STEM
Watt is love? – Getting girls interested in STEM

With a small percentage of women in STEM related careers, there is a need to sparks girl's interest in the field that has been historically male dominated.

Recent studies demonstrate that while many girls show enthusiasm for STEM subjects, and may voice STEM-related career goals, during early elementary years, there is a marked drop-off in interest in STEM that begins as early as grade 4 or 5 and continues to taper off throughout elementary and high school years.

No more baking soda volcanoes – it is time to have girls interested in a new age of science, technology, engineering and math.

SCIENCE

Animation
(Art Production, Body Works)

Materials:

- White poster board
- Pencil with eraser
- Scissors
- Pushpin
- Mirror

Directions:

1. Draw a large circle (approximately 20 -25 cm in diameter) on the poster board. Cut out the circle.
2. Draw lines to divide the circle into twelve equal slices, like a pizza. The easiest way to do this is to first divide it into quarters, then divide each quarter into three.
3. On each line, cut a slot about 4 mm wide from the edge of the circle in about 3 cm.
4. On each slice, draw a series of simple images showing a sequence of motion. Each image should be slightly different than the one before. This image should repeat (ball bouncing, eye winking), and should start the same way it ends so it can repeat
5. Push the pushpin through the center of the circle and jiggle it around a little bit so to make the hole a bit bigger. Then push it into the pencil eraser. The circle should spin easily on the pushpin.
6. Stand facing a large mirror and hold your phenakistoscope so that the drawings are turned away from you toward the mirror.
7. Hold the phenakistoscope up so that you can see through the slots around the edge. Give it a good spin and look through the slots so you can see your drawings in the mirror

Explanation:

- In this activity, you are building a toy called a phenakistoscope to explore how your eye and brain work together to make the image look animated.
- Your drawings should appear to move as the phenakistoscope spins. Because you are looking through the narrow slots, you only see each image for a very brief moment of time, before the circle of cardboard blocks your view

- Your brain "remembers" the image, though, so you don't realize that you spend a lot of the time looking at the back of a sheet of paper.
- When the next slot comes around, the image is updated in your brain with one that is slightly different, making you think that you are seeing movement.

Source: http://www.girlguides.ca/Documents/BC/STEM/science_book.pdf

Dancing Raisins
(Chemistry, Science)

Materials:

- A clear glass/jar
- Clear Carbonated drink (soda water, Sprite, etc)
- Raisins

Directions:

1. Pour the carbonated drink into the glass/jar.
2. Drop the raisins into the glass/jar.
3. Observe!

Explanation:

- The bobbing up and down works because the bubbles of carbon dioxide gas in the drink are much less dense than the drink or the raisins.
- Once the raisins start bobbing up and down, they will continue to rise and fall for about an hour.
- Raisins are denser than the carbonated drink, so they will sink.
- Gas bubbles attach to the wrinkles on the raisins.
- When the raisins are covered with the bubbles they become less dense than the drink, so they start to rise.
- The gas bubbles start bursting and then the raisins become denser than the drink, so they sink again.

Source: http://scifun.chem.wisc.edu/homeexpts/dancingraisins.htm

Colour changing flowers
(Chemistry, Science)

Materials:

- Small Vases or test tubes
- White Carnations
- Food Colouring

Directions:

1. Mix a few drops of food colouring and water
2. Insert carnation
3. Observe! (over a long period of time – may work best at a weekend camp or overnight)

Explanation:

- Shows the science behind how water is absorbed by plants and how it travels through the different part of a flower.
- Flowers naturally draw up water through the fine tubes in their stems, known as capillaries (similar to blood capillaries in our bodies).
- Because carnation petals are very translucent, once the colored water makes it to the blossom, the flower takes on the color of the water.
- Adding more food coloring to the water and using a dark color also provides a faster visible reaction.
- You can also slice the carnation stem in half, and add then halves to two different colours to watch how the carnation will react.

Pop Rocks Rock!
(Chemistry, Science)

Materials:

- Package of pop rocks or similar popping candy (one package per bottle)
- Funnel
- Small Bottle of pop (500mL)
- Balloon

Directions:

1. Empty a package of pop rocks into an empty balloon using the funnel
2. Place balloon over open end of the bottle
3. Dump the contents of the balloon into the bottle
4. Observe!

