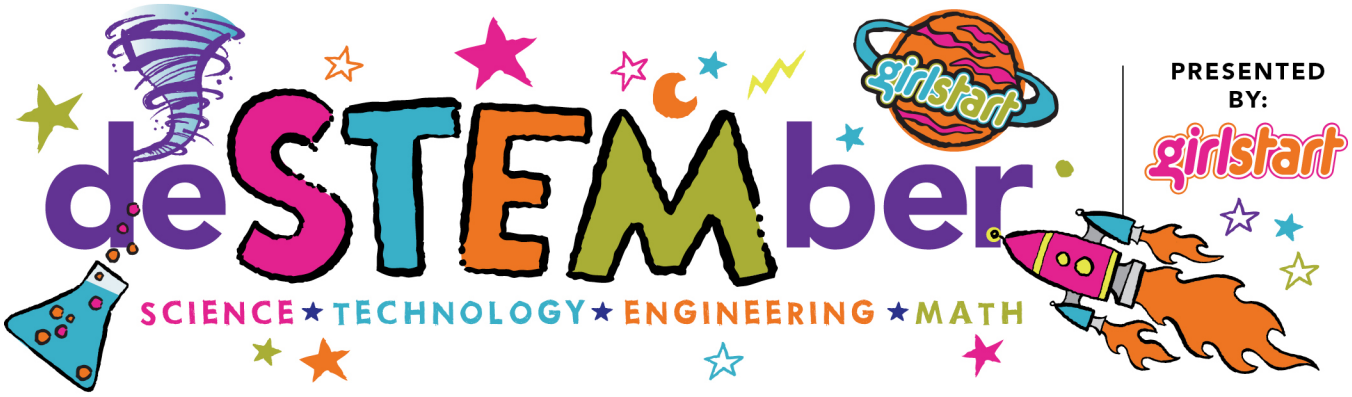

Girlstart's DeSTEMber Collection 2013

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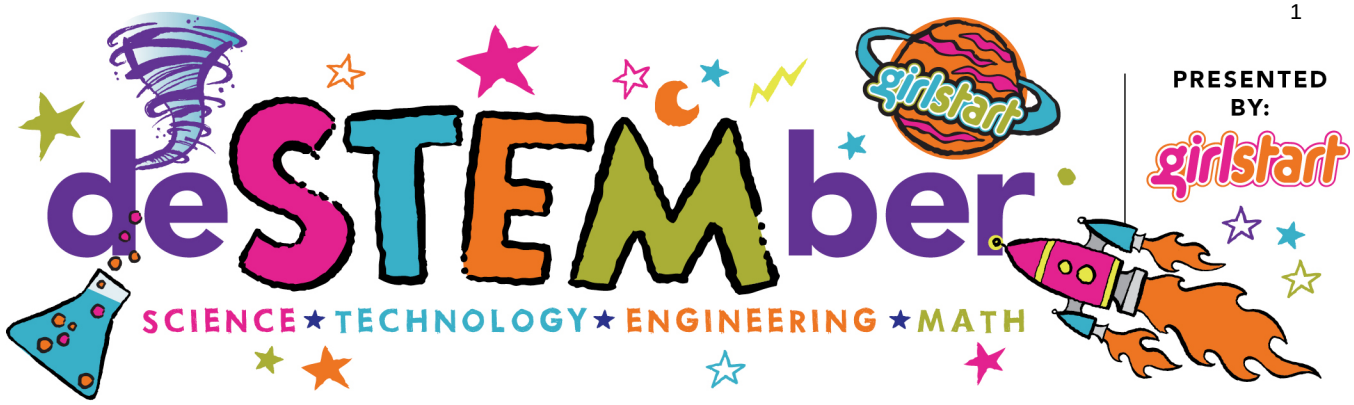
31 Days of STEM FuN!



Oreo Moon Phases

New moon, waxing crescent, waning gibbous – what do you see when you look at the moon in the night sky? Discover the phases of the moon using Oreo cookies, and find out why the moon changes shape each night!

TEKS:

4.2 Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and out-door investigations.

4.3C Represent the natural world using models such as rivers, stream tables, or fossils and identify their limitations, including accuracy and size.

5.2 Scientific investigation and reasoning. The student uses scientific methods during laboratory and outdoor investigations.

5.3C Represent the natural world using models and identify their limitations.

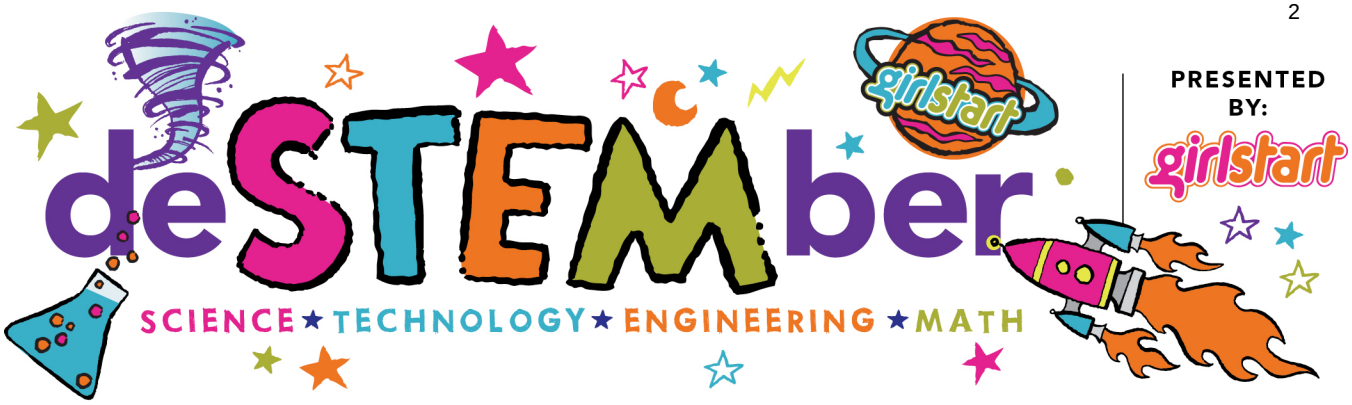
5.6A Identify events that occur on a regular basis such as in daily, weekly, lunar and seasonal cycles.

Materials:

- 4 Oreo cookies
- Crayons
- Knife or spoon
- Life Cycle of the Moon Handout (optional)
- Paper plate

How To

1. On the top of the paper plate draw the Sun (color ¼ of the plate edge yellow).
2. Draw the Earth (in the middle) of the paper plate making sure to leave room for your Oreo cookies.
3. Write the respective moon phases clockwise around the plate: New Moon (starts in middle of the Sun), Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, and Waning Crescent.
4. Create the phases of the moon with your Oreo cookies by twisting the top off of each cookie and removing the cream filling with a knife or spoon to replicate each moon phase (see picture on page 2)
5. Place your Oreo cookie phases next to their respective names around the plate.



Oreo Moon Phases

Why Does it Work?

The moon reflects the light of the Sun rather than creating its own light. The phases are caused by the moon's revolution around Earth, and the amount of sunlight reflecting off its surface. In sequential order, the phases are: New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, and Waning Crescent. The phases are a cycle that repeats once a month. As the moon moves between the Earth and the Sun, sunlight hits the back of the moon which faces away from Earth. To us, the moon appears completely dark (New Moon). When the moon revolves so that Earth is between it and the Sun, sunlight hits the side of the moon that is facing Earth. We can see a complete circle of the moon (Full Moon).

Career Connection:

Astronomers study planets, moons, stars, galaxies, meteors, comets and their interactions with each other. They must have an in depth knowledge of physics to understand how forces such as gravity change throughout space. Astronomers work together sharing their knowledge in order to better understand how the universe works at microscopic and macroscopic levels.

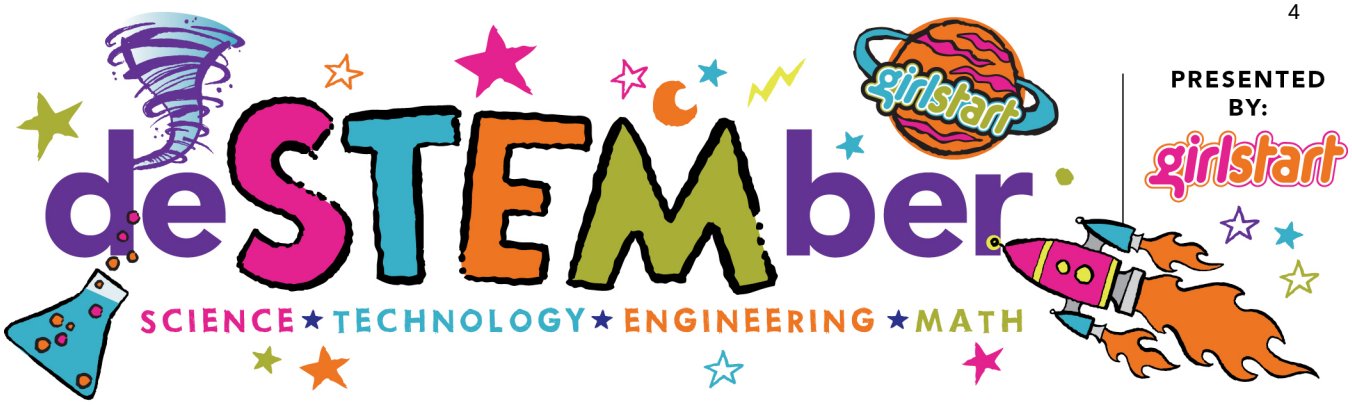
Resources: http://spaceplace.nasa.gov/oreo-moon/en/

Life Cycle of the Moon

girlstart

Draw the phase of the moon you see each night and watch how it changes during the month.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday



Splash Zone

Watch out for that wave! Discover how plants and animals living along rocky shorelines adapt to the changing tides. Create your own tide pool and sea creature to observe how organisms withstand the force and pull of crashing water.

TEKS:
4.5B Predict and draw conclusions about what happens when part of a system is removed.
4.8C Collect and analyze data to identify sequences and predict patterns of change in shadows, tides, seasons, and the observable appearance of the Moon over time.
4.11B Summarize the effects of the oceans on land.
6.3C Represent the natural world using models and identify their limitations.

Materials for Tide Pool:

- 1- 8oz cup of water
- Mini foil loaf pans (one per student)
- Pebbles
- Sand
- Shells
- Water

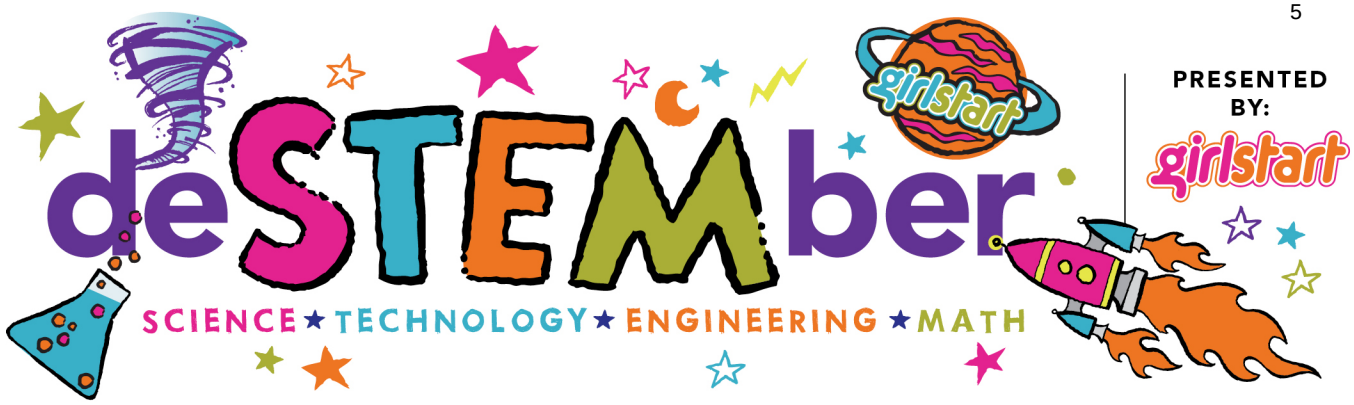
Materials for Sea Creature:

- Foam pieces
- Fuzzy balls
- Modeling clay
- Old newspaper
- Pipe cleaners
- Potato halves/stryofoam balls
- Toothpicks

How To

1. To make your tide pool add sand and pebbles to fill the bottom layer of the dish pan. (Keep in mind the topography of coastal shorelines, showing pictures can be helpful)
2. Using the sea creature materials, create your own sea creature.

   Helpful questions:
   - What feature on your animals will help them against the forces of gravity?
   - Does your creature have any defense mechanisms?
   - Where can your animal navigate, above ground, underwater or both?
3. Place your sea creature in your tide pool.
4. Add extra shells or rocks as protection around your creature.
5. Fill tide pool with ¼ cup of water to observe how your creature survives the low tide water flow.
6. Record what happens by drawing a picture, or list observations.



Splash Zone

How To Continued...

7. Add more water to observe the differences in your sea creature's habitat as high tide enters the tide pool.
8. Record what happens by drawing a picture, or list observations.
9. Move the water around to test how well your creature can withstand living in the tide pool.

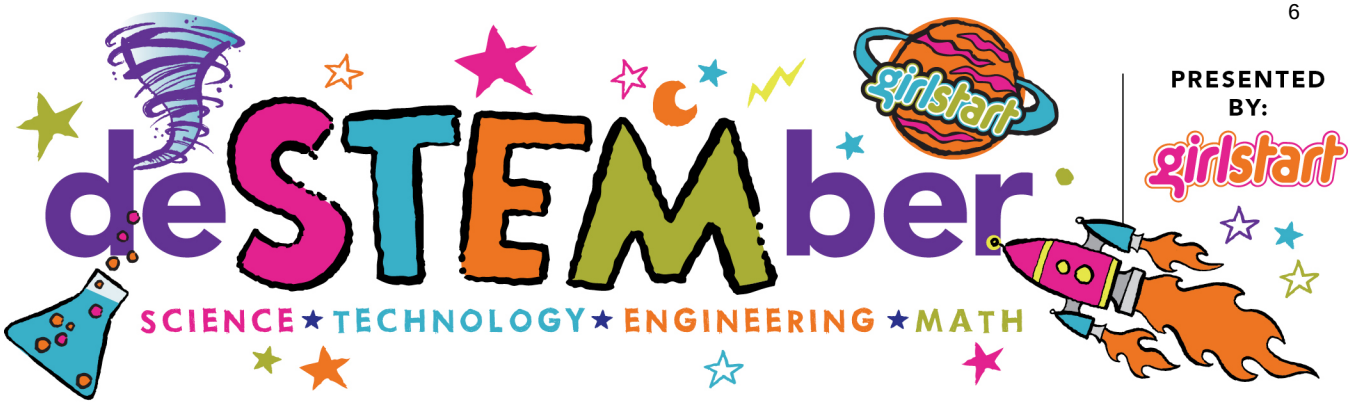
Why Does it Work?

The moon's gravitational force causes the tides. The Earth and the moon are attracted to each other like magnets. The moon and Earth never run into each other because they have enough mass to outweigh the gravitational pull of each other. The moon's gravity tries to pull anything on the Earth closer. The water moves closer to the moon as the moon rotates around the Earth. It creates low and high tides.

Career Connection:

Marine Geophysicists work on projects such as ocean drilling, understanding seismic activity in the ocean, and how oceanic geology changes. Studying coastal geology is extremely important because humans and natural processes change the coast lines continually, so marine habitats and populations will also change.

Resources: http://oceanservice.noaa.gov/education/kits/tides/media/supp_tide06a.html



Game in a Bag

Think outside the bag! In this activity kids will use their creativity to design their very own game. The name and design are all up to them, but they need to keep in mind the key game components. Kids can even create a fun plot line to add to the characters.

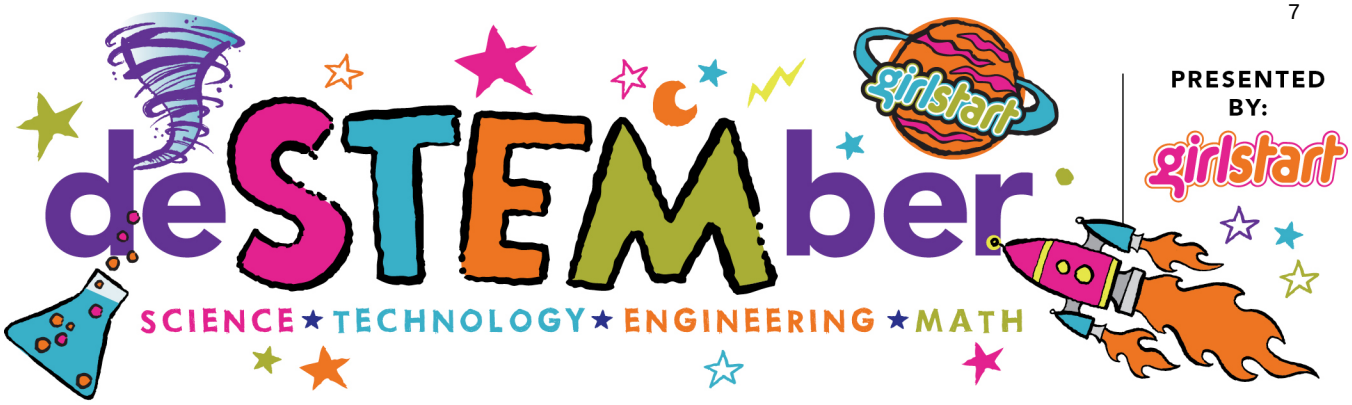
Materials:

- 2-6 pieces of candy
- 4 Rubber bands
- Dice
- Dixie cup
- Pencil
- Plastic jewels
- Post-it notes
- Poster board
- Markers

How To

Discuss the components that make up a game. Review the definitions of each game component.

- **Rules** – you need rules so that the game isn't too crazy and chaotic
- **Goal/purpose** – there will be something that you are working towards in the game
- **Challenge** – there are obstacles, enemies, etc. that make it more difficult to accomplish your goal, this makes the game fun and exciting! Remember, you don't want the game to be impossible because then it becomes boring if you can never reach your goal.
- **Characters/Agents** – the different people, animals, things, etc. in the game
- **Setting** – the virtual world where the game takes place, this can be simple or complex
- **Fictitious** – a game is not real, so it can be as fantastical as you want to make it



Game in a Bag

How To Continued…

In each bag you will find various materials, your job is to create a game with these materials.

You will need to:

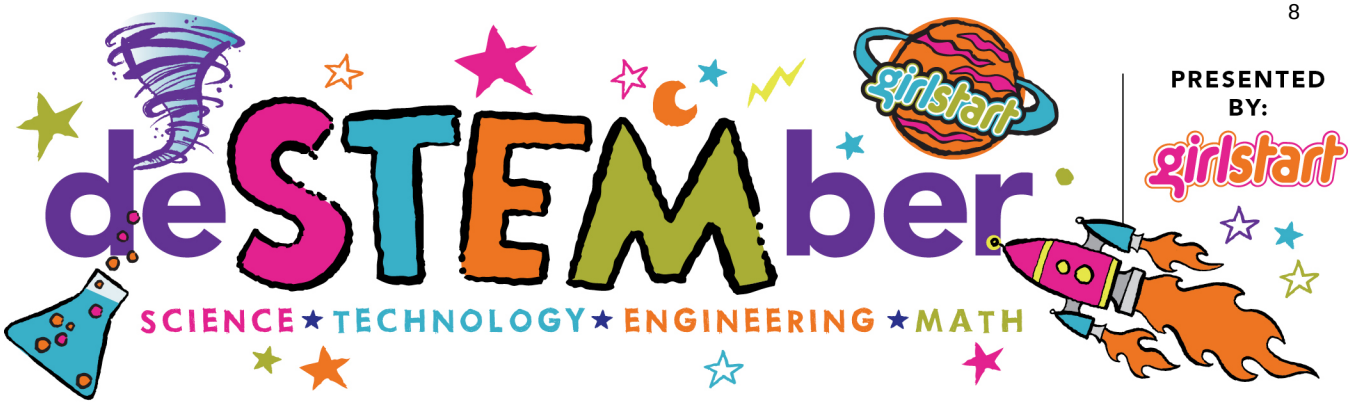
- Name your game
- Create a goal/purpose for your game
- What is the challenge?
- What is the setting?
- What are the characters and what are their rules?
- List the rules in the game
- Be sure that you create attributes and parameters for your characters.

Why Does it Work?

When the kids are finished designing their game, have them explain the rules and start to play! Decide if the challenge or goal is too difficult or easy. From that you can adjust and revise your game to make it even better. Take turns playing all the kids games.

Career Connection:

Game Designers and ***Game Developers*** use computer programming knowledge to program the components of a game. They may use their own digital art or employ digital designers to create the setting and characters of a game. They often work in teams and work through a 'design process' that involves storyboards, drafting, problem solving, and redesigning to improve their work.



Solar Homes

Wood, brick, tile and more! What thermal mass material would you use to effectively heat and cool your home? Create and build a prototype model home that uses passive solar design.

TEKS:

4.6B Differentiate between conductors and insulators.

5.6A Explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy.

5.7C Identify alternative energy resources such as wind, solar, hydroelectric, geothermal, and bio-fuels.

6.7B Design a logical plan to manage energy resources in the home, school, or community.

6.9A Investigate methods of thermal energy transfer, including conduction, convection, and radiation.

