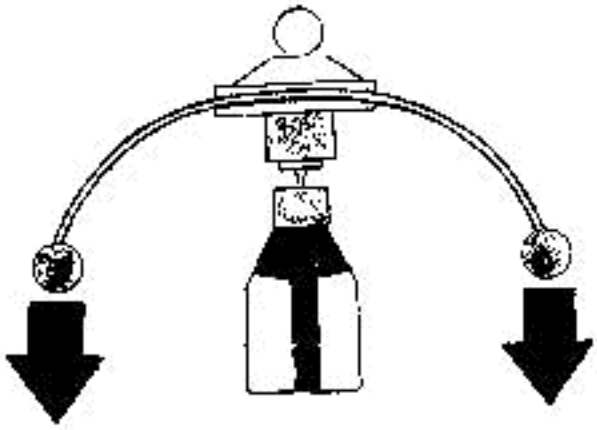
Girl Guides of Canada
Guides du Canada

Science Ideas for Guides and Pathfinders

BALANCING WEIGHT



Equipment: Cardboard, a 12” piece of 18 gauge floral wire, or a straightened coat hanger, a thumb tack, glue, two small play dough balls, a pop bottle

1. Draw a “man” onto some thick white cardboard. Color him, or her, as you wish. Glue the thumb tack onto the bottom of the cardboard, at his feet.
2. Glue the wire onto the man, at his arms, like he was carrying a pole horizontally in front of him.
3. On each end of the wire, place a small play dough ball.
4. Balance the man on top of the bottle. You will likely need to curve the wire downward to lower his center of gravity. You may need to adjust the size of the balls. He may wobble, but he should keep his balance. (Science for fun Gibson, G, 1996, p 66)

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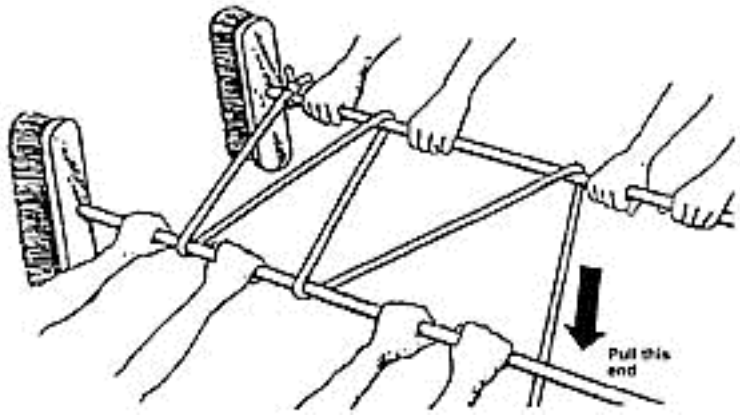
11055 - 107 Street NW
Edmonton AB T5H 2Z6
Phone: 780.424.5510
Fax: 780.426.1715
info@albertagirlguides.com

BRUSH AND ROPE TRICK



Equipment: two long handled brooms, a length of rope (from a bedroll works great), talcum powder, 3 or five people

This activity is part of the Guide Techno-Whiz Challenge.

1. Have 2 or 4 people hold the brooms horizontally in front of them, a couple of feet a part.
2. Tie the rope near the end of one broom, and thread it back and forth along the two brooms in a zig zag pattern. Use some talcum powder on the broom if you are not using nylon rope slide.
3. Take hold of the free end of the rope. Ask the people holding to try to keep the brooms apart, while you try and pull them together. You should be able to easily beat the pulling power of those pulling the brooms apart.

What happens: the pulleys (or loops of rope) on the broom handle doubles the effect of the pulling power on the rope.

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HOW TO MAKE A SOLAR STILL

1. Dig a hole in the ground about 18 inches in diameter. Select a location that gets sun during the day.
2. Place a small cup/dish etc in the middle of it.
3. Tear up green leaves and other fresh foliage if available and lay in the area around the dish.
4. Cover the hole with poly. Use stones to hold it in place.
5. Place a stone in the middle of the poly (over the dish) so the material sags slightly there.
6. Leave under sunshine for several hours - all day is best.
7. Remove poly and observe water in the cup.

Why does this work? Water from the exposed plant tissue and from the exposed earth evaporates in the heat of the sun, but is unable to disperse in the air because of the cover. It collects in droplets against the poly and slowly runs down to the lowest point. When the droplets are large enough they drip down from the poly into the cup.

Why should we know this? In a survival situation people can last a long time without food, but only a few days without water. This is a way that you could gather enough clean water to drink to keep yourself alive if you were lost in the wilderness for a long time.

MAKING A SUNDIAL

1. Pick a spot on the ground that gets sun for most of the day and does not have trees or buildings that shadow it (this is why you will often see sundials in the middle of an empty spot in a garden.)
2. Fasten a large piece of white paper to the ground with tent stakes or large rocks.
3. Push a large stick into the ground in the middle of the paper.
4. Every hour use a pencil to mark where the shadow of the stick is.
5. Once you have done this for 24 hours you have made a working sundial and can tell the time without using your watch - But only on sunny days.

Problems with sundials: In Canada, we are so far from the equator that the angle the sun hits the earth changes a lot throughout the year. Shadows are different - shortest at the equinoxes (beginning of spring and fall) and longest at the solstices (beginning of winter and summer). For sundials to work in our country they need to be "recalibrated" regularly to keep them accurate.

In countries on or near the equator the angle of the sun doesn't change and shadows stay the same through the year. Sundials work great here - as long as it's sunny!

