Make sure there are no air bubbles inside the cup.
4. Remove your hand. Does the water fall out? Peel a corner of the cardboard from the cup. What happens to the water?

**What's going on?**
You worked with air pressure! Air pressure is the air's force on us and other objects. Similarly, water pressure is the water's force on us and other objects. Water pressure is the resistance you feel when you move around in a pool. Filling the drinking cup with water and flipping the cardboard over creates water pressure, which pushes against the drinking cup walls and cardboard. Air pressure pushes against the drinking cup walls and cardboard from the outside. The air pressure is stronger than the water pressure, so you could turn the cup upside-down with the cardboard on top without losing any water. If there is an air bubble inside the cup, the bubble's air pressure will equal the air pressure outside the cup, and the water will pour out as soon as you flip the cup upside-down.

**Falling For Science**

**What you need:**
- Metal cookie tray
- Tennis ball
- Golf ball
- Feather
- Sand

**What you do:**
1. Set the cookie tray upside-down on the floor.
2. Stand up and hold the golf ball and the tennis ball over your head, at the same height.
3. Aim the balls at the tray, and then drop them at the exact same time. Which hits the tray first? Do you hear the sound of one ball or two balls?
4. Turn the cookie tray over and fill it with sand. Smooth out the sand so that it is flat.
5. Drop the balls again from above your head. Examine the dents in the sand. How are they different?
6. Repeat the experiments with a feather and the golf ball. Is there a difference?

**What’s going on?**
You just demonstrated gravity! The Earth's gravity pulls objects toward itself. This is why anything released on Earth falls to the ground. When you drop the tennis ball and the golf ball over the cookie tray, they both hit the tray because of gravity. When you drop the tennis ball and the golf ball over the sand, they both land except the golf ball makes a deeper impact in the sand. This is because the golf ball is heavier than the tennis ball. Objects that are heavier fall harder towards the ground. This experiment does not work with a golf ball against a feather. A feather floats to the ground because of air resistance. The feather is too light to push against the air the way the golf ball does.

**Fun Facts!**

Atmospheric pressure is the air pressure around us. It includes water pressure if you're under the ocean. The ocean's deepest pressure is 1000 times heavier than at sea level where the water meets land!

Fun Facts!

There's no air on the Moon, but there is gravity. If you drop a feather and a golf ball on the Moon, they do hit the ground! Astronaut Gregg Scott ran this experiment on the Moon in 1972.
**Shoeprint Setup**

**What you need:**
- Shoe
- Poster board with one shiny side (Bristol board)
- Sheet of white paper
- Cooking spray (PAM)
- Cocoa powder
- Clear, wide packing tape
- Scissors
- Spoon
- Adult helper

**What you do:**
1. Put the poster down on the floor (shiny side up).
2. Have your helper spray the bottom of your shoe with cooking spray.
3. Step down directly and apply weight steadily onto the poster board.
4. Lift your foot up without smudging the shoeprint.
5. Use a spoon to sprinkle cocoa generously over the footprint.
6. Shift the paper around to ensure evenly coating the footprint with cocoa. Shake the excess powder into the garbage.
7. Ask your helper to cut a piece of packing tape that is a bit longer than the footprint (avoid getting your fingerprints on the tape).
8. Place the tape over the footprint, and press down gently and evenly.
9. Lift the tape off the poster board (the cocoa print should stick to the tape).
10. Put a sheet of white paper on the floor. Carefully stick the tape, pressing down firmly and evenly, onto the paper.

**What's going on?**
A footprint is the impression a person's foot or shoe leaves as they walk. Photographs, drawings, castings, or lifts are used to record footprints and tire tracks. Footprints give us clues about a person's shoe type, height, stride length, and gender. Lifts involve pouring a plaster solution into a print and lifting it out when it hardens.

**Think Ink**

**What you need:**
- Spray bottle filled with water
- 2 coffee filters
- 2 different black markers (water-soluble, washable, water-based)
- Watch or clock
- 2 paper towels

**What you do:**
1. Use one marker to draw a circle or a smiley face in the middle of one coffee filter.
2. Use the second marker to make a similar picture on the second coffee filter.
3. Compare the ink on the filters. Do you see one colour or many?
4. Place your coffee filters on a piece of paper towel.
5. Spray each coffee filter with a few squirts of water to dampen.
6. Wait five minutes, and observe the changes in the ink. What do you notice?
7. Wait five more minutes, and observe the changes again.