Explanation:

- The balloon should expand when the pop rocks are added due to the release of carbon dioxide
- The carbon dioxide contained in the candy isn't enough to cause even the small amount of inflation you observe in the experiment, but when mixed with the soda, which also contained carbon dioxide, the reaction is clearer.
- When the Pop Rocks are dropped into the soda, some carbon dioxide is able to escape from the soda and, because the carbon dioxide gas has no where to go in the bottle, it rises into the balloon

Source: http://www.stevespanglerscience.com/lab/experiments/poprocks

Starburst Rock Cycle:
(Science)

Materials:

- Aluminum Foil
- Wax Paper
- Starburst in a variety of colours
- Access to oven or toaster oven

- Towels
- Oven mitts
- Tongs

Directions:

For each rock type:
1. Unwrap your Starburst
2. Lay the foil flat on the table. Place the wax paper on top.
3. Stack the 3 Starburst (of different colours) in the center of the papers.
4. Roll the papers over the Starburst tightly and form the foil around the starburst.

Sedimentary rock:
1. Have the girls squish the Starburst package by applying pressure to it.

Metamorphic rock:
1. Place Starburst package in the toaster oven for 1-2 minutes
2. Wrap in a towel (to protect from heat), and have the girls push down on it

Igneous Rock:
1. Place Starburst package in the toaster oven for 5-10 minutes (until candy is melted)
2. Do not let the girls touch this one, as it can be extremely hot!
3. Wait for candy to cool down, peel it off the wax paper to show how igneous rock is made

Explanation:
- Used to explain how different rock types are formed – Sedimentary = Pressure; Metamorphic = Heat + Pressure; Igneous = Extreme Heat
- Ask the girls what real-life scenarios these rock forms would happen or can be seen (igneous rock from volcanoes, sedimentary rock can be seen in layers of a cliff, metamorphic rock changes over time (marble, may have layers similar to sedimentary)

Source: http://lemonlimeadventures.com/edible-rock-cycle-for-kids/#_a5y_p=1341452

TECHNOLOGY

Dissect a Device

(Engineering, Try New Things)

Materials:
- Old and unwanted electronics or dollar store electronics
- Small screwdrivers
- Old credit cards or guitar picks (used to pry out small pieces)

Directions:
1. Have the girls in a patrol or small group take apart the device and try to identify the purpose of the pieces
2. If you have access to the internet in your meeting place, try to use the internet to identify the unknown parts
3. See if they are able to put the item back together again!

4. Recycle the pieces in an electronic recycling box

Explanation:
- Girls can find out how and why things work
- Challenge them to identify pieces, and put it all back together

Smart Gloves
(Try New Things)

Materials:
- Dollar store gloves
- Conducive thread (available online on Esty or Amazon, or some specialty stores)

Directions:
1. Sew a few stitches of the conductive thread on the index finger and thumb of the glove

Explanation:
- Your touchscreen responds to the electricity in your hands, but normal gloves block that current, which is why you can't use your screens with your gloves on. The thread, which is made with a bit of metal, allows the electricity from your hands to reach your screen.

Cell Phone relay game
(Try New Things)

Materials:
1. Pairs of coloured flags/bandanas to represent the signal and the cell phone.

Directions:

1. Divide the girls up into two teams, "Towers" and "Talkers". You might want to start with a lot of Towers and only a couple of Talkers until everyone gets the hang of how to play. Once they do, add more Talkers to make the game more fun and challenging.
2. Arrange the Towers in a grid so that each Tower can just reach her neighbour when they both have their arms outstretched.
3. Give each Talker the two flags. She needs to attach one flag to herself so it is clearly visible. Talkers take their place all around the outside of the Tower grid.
4. On the word "Go!" each Talker hands one of her flags to the nearest Tower, and starts walking through the Tower grid.
5. As she walks, the Towers must keep her flag at the tower closest to her by passing it to the next Tower.
6. Each Tower can only hold two flags (calls) at a time. If she already has two and a third one is passed to her, she must drop one of the flags.
7. If the flag gets too far away from the Talker, or a flag is dropped on the ground, the call is dropped.

Explanation:
- This game models a cellular phone network. Several people who are making phone calls move around an area, and as they go, their phone calls are passed from one cellular tower to another.
- How many people can be talking at the same time before calls start getting dropped

- As the girls get used to the game, try to experiment by removing some towers. How does this affect the results?
- Add more talkers, and make their walking patterns more complex (making more turns through the grid). How does this affect the results?

Source: http://www.girlguides.ca/Documents/BC/STEM/technology_book.pdf

It's beginning to look a lot like Christmas!
(Physics, Science)

Materials:

- Christmas tree lights
- Copper wire strippers
- AA batteries
- Electrical tape

Directions:

1. Review electrical safety. Remind the girls to never try an electrical experiment without adult present. Since mixing electricity with water is very dangerous, make sure they knows that their hands must be dry whenever they works with electricity.
2. Use the copper wire strippers to cut one light from the string of Christmas tree lights. You'll want to leave at least one inch of the strand on either side of the light.
3. Help to strip the green insulation off the last quarter inch of both of the strand's ends.
4. Take a closer look at the green insulation and the copper wire inside the strand.
5. Review basic electrical circuits with your girls. In order for the light to go on, the battery, light, and bulb must be arranged in a circuit -- which, as the name suggests, is a circle.
6. Using the electrical tape to secure the stripped wire on the battery, let the girls practice (trial and error), to get the light to turn on. (Hint: The correct arrangement has the stripped wires of the light touching the top and bottom of the battery – Always press the wire on the battery through the electrical tape)

Explanation:

1. The plastic green insulation does not carry electricity; instead it provides protection for the copper wire, which does carry electricity.
2. The electrical circuit needed comes from creating a circle of current through the battery and the light.
3. One end of the wire will have to be attached to each end of the battery

Source: http://www.education.com/activity/article/recycling-christmas-lights/

ENGINEERING

Goofy inventions
(Engineering, Inventing, Discover your Creativity)

Materials:

- Paper
- Coloured pencils/markers

Directions:

1. Have the girls think of what would make their life easer
2. What invention could be made to help in every day life (for example – hair dryer stand, hands free toothbrush)
3. Have the girls design what this invention might look like
4. What would be required to build this?
5. If possible, see if there is something that could be built in a later meeting so they can watch their inventions come to life.

Gravity Cars:
(Try New Things, Engineering)

Materials:

- Bristol board, foam board or cardboard
- Household items: cardboard, boxes, tubes, straws, paper, beads, buttons
- Tape
- Glue (of glue guns)
- Lego wheels or craft wheels

Directions:

1. Create a ramp using the Bristol board, prop up on a chair or table
2. Have girls work in patrols with the objects provided to create a vehicle that can be sent down the ramp
3. Have a rally or competition to see who's car can go the furthest
4. Let the girls use the ramp to try out their designs prior to the final run
5. Design → Build → Test → Redesign/Change

Explanation:

- See how far their creations can go!
- Girls will learn about wind resistance, gravity and designs of a car.
- Teaches trial and error of design and engineering. What works, what didn't? What did you need to change?

Newspaper throne:
(Engineering)

Materials:

- Newspaper
- Tape
- Stuffed animal

Directions:

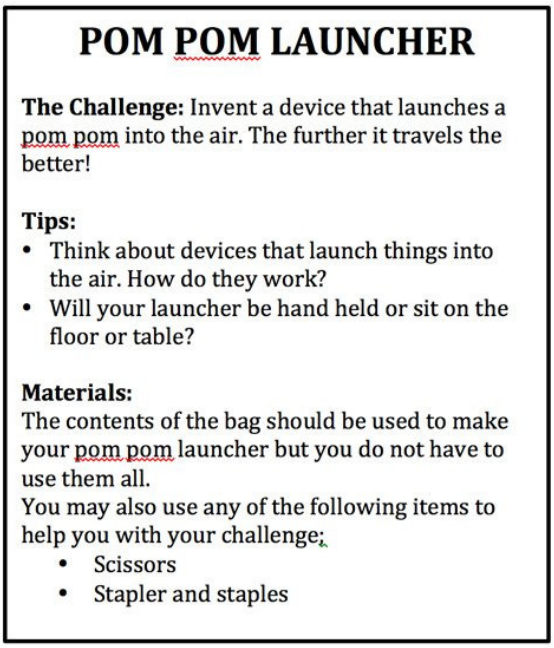
1. Give each patrol 3-4 sheets of newspaper (can be altered based on size and weight of stuffed animal) and a specified amount of tape (1m suggested).

2. Have the girls try to make a chair that can hold up the stuffed animal
3. Design → Build → Test → Redesign/Change

Explanation:
- Allows girls to use the trial and error structure to make a creation
- Team building and problem solving with limited resources

Mystery bag
(Engineering)

Materials:
- Pom poms
- Large index cards
- Paper drinking cups
- Tape
- Drinking straws
- Popsticks
- Rubber bands
- String
- Paper clips
- Paper bag



POM POM LAUNCHER

The Challenge: Invent a device that launches a pom pom into the air. The further it travels the better!

Tips:
- Think about devices that launch things into the air. How do they work?
- Will your launcher be hand held or sit on the floor or table?

Materials:
The contents of the bag should be used to make your pom pom launcher but you do not have to use them all.
You may also use any of the following items to help you with your challenge:
- Scissors
- Stapler and staples

Directions:

1. Include the items listed above, and the information card (right) in a paper bag
2. Give no further directions, or hints, and let the girls work I patrols to try to figure out how to launch their pom poms

Explanation:
- The girl's designs are likely going to differ. Have them discuss how their launcher works, and give a demonstration
- The activity can be done with other challenges, such as a marble roller, a tool to pick things up off the floor, etc the items in the bag can differ, but the concept will remain the same.

MATH

Coloured bubbles
(Try New Things)

Materials:
- Bubbles and bubble wands
- Food colouring
- Large sheets of white paper
- Protractors

Directions:

1. Add a drop of food colouring to bubble solution.
2. When you blow the bubbles, let them pop on a sheet of white paper.
3. Measure the angles of where two bubbles meet, or if they intersect

Explanation

- Teaches girls how to use a protractor
- What happens when two bubbles are touching?
- Look at the angles of the lines when two or more bubbles touch?
- Is this angle always the same?

Water measuring
(Water)

Materials:

- Paper and a pen
- Calculators
- Measuring cup

Directions

1. Run the tap for 5 seconds, into a measuring cup
2. Multiply that by 24 to find out how much water you run in 2 minutes when brushing your teeth.
3. Find out how much time you will need to rinse your tooth brush 2-3 times, instead of running the water constantly for 2 minutes.
4. How much water are you saving by turning off the tap?

Explanation:

- Having the girls learn how much water they are really using daily. This experiment can be done with a variety of activities (washing dishes, having a shower, waiting for the water to cool down when running the tap to get a drink).
- This can also be done at home with low-flow and regular flow toilets, or energy star appliances and regular appliances (some additional research may be required for this)

Shopping!
(Basic Camper, Learn How to Plan)

Materials:

- Flyers
- Calculators
- Paper/pens

Directions:

1. Have girls in patrols or small groups “shop” for an event or activity. This could be food for camp, the supplies needed for a craft, items needed for enrolment, Christmas service project, etc.

2. Give them a budget
3. Make pretend sales at the store if necessary, have them calculate the new price
4. Have them add in tax

Explanation:

- Every girl loves shopping!
- This teaches them money management, how to calculate item sales and taxes.
- Girls can try to incorporate the food guide into this if planning for camp.

Learning to estimate
(Try New Things)

Materials:

- Measuring tape
- Calculators

Directions:

1. Have the girls in partners measure how long their stride is
2. Have then count the number of steps it takes to get them across the meeting place
3. Multiply their stride, by the number of steps to create an estimate of how long they think the meeting place may be
4. Compare the results with the actual measurement

Explanation:

- Teaches girls different tools they can use to estimate
- What may have skewed the results of the girls who were the most off? Where they taking extra long steps?

Questions to ask after/during the experiments/activities:

- What is happening?
- Why is it happening?
- How is this related to STEM?
- How would this relate to a future career?
- What experiment designs worked best?
- Why did/didn't the experiment or design work?

Outside programs and resources to engage girls:

- colleges and universities
- local organizations or tech companies
- Scientist in the School - http://www.scientistsinschool.ca/
- National Engineering Month (March) - http://nemontario.ca/
- Ontario Science Centre Sleepovers - https://www.ontariosciencecentre.ca/sleepovers/
- Girl Guides of Canada – Ontario Council Events Calendar!

STEM
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Guide program relation to STEM:

- Computer Skills
- Engineering
- Career Awareness
- Science
- Chemistry
- Physics
- Inventing
- Water
- Weather
- Ecology
- Career Awareness
- Business Communication
- Naturalist
- Outdoor Cooking
- Camping
- Cookie Rising
- Beyond You – Try New Things
- You and Others - Learn How to Plan
- Cyber Citizen Challenge