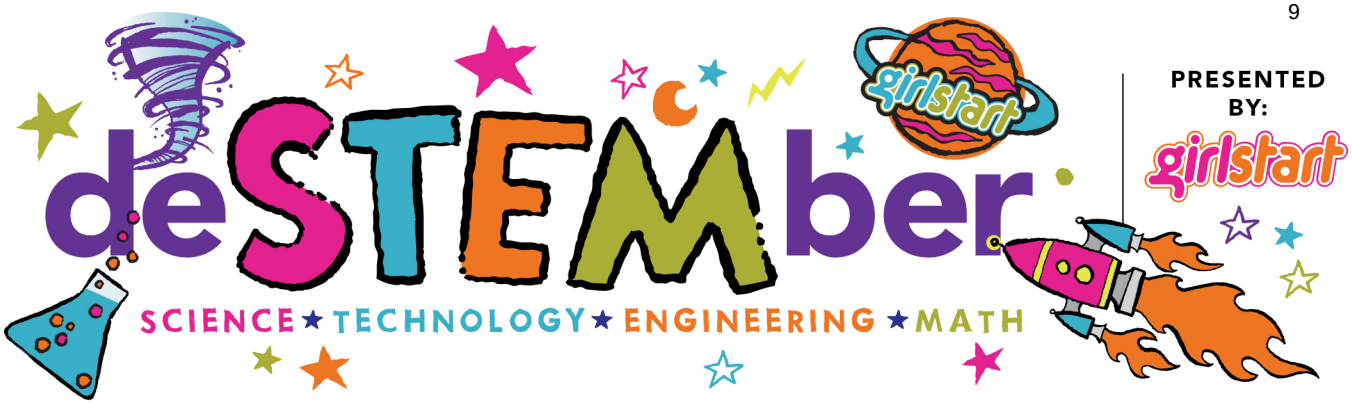
Materials:

- 100 W bulb or greater
- Aluminum foil
- Cardboard box (small cake boxes work well and can be purchased at most craft supplies stores)
- Clear tape
- Craft sticks
- Dark fabric/carpet pieces
- Foam board
- Heat lamp
- Plastic wrap or clear plastic sheets
- Stone tile (Stone tile can be purchased at any home and garden store. Tile made of smaller squares works best)
- Thermometers (digital ones are most accurate)

Testing Materials How To

Testing materials: In order to decide which materials to use on the solar home, we first need to test which materials will work best keeping in mind which materials got hottest and how fast they cool down.

1. Gather carpet/fabric, tile, foil, and foam board.
2. Lay out each material and place a thermometer on top of each one.
3. Lay another piece of material on top of the thermometer so that the thermometer is in between two pieces of each material.
4. Place heat lamp about 8 inches away from each material so that each material is getting an equal amount of heat.
5. Record the temperature of each material at the start and then in 10 minute intervals for 30 minutes. You should have a total of four temperature readings for each.



Solar Homes

Solar Home How To

Design Challenge: Design and build a one-room model home using passive solar design techniques to warm the house as much as possible and sustain the temperature for as long as possible.

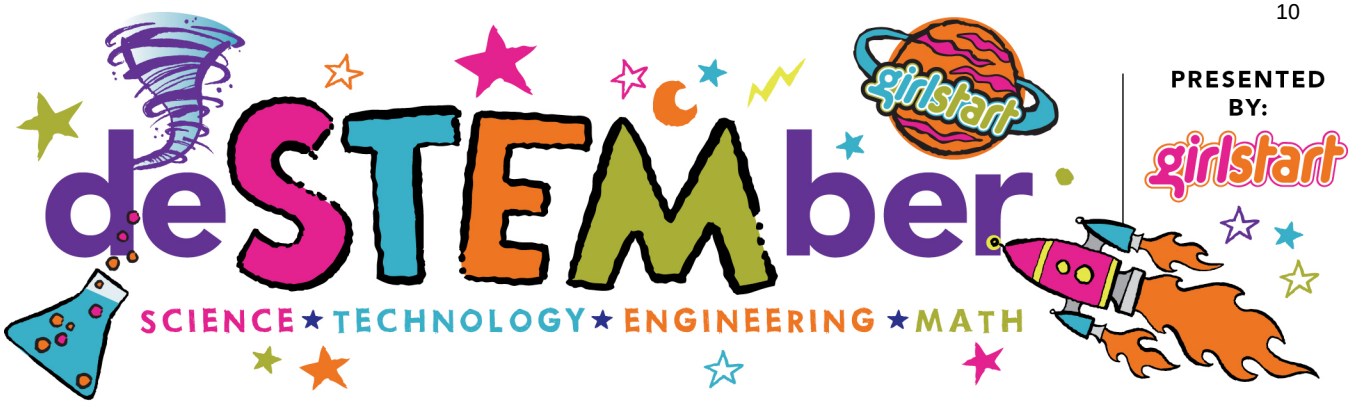
Design Constraints:

- Floor size – between 60 and 70 square inches
- Roof height – at least 5 inches
- Door large enough to fit a thermometer so that it can be placed entirely inside the middle of the house with the door closed.

Guidelines:

- The floor plan can be any shape as long as it is between 60 and 70 square inches.
- More than one type of thermal mass may be used.
- Window(s) must allow enough light and heat to enter.
- Include overhangs and shading.

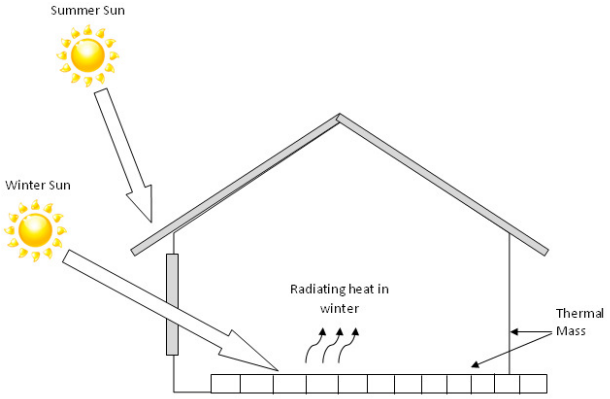
1. Use cardboard or foam as the structure of the solar home following the dimensions in the guidelines. (don't make the roof just yet because you will be adding to the inside!)
2. Make sure that your design includes windows and a door!
3. Cover the walls on the inside of the house with the thermal mass that you found to work best. You can use more than one!
4. Attach the roof with a glue gun and cover it with materials that you think will benefit your design.
5. First you will simulate a winter day. Set up the heat lamp at a 45-degree angle about 8 inches from the roof. Place a thermometer inside the home. Take the temperature every 10 minutes for 30 minutes.
6. To simulate nighttime conditions remove the heat lamp and turn off the lights. Record the temperature inside the house at 10 minute intervals for 30 minutes.
7. To simulate summer, place the heat lamp about 8 inches from the roof, directly over the home and repeat steps 5 and 6.



Solar Homes

Why Does it Work?

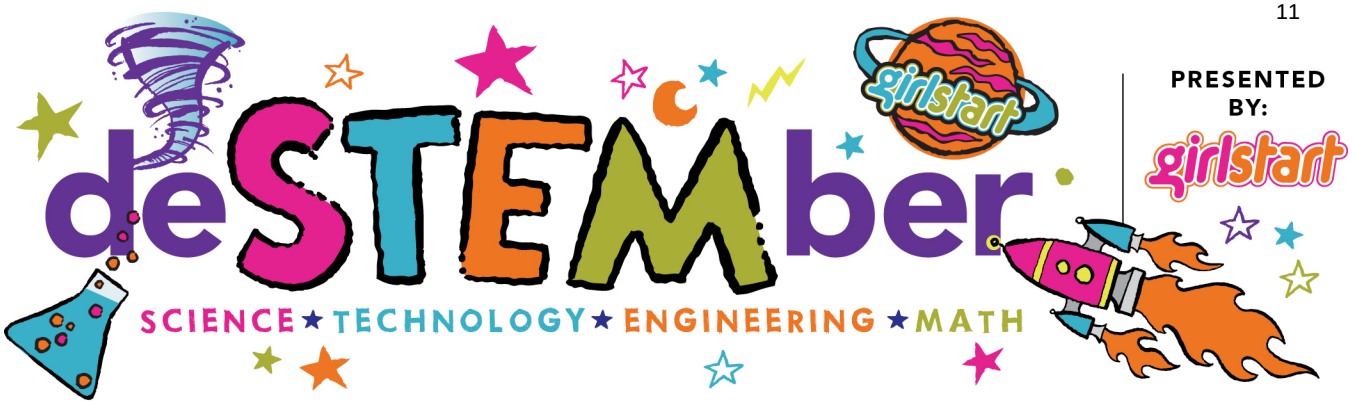
During the summer, the sun is much higher in the sky than in the winter. Windows help let light and heat inside during the winter and also help ventilate in the summer. Thermal mass is a material that absorbs heat during the day, like tile or brick, and slowly releases it to keep a comfortable temperature inside as it gets dark outside during the winter. Overhangs block the hot summer sun but don't cover the windows too much during the winter when you want heat from the sun to enter your home. This design allows for the most efficient way to block the sun in the summer and use the suns heat in the winter.



Career Connection:

Solar Engineers study and design the heating, ventilating and air conditioning systems in existing and newly-constructed buildings. They suggest ways to use more passive solar design techniques to lower costs and energy use, minimize maintenance, reduce greenhouse gas emissions, and provide comfortable indoor environments for people.

Resources: http://www.consumerenergycenter.org/home/construction/solardesign/
http://www.teacherstryscience.org/lp/passive-solar-design-zero-energy-housing



Engineer a Chariot

Before there were planes, trains or cars, the ancient Greeks used horse-drawn chariots as fast transportation. Explore how the simple machines of a wheel and axle are used to make your own chariot. What animal would you use to pull your chariot? How would transportation be different if we still used chariots?

TEKS:

5.6A Explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy.

5.3C Draw or develop a model that represents how something works or looks that cannot be seen such as how a soda dispensing machine works.

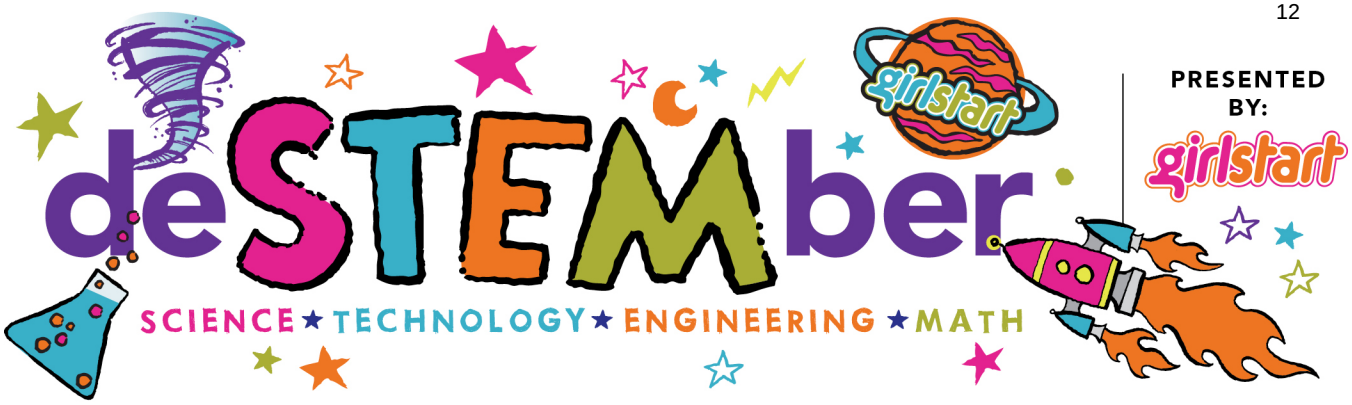
4.6A Differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal.

Materials:

- 2 cardboard wheels per car
- 2 dowels per car
- Cardboard body
- Duct tape
- Scissors

How To

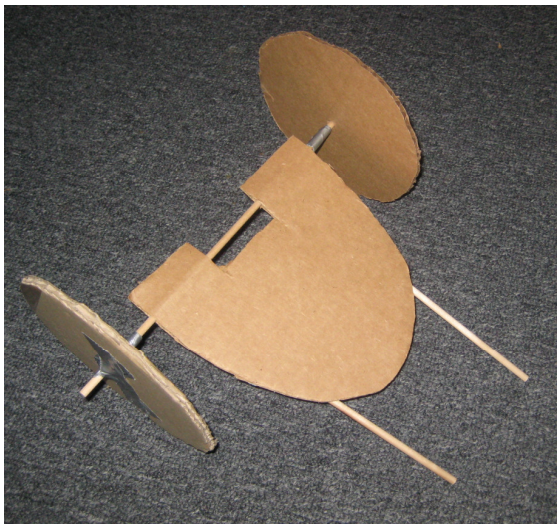
1. To make a chariot, you will need a cardboard body, 2 wheels, duct tape, and two dowels. You will need to remove 2in x 1in piece of cardboard from the middle of the flat end of the cardboard. (The corrugation in the cardboard should be going side to side)
2. Locate the end of the cardboard containing a space where the piece was removed. Students push the dowel through the corrugation on one side of the cardboard. About ¾ of an inch from the edge. Students push the dowel through to the opposite side of the cardboard, being sure to keep the dowel parallel to the edge of the cardboard.
3. Wrap a small piece of tape around each end of the axle approximately one inch from the end. This will prevent the wheel from moving up against the vehicle. Make sure the tape does not rub against the vehicle.
4. Poke a hole through the center of each wheel then insert a wheel into each end of the dowel. Use tape to secure the wheel to the dowel so it does not move freely around the axle.



Engineer a Chariot

How To Continued...

5. Cut the remaining dowel in half, taping each one on one side of the front of the body. (These will represent the parts of the chariot that are pulled to make it move)
6. Test your completed chariot by pulling on the dowels in the front and making sure it rolls! You can even attach it to a toy car or something to make it move forward on its own.

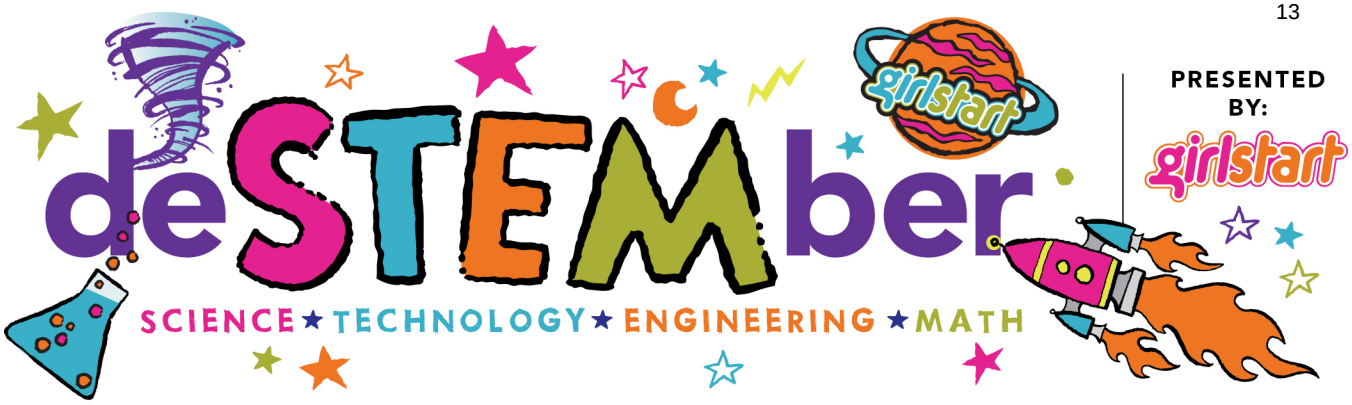


Why Does it Work?

A wheel and axle is one of the six simple machines. In a wheel and axle, the wheel (or wheels) is attached to the axle and they rotate together as one. This makes it easier for something to move along a surface, by the spinning of the wheels and axle, less work has to be done to move forward.

Career Connection:

Automotive engineers design the vehicles that we use in our daily lives. They follow the engineering process from design to final product. Automotive engineers work to design and produce vehicles that meet safety, style, comfort, handling, and other consumer needs.



Solar Sweets

Just how big are the planets in our solar system? Venus to Saturn, M&M's to Peppermints, candy will help you visualize the relative size of each planet. This activity will bring out the sweet tooth in everyone!

TEKS:

3.8D Identify the planets in Earth's solar system & their position in relation to the Sun.

Materials:

- Candy
  - Atomic Fireball
  - Cinnamon Imperials (Round Red Hots)
  - Giant Sweet Tarts
  - Gumballs
  - M&Ms
  - Peppermints
  - Smarties
- Orange

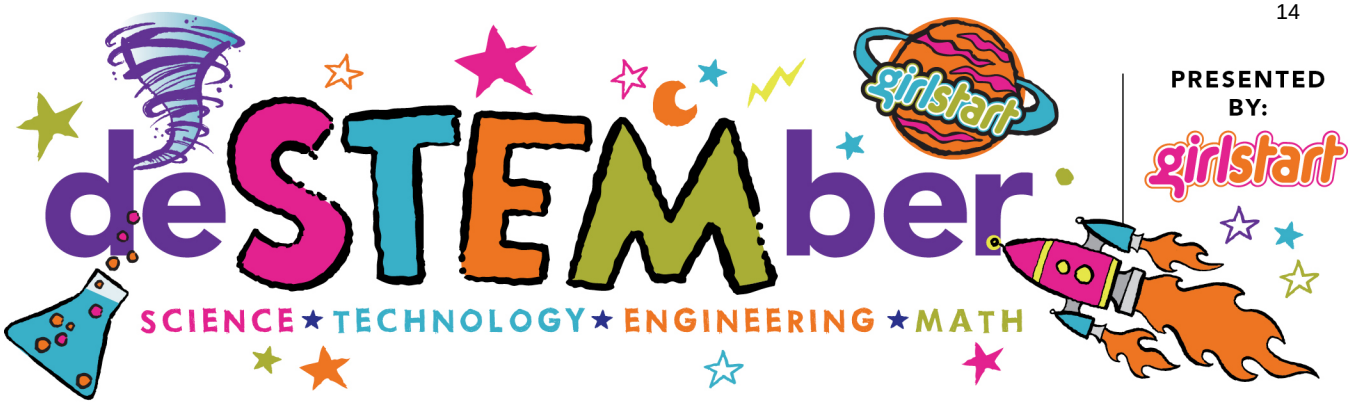
How To

Compare the sizes of the planets and the sun using the candy sizes. Place them in order of the solar system. Then rearrange the planets in order of size, from largest to smallest.

- Sun - Orange
- Mercury - Cinnamon Imperials
- Venus - M&Ms
- Earth - Gumball
- Mars - Smarties
- Jupiter – Giant Sweet Tarts
- Saturn - Peppermint
- Uranus - Atomic Fireball
- Neptune - Atomic Fireball

Why Does it Work ?

Planets are huge! The diameter of the largest planet, Jupiter, is 143,000km (88,900miles) and the smallest planet, Mercury, has a diameter of 4,900km (3,000miles). The diameter of Mercury is 100 miles longer than the distance from California to New York! In comparison, Pluto is a dwarf planet with a diameter of 2,300km (1,400miles).



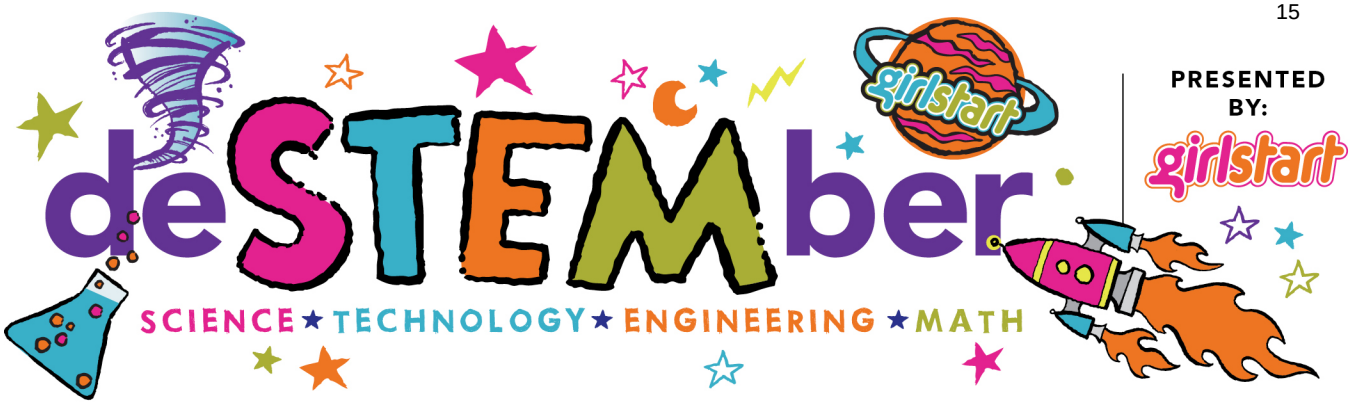
Solar Sweets

Why Does it Work Continued...

The diameter of a planet is the straight line passing from one side of the planet to the other, crossing through the middle. These large dimensions are hard to image because we have never seen anything near these large sizes. For this reason we use relative size. Relative size of the planets is referring to how big the planets are when compared to each other and the sun. When we compare the orange to the different sizes or candies we can see that the sun is a lot bigger in proportion to any of the other planets. Also by looking at the candies we can see the planets compared to the other planets. We can judge the largest to smallest planets this way. In order from largest to smallest the planets go in this order: Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, and then Mercury. We used the same candy for both Uranus and Neptune because their sizes are almost exactly the same. Uranus is only slightly bigger than Neptune. Therefore the relative sizes of the two planets are the same compared to the other planets.

Career Connection:

Astronomers study planets, moons, stars, galaxies, meteors, comets and their interactions with each other. They must have an in depth knowledge of physics to understand how forces such as gravity change throughout space. Astronomers work together sharing their knowledge in order to better understand how the universe works at microscopic and macroscopic levels.