**What's going on?**
Different colours make up ordinary black ink. These coloured dyes can separate when dissolved in a liquid like water. This process is called chromatography. Different dye mixtures make different inks, and chromatography can help you identify the ink. Adding water to the filter paper dissolves the dyes in the ink. The dissolved dyes move through the filter paper and form a colour pattern because some dyes travel farther than others. Chromatography test results can show whether two ink samples match.
**Mysterious Message**

**What you need:**
- Baking soda (125mL)
- Water (125mL)
- Purple grape juice from concentrate (125mL)
- Measuring cup
- Spoon
- Small bowl
- Small cup
- 2 paintbrushes
- White paper

**What you do:**
- Put the baking soda and water in the bowl and mix with the spoon.
- Think of a secret message to write.
- Use a paintbrush to write your message on a sheet of paper with the baking soda and water mixture. Leave some space between the letters.
- Wait about 15 minutes for the message to dry.
- Pour the grape juice into the cup.
- Use a clean paintbrush to paint a thin layer of grape juice over the paper. The message will appear!

**What's going on?**
You made an invisible message appear! Purple grape juice contains a chemical that changes colour when it reacts with a base. The baking soda and water solution is a base. You make a chemical reaction when you add purple grape juice to the baking soda!

**Copy-Cat Solution**

**What you need:**
- Vanilla extract
- Liquid dish detergent
- Small bowl
- Teaspoon
- Paintbrush
- 2 sheets of white paper
- Black pen

**What you do:**
- Use the black pen to draw an animal on a sheet of paper. Make the lines of the picture as thick as possible.
- Mix one teaspoon of vanilla extract with one teaspoon of liquid dish detergent in the bowl.
- Use the paintbrush to paint a thin layer of the vanilla and detergent mixture over your drawing.
- Cover your drawing with a second sheet of white paper.
- Use the back of the spoon to press down on the paper and rub in small circles.
- When you can see your drawing through the paper, peel off the top sheet. What do you see?

**What's going on?**
You copied your drawing! The detergent in your mixture binds to the ink in your picture. The ink mixture transfers to the second page when you press the sheets together. If you draw with thick lines and lots of ink, you can make more than one copy.

**Fun Facts!**
The science of hiding messages is called steganography. It gets its name from the Greek words steganos hidden and graphe writing.

**Fun Facts!**
Most photocopy machines use xerography to make copies, a dry process using heat. Because copiers tend to have small glitches in the way they print, an investigator can use forensic identification to trace a copied page to a copier.
Fun Facts!

You can tear up a secret message to destroy it, but someone could put the pieces back together. Government agents and business people use shredding machines to destroy sensitive information.

Fun Facts!

Detectives can use plaster of Paris to make casts of footprints that they find in the dirt. They can compare a cast to a suspect’s shoe to figure out whose shoe was at the crime scene!
What's an amp?

The ampere (A or amp) is a unit used to measure electric current. The unit is named after French physicist André-Marie Ampère (1775-1836), a pioneer who studied electricity.

What's a decibel?

The decibel (dB) is based on the unit bel (B) to measure the intensity of sound. On the sound scale, 10 decibels equal 1 bel. The decibel is named after Alexander Graham Bell (1847-1922), the inventor of the telephone.

What's a darwin?

The darwin is used by scientists to measure the rate of evolution in characteristics of organisms. The unit is named after English biologist Charles Darwin (1809-1882), who founded the theory of evolution.

What's a degree Fahrenheit?

The degree Fahrenheit (°F) is a traditional unit of temperature commonly used in the United States. The unit is named after German physicist Daniel G. Fahrenheit (1686-1736), who also invented the mercury thermometer.

What's a hertz?

The hertz (Hz) is the unit used to measure frequency. The frequencies of radio and television waves are measured in kilohertz (kHz), megahertz (MHz), and even gigahertz (GHz). Cellular phones and microwave ovens operate with radio waves that have frequencies in the gigahertz range. The unit is named after German physicist Heinrich Rudolf Hertz (1857-1894), who worked on discovering how frequencies travel.

What's a mach?

The Mach or mach (M or Ma) is used to describe the speed of an aircraft relative to the speed of sound. "Mach 1.0" is the speed of sound; "Mach 2.0" is twice the speed of sound, and so on. The unit is named after Austrian physicist Ernst Mach (1838-1916), who helped establish this value.

What's a volt?

The volt (V) is a unit used to measure electric potential, or the potential energy in an electric charge. The name of the unit honors the Italian scientist Count Alessandro Volta (1745-1827), who invented the first battery.

Seventh Generation Club
Mission Statement

To create a club where First Nations youth can envision their future by recognizing their own energy, the culture of their people, and the teamwork needed to succeed by giving them opportunities to make healthy life choices, participate in their community, and to meet the challenges of life.

The Seventh Generation Club would like to thank the following partners: