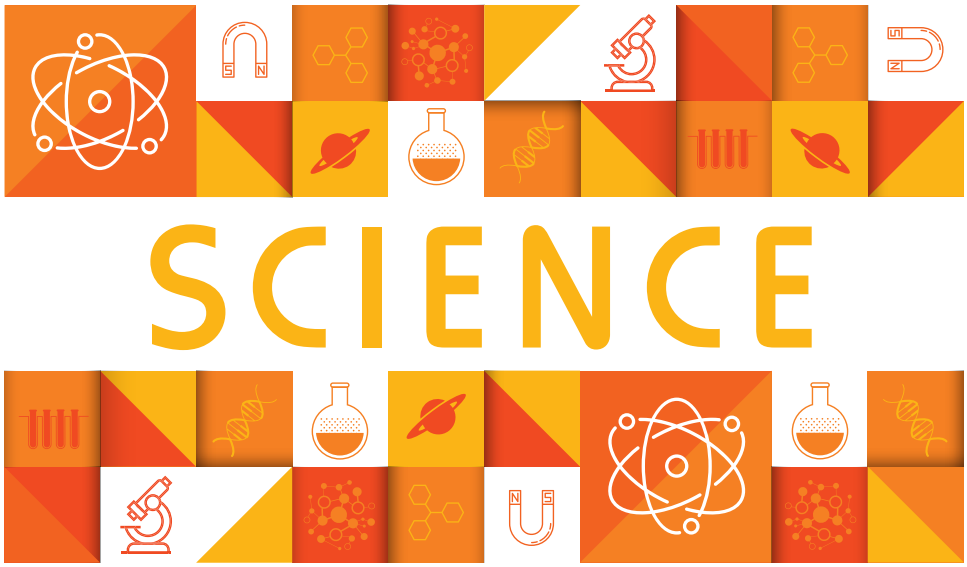

SCIENCE

greater cincinnati STEM collaborative

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

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A-4 CARDS
students Pre-K - 2nd grade

5-9 CARDS
students 3rd – 5th grade

10- K CARDS
students 6th grade and older

Let us know what you think of them by contacting us and include pictures!

A MAGICAL MILK

MATERIALS:
- 1 cup of milk
- 4 tbsp vinegar
- food coloring (optional)
- microwave
- strainer (or paper towels)

STEPS:
1. Warm milk in microwave for one and a half minutes.
2. Add vinegar slowly and stir for about a minute, the milk should start to clump.
3. Strain the milk using the strainer or paper towel, push out all the liquid.
4. Take the solid "plastic" out of strainer and add food coloring if you wish.
5. Use the "plastic" to create different shapes.
6. Set aside to dry – about 2 nights.

ENDING QUESTION:
Why do you think the milk reacted the way it did to the vinegar?

FUN FACT!
The process you just went through is very similar to how you make a popular Indian Cheese, paneer!

A

2 HOT ICE

MATERIALS:
- 4 cups of white vinegar
- 4 tbsp of baking soda
- glass measuring cup
- a pot
- a plate
- a spoon

STEPS:
1. Place 4 cups of vinegar in a pot.
2. Add baking soda to pot, slowly, one tablespoon at a time, stir.
3. Boil the solution over medium low heat for an hour.
4. Pour solution in a glass and place in the fridge to cool (45 minutes).
5. On the plate, add some of the crystals from the pot.
6. Slowly pour the liquid on the plate on top of the crystals.

ENDING QUESTION:
How does how you pour the solution relate to how your ice looks?

CONCEPT EXPLORATION:
You made a solution called sodium acetate, research the qualities of it to learn how this experiment worked!

2

3 WATER XYLOPHONE

MATERIALS:
- mason jars or other glasses (4+)
- food coloring
- water
- spoons

ACTIVITY:
Investigating sound/pitch using water.

STEPS:
1. Fill the jars with varying levels of water.
2. Add food coloring to color the water.
3. Tap an empty jar with the spoon.
4. Predict how the jars with water will sound.
5. Tap jars with varying levels of water with the spoon.
6. Have fun creating different beats or songs!

ENDING QUESTION:
How do jars with more water sound compared to jars with less water?

FUN FACT!
*When you made your prediction, you were making something called a **hypothesis**. Try making hypothesizes in other experiments!*

3

4 PENDULUM PAINTING

MATERIALS:
- foam or paper cup
- 2 chairs
- broom
- large paper
- paint or water
- scissors
- string
- tape
- drop cloth

STEPS:
1. Cover the floor with a drop cloth.
2. Poke a hole in the bottom of the cup, and one whole on each side near the rim.
3. Tie the string through the two holes.
4. Place the broom horizontal between two chairs, put string tied cup in middle of broom, over drop cloth.
5. Place paper under cup.
6. Tape the hole on bottom of cup and add paint.
7. Grab the cup, remove the tape and swing.

ENDING QUESTION:
How would changing the length of the string effect the experiment?

FUN FACT!
Take it outside! 1/3 cup of cornstarch, 1/3 cup of water, and a tbsp of washable paint makes washable sidewalk paint.

4

5 RAINBOW CELERY

MATERIALS:
- Celery (with some leaves)
- jars/glasses
- water
- food coloring

ACTIVITY:
Explore "capillary action" in plants using colored water.

STEPS:
1. Add food coloring to the jars/cups of water to create a rainbow.
2. Break celery apart into stalks, add the same amount of water in each cup.
3. Add celery into the cups so the leaves are at the top.
4. Create an observation sheet, mark how you created each color and how many drops you used.
5. Let the celery soak overnight. *Write your prediction on your observation sheet.*

ENDING QUESTION:
What is something other than celery you could use for this experiment?

TIP!
Make sure your water colors are vibrant, if you don't use enough food coloring the experiment will be harder to see.

5

6 ICE GAME

MATERIALS:
- 1 ice cube per player
- ripped paper
- water
- dice
- 6 bowls
- salt
- crushed ice
- coins

STEPS:
1. With 5 of the bowls, fill with the materials so there's one bowl of each material. Leave one empty.
2. Put the bowls in a circle.
3. Have each player put their ice cube in the empty bowl.
4. Take turns rolling the die and moving your ice cube around the "game board".
5. Play until there is only one ice cube left.
6. Last one standing is the winner!

ENDING QUESTION:
What are some other materials that might keep the ice from melting quickly?

FUN FACT!
Hot water freezes faster than cold water.

6

7 FINGER PRINTS

MATERIALS:
- baby powder/flour
- dark piece of paper
- clear tape
- makeup brush

ACTIVITY:
Look for finger prints around the house and match them to family members.

STEPS:
1. Have each family member dip one finger in baby powder/flour.
2. Press finger onto clear tape.
3. Tape the finger print onto the dark paper, write name underneath.
4. Examine finger prints.
5. Using makeup brush, apply baby powder/flour to surfaces/items that might have finger prints.
6. Use the clear tape to pull up the finger print.
7. Try to match the finger prints!

FUN FACT!
The study of fingerprints is called dactyloscopy. No two fingerprints are alike!

7

8 MYSTERIOUS "M"

MATERIALS:
- bowls or cups
- M&M's in all colors
- water

STEPS:
1. Pour water into bowls or cups.
2. Place 1 M&M in each bowl or cup with the "m" facing up.
3. Predict what you think will happen.
4. Wait and observe.

ENDING QUESTION:
The chocolate and candy shell are water soluble meaning water molecules surround the solid and dissolve it in the water.

What else is water soluble?

ONE STEP FURTHER:
Try this activity with other candies to see if they are water soluble (maybe Skittles?).

8

9 RING THE GONG

MATERIALS:
- two different sized metal spoons
- a ruler
- string

ACTIVITY:
Explore sound waves and vibrations by ringing a spoon.

STEPS:
1. Tie the string around the spoon handle so it's in the middle of the string.
2. Wrap the ends of the string around your pointer fingers and plug your ears.
3. Gently hit the ruler against the round part of the spoon.
4. Repeat the experiment using the other sized spoon.

ENDING QUESTION:
How do you think changing the length of the string would affect the sound you hear?

FUN FACT:
The string allows sound waves to travel, the sound of the spoon reverberates, meaning it continues even after you hit the spoon.

9

10 HEAT OF A RAINBOW

MATERIALS:
- different colors of construction paper
- tape/glue
- ice cubes
- lamp
- stopwatch

STEPS:
1. Create open faced paper cubes for each color of paper (see TIP!).
2. Place the paper cubes on it's side under the lamp, put the ice cube inside, turn on the lamp.
3. Start your stop watch (your phone works well!).
4. Record how long it takes for each ice cube to melt.

ENDING QUESTION:
How does knowing which color is the warmest help you in everyday life?

TIP!
Create your cube by cutting the construction paper into a square. Fold the square diagonally, open up and fold the other diagonal. Open up to the square and fold in thirds one way, and then the other. Fold the corners in and tape/glue to hold them.

10

J CLEAN COINS

MATERIALS:
- 1/2 cup lemon juice
- 1/2 cup dish soap
- 1/2 cup baking soda paste (water and baking soda)
- 1/2 cup water
- 1/2 cup cola
- 5 nickels
- 5 pennies

ACTIVITY:
Explore various cleaning solutions and their effects on tarnished and oxidized coins.

STEPS:
1. Fill two cups each half way full with each of the cleaning solutions (i.e. two cups with 1/4 cup of soap each).
2. Record the condition of each coin.
3. Place one of each coin into each solution, soak overnight (i.e. a penny in soap, a nickel in soap).
4. Scoop the coins out of the solutions, label and record the condition of each.
5. Use the toothbrushes to clean the coins, rinse and then re-examine.

ENDING QUESTION:
Did the coins become clean or remain tarnished? Is there a solution that worked best?

EXTEND YOUR LEARNING!
Try this experiment using pennies, nickels, dimes, and quarters. Or use different "cleaning solutions".

J

Q SALTY EGGS

MATERIALS:
- 2 clear glasses
- lukewarm water
- teaspoon
- salt
- egg

ACTIVITY:
Make an egg float using salt.

STEPS:
1. Fill the two clear glasses with water.
2. Drop the egg into one glass of water water. *Record/discuss what happens.*
3. In the other cup, add 1 teaspoon of salt, stir, add the egg. *Record/discuss what happens.*
4. Take turns removing the egg, adding 1 teaspoon of salt, adding the egg until the egg floats at the top of the water.

ENDING QUESTION:
How might this experiment change if you used a different size glass?

FUN FACT!
An object sinks when its density is greater than that of the liquid. An object floats when their density is less than that of the water.

Q

K AN APPLE A DAY

MATERIALS:
- 1 apple (sliced)
- baking soda
- lemon juice
- milk
- vinegar
- 5 bowls

ACTIVITY:
Is there a substance that keeps apples from browning?

STEPS:
1. Slice the apple into equal pieces.
2. Place one apple slice in each bowl.
3. Cover the slice with one substance per bowl, leave one apple with nothing on it.
4. Let the apples soak for an hour.
5. Compare each apple in a substance to the "control" apple.

ENDING QUESTION:
Oxygen reacts with an enzyme in the apple to brown it. How is this similar to when iron or steel rusts?

FUN FACT!
Having a control in an experiment allows you to see how variables (elements that change) affect what you're testing. Try this experiment again but with new variables!

K

greater cincinnati Stem collaborative

The Greater Cincinnati STEM Collaborative (GCSC) is the backbone K-12 STEM education nonprofit on a mission to create a robust STEM pipeline of diverse talent to meet the accelerating demands for STEM jobs in our regions. GCSC connects business, education, and community partners together to create hands-on learning experiences which prepare students to be the innovators and problem solvers of tomorrow.

In collaboration with schools and educators, GCSC supports the following programs:

- 3d Printers Club
- STEM Bicycle Club
- Summer of STEM
- Garden Engineers
- Game On!

To learn more about GCSC and how you can get involved, visit us at:

greater cincinnati Stem collaborative | greatercincystem.org | gcscstemed@gmail.com

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TECHNOLOGY

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A PATTERNED JELLY BEANS

MATERIALS:
- jelly beans (or other multi-colored candies)

ACTIVITY:
Practice writing and understanding patterns using jelly beans.

STEPS:
1. Pour jelly beans on the table and sort by color.
2. Create an *a-b-a-b-a-b* pattern, *a-a-b-a-a-b*, and *a-b-b-a-b-b* pattern together.

   Create an *a-b-c-a-b-c* pattern, *a-a-b-c-a-a-b-c* pattern and *a-b-c-c-a-b-c-c* pattern.
3. Create 3 more patterns together.
4. Take turns starting a pattern and then ask another player to finish the pattern (4 jelly beans).

HOW IS THIS TECHNOLOGY?
Computers are programmed to read complex patterns. Understanding patterns and how they work is a foundational skill for programming.

A

2 PB&J PROGRAMMING

MATERIALS:
- 2 slices of bread
- peanut butter
- blindfold
- jelly
- spatula

ACTIVITY:
Explore how specific a computer programmer must be when programming a robot to do a task.

STEPS:
1. Choose one person to be the "robot" and one to be the "programmer", the robot puts on the blindfold.
2. Robot starts with materials in front of them and spatula in hand.
3. Programmer verbally instructs the robot to make a PB&J sandwich.

RULES:
The programmer cannot use the words "peanut butter, jelly, or bread. The robot must follow the directions exactly as said.

FUN FACT!
The world's largest peanut butter and jelly sandwich weighed 1,342 pounds!

2

3 BREAK THE CODE

MATERIALS:
- cereal box
- construction paper
- marker
- scissors
- ruler

ACTIVITY:
Create a code breaker strip and write your own secret codes.

STEPS:
1. Cut a 3" x 7.5" rectangle from the cereal box.
2. Make a 1" slit at the top and bottom of the rectangle.
3. Cut a 1" x 9" strip of construction paper and thread it through the slits of the rectangle.
4. On the cereal box rectangle, write letters A-M on the left and N-Z on the right.
5. On the construction strip, write the letters in any order.
6. Line the letters on the strip to the cereal box letters to reveal your code.
7. Create fun secret messages for family members to figure out!

3

4 BE MY GUIDE

ACTIVITY:
Explore the concepts of algorithms by guiding someone to a destination.

STEPS:
1. Start in a room in your house, blindfold one player.
2. Pick a different room or place to direct the blindfolded player.
3. The remaining family members will take turns giving one direction to the blindfolded player.
4. Once the player gets to the new destination they have to guess where they are. Then a new person is blindfolded and the game repeats.

ENDING QUESTION:
Which direction is the hardest to give and follow?

GO FURTHER!
Have each family member give their direction and have the blindfolded person complete the actions after everyone has said it.

4

5 BACKYARD CODING

ACTIVITY:
Explore how conditional statements work in coding.

STEPS:
1. Assign one person to be the "Programmer", everyone else is a "Computer".
2. The "Programmer" will give a command and perform it, and the "computers" respond accordingly:

   "Programmer" Commands

   If I Do This, Then You Do This.
   -If I jump, then you jump.

   If I Do This, Then You Do That.
   -If I jump, then you sit.

   If I Do This, Then You Do That, Else You Do Something Else.
   -If I jump, then you sit, else raise your right arm.
3. If the "computers" respond incorrectly they are out, last person in wins and becomes the "computer".

5

6 SUPERHERO CODING

MATERIALS:
- post-its or paper squares
- superhero
- "obstacles"
- "coins"
- paper
- paper

ACTIVITY:
Use basic programming ideas and commands to direct the superhero from the start to the finish avoiding obstacles and collecting "coins".

STEPS:
1. Set up your game board by laying out post-its or paper squares in a 10 x 10 grid.
2. Have one player mark a start and finish square, place "obstacles" in any box (make sure a route is still available), add "coins" for the superhero to grab.
3. A different player should write the code, one box at a time, using the commands *"Forward, Turn Left, Turn Right"* on paper.
4. Give the piece of paper to the first player and have them move the superhero through the course according to the commands.

6

7 STOP ACTION MOVIE

MATERIALS:
- camera
- toys

ACTIVITY:
Create a 1-minute Stop Action Movie.

Stop action movies are created by putting together multiple still frame pictures. Between pictures you move the characters slightly so when put together it looks like they are moving.

GUIDING QUESTIONS:
1. What will your movie be about?
2. How do you want your characters to move? Which toys would be best?
3. Where is the best lighting for your set?

STEPS:
1. Put together your set and characters.
2. Take pictures as necessary (at least 100).
3. Use a Stop Motion software (Stop Motion Studio is FREE!) to create your movie.
4. Add narration, voiceover or music.

FIND INSPIRATION!
Wallace and Gromit, or the Box Trolls are examples of Stop Action Movies. Look up other movies or videos to understand how they work.

8 TOONTASTIC

ACTIVITY:
Use the Toontastic program/app to create a story and bring it to life – in 3D!

STEPS:
1. Together, decide what you want your story to be about.
2. Download Toontastic.
3. Have each family member create a character for the movie.
4. Plot your story using one of Toontastic's Story Arcs.
5. Animate your movie and record your voice as narration.
6. Add music to the background. *Pop some popcorn and watch your movie together!*

ENDING QUESTION:
Which part of making your own movie was the most fun?

TIP:
If you don't have a computer or smart phone, plan a trip to the library! They have computers and tablets you can use with your library card.

9 BINARY JEWELRY

MATERIALS:
- Binary Code
- 3 different colors of beads
- paper
- pencil
- string

ACTIVITY:
Write your names in binary code and use beads to make jewelry.

STEPS:
1. Google "Binary Code Alphabet" and write each letter and its code on your paper (ex. A= 01000001).
2. On a new piece of paper, write each letter of your name, next to it write the correct code.
3. Assign one color of beads for 0, 1 and a space.
4. Using your sheet is a guide, thread the beads on the string for each letter in your name or just your initials according to binary code.

Wear your latest fashion proudly!

ENDING QUESTION:
Why is binary code only 0s and 1s? What does that mean?

10 PROGRAMMING PICTURES

MATERIALS:
- Graph Paper
- pencils

PROGRAMMING KEY:
- Move one square forward
- Move one square backwards
- Move one square up
- Move one square down
- Change to the next color
- Fill in square with color

STEPS:
1. Have each person create a picture in a 10 x 10 square on graph paper.
2. Using the programming key, write an "algorithm" for each line. You should only use the symbols, no words.
3. Give your algorithm to a different family member with a clean sheet of graph paper.
4. Follow the algorithm to draw the picture, see if they got it right. *If they didn't, look back at the algorithm and see what might have happened.*

CONCEPT EXPLORATION:
An algorithm is a series of instructions on how to accomplish a task. Computers use algorithms constantly.

J SCRATCH!

ACTIVITY:
Explore the website/app "Scratch" and create your own chase game.

STEPS:
1. Log onto Scratch or download the app onto a smartphone or tablet.
2. Spend some time looking at some of the projects people have made.
3. Together, design a chase game. Think about the characters you might want.
4. Work together to drag and drop code the game, how do you want your characters to move?
5. Decide how you want to earn points during your game.
6. Finish the game and take turns playing!

ENDING QUESTION:
How might you adjust your game to make it harder?

KEEP GOING!
You can use Scratch to make stories and animations as well. Try and make something else as a family! You can also try Scratch Jr. if Scratch is too hard.

Q BREAK THE RIDDLE

MATERIALS:
- binary code alphabet (found on google)
- pen
- paper

ACTIVITY:
Use binary code to solve riddles.

STEPS:
1. Have each family member come up with two riddles and write them on a piece of paper. Don't write the answer.
2. Write the answer on a different piece of paper in binary code.
3. Cut the riddles and answers into strips and place them in two different piles.
4. Translate the answers into letters from code.
5. Pick a riddle from the pile and read it, pick the decoded answer that best fits.

ENDING QUESTION:
Do you notice a pattern in binary code?

RIDDLE!
How far can a fox run in the woods?

Only halfway, otherwise it would be running out of the woods!