Keeping Warm

If you could wear a jacket underneath your skin to keep you warm, would you? Discover how whales use their blubber as an insulator to protect them from the freezing ocean temperatures. Explore the cause and effect of heat transfer as you experiment with your very own blubber!

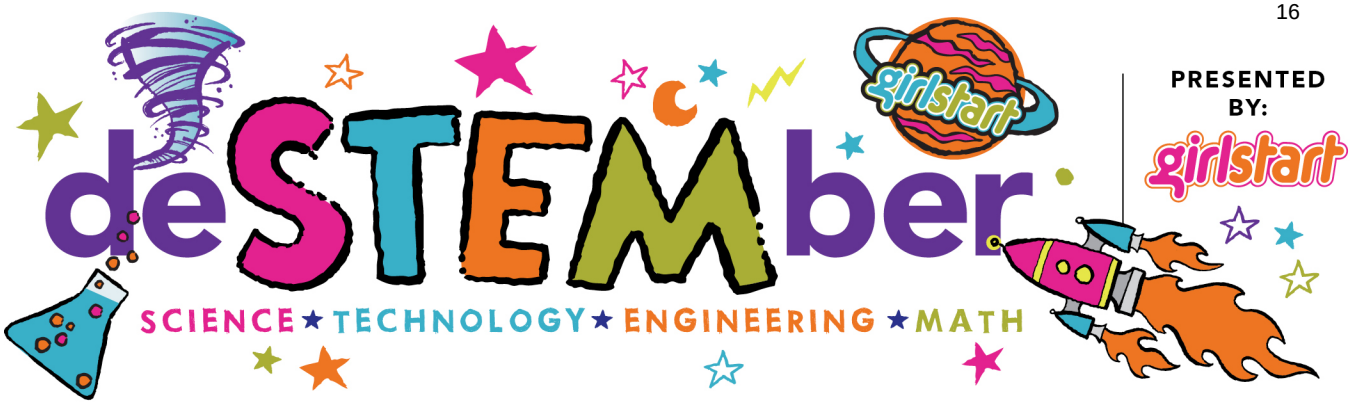
TEKS:
K.6A Use the five senses to explore different forms of energy such as light, heat, and sound.
1.6A Identify and discuss how different forms of energy such as light, heat, and sound are important to everyday life.
2.6A Investigate the effects on an object by increasing or decreasing amounts of light, heat, and sound energy.
3.6A Explore different forms of energy, including mechanical, light, sound, and heat/thermal in everyday life.
4.6B Differentiate between conductors and insulators.
5.6A Explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy.

Materials:

- Bowl
- Cold water
- Ice
- Kitchen mitten
- Paper towels
- 3-Sandwich sized plastic bags
- Shortening (optional)

How To

1. Pour cold water into the bowl and add ice. Make sure the water is cold.
2. In one hand wear the kitchen mitten, and wear the baggie around the mitten so that the mitten doesn't get wet.
3. Now, dip both hands into the water for about a minute. Than take your hands out and dry them. Which hand was colder? Why?
4. Take the second baggie and fill it 1/3 of the way with shortening.
5. Take the third baggie and turn it inside out and put it inside the second baggie. Now you can zip the first baggie to the second one so that your hands don't get messy!
6. Now put one hand inside the double baggies with shortening. Dip your bare hand and your hand with the shortening baggies into the cold water for another minute. Does it feel any colder? How is it different from the mitten?



Keeping Warm

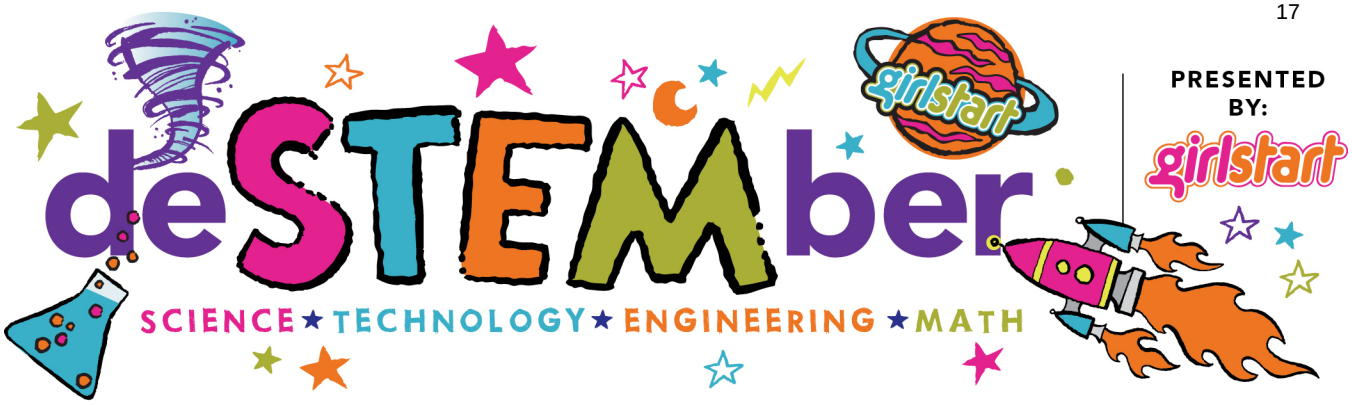
Why Does it Work?

Blubber is the layer of fat under the skin of sea mammals, which is built up by their food consumption and acts as an insulator. In the experiment, when you put your hand into the mitten or baggie, you were actually making an insulator for your hand. An insulator is a material that delays the transfer of heat, sound or electricity from one place to another. In our case heat is traveling and heat always travels from hot to cold! The mitten and the shortening are both insulators that slow down the transfer of heat from your hand to the water. Similarly, sea mammals at the Poles use blubber to slow down the amount of heat loss while they are in the water!

Career Connection:

Marine biology is the study of plants and animal life in the seas ecosystems. ***Marine biologists*** do projects such as impact studies, growth and reproduction, ecological effects, and research. Marine biologists usually obtain a Bachelor of Science degree with a stream in marine biology for vast employment opportunities.

Resources: http://www.howstuffworks.com/zoology/marine-life/whale.htm



National Brownie Day

Brownies are fun to make and delicious to eat! We have added a spin to making these brownies; get your math skills ready. Discover different measurements and the process of converting them in this tasty recipe.

TEKS:
3.5D Explore and recognize that a mixture is created when two materials are combined such as gravel and sand and metal and plastic paper clips.
5.5D Identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water.

Math TEKS:
4.7B Convert measurements within the same measurement system, customary or metric, from a smaller unit into a larger unit or a larger unit into a smaller unit when given other equivalent measures represented in a table
5.7 Geometry and measurement. The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving measurement. The student is expected to solve problems by calculating conversions within a measurement system, customary or metric.

Materials:

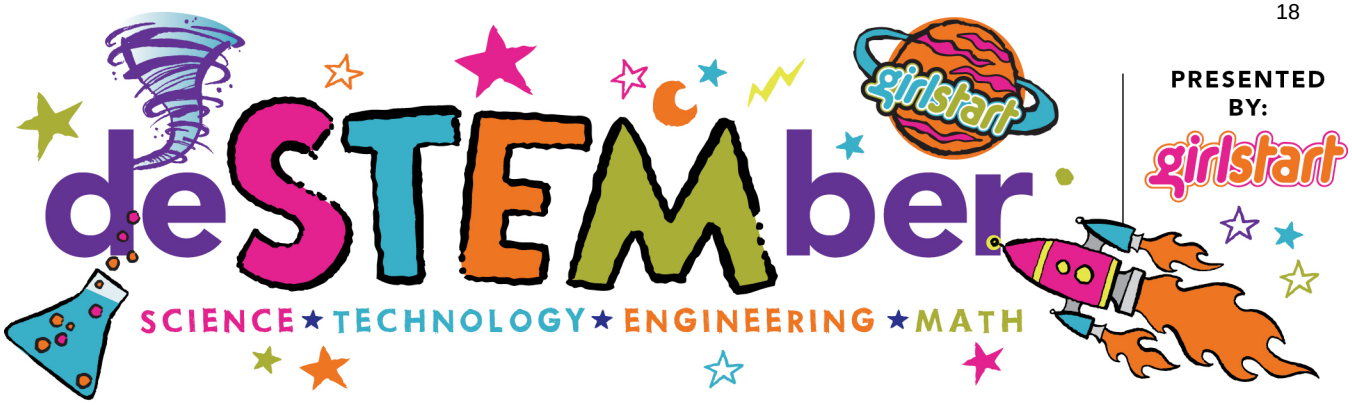
- 9in x 13in pan
- Measuring spoons
- Mixing bowl

Ingredients:

- ½ teaspoon baking powder
- ½ teaspoon of salt
- 1 teaspoon of vanilla extract
- 4 eggs
- 8 tablespoons of cocoa powder
- 16 tablespoons of butter or margarine
- 24 tablespoons of all- purpose flour
- 32 tablespoons of white sugar

How To

1. Melt the butter or margarine
2. Add each ingredient to the mixing bowl in the order listed and mix well.
   - 16 tablespoons of butter or margarine
   - 32 tablespoons of white sugar
   - 8 tablespoons of cocoa powder
   - 1 teaspoon of vanilla extract
   - 4 eggs
   - 24 tablespoons of all- purpose flour
   - ½ teaspoon baking powder
   - ½ teaspoon of salt



National Brownie Day

How To Continued...

3. Preheat oven at 176.66 degrees Celsius
4. Spray your 9in x 13in pan with nonstick cooking spray
5. Pour mixture into pan
6. Bake the brownies for 1200 seconds to 1800 seconds
7. Take the brownies out and let them cool. Ask an adult for help; the pan will be hot!

Why Does it Work?

Conversions are everywhere and it is always best to be prepared. You may only have teaspoons instead of cups or tablespoons and vice versa available to use. Possibly even a timer that counts in seconds instead of minutes. A slightly bigger pan or even a smaller pan and you have to change the proportions of your ingredients. Here are a few conversions that will make this project and other projects easier.

°C (9/5) + 32 = °F

16 tablespoons = 1 cup

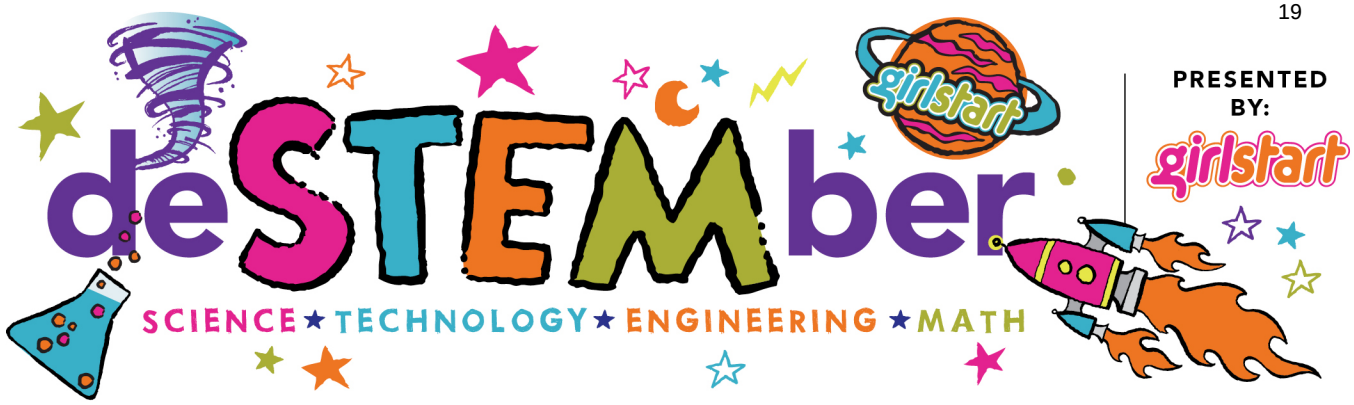
3 teaspoons = 1 tablespoon

60 seconds = 1 minute

Career Connection:

A career that benefits from the knowledge of conversion of units is a ***Chemists***. In order to do any of their experiments they must be able to measure the substances they use accurately in equal proportions.

Resources: http://allrecipes.com/Recipe/Quick-and-Easy-Brownies/



Bungee Jump Physics

Ever wanted to take the plunge and bungee jump off a bridge, building or platform in mid air? Does the thought of jumping make you nervous? Test the bungee cord elasticity and see if you can keep the egg from cracking.

TEKS:

6.8A Compare and contrast potential and kinetic energy.

6.8B Identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

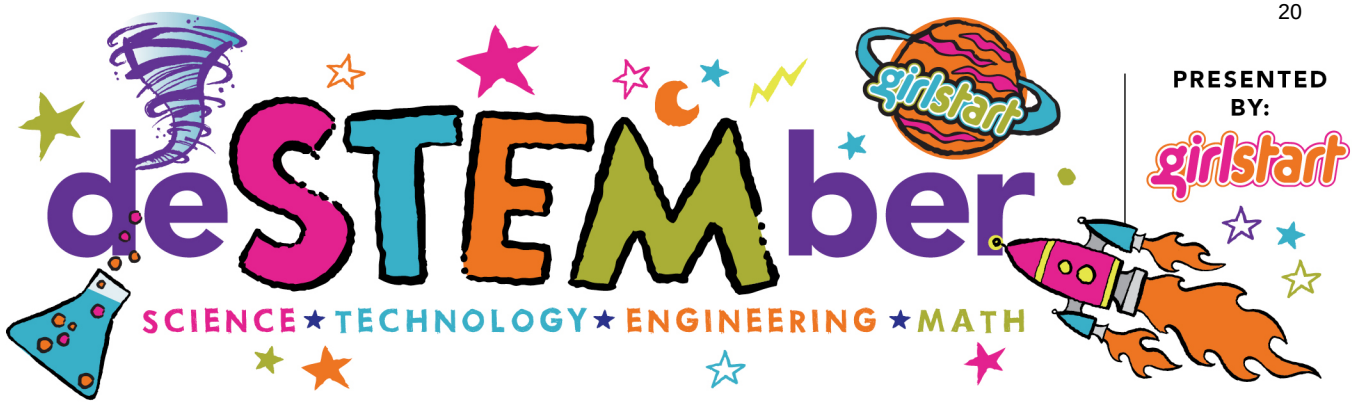
6.9 Force, motion, and energy. The student knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form.

Materials:

- 6 eggs (just in case), hopefully you only need 1
- 30 pennies
- Duct tape
- Loose sheets of newspaper (in case you do the activity inside this will protect the floor)
- Pair of pantyhose
- Ruler

How To

1. Choose an elevated spot for the bungee jump. A tree branch outdoors is ideal, but a ladder also works. You want the egg to fall to within an inch of the child's face when he/she is lying on the ground looking up at it, but no closer.
2. Use the ruler to measure the distance from the back of his/her head to the tip of his/her nose; add an "inch for safety" to this number.
3. Before experimenting with the egg, have the child work out the weight of the egg for a test run. Ask him/her to hold the egg in one hand and add pennies to the other hand until it feels like the coins weigh the same as the egg.
4. Add the "egg's worth" of pennies to one leg of the pantyhose and push them down to the toes. Tape the toes end of the other pantyhose leg to the branch or ladder.



Bungee Jump Physics

How To Continued…

5. Do the test run. Hold the "egg" of pennies on the edge of the branch or ladder step and let the pantyhose full of coins fall toward the ground. Check its distance from the ground. It should stop above the ground at exactly the distance calculated in step two. If it doesn't, adjust the height by re-taping the hose to the branch or ladder higher up or down on the leg.
6. Test again if needed to check your adjustments.
7. Now you are ready for the real thing. Remove the pennies from the pantyhose and replace them with an egg. Call in your audience, have the child settle in his/her place on the ground, and after a suspenseful countdown, do the drop. Bombs away!

Why Does it Work?

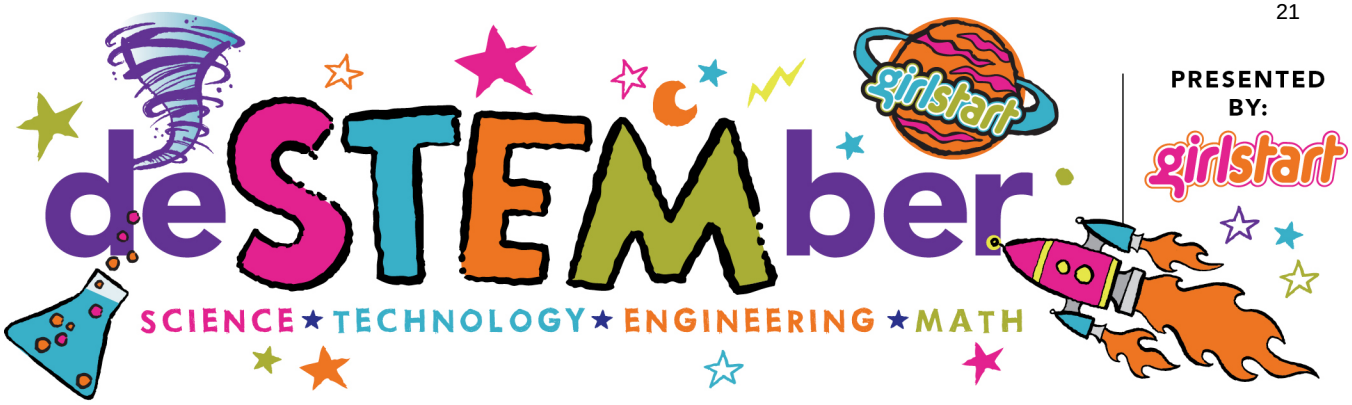
The nylon in the pantyhose has a natural elasticity and works like a bungee cord; the force of the falling egg causes it to change its form. As the cord stretches, it slows the egg until it stops falling, and the spring in the cord pulls the egg up and away from the ground. Elastic materials return to their original shape after they have been stretched, and for this activity the amount of elasticity in the pantyhose and how much the egg weighs determine how far the hose will stretch. As you measure and conduct test runs, you'll be working out the components of Newton's famous physics equation: force = mass × acceleration.

Career Connection:

Materials Engineers are in charge of researching and designing new materials that are improving technology in every field. Memory metals are a specific example of a new elastic material engineers designed to remember their original shape and return to them if they are bent or misshapen, for example sunglass frames. Other examples of products created by materials engineers include mosquito repellent clothing, nano-sized polymers to repair broken bones, polymers used in LCD technology for smart phones and improved skin grafts for burn victims.

Resources: http://www.education.com/activity/article/egg-bungee-jump/

http://pbskids.org/zoom/printables/activities/pdfs/eggbungeejump.pdf



Water Cycle

Fog, water, rain! Create your own water cycle in a plastic bag and observe the steps of evaporation, condensation and precipitation.

TEKS:

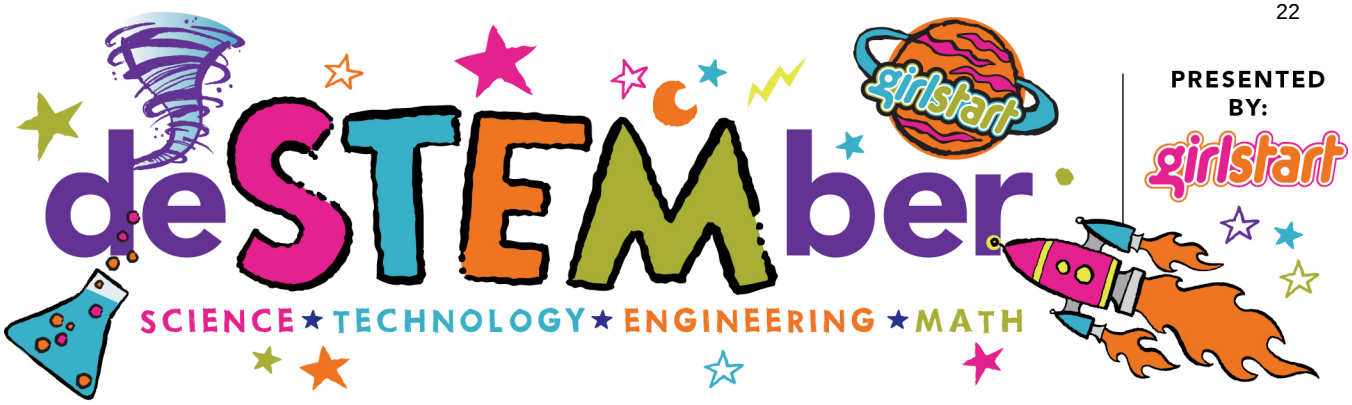
4.8B Earth and space. The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to: describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process.

Materials:

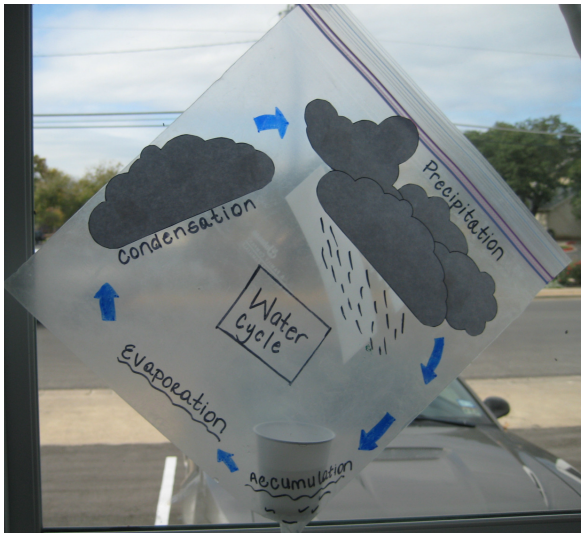
- Food coloring
- Gallon size Ziploc bag
- Permanent marker
- Small clear, plastic cup
- Tape
- Water

How To

1. Fill clear, plastic cup half way with water. Put 1 or 2 drops of food coloring in the water and stir.
2. Mark with a permanent marker where the water level is.
3. Draw arrows going around the outside of the bag to describe the water cycle. Begin with evaporation starting at one bottom corner and going to the opposite top corner. Condensation is at the top corner. Precipitation then goes from the top corner back down to the bottom corner to complete the cycle. (See picture on page 2)
4. Place the cup carefully in the bottom corner that you started your diagram at. Be sure not to spill any water!
5. Seal your bag, making sure to leave some air in the bag to represent the air in our atmosphere.
6. Carefully tape the top corner of your bag to a sunny window so that the cup is nested upright in the bottom.
7. Leave your bag hanging and watch the water cycle take place throughout the day.
8. The next day, observe what has happened to the water in the bag and the water level in the cup.



Water Cycle



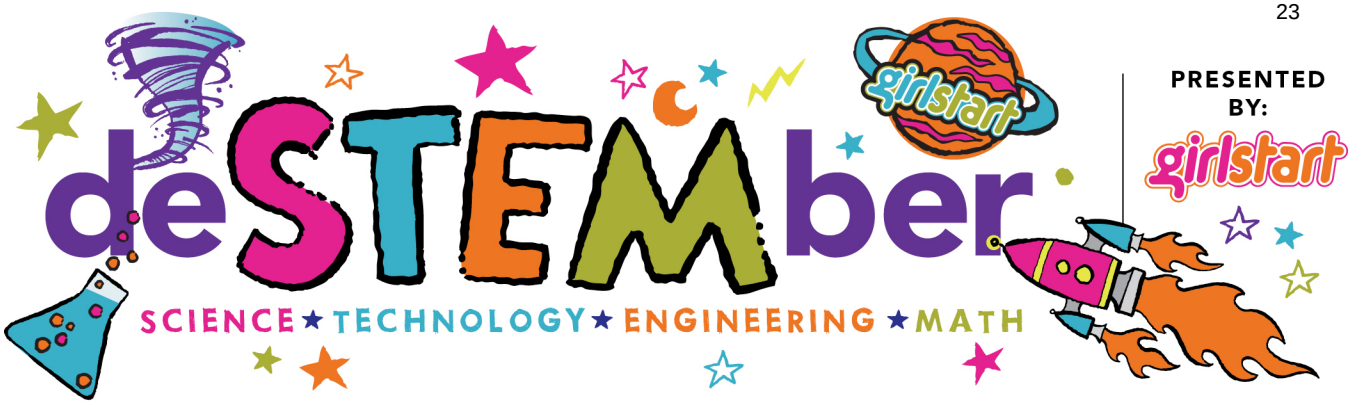
Why Does it Work?

The water from the cup represents a body of water (river, ocean, lake, etc.) and evaporates into the bag due to the heat from the sun. Evaporation is the process of water converting to vapor, which then collects to form clouds during condensation. This is represented by the water droplets on our plastic bag. The droplets then drip down the side of the bag and collect at the bottom due to gravity and the weight of the droplets. This represents precipitation, which can be in the form of rain, snow, hail, etc. The water will then evaporate again to continue the cycle.

Career Connection:

Meteorologists study the Earth's atmosphere by observing temperature, air pressure, water vapor, and their interactions and changes over time. They use simulations to help them predict the weather and to understand weather patterns so they can piece together climatic schemes, or focus on more complex weather such as hurricanes, tornados, etc. Meteorologists need an in depth knowledge of physics, geology, chemistry, and other subdisciplines of atmospheric sciences including climatology, hydrology, and even oceanography. These scientists are important to the fields of energy production, transportation, agriculture, and more!

Resources: http://media-cache-ec0.pinimg.com/originals/57/d0/12/57d012bce3d2b5fb45007c60b886ee1f.jpg
http://celfeducation.org/documents/WaterCycleBag.pdf



Forces and Friction

3, 2, 1, Go! Design an experiment to determine the role friction has on speed. Predict which material will affect the distance a toy car will travel. Gather your materials and we are ready to roll.

TEKS:
4.2 Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations.
4.6D Design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.
5.2 Scientific investigation and reasoning. The student uses scientific methods during laboratory and outdoor investigations.
5.6D Design an experiment that tests the effect of force on an object.

Materials:

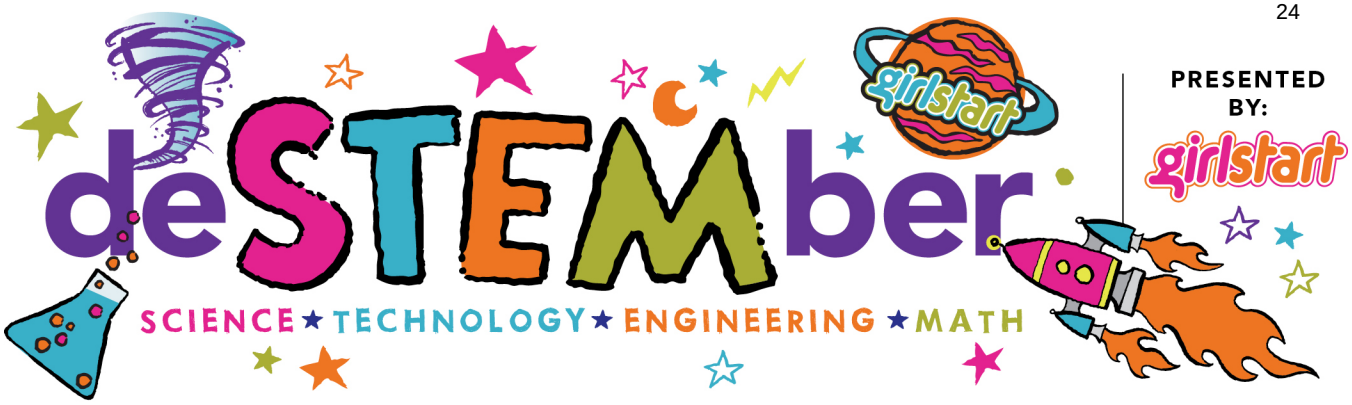
- 1 clipboard for each material
- A toy car
- Bubble wrap (enough to cover the surface of clipboard)
- Colored duct tape
- Meter stick or measuring tape
- Sand paper (enough to cover the surface of clipboard)
- Wax paper (enough to cover the surface of clipboard)

How To

1. Cover each clipboard with the materials listed: bubble wrap, sand paper, and wax paper.
2. Set up clipboards clip-side down to make a ramp.
3. Start the car at the top of the ramp and let it roll without pushing it.
4. Put a piece of tape where the car stops rolling.
5. Measure the distance between where the car started and the tape.
6. Repeat this 3 times and find the average distance travelled for each material.

Why Does it Work?

Gravity is the force that pulls the car down the ramp, causing it to move. The car continues to move until it is acted upon by another force. This force is called friction, which acts on the car, causing it to slow down by resisting motion between the car and the material.



Forces and Friction

Why Does it Work Continued...

Each material exerts a different amount of friction on the car, which allows it to travel different distances. Friction is the transfer of kinetic energy to heat energy, which is why your hands get hotter when you rub them together. This force also allows us to stop a car, open a jar lid, start a fire, and even stand up. Without friction, we would just slide around everywhere!

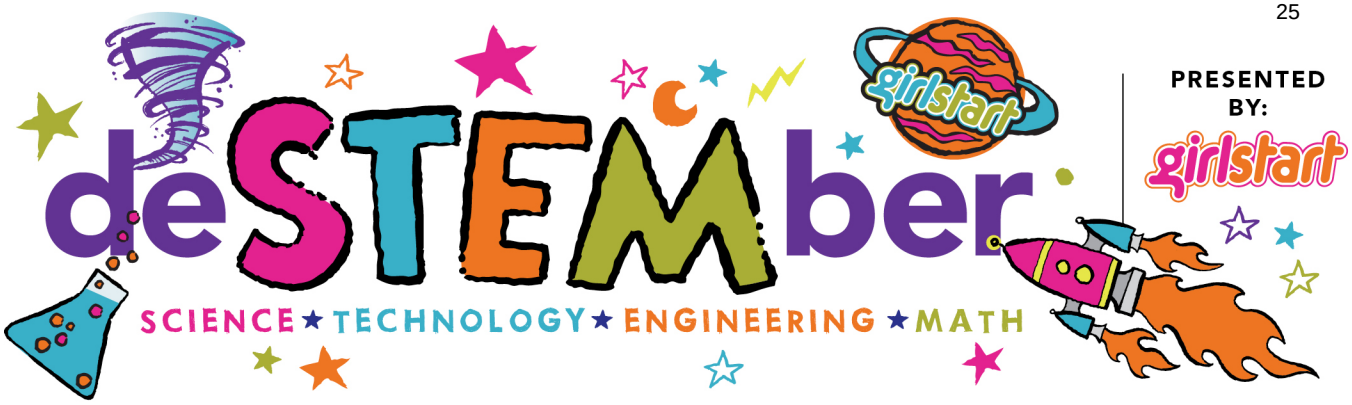
Career Connection:

Aerospace engineers design and develop some of the world's most marvelous machines. Commercial airplanes, military fighter jets, and space telescopes are all brainchildren of aerospace engineers. But aerospace technology has plenty of earthbound applications, such as aiding in the design of race cars and golf balls.

Resources: http://www.discoveryeducation.com/teachers/free-lesson-plans/friction-in-our-lives.cfm

http://www.ehow.com/info_10055596_fifthgrade-science-lesson-force-motion.html

http://www.ehow.com/info_8372263_force-science-games-5th-grade.html



Last Tower Standing

Can you build the next Leaning Tower of Pisa or Eiffel Tower? Construct a tower that can hold weight and withstand winds using only paper and tape. Discover which shapes and structures are the strongest and see if you can make the last tower standing!

TEKS:

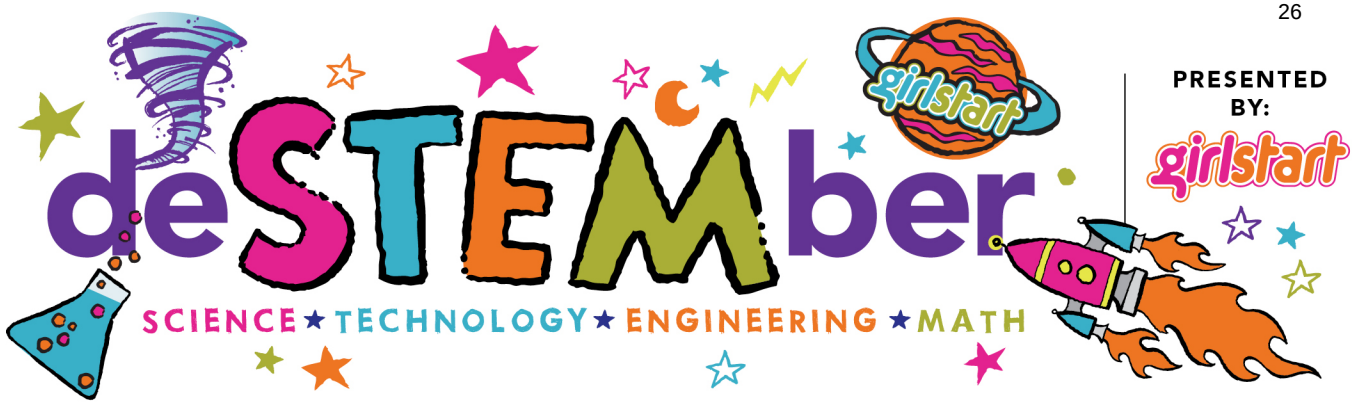
6.8B Identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

Materials:

- 4” x 6” index card
- Blow dryer
- Copy paper
- Scissors
- Scotch tape
- Straws
- Weights for testing – (work out weights, fishing weights, books, etc.)

How To

1. Place a piece of paper on a flat surface. Place a straw in the corner of your paper and use it to roll your paper into a thin tube.
2. Tape your tube so that it doesn’t come unraveled. Notice that your tube is strongest in the middle where there are more layers of paper.
3. Trim the ends of your tube so that it is 8 inches long.
4. Continue these steps to make 4 more tubes.
5. Tape four of these tubes together at their ends to make a square. Observe that this square on its own wouldn’t carry very much weight.
6. Visit http://www.pbs.org/wgbh/buildingbig/lab/shapes.html to test out the strengths of different shapes when building structures.
7. We now know that structures are stronger when they are made of triangles. Tape one more tube diagonally in your square, making it into two triangles.
8. Repeat steps 1-7 to make 6 squares, then tape them together to make one cube.
9. Using your knowledge of structures, continue to build onto your tower to make it as strong as it can be.



Last Tower Standing

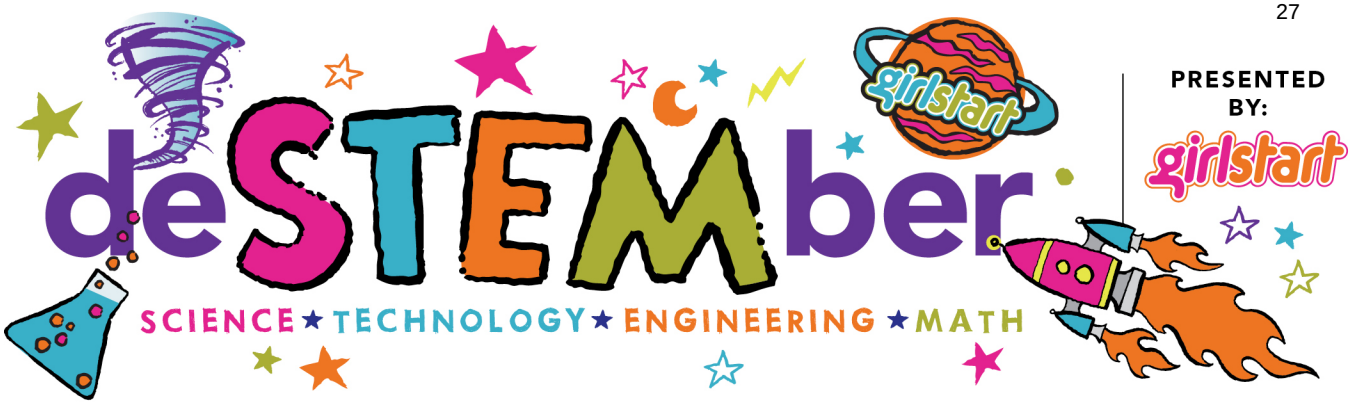
Why Does it Work?

Towers use different forces to remain standing. Triangles are the most rigid shape because they only experience one force at a time on each side. Your tower is able to hold the most weight when you use triangles in its structure.

Career Connection:

Structural Engineers are concerned with the design and construction of all types of structures such as bridges, buildings, dams, tunnels, power plants, offshore drilling platforms, and space satellites. Structural engineers research the forces that will affect the structure, and then develop a design that allows it to withstand these forces.

Resources: http://www.pbs.org/wgbh/buildingbig/index.html



Lights Out

Can you see me? Red, orange, yellow, green or blue – what color do you think the majority of sea creatures are in the deep ocean? Simulate the behavior of light at varying ocean depths using blue filter goggles and understand why different types of creatures live in each layer.

TEKS:

5.1B Make wise choices in the use of conservation of resources and the disposal or recycling of materials (use recycled materials to make glasses)

5.2D Communicate valid conclusions

Materials:

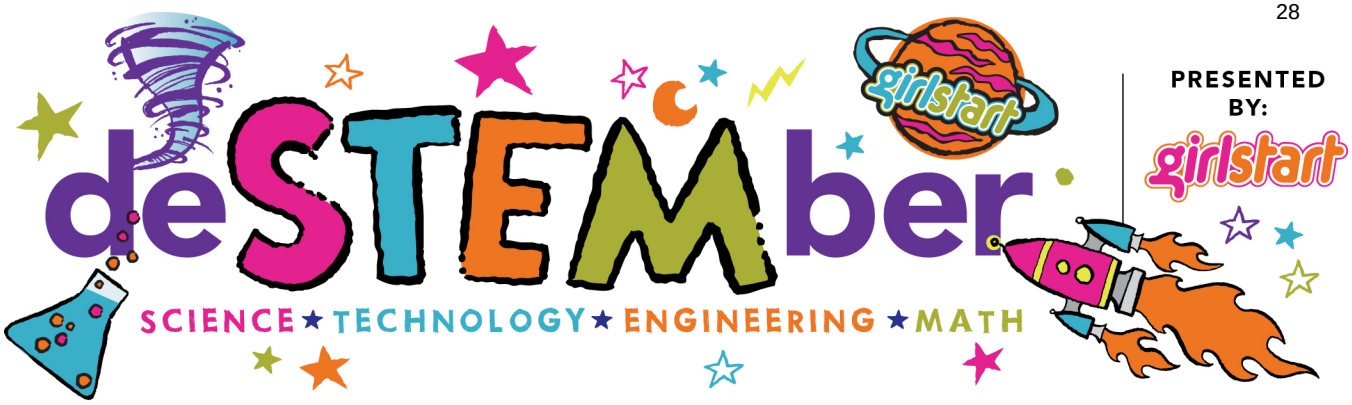
- 1 1”x1” felt square in red, orange, yellow, green, blue, and purple
- 1 9”x12” sheet of black felt
- Blue cellophane
- Colored Pencils
- Multiple printouts of the glasses template
- Recycled file folders
- Scissors
- Optional: Pictures of deep sea organisms

Preparation How To

- Attach each of the colored squares onto the larger black piece of felt
- Use the template to cut 4 pairs of glasses per group out of recycled file folders
- Cut blue film into strips approximately 5.5 inches long by 1.5 inches wide

Activity How To

1. Tape blue film strips onto each pair of glasses covering the eyeholes. Each student in the group will either attach 1, 2, 3, or 4 layers of blue film.
2. Examine the various colors of felt over the black background using each pair of glasses and observe which colors are visible.



Lights Out

Why Does it Work?

A colored filter allows only one color of light to pass through the filter; all other colors are absorbed and therefore blocked from the eyes of the viewer. In the case of the blue plastic filter, all colors except blue are absorbed and the only color that can pass through is blue light. This simulates blue light being the only light that penetrates into deeper water. On land, an item will appear a specific color because it is absorbing all other colors and reflecting back its "color" to our eye.

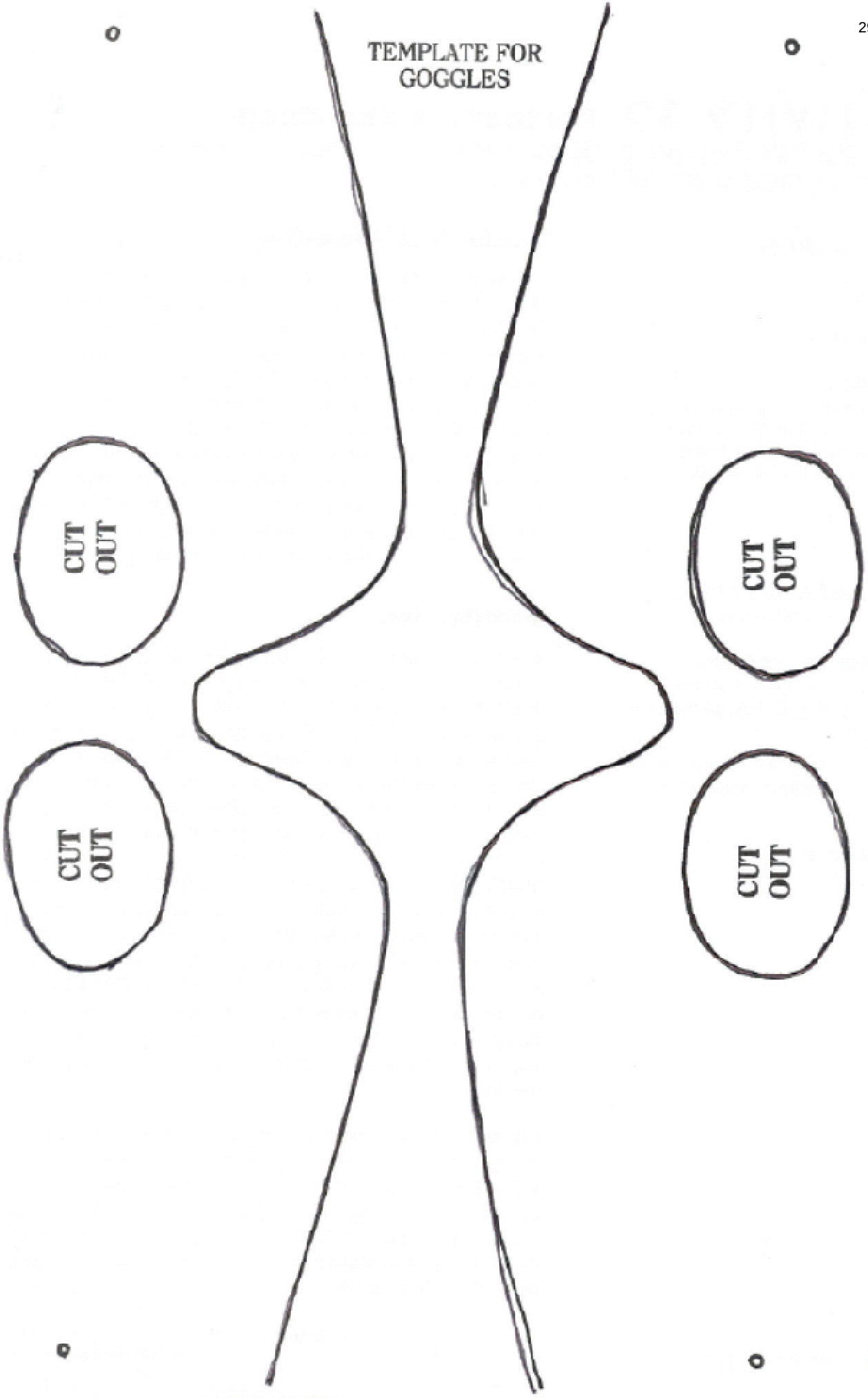
Each color of the spectrum has specific wavelength ranges. The colors at the middle of the visible spectrum (yellow, green and blue) penetrate seawater to the greatest depth, while colors of shorter (violet) and longer (red and orange) wavelengths are absorbed and scattered more rapidly. This property of light influences the coloration patterns and distribution of marine organisms. Several organisms living in deep ocean depths have red coloration. Their red color effectively makes them "disappear" in the inky darkness, because no red wavelengths are present.

Career Connection:

Physicists study the natural world, from the tiniest subatomic particles to the largest galaxies. They study what things are made of (matter) and how things behave including the behavior of light through the electromagnetic spectrum. Understanding light's wavelength and intensity is important in order to learn about certain characteristics of deep water creatures.

Additionally ***Marine scientists*** use this information to understand sea life habitats and adaptions.

TEMPLATE FOR GOGGLES



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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Around the Sun

Around and around we go! Explore how the earth orbits the sun and the moon orbits the earth. Students will create a model to visualize the earth, moon and sun's placement throughout the day.

TEKS:

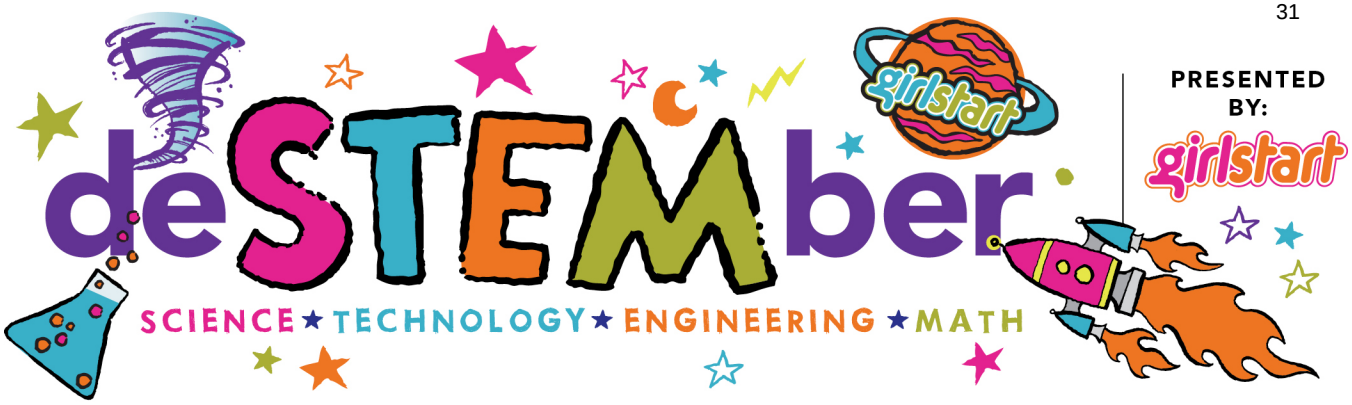
3.8C Earth and space. The student knows there are recognizable patterns in the natural world and among objects in the sky. The student is expected to construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions.

Materials:

- Brads
- Glue
- Markers
- Scissors
- Template (on page 3)

How To

1. Color and cut out the Earth, Sun, Moon and both rectangles.
2. Glue Moon to labeled end of the short rectangle, then attach Earth on the opposite side with a brad.
3. Attach one end of the long rectangle to Earth using the same brad from the short rectangle and close the brad.
4. Push a brad through the center of the sun. With the same brad, attach the long rectangle piece to the back of the sun.
5. Attach Sun on the opposite side of the long rectangle with a brad and close the brad.
6. While holding the sun in place, rotate the earth around the sun and the moon around the earth to explore the orbital patterns of each object!



Around the Sun

Why Does it Work?

When you look into the sky, it's hard to see how the earth, the sun, and the moon are all moving in reference to each other. This activity demonstrates how the earth revolves around the sun while at the same time the moon is revolving around the earth. Keep in mind that the sun's radius is 109 times larger than the earth's, and the earth's radius is about 3.6 times larger than the moon's! Also, the distance from the earth to the sun is about 93 million miles while distance from the moon to the earth is about 240,000 miles.

Career Connection:

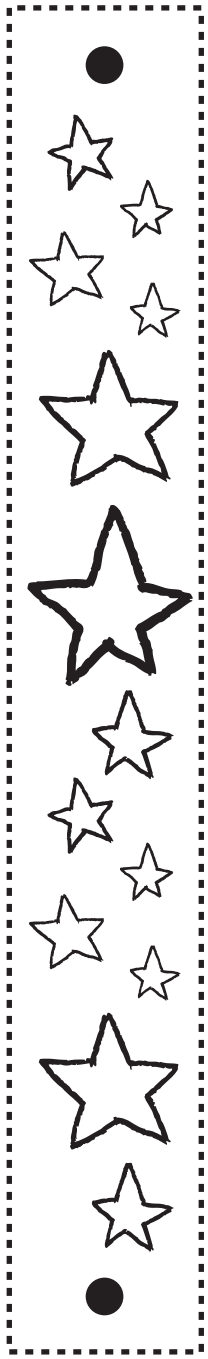
Aerospace engineers develop new technologies for use in aviation, defense systems, and space exploration. They also help develop machines such as satellites and space stations which need special materials to insure that they can withstand the harsh space environment.

Resources: http://moretime2teach.blogspot.com/2013/02/earths-orbit-misconception.html
http://www.nasa.gov/vision/universe/solarsystem/sun_for_kids_main.html
http://www.nasa.gov/audience/foreducators/k-4/features/A_Earth_Moon_Mars_Balloons.html

Earth, Sun & Moon

Color and cut out the Earth, Sun, Moon and both rectangles. Glue Moon to labeled end of the short rectangle, then attach Earth on the opposite side with a brad. Attach one end of the long rectangle to Earth using the same brad from the short rectangle and close the brad. Attach Sun on the opposite side of the long rectangle with a brad and close the brad.

GLUE



deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Sweet Crystals

Maple syrup tastes great on pancakes, but did you know it has other amazing characteristics? It can form different sizes and shapes of crystals under certain conditions. Heat and cool some maple syrup to see what kind of crystals you can form.

TEKS:

K.1B Observe, record, and discuss how materials can be changed by heating or cooling.

1.5B Predict and identify changes in materials caused by heating and cooling such as ice melting, water freezing, and water evaporating.

2.5B Compare changes in materials caused by heating and cooling.

2.5C Demonstrate that things can be done to materials to change their physical properties such as cutting, folding, sanding, and melting

3.5C Predict, observe, and record changes in the state of matter caused by heating or cooling

4.5A Measure, compare, and contrast physical properties of matter, including size, mass, volume, states (solid, liquid, gas), temperature, magnetism, and the ability to sink or float

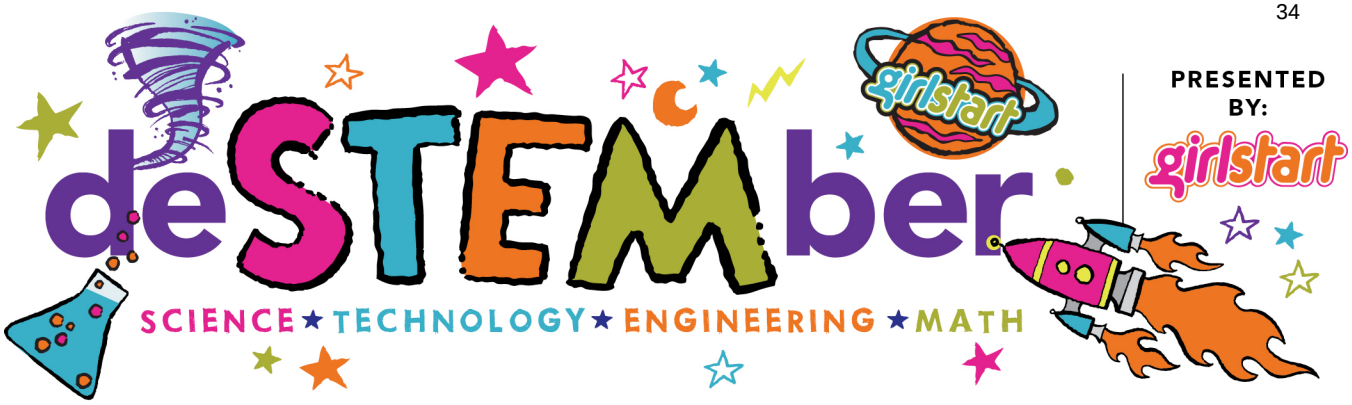
4.5B Predict the changes caused by heating and cooling such as ice becoming liquid water and condensation forming on the outside of a glass of ice water

Materials:

- Baking pan or flat tray
- Hot plate or stove
- Large spoon
- Magnifying glass
- Pure maple syrup
- Sauce pan
- Stopwatch (optional)
- Water

How To

1. Before you heat the maple syrup, make a sheet of ice by placing a thin layer of water in a baking pan or tray and keeping it in the freezer until it is frozen solid.
2. Once the water in the baking pan is frozen, heat the maple syrup over medium heat in the saucepan, stirring constantly.
3. Bring the syrup to a boil and allow it to cook, uncovered, until it is very thick and viscous. Keep stirring to make sure that it does not burn.
4. Set out the baking pan with the sheet of ice on the countertop.
5. Use your spoon to drop one dollop of the hot, thick maple syrup onto the ice.
6. Do not touch the dollop —it will still be really hot!



Sweet Crystals

How To Continued…

7. Watch as the maple syrup cools. Try using a stopwatch to time how long it takes for crystals to form and solidify on the dollop.
8. Observe the shape and length of the crystals. Use a magnifying glass to get a close look at the crystals.
9. What happens when you place a dollop of the heated maple syrup on a room temperature tray?

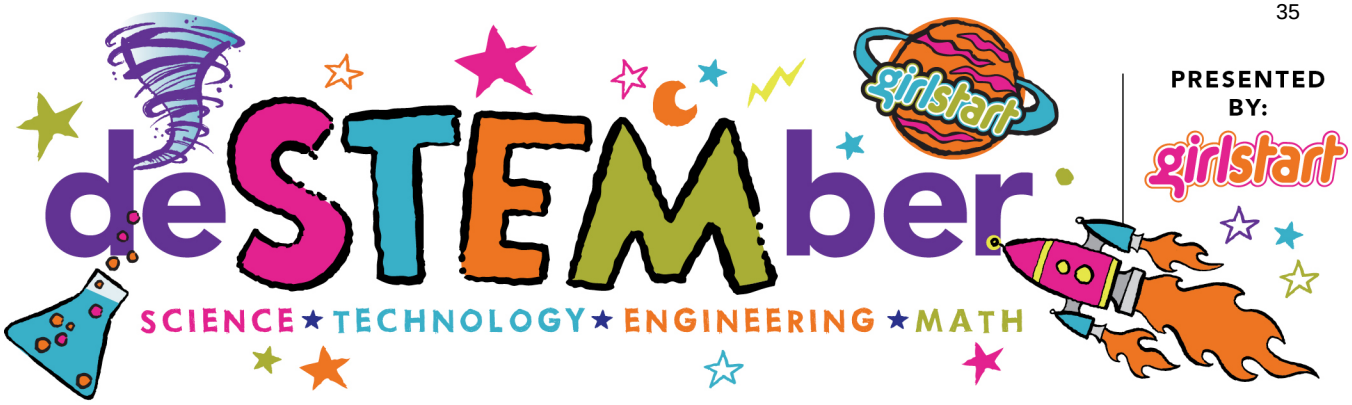
Why Does it Work?

Maple syrup is a concentrated solution of sugar in water, with many minor flavoring compounds. When it is heated, some of the water evaporates off and the sugar becomes more concentrated. As the water evaporates, the sugar molecules bump into one another frequently because there are so many of them, so close together. Occasionally, when they bump into each other, the molecules end up sticking together. As the heated maple syrup cools, the sugar molecules form crystals. Unlike the sugar molecules in liquid syrup, which are free to float around, sugar molecules in the heated, concentrated syrup form these crystals, which line up and arrange themselves in an orderly and repetitive pattern.

Career Connection:

Food science technicians test and catalog the physical and chemical properties of food to help ensure that they have good taste, texture, quality, and are safe to eat. A food scientist might help develop a delicious new candy, check for bacterial contamination to prevent food poisoning, and test cereal to make sure that nutrition labels are correct.

Resources: http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p044.shtml#summary



Rockin' Roller Coasters

Spins, loops and drops! Roller coasters take us on crazy rides with high speeds and big adrenaline rushes! What causes them to travel so fast and who is in charge of designing them? Create your own roller coaster to discover the different types of energy they use and what is involved in getting people from start to finish safely.

TEKS:

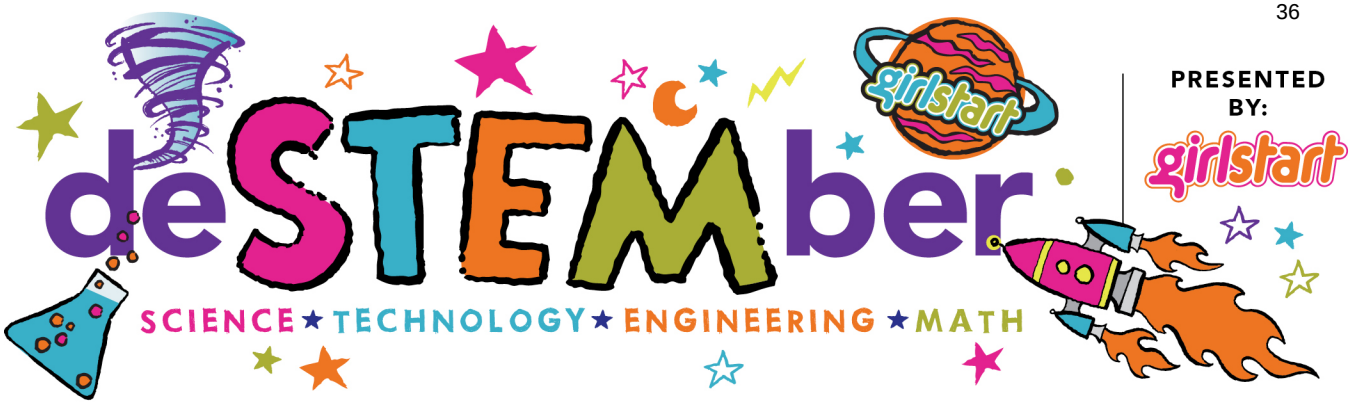
6.8A The student knows force and motion are related to potential and kinetic energy.

Materials:

- Cup to catch marble
- Household objects with different heights
- Marble
- Paper Towel Rolls
- Tape (Blue painters tape or duct tape works best)
- Toilet Paper Rolls

How To

1. *Optional* Begin by cutting your toilet paper and paper towel rolls in half across the diameter of the roll. This will create the open track for your roller coaster. You may want to leave some pieces as the whole tube if you want your coaster to have some tunnels.
2. Place the first piece of your track at a higher elevation (on a chair, bookshelf, etc). This will create a bigger drop for your roller coaster and higher speeds.
3. Connect more pieces of track by taping them end to end.
4. Use your own creativity to create turns, loops, and drops as you add each piece.
5. After designing, your rollercoaster from start to finish, tape the cup to the very last piece of track. This will catch your marble after each run.
6. Drop your marble from the beginning of the roller coaster and watch it drop, loop and turn!



Rockin' Roller Coasters

Why Does it Work?

In physics, objects have energy if they can cause changes to occur. This energy can come in many different forms.

Stored energy is called potential energy. To store energy, work must be done, such as winding up a spring, charging a battery, or, in this case, holding the marble just about the start of the rollercoaster track. An object that has potential energy may release its stored energy to be transformed in other forms of energy.

Kinetic energy is the energy of motion. Any object that has mass and is moving has kinetic energy. Once the marble is released onto the rollercoaster track and begins rolling, its potential energy is transformed into kinetic energy as it moves down the track.

Career Connection:

Roller coaster engineers combine several types of engineering to create the thrilling coasters that so many people line up to ride. They use mechanical engineering to design the famous loops and drops using calculations to understand all of the different forces that will act upon the riders, cars, and track. Then, roller coaster engineers use structural engineering to understand how to actually build the coaster, from what types of material will be used to how will the coaster be supported at such high speeds. The third piece of being a roller coaster engineer is electrical engineering. They design computer programs to model their roller coasters and calculate the safe amount of time between each run of the track.

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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Spinning Arm

What can you create with a Ping Pong ball, 3 volt motor, wires, battery and paint stirrers? A motorized arm--kicking stick--to hit the Ping Pong ball across the floor!

TEKS:

4.6C Demonstrate that electricity travels in a closed path, creating an electrical circuit, and explore an electro-magnetic field.

4.6D Design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

Materials:

- 2 craft sticks
- 3 volt motor (the kinds with gear attached to shaft)
- AA battery in a battery holder
- Aluminum foil
- Cardboard
- Duct tape
- Hook-up wire
- Paint stirrer
- Paper clips
- Ping pong ball
- Rubber faucet washer (3/4 inch or larger)
- Scissors
- Wire strippers

How To

1. First build the circuit by connecting the battery, wires, and motor. To create a switch, add two pieces of aluminum foil at the end of the wires (see picture below). The motor will work if the aluminum foil pieces are touching, as that is a closed circuit and the electricity can run through.

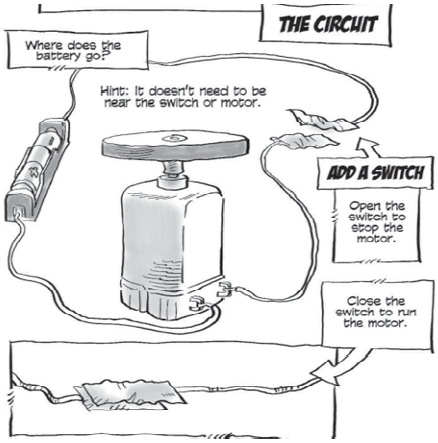
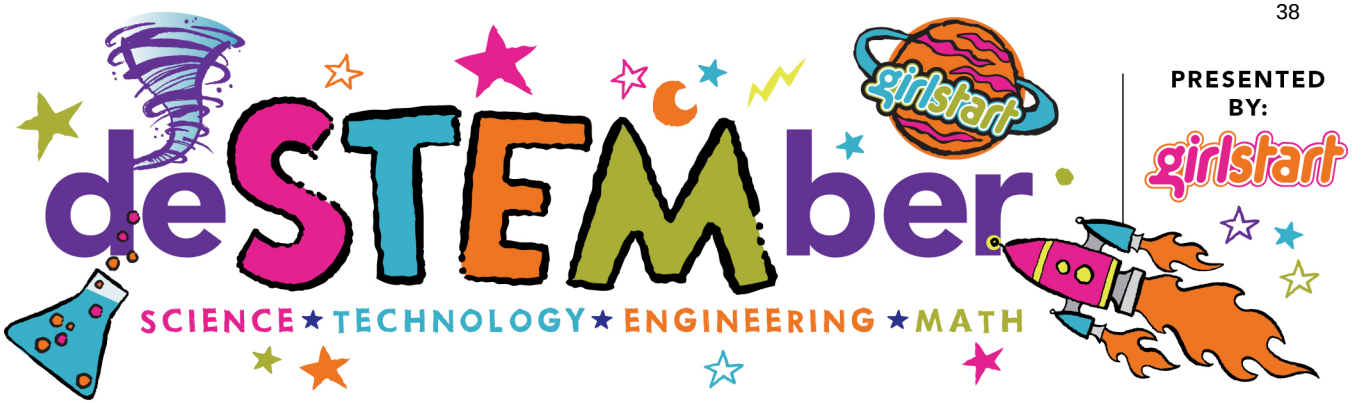


Image by Design Squad

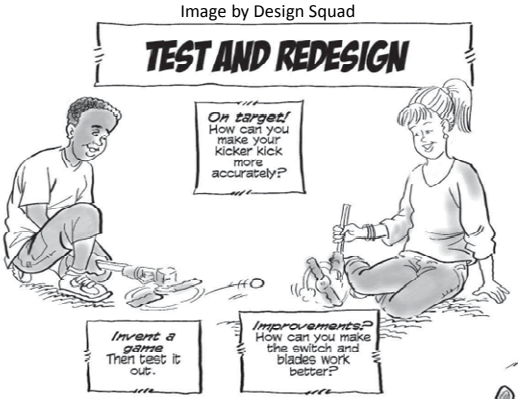


Spinning Arm

How To Continued…

2. The large washer slips onto the gear on the motor and spins when the shaft spins. The blades will be attached to this washer through tape. The blades can be created out of craft sticks, paper clips, paper or duct-tape strips rolled tightly. The choice is yours for the type of blades that you want to use. You also have the choice of where on the motor you will connect to the paint stirrer or stick (in the middle of the stick, the end pointing out, the end pointing down), as the paint stirrer will serve as the handle for this kick stick. Construct and attach the blades and paint stirrer and give your kick stick a try!

Image by Design Squad



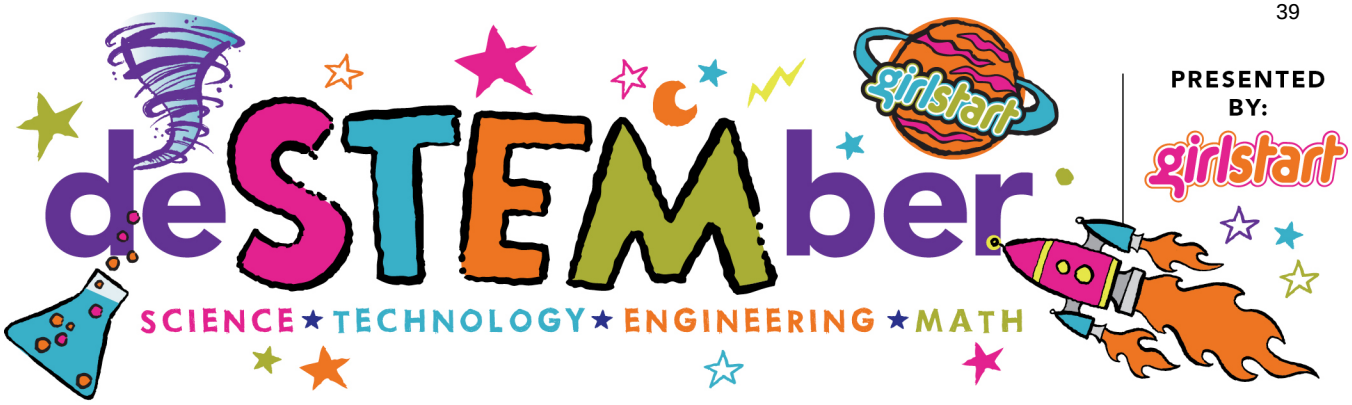
Why Does it Work?

The battery powers the motor as the current travels a single path through the wires from the battery terminal. When the motor is powered, the shaft spins and causes the blades to rotate. The rotating of the blades can kick a ball, when the kick stick is held by the paint stirrer which is attached to the motor.

Career Connection:

Engineers build and improve things that matter to people! Engineers can make games, and that matters because games entertain people.

Resources: Pbs.org/designsquad



Crazy Catapults

Levers, levers, everywhere! Look around and count how many you can see. Are there more than you thought? All you need are two tongue depressors, rubber band, and pencil to design a lever to launch your gummy bear across the room.

TEKS:

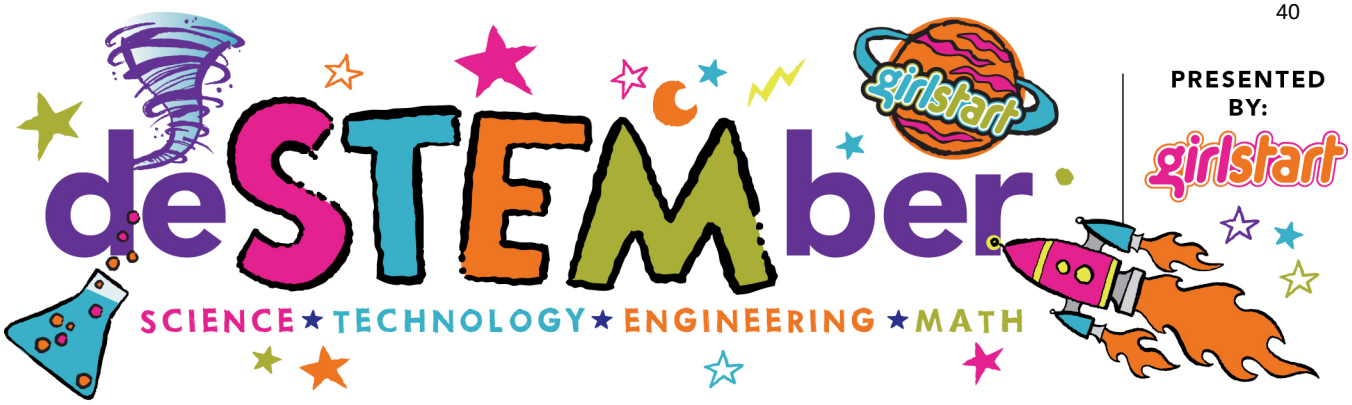
6.8B Identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

Materials:

- 1 wooden pencil
- 2 heavy duty rubber bands
- 2 tongue depressors
- 10 gummy bears
- 3” strip of duct tape
- Flat surface
- Paper to record results
- Tape measure or ruler

How To

1. Pass out the supplies to each group, or create the catapult on your own at home.
2. Place the tongue depressors on top of each other and wrap them together with a rubber band on one end, about an inch from the end.
3. Wrap a second rubber band around the first to ensure it is secure.
4. Slide the pencil between the two tongue depressors near the rubber band.
5. Use the strip of duct tape to tape the bottom tongue depressor to the flat surface.
6. Now you are ready for launch! Place the gummy bears one at a time at the elevated end of the top tongue depressor and use your pointer finger to pull the depressor toward the flat surface. Then let go!
7. Measure the distance each gummy bear travels using the end of the depressors with the rubber band as your start point.
8. Find the average distance all ten gummy bears traveled.
9. As an option: Give the pairs/groups the supplies and allow them to design their own catapult to test. Add a few materials to the list: 1 plastic spoon, 2 more rubber bands, and an extra strip of duct tape.



Crazy Catapults

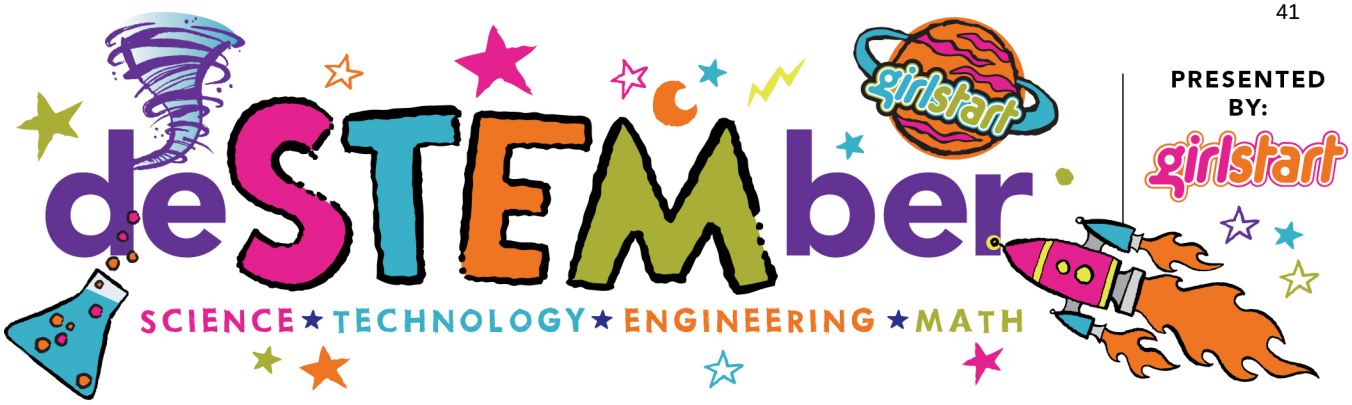
Why Does it Work?

Levers make work easier by converting a small amount of effort into a lot of force (like a hammer) or by converting a little movement into a large movement (like a broom or golf club). And who doesn't want to get more done with less effort? Hundreds of years ago, soldiers hurled heavy stones using catapults, which use a lever system to send the rocks flying. Baseball players use a lever every time they are up at bat. When you swing a bat, you move the part you're holding just a little bit. But the other end of the bat moves a lot! The same with the flippers on pinball machines—a little flick sends the ball flying. A see-saw is a big lever, though you'd need a great deal of force to send someone flying!

Career Connection:

Manufacturing Engineers create and make things. They design, direct and coordinate the processes and systems for making almost any kind of product – from beginning to end. Manufacturing engineers apply scientific principles in designing and producing quality products. This includes finding ways to improve what they make and packaging planning.

Resources: http://www.brunswick.k12.me.us/pgroves/files/2013/05/AP-Stats-Gummy-Bear-Project.pdf



Flashlight Constellation

Welcome Winter Solstice! Grab a flashlight and tissue paper to design a cool constellation to light up your room during the longest night of the year. Share your unique designs on Instagram: #iheartgirlstart

Fun Fact: National Flashlight Day is December 21st
December 21 is Winter Solstice which is the shortest day, and longest night, of the year. It is believed that National Flashlight Day came about because of all the dark night visits with family during the holidays.

Materials:

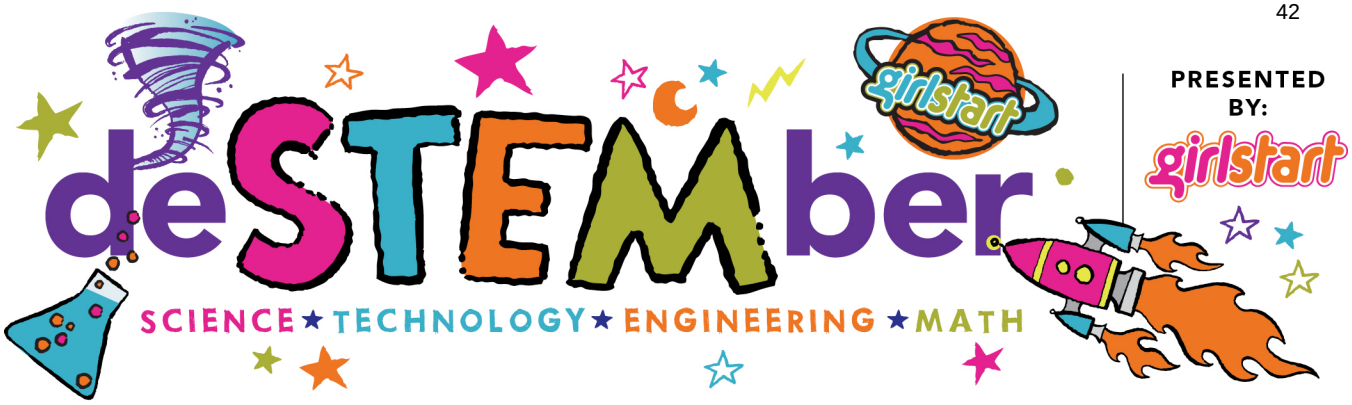
- Flashlight
- Pencil
- Scissors
- Tape or Rubber Band
- Tissue Paper
- Toilet Paper Roll

How To

1. Cut a 4”X4” square out of the tissue paper
2. Place the tissue paper over one opening of the toilet paper roll and secure using tape or a rubber band.
3. Using the tip of the pencil, gently poke holes into the tissue paper to form a constellation (picture).
4. Now you are ready to display your constellation! Shine the flashlight through the open end of the toilet paper roll so the stars are displaying onto a blank wall.
5. Create a story to go with your constellation!

Where Do Stars Come From?

A star begins as a giant cloud of gas and dust, called a nebula. Gravity pulls the gas close together to form a gas clump that heats up and becomes a protostar. The protostar continues to heat up until about 15,000,000°C (27,000,032°F!), causing the gas to clump closer together and form a main sequence star— the star we see.



Flashlight Constellation

Where Do Stars Come From Continued...

These stars shine for millions, even billions of years! Then the star cools down, causing the inside to contract, and the outside to expand. The star is now red, and is called a red giant. Eventually, the red giant collapses, causing the star to reach over 100,000,000,000 °C (over 180,000,000,000°F!), resulting in a supernova explosion.

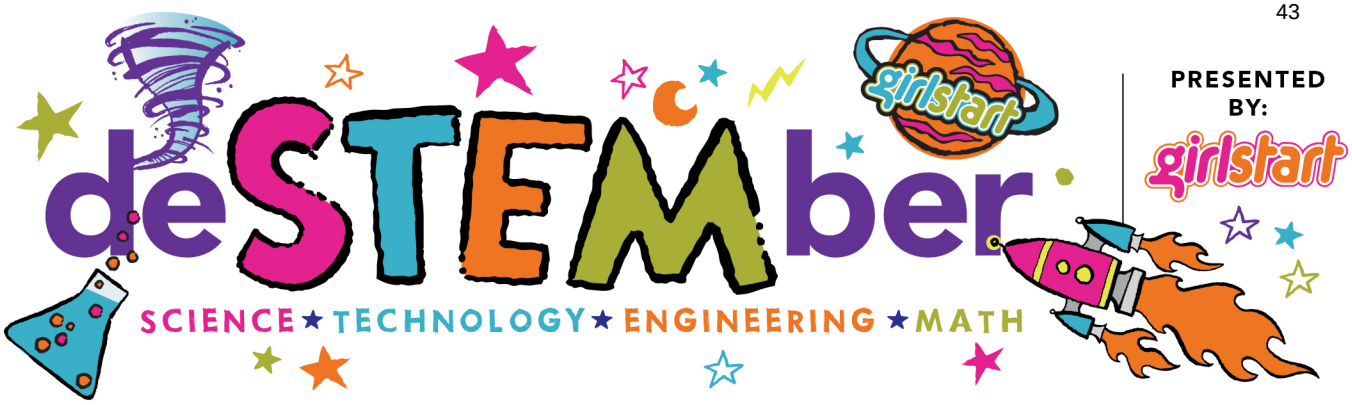
Career Connection:

Stellar physicists research the formation, evolution, interior and the atmospheres of stars.

Resources: www.nasa.gov

www.enchantedlearning.com

www.astronomynotes.com



Rooftop Garden

Explore the benefits a rooftop garden provides an urban environment including agriculture, beauty, parks and clean air. Construct your own rooftop garden prototype incorporating structural and architectural engineering principals to ensure your design can support the building, plants and soil.

Materials:

- 2 small shoeboxes – should be at least 5 inches tall
- 2-4 thermometers (use digital thermometers if available)
- 6”x 6” sheets of dark plastic (trash bags)
- Aluminum foil
- Construction paper
- Foam board strips
- Glue gun/glue (optional)
- Heat lamp
- Heavy clear tape
- Ruler
- Scissors
- Sheets of black sand paper
- Small sections of sod/ moss or pre-potted ground cover
- Timer, clock, or stop watch

TEKS:

4.6B Differentiate between conductors and insulators.

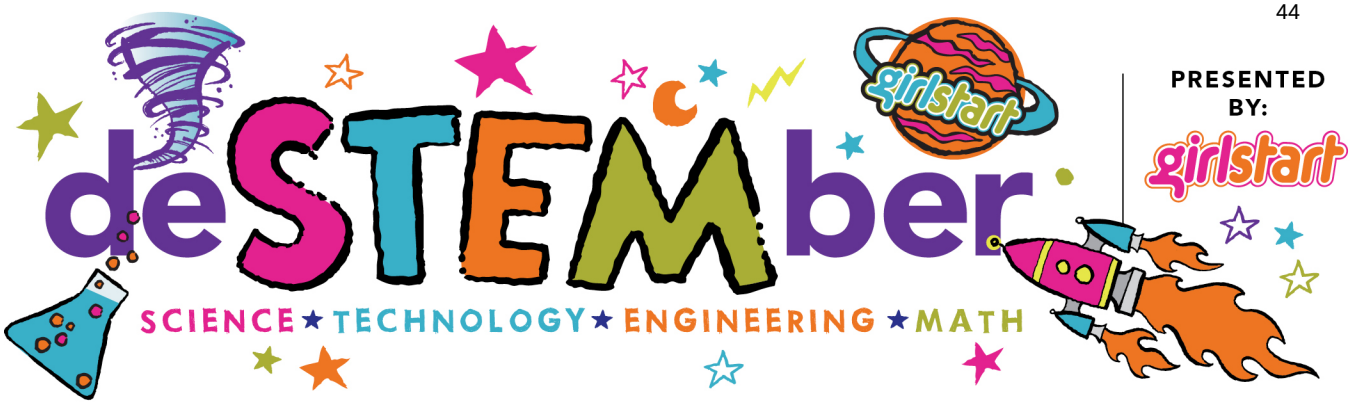
5.7C Identify alternative energy resources such as wind, solar, hydroelectric, geo-thermal, and bio-fuels.

5.9D Identify the significance of the carbon dioxide-oxygen cycle to the survival of plants and animals.

6.7B Design a logical plan to manage energy resources in the home, school, or community.

How To

1. Turn your shoe box upside down so the open side is on the table.
2. Cut a doorway into the bottom of one side, leaving the door attached so it can be closed.
3. Attach the black sandpaper to the top of the box.
4. Attach the black trash bag on top of the sandpaper.
5. Arrange soil and plants over the plastic.
6. Attach strips of foam board around the perimeter of the roof to create a small wall around the plants.
7. Decorate your building!
8. Turn your second shoe box upside down and attach black sandpaper to the top.



Rooftop Garden

How To Continued…

9. Place both shoeboxes under a heat lamp and put a thermometer inside each box, as well as on top of each box.
10. Record the starting temperature of each thermometer.
11. Record the temperature of each after 5 minutes. Do this 3 times.
12. Now remove the shoeboxes from under the heat lamp and place a fan blowing on them. Turn off the lights to simulate nighttime.
13. Repeat steps 10-11 for the windy night scenario.

Why Does it Work?

The temperatures inside the buildings will be cooler because the building insulates from some of the heat. The garden may be cooler since black absorbs more heat. A rooftop garden acts as an extra insulator, keeping the house cooler in heat and warmer in the cold. Soil is moister and takes longer to heat up, which cools down the house during hotter times. It also holds heat during the colder days because it takes longer to cool down than concrete and tar.

Career Connection:

Structural engineers design or reinforce buildings so they are strong enough to support rooftop gardens. They might also determine how best to direct water to flow from the roof of the building to the ground. ***Environmental engineers*** play a role in determining how effective the garden might be at improving air quality. ***Agricultural engineers*** find ways to improve crop yield so that people in the city can grow their own food.

Resources: http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_rooftop/cub_rooftop_lesson01_activity1.xml
http://www.huffingtonpost.com/2009/08/31/8-rooftop-gardens-from-ar_n_268573.html
http://www.dailymail.co.uk/news/article-2139899/New-Yorks-secret-skyline-Amazing-aerial-shots-rare-glimpse-hidden-rooftop-world.html

deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Fossil Detective

Fossils, molds, grids and dirt! Gather your shovels and brushes to find the hidden treasures in the soil layers. Excavate and examine the sedimentary rock to discover the fossils and environments in the prehistoric layers.

TEKS:

5.7A Explore the processes that led to the formation of sedimentary rocks and fossil fuels

5.7D Identify fossils as evidence of past living organisms and the nature of the environments at the time using models.

4.2 & 5.2 The student uses scientific methods during laboratory and outdoor investigations.

4.3 &5.3 The student uses critical thinking and scientific problem solving to make informed decisions.

Materials for sedimentary fossil layer model:

- 4 different colors of clay
- 3 small objects to represent fossils (shells, toy dinosaurs, small plastic plant leaves, etc)
- Paper or plastic cup
- Small amount of sand or dirt

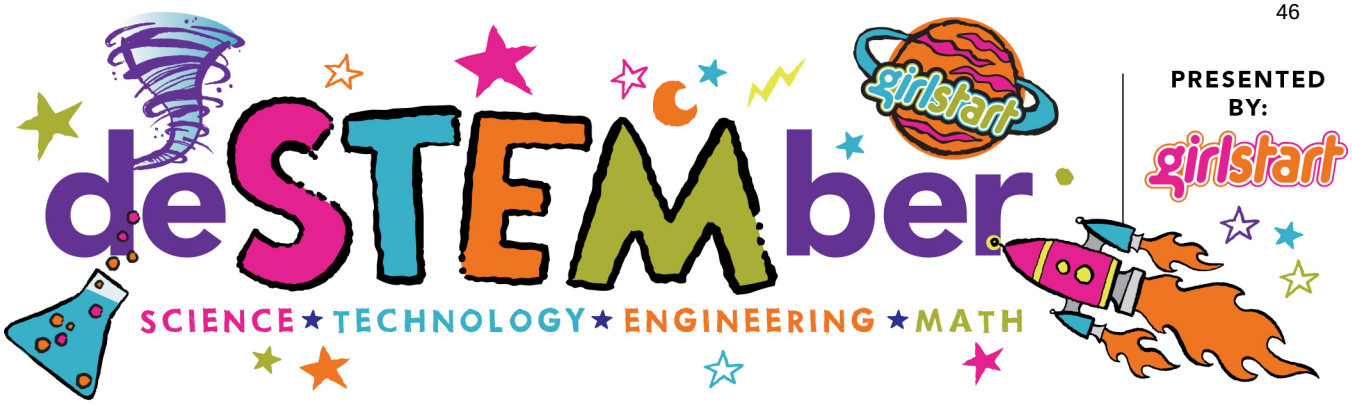
Materials for excavating fossil model:

- 2 paper plates
- Excavation tools – Toothpicks, craft sticks, cotton swabs, etc
- Small paint brush or tooth brush

How To

Prepare sedimentary fossil layer model using the following steps:

1. You will create 3 sedimentary layers. Each will contain a model of a fossil.
2. Form each color of clay into a round flat layer.
3. Place one piece of clay into the bottom of the paper/plastic cup.
4. Using one small object, press it into the layer of clay.
5. Add another layer of clay to the cup and press another object into it.
6. Repeat step 5 with another layer of clay and your last object.
7. *Optional: You may add more layers of clay and fossil objects if you like.
8. Finally, press the fourth layer of clay (no fossil imprint) on top of the others.
9. Sprinkle some sand/dirt on top to create an earthy surface.



Fossil Detective

How To Continued…

Excavating your fossils:

1. Peel the paper/plastic cup away from the fossil model and set onto one paper plate.
2. Using excavation tools, peel and brush away layers to uncover fossils.

** Remember, paleontologists have to be SUPER careful because fossils are very old and fragile! They also don't touch them with their bare hands to protect them from any oil in our skin that might damage them.

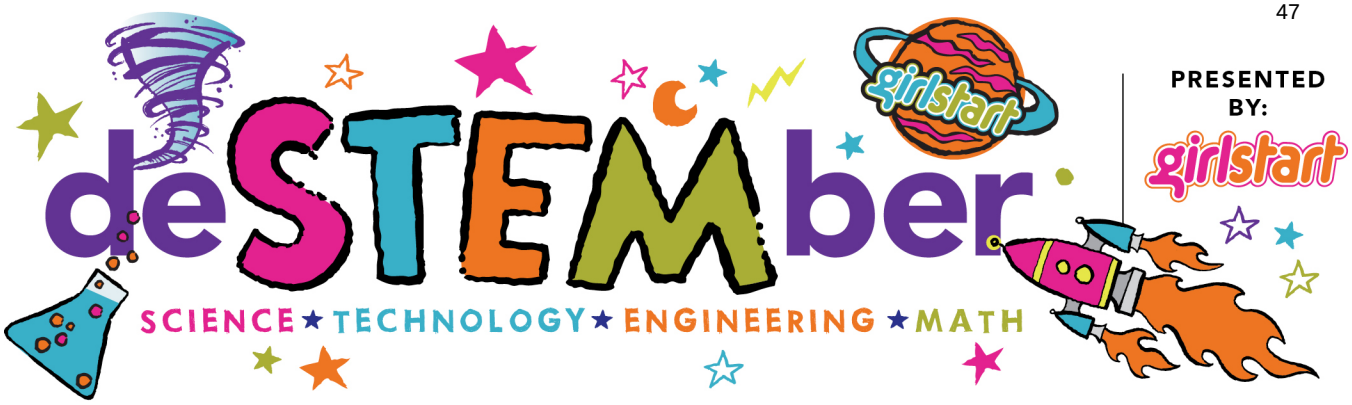
3. Use your paint brush to dust away any dirt and clay from the fossils. Lay each fossil out onto the second paper plate and talk about what you can learn from it. Is your fossil from a plant or animal? What type of climate might it have lived in?

Why Does it Work?

Fossils are formed when once-living organisms are pressed between layers of sediment as sedimentary rock forms. When the sediments harden into rock over long periods of time (thousands to millions of years), evidence of the organisms remain in the rock. There are four common types of fossils:

1. *Trace fossils:* These fossils include footprints, tracks, eggs, and burrows made by organisms and preserved in rock.
2. *Molds:* Molds formed when an organism died and became buried in sediment or mud. The organism eventually decayed or dissolved away leaving a cavity or shape of the organism in the rock.
3. *Cast:* A cast formed when a mold was filled in with minerals or grains of rock, and then turned into solid rock.
4. *Petrified fossil:* A petrified fossil formed when the hard parts of an organism were replaced by minerals. The fossil looks like a bone or tree trunk but it is really made of rock.

Like paleontologists, we can carefully dig through the sedimentary rock layers using tools so that we do not damage the fossils inside. We can learn about the organism's environment and, possibly, even predict when they lived based on the age and number of layers in the sedimentary rock.

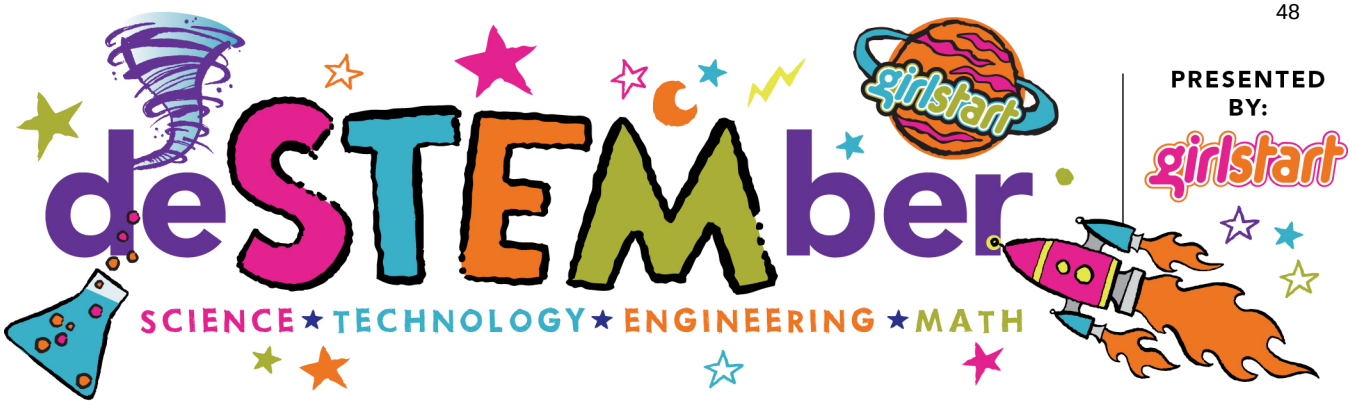


Fossil Detective

Career Connection:

A ***Paleontologist*** studies fossils and uses fossils to try to reconstruct the history of the Earth and the life on it. Paleontologists can provide historical data on past climates and apply it towards understanding future trends and their likely effects. Some paleontologists teach at colleges and some work in museums, while others work for the government or for oil companies needing help finding sources of petroleum.

Resources: http://www.oum.ox.ac.uk/thezone/fossils/intro/form.htm
http://idahoptv.org/dialogue4kids/season6/fossils/facts.cfm
http://petrifiedwoodmuseum.org/FossilTypes.htm



Tech Tuesday

Welcome to Tech Tuesday! One of the many technologies Girlstart empowers our girls to use is Google SketchUp. From architects to engineers, many careers use this software to create models and prototypes. Explore the basic tools within Google SketchUp and create your own 3D virtual masterpiece.

TEKS:

3.6C Create two-dimensional figures, including circles, triangles, rectangles, and squares, as special rectangles, rhombuses, and hexagons

3.6D Identify two-dimensional shapes, including circles, triangles, rectangles, and squares, as special rectangles, rhombuses, and hexagons and describe their attributes using formal geometric language

3.6E Identify three-dimensional solids, including spheres, cones, cylinders, rectangular prisms (including cubes), and triangular prisms, and describe their attributes using formal geometric language

Materials:

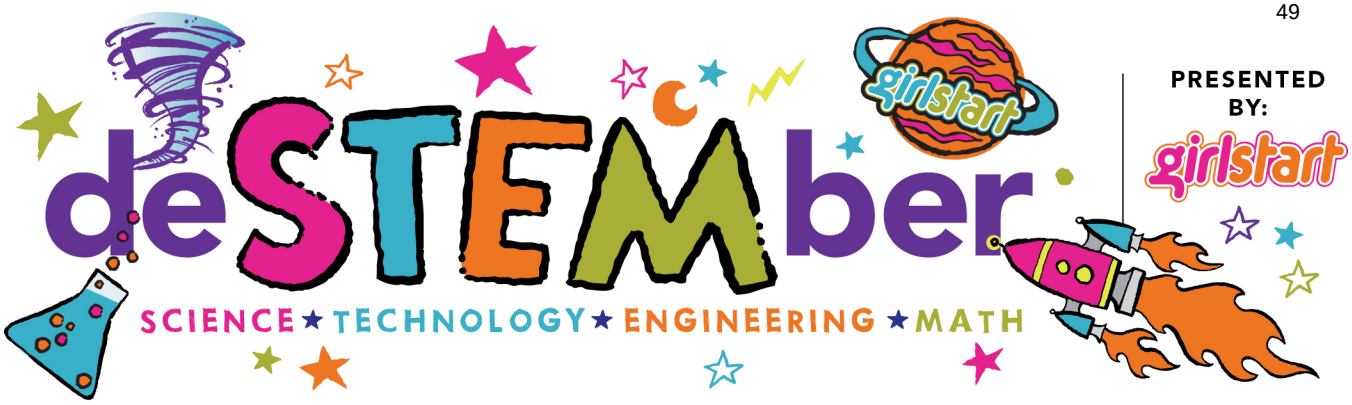
- Computer
- Mouse (not required but is easier to use)
- Access to the internet (only if Google SketchUp isn't already downloaded)

How To

1. Start by downloading Google SketchUp to your computer by going to the link below (ask permission before downloading software):

   http://google-sketchup.en.softonic.com/

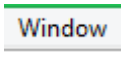
2. Click on the green Free Download button. It should take 1-2 minutes for the download to complete. Step through the set up wizard. When it is finished Google SketchUp is ready to use.
3. Now that you have Google SketchUp downloaded and installed, it's time to learn the basics. Click on the SketchUp icon on your desktop. When the application opens click Start using SketchUp. If it is the first time you use the application, a screen will pop up asking you to choose a template before you can begin using SketchUp.



Tech Tuesday

How To Continued...

4. To begin creating in SketchUp you can use the built in shape tools to create a circle  , rectangle  , or polygon 

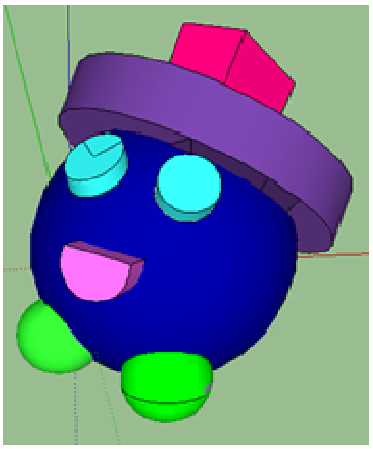
(then click on polygon). You can also freehand your own shape by using the pencil tool  , just make sure any shape you create this way is fully connected otherwise SketchUp will not create a face for it. You now have a two dimensional shape! To make it three dimensional, use the pull/push tool  . You now have a three dimensional object. You can move or rotate a face or edge of the shape you created using the move  or rotate  tools. To move or rotate the whole shape you must use the select tool  and select the whole shape (make sure every face and edge is highlighted blue otherwise some part will be left behind) before using the move and rotate tools. If you make a mistake and want to erase something you can use the erase tool  or go to the edit menu and click undo. To change your view of your object without changing the object itself you can use the pan  , orbit  , and zoom  tools. For more details on how to use each of the tools above you can click on the 

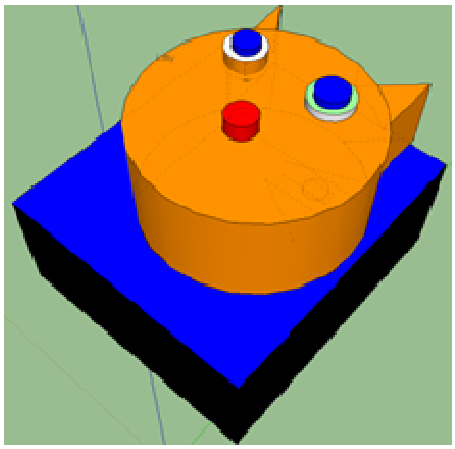
menu and select Instructor, which will open a window which will give you more information about each tool you click on.

Tech Tuesday

How To Continued…

5. Now that you know the basics to Google SketchUp, channel your inner Product Engineer and design a toy prototype. Make sure to define the appropriate age group and functionality of your toy. Here are a few examples Girlstart's Summer Campers created:





Career Connection:

Product engineers are responsible for developing the concept of the product and the design and development of its mechanical, electronics and software components. Product engineers keep in mind cost, producibility, quality, performance, reliability, serviceability and user features. These product characteristics are generally all considering in the attempt to make the resulting product attractive to its intended market.

Resources: http://google-sketchup.en.softonic.com/

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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Electric Pinball

Have you ever played a Pinball game at the arcade? Use your kick stick from December 19th to create your own version of the popular game with a Ping Pong ball. Design a buzzer to sound when you hit your target!

TEKS:

4.6C Demonstrate that electricity travels in a closed path, creating an electrical circuit, and explore an electromagnetic field.

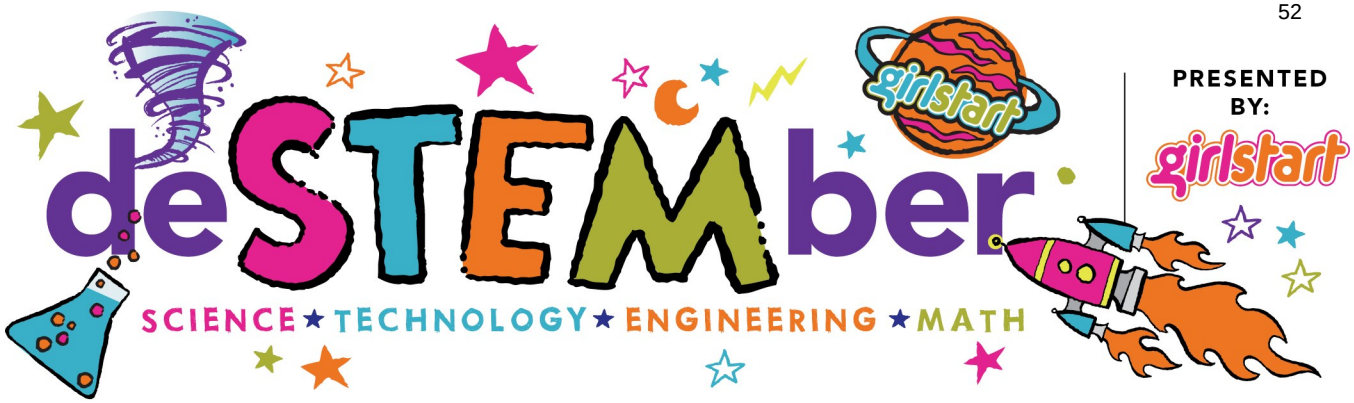
4.6D Design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

Materials:

- 3 oz. paper cup
- 9V battery and holder
- Aluminum foil
- Buzzer
- Duct tape
- Hook-up wire
- Kick stick from December 19th
- Paper clips
- Ping pong ball
- Scissors
- Shallow cardboard box (top of copier-paper box)
- Wire strippers

How To

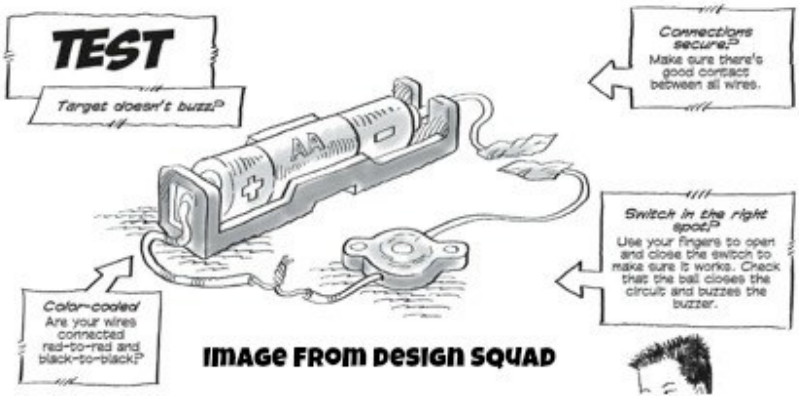
1. Connect the battery, battery holder, wires and buzzer to test the buzzer. All wires must be connected to create a closed circuit and so the buzzer will buzz.
2. Think of the game that you want to play. How do you want to sound the buzzer? How can you create a switch so the buzzer buzzes when the ball hits the target? (Ideas for the target, a sheet of foil hanging down, which can be pushed into contact with wires or paper clips when the ball hits the foil. A ball could also be wrapped in foil, and could contact other foil to close the circuit).



Electric Pinball

Why Does it Work?

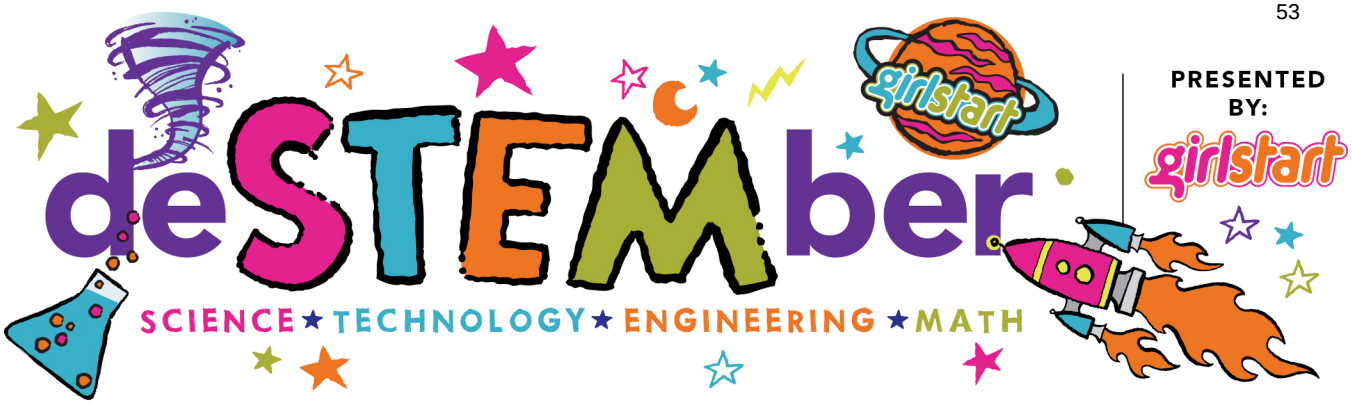
The buzzer only works when the leads are connected red to red and black to black. This is because, to work, a buzzer uses an internal electromagnet. If the current runs the wrong way, the electromagnet doesn't work and the buzzer can't buzz. For the switch to work and the buzzer to buzz, the metal conductors need to touch and contact each other to close the circuit.



Career Connection:

Electrical Engineers study electricity and the equipment to generate and distribute power through the control of machines and communication.

Resources: Pbs.org/designsquad

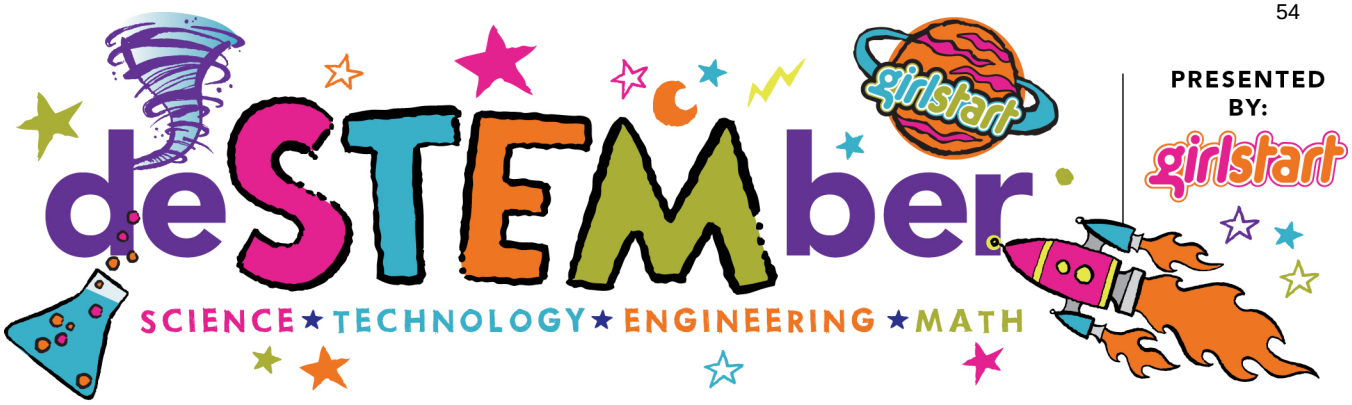


Google Earth Scavenger Hunt

DIRECTIONS: Type these coordinate numbers into Google Earth and guess the famous place. Zoom in and out of the image and click on the pictures available for each site to further explore these amazing places. You can see the answers on the reverse side. Happy Travels!

Coordinates:

1. 14.8388, -17.2339 _____ is known for its pink waters, caused by algae in the water that produces a red pigment that uses sunlight to create more energy, turning the waters pink.
2. 36.7917, -2.8178 _____ is also known as "sea of plastic" due to the numerous greenhouses that cover the area.
3. -77.85, 166.6667 _____ is a U.S. Antarctic science research center. With all months having an average temperature below freezing, this station features a polar ice cap climate. The highest temperature ever recorded was 10.5°C on December 30, 2001.
4. 25.1969, 55.2739 _____ is the tallest man-made structure in the world!
5. 34.901, -107.9381 _____ is a park covered with extremely rough, rugged lava flow.
6. 17.315278, -87.534444 _____ is a limestone, circular sinkhole off the coast of Belize that is nearly 1,000 feet across and has a depth of just over 400 feet. The largest natural formation of its kind in the entire planet!
7. -13.1633, -72.5458 The stones used to build _____ were cut so precisely, and wedged so closely together, that a credit card cannot be inserted between them. This building method is a great engineering advantage for the site since it lies on a seismically unstable country.
8. 46.2339, 6.0558 The _____ is a wooden sphere 27m high and 40m in diameter that symbolizes Planet Earth. This magnificent structure houses a permanent exhibition and is becoming a major symbol of advanced scientific research in the Geneva area.
9. 40.4325, 116.5639 _____ is one of the largest building construction projects ever completed: it is over 5,000 km long!
10. 36.0769, -75.7047 _____ is the place where the self-taught engineers, the Wright Brothers, achieved the first successful airplane flights in 1903, changing our world forever!



Google Earth Scavenger Hunt

Answers:

1. Lake Retba, Senegal
2. Poninente Almeriense in Almeria, Spain
3. McMurdo Station
4. Burj Khalifa
5. El Malpais National Monument
6. The Great Blue Hole
7. Machu Picchu
8. The Globe of Science and Innovation at CER
9. The Great Wall of China
10. Kitty Hawk, North Carolina

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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Sliding Science

Explore the earthquake Richter Scale to visualize how the Earth's movements cause landslides. Design a model town to simulate the effects a sand landslide, gravel landslide or water landslide has on a community and Earth's surface.