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HOW TO MAKE A BAROMETER

1. Cut a circle of material from a balloon.
2. Stretch the material over the top of a jar and secure it with a large rubber band.
3. Tape the end of a long straw to the middle of the balloon material.
4. Tape a piece of paper to a tree. Sit the jar next to the tree so that the end of the straw is in front of the paper.
5. Use a pencil to mark where the end of the straw points at several different times. You will notice that it is not always in the same place.

Why does the straw move and what does it mean? Air is a 'thing' just like liquids or solids, so it pushes down on the things under it just like they would. For example - if you went to the bottom of the pool your ears might hurt because there is water pushing down on you. Air does the same thing, it just weighs less.

We mostly don't notice changes in the heaviness of air because of this. You might if you were to go up a steep mountain or up in an airplane because your ears would pop. This is because the air outside (high up) is lighter than the air stuck in your head and your head air 'pops' out to make them even. This is what is happening to the balloon - sometimes the outside air is getting heavier and it pushes down harder on the middle of the balloon - pushing the end of the straw up (try it with your finger if you don't believe me). We call this "High Pressure" because the air is heavy. Sometime the outside air gets lighter and the heavy air in the jar wants to thin out so that it is the same - then the balloon bulges out and the straw will tip down. We call this "Low Pressure" because the air is lighter.

If your barometer tells you that your pressure is high you are probably having nice settled weather - not a lot is going on. This is because cool air is busy sinking to the ground. It gets warmer and drier the closer it gets to the ground so the weather is Warm and Dry!

If your barometer tells you that the pressure is low, get ready for cloudy rainy weather. This happens in an area where warm air is rising and it’s going to cool and give you rain!!

HOW TO MAKE A RAIN GAUGE

Take a glass with a flat bottom and straight sides (directly up and down). Put the glass on the flat block of wood in a fairly open area (no trees above). Tape a ruler to the glass so that the bottom of the ruler is lined up with the bottom surface of the inside of the glass (not the actual bottom). Observe. Always read your level by looking at the bottom of the curve of the water's surface (called the meniscus).

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HOW TO MAKE A WEATHER VANE

1. Cut out an arrow from the cardboard provided. Tape a large pen cap to one side.
2. Insert a pencil into the ground firmly in an area that is not sheltered from the wind by trees or buildings.
3. Place the pen cap over the eraser of the pencil. Test to ensure that it can spin freely.
4. Use a compass to determine where north is. Identify this by placing a large stone in this direction.

Your weather vane will always point directly into the wind because the wind is pushing hardest on the big part (the tail) and the object will move to lessen the amount of force on this part.

Wind is caused by air moving from areas that have one temperature and pressure to another (remember your barometer experiment). Certain areas of the earth have 'usual' winds based on the most frequent type of weather they experience. These are called prevailing winds. Winds spin because the earth is spinning. In Alberta, most of our wind comes from the Northwest because high pressure systems (nice weather) moves from west to east and because most of the unpredictable low pressure systems that we see are produced over large bodies of water - for us the Pacific and Arctic oceans found to the West and the North.

HOW IS RAIN FORMED?

1. Tape a piece of black construction paper to the back of a pickle jar.
2. Fill the jar about 1/2 full with warm water.
3. Light a match and hold it just into the mouth of the jar so that the smoke goes into the jar.
4. Blow out the match and quickly cover the jar with a frozen carton of milk. Observe.

You will notice that a cloud formed in the jar (or should have). This is because the air near the water is warm; it can hold a lot of moisture. It is also light because the molecules are far apart when it is warm. (Just like how when the girls are cold they hold their arms close to their body and when they are warm they hold them away and take up more space). The light, moist air floats upward towards the milk where it cools. This is just like the atmosphere, because the high atmosphere near space is very cold and low near the ground traps the warm rays of the sun.

When the air cools it is not able to hold so much water and wants to get rid of some. In order to condense, water must have something solid to form around. This is why we use the smoke in this experiment. In real life clouds form around dust, smoke and other particles in the air. This is why we see a cloud behind an airplane - the airplane leaves a small trail of exhaust dust and a big cloud of water can collect around it. It is also one reason why it is cloudier in places with a lot of air pollution - there are more particles in the air for water vapor to attach to and condense.

If these little droplets that make up a cloud bounce into each other they become bigger droplets. This can happen again and again until the drops become to heavy to float in the air. Then they fall as rain.

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DESCRIBING THE DEW POINT

Remember how in our cloud experiment water from the moist air condensed when the air cooled near the top of the jar. Dew occurs in a similar manner.

Take out a frozen jug of milk and dry it off with a towel. Show the girls how it starts out dry but gathers condensation outside of it. This is dew. Dew does not collect at night when things are cooling off, but in the morning when the air is starting to warm up. It occurs because air warms up faster than other things in the environment (like grass, picnic tables, etc). As the air warms up in the morning it gathers more moisture. When this moist, warm air comes near the cooler object it might cool down enough that it has to 'drop' some of its moisture. If the object is this cool, then we say it is at or below the dew point temperature.

Kathy Tauscher, Area Program Adviser

Check out some of the resources listed below, to find the scientist in you!

REFERENCES:
Gibson, G, (1996) Science for fun: experiments. Cooper Beech Books. Brookfield:CT.
The Ontario Space Sciences Centre (1995) Starting with Science: Solids, Liquids and Gases. Kids Can Press Ltd. Toronto, ON
Walpole, B. (1987) Fun with science: movement. Warwick Press. Toronto, ON.

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