TEKS:

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

4.2 & 5.2 The student uses scientific methods during laboratory and outdoor investigations.

4.3 & 5.3 The student uses critical thinking and scientific problem solving to make informed decisions.

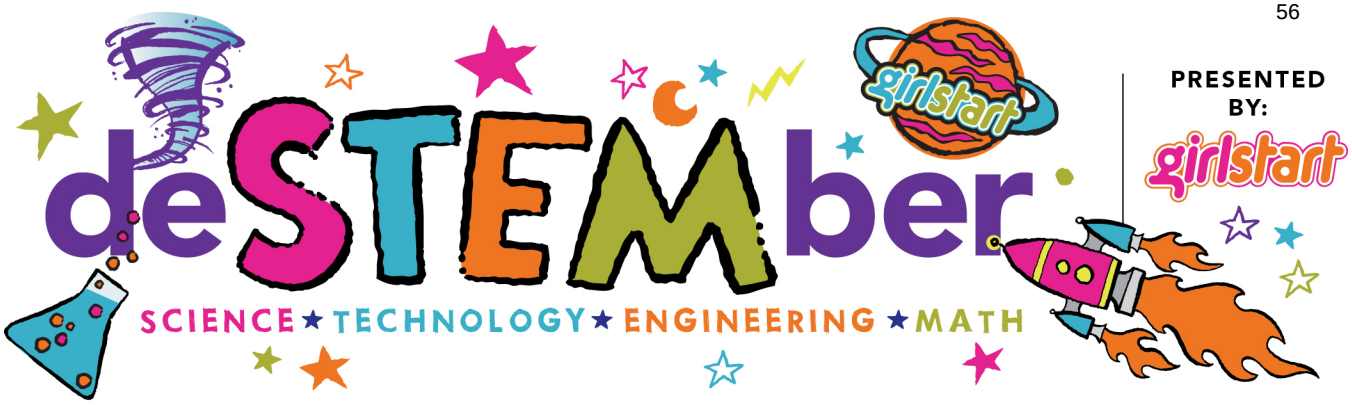
5.6A Identify events that occur on a regular basis such as in daily, weekly, lunar and seasonal cycles.

Materials:

- 2 straws
- 3-4 Lego "houses"
- 9" x 13" Aluminum pan
- Glue
- Large paper clip
- Manilla folder
- Plastic ruler
- Poster board
- Rocks
- Sand
- Sand paper
- Scissors
- Scotch tape
- Tablespoon
- Timer or stopwatch

How To Make Your Town Model

1. Cut out one 2½" x 8" piece of sand paper and a 3½" x 8" piece of poster board. Fold each side of the poster board strip up about ½ inch to form the walls of the slope. Glue the sand paper to ramp with the rough side facing up. Place this ramp on one of the short sides of your aluminum pan so that it goes towards the middle of the pan like a slide and tape it so it stays in place.
2. Place your Lego houses in the pan opposite from your sand paper ramp.
3. Cut out earthquake scale (page 3) and glue along the long side of the Manilla folder with the "Level 1" square in the bottom left corner.
4. Tape a straw on each short end of your Manilla folder and set the aluminum pan in between them.



Sliding Science

How to Make Your Earthquake

1. Place a tablespoon of sand at the top of the ramp and place the paperclip on "Level 1" on the Manilla folder. This marks the level of your "earthquake".
2. Place the Manilla folder with the paperclip lined up along the edge of a table. Gently pull and push the folder for 10 seconds, making sure that the paperclip never goes past the side of the table.
3. Evaluate the damage that was caused to your "town". Did your houses survive or were they wiped out?
4. Repeat steps 1-3 for Levels 2-5 and then do all 5 levels using rocks.
5. Which caused more damage: Level 1 or Level 5? Were rocks more harmful to your town or was sand?

Why Does it Work?

Moving the pan back and forth represents movement of the Earth and when the Earth moves, debris like the sand and rocks starts to shift and fall closer to the Earth's center as a result of gravity. The amount of movement affects how much debris is shifted and the amount of debris affects how much damage is done to a certain area.

Career Connection:

Astronomers study planets, moons, stars, galaxies, meteors, comets and their interactions with each other. They must have an in depth knowledge of physics to understand how forces such as gravity change throughout space. Astronomers work together sharing their knowledge in order to better understand how the universe works at microscopic and macroscopic levels.

Resources: http://video.nationalgeographic.com/video/player/environment/environment-natural-disasters/landslides-and-more/landslides.html
http://science.howstuffworks.com/nature/natural-disasters/earthquake6.htm
http://science.howstuffworks.com/environmental/earth/geology/landslide.htm

Level 5
Level 4
Level 3
Level 2
Level 1

Modified Mercalli Scale		Richter Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibration like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; autos rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos	4.5
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up in air	7
		7.5
		8

Richter Scale

Level	x Level 1
1	-
2	10 x level 1
3	100 x level 1
4	1,000 x level 1
5	10,000 x level 1
6	100,000 x level 1
7	1,000,000 x level 1
8	10,000,000 x level 1
9	100,000,000 x level 1

Images from: kgs.ku.edu

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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Sand Waves

Have you ever noticed how the patterns in sand dunes look like waves? Explore how different sand dunes are formed, move and the effects of sand dune migration. Engineer a solution to help prevent sand dune movement through a costal city.

TEKS:

4.7B Observe and identify slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice.

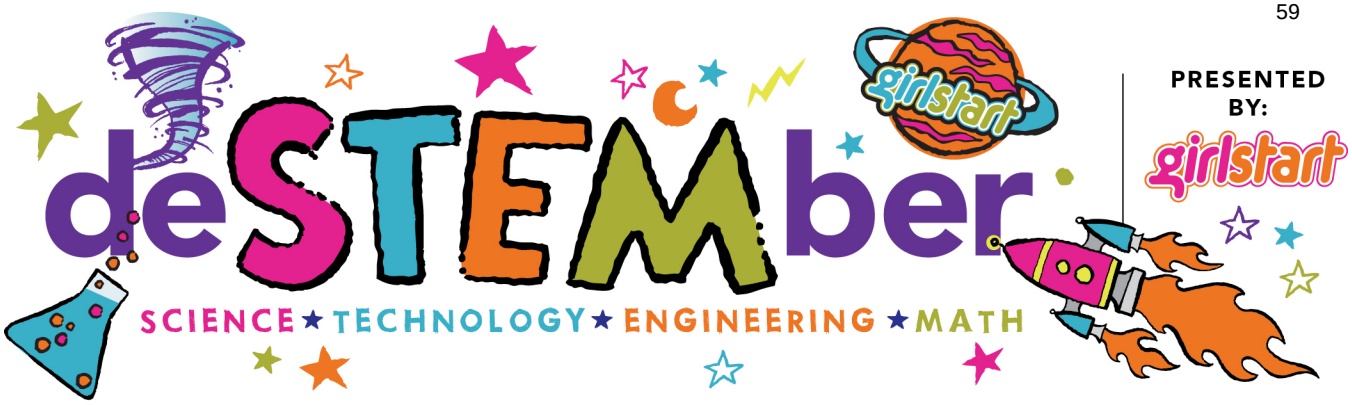
5.7B Recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice.

Materials:

- Aluminum trays
- Craft sticks
- Flexible straws
- Lego pieces
- Natural materials (sticks, rocks, etc.)
- Sand (36 oz. per tray)
- Tape

How To

1. Fill each tray with 36 oz. (four small cupfuls) of sand.
2. Arrange students into groups of 3-4, with one tray of sand per group.
3. Have students take turns blowing gently through straws to form four different types of sand dunes:
   a. Parabolic Dunes – Aim straw at one point and blow
   b. Longitudinal Dunes – Blow over the sand in sweeping side-to-side motions
   c. Star Dunes – Hold straw perpendicular to sand, blow in erratic, inconsistent motions
   d. Arc Dunes – Combine 3 or 4 straws, blow over the sand in an arc pattern
4. Explain that the wind causes sand dunes to migrate, or move across the land (they may have observed this when creating their own dunes).



Sand Waves

How To Continued...

7. Have students set up a "town" with the Legos on one end of their tray, then brainstorm ways to protect the town from migrating sand dunes.
8. Let students build their protective designs from craft sticks, tape, and natural materials.
9. Have students test their designs by blowing sand dunes towards the town and seeing if their obstacles prevent the dunes from covering the town.

Why Does it Work?

Sand dunes form naturally from different patterns of wind. The force of the wind often causes them to migrate across deserts. Migration can be slow (one of the fastest known migrating dunes moves about 100 feet per year) but it's also difficult to stop. Since ancient times, desert civilizations have built walls and other obstacles to prevent migrating dunes from burying their towns.

Career Connection:

Geologists study Earth, the materials of which it is made, the structure of those materials, and the processes acting upon them. Many of the processes include earthquakes, volcanoes, landslides, and floods. An important part of geology is the study of how Earth's materials, structures, processes and organisms have changed over time.

Resources: http://geography.howstuffworks.com/terms-and-associations/sand-dune1.htm

http://pubs.usgs.gov/gip/deserts/dunes/

http://www.nps.gov/grsa/naturescience/dune-types.htm

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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Lava Flow

Have a blast exploring volcanic eruptions! Create your own volcano and watch the lava flow. Try this experiment several times and change variables to see if you can get different results.

TEKS:

3.3C Represent the natural world using models such as volcanoes or Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials.

4.3C Represent the natural world using models such as rivers, stream tables, or fossils and identify their limitations, including accuracy and size.

3.7B Investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides

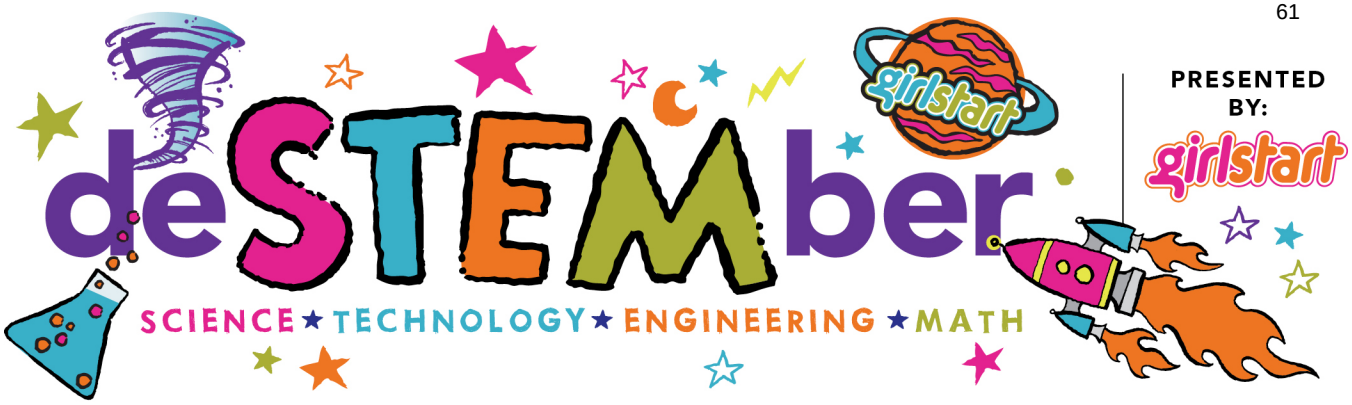
5.5D Identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water.

Materials:

- 1 piece of copy paper
- Baking soda
- Crayons or markers
- Dish soap
- Flat tray or pan
- Red and yellow food coloring
- Scissors
- Spoon
- Tape
- Vinegar
- Vitamin jar or container of similar size

How To

1. Cut a strip of copy paper in half lengthwise.
2. Form an open ended cone shape that is large enough to fit over the vitamin bottle. Make sure that the smaller opening (top of the cone) is large enough to fit your metal spoon through. Tape the ends of the paper to secure the cone shape. Trim the bottom of the cone so that it is straight and can stand up upright.
3. Decorate the cone so that it looks like a volcano.
4. Place the vitamin bottle on the tray with the cone over the top of the bottle.
5. Add two spoonfuls of baking powder.
6. Add about a spoonful of dish soap.
7. Add several drops of red and yellow food coloring.
8. Now that you are ready. Pour in about an ounce of vinegar.
9. Quickly set the lid of the container over the opening. Do not fasten it on the bottle.
10. Watch what happens!



Lava Flow

Why Does it Work?

A volcano is produced over thousands of years as heat and pressure build up. A volcano consists of an opening, or a vent, through which magma and dissolved gases are released. Just underneath the Earth's crust is a layer called the mantle, which is made of up plates that are always moving and shifting. Sometimes the plates separate. That creates heat and causes the mantle to melt into magma. The magma comes up through the crack between the plates, and forms lava at the Earth's surface. The lava spreads out, cools down, and becomes rock again.

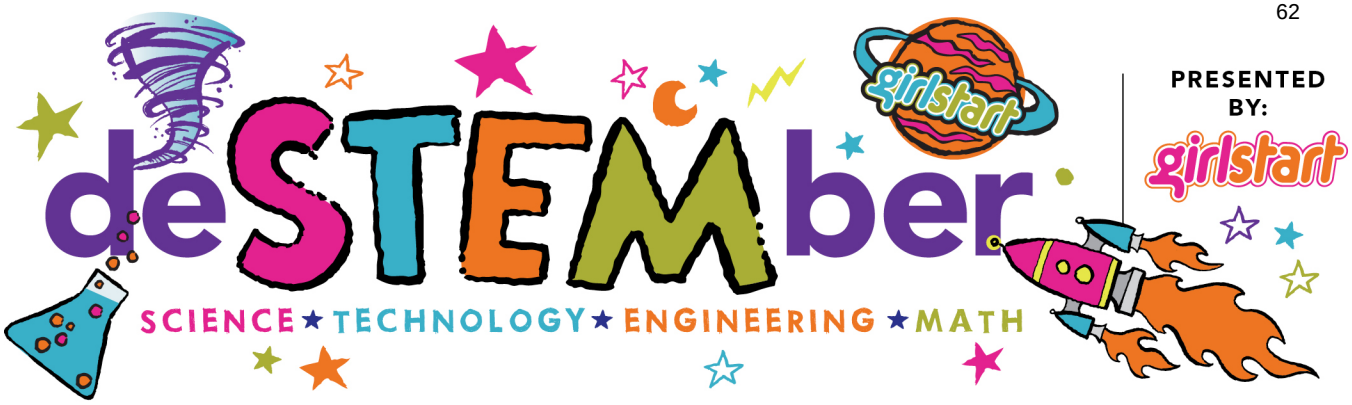
How is this experiment like a volcanic eruption? This volcano model erupts due a chemical reaction between the baking soda and vinegar, and not due to heat and pressure as in a real volcano. Like some volcanoes, this model releases a gas (carbon dioxide) into the air and lava flows slowly over the sides of the vent to form a river or lake of lava. By placing the lid over the medicine bottle you can see how the force of the eruption pushes the lid away from the vent, allowing the lava to flow.

Career Connection:

A ***volcanologist*** studies the remains of either dead or dormant volcanoes and monitors currently present volcanoes that may be active. Volcanologists work to understand how and why volcanoes erupt, how to predict eruptions, the impacts of eruptions on Earth's history and how eruptions affect humans and their environment.

Resources: http://www.sciencebob.com/experiments/volcano.php

http://www.stevespanglerscience.com/lab/experiments/erupting-peroxide-volcano



Dream Big

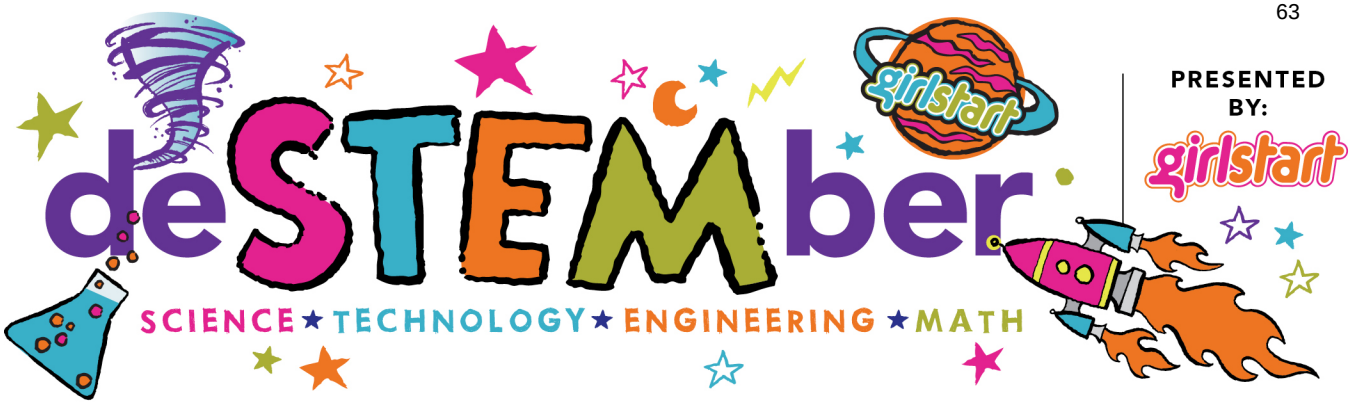
"Every great dream begins with a dreamer." -Harriet Tubman
When coming up with dreams and goals, we not only need to think big but think about the steps it will take to get there. The education and support we receive will help us accomplish these dreams.

Materials per person:

- Ribbon
- 7 beads of different colors:
  - Green
  - Purple
  - Blue
  - Red
  - Orange
  - White
  - Yellow

How To

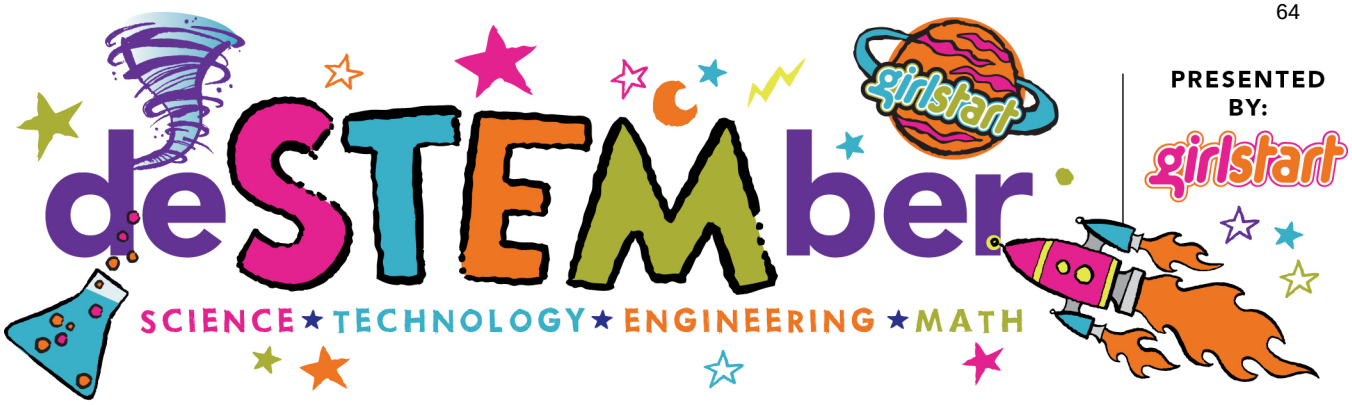
1. Talk about how setting goals is important because it helps set you up for success. They give you something to focus on and work towards. Discuss some of your previous goals with the child and how you have achieved them.
2. Allow child to share their hopes and dreams. Some questions that might get them thinking are: "What is your favorite subject in school and how could you apply that interest and excitement to a future career?" or "If you could be famous for one thing, what would it be?"
3. Discuss how these goals can be achieved. Do you need a certain type of education or support? Do you need to make some short term goals along the way?
4. Talk about obstacles that may come up and how to overcome these obstacles.
5. Tell the child that they are going to make a bracelet to remind them of what they need to achieve their dream. Have them tie a knot on one end of their ribbon so the beads don't slip off as they string their own bracelet.



Dream Big

How To Continued...

6. Pass out one bead at a time and describe the meaning behind each colored bead.
   - White = Elementary School- Starting school gives us a chance to make good habits. Getting our home-work done on time and hard work are a great start to our goals!
   - Yellow = Middle School- Middle school gives you a chance to explore new subjects and other clubs/ school activities that may help grow your dreams.
   - Orange = High School- Working hard in high school gives you a more successful chance of attending the right college for you.
   - Red = College- In college, you can select your major to study exactly what you want to in order to achieve your dreams!
   - Purple = Graduate School- Sometimes for our goals, we need to go to graduate school after school. It allows us to learn more specialized information to be successful.
   - Blue = Professional Program/On the Job Training- Certain jobs require extra certifications and training. These programs usually continue as you work.
   - Green = Career- You've reached your goal career! You can still create new goals to expand your knowledge and help other kids get excited about their futures too.
   - Ribbon = Family & Friends – They are your support through each step and they always help 'tie it all together.'
7. Have the children think about how each bead represents the education and goals they need to achieve their dreams. Some routes may look different but we all need the support to tie it all together.
8. Tell the children to wear their bracelets as a reminder of how to achieve their dreams.



Dream Big

Why Does it Work?

This activity gives children the opportunity to think about their goals and what it takes to meet these goals. They are reminded of the support they will need to achieve them.

Career Connection:

Based on the child's desired career, their path may be different from their peers. But, they all need the same basic supports, such as school, family and friends to succeed. This activity can be used with any career as the end goal and the steps to get there all looking a little different.