K TELESTORY STAR

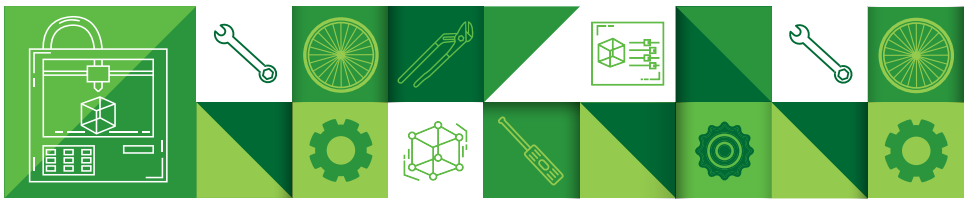
ACTIVITY:
Use the app "Telestory" to create a family TV show.

STEPS:
1. Download the app "Telestory" on a tablet or smartphone.
2. Choose a theme for the tv show.
3. Take turns selecting a scene, cue card, and costume. Each family member should record at least one scene for your TV show.
4. Save your TV show and share it with friends!

TV SHOW IDEAS:
Make a parody of a tv show you watch as a family, create your own reality tv show, pretend you have your own cooking show, solve a crime.

ENDING QUESTION:
How else can you combine STEM and art?

FUN FACT!
The average person in the United States will spend 15 years of their life watching TV!



ENGINEERING

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A WRECKING BALL

POTENTIAL MATERIALS:
- plastic cups
- "ball"
- other household materials
- straws
- string
- tape

DESIGN CHALLENGE:
Create a wrecking ball out of household items that will knock over a pyramid of cups.

DESIGN ELEMENTS:
Wrecking balls are made of a heavy materials and hung from a cable/chain which is attached to a tall structure.

GUIDING QUESTIONS:
1. What might make a good "wrecking ball"?
2. How will you support the weight of the wrecking ball?
3. Besides being tall, what else is needed of your structure?

ENDING QUESTION:
What element of the system was most important?

FUN FACT!
Today, wrecking balls are being replaced by high reach excavators!

A

2 PARACHUTE PHYSICS

POTENTIAL MATERIALS:
- cloth
- plastic bags
- small object
- paper
- string
- scissors

DESIGN CHALLENGE:
Create a parachute that will allow the object to fall the slowest.

DESIGN ELEMENTS:
Parachutes are made of a light, strong fabric designed to make heavy objects fall slower.

GUIDING QUESTIONS:
1. What material could you use as the parachute?
2. How do you need to attach the parachute to the object?
3. What shape/design should the parachute be?

ENDING QUESTION:
Why do certain materials work better than others as a parachute?

ACTIVITY EXPLAINED!
Parachutes work because of air resistance. The more of the air's mass the parachute can "catch" the slower it falls.

2

3 SPAGHETTI TOWER

MATERIALS:
- 20 spaghetti noodles (uncooked)
- 1 yard of tape
- 1 yard of string
- 1 marshmallow

DESIGN CHALLENGE:
You have 15 minutes to build the tallest possible tower that can support a marshmallow.

GUIDING QUESTIONS:
1. Spaghetti noodles are very brittle, how can you make them stronger?
2. How will you get your tower to stand on the table?
3. What shapes might be good for building a tower?
4. What is the best way to add the marshmallow to your structure?

ENDING QUESTION:
What is one thing you would change about your tower and why?

TRY IT AGAIN!
Try this activity again but have each person make their own tower! Whose tower was the tallest?

3

4 CATAPULT

POTENTIAL MATERIALS:
- popsicle sticks
- rubber bands
- plastic spoon

DESIGN CHALLENGE:
Using the materials, design a catapult that will launch a pom pom (or other small object) in the air.

DESIGN ELEMENTS:
The most common catapult is a "mangonel" which has an arm with a bowl shaped bucket, a frame containing a cross bar to stop the arm, and a mechanism to allow the arm to spring forward.

GUIDING QUESTIONS:
1. How might you get the arm to spring forward?
2. Where do the arm and frame need to connect?
3. What action do you need to do to launch the catapult?

FUN FACT!
The first catapults were used in ancient Greece around 399 B.C. They're also a great way to teach Newton's 3 Laws of Motion!

4

5 MARBLE ROLLERCOASTER

POTENTIAL MATERIALS:
- paper towel/toilet paper tubes
- marbles (or other small balls)
- tape
- scissors

DESIGN CHALLENGE:
Create a marble rollercoaster out of household items.

DESIGN ELEMENTS:
Create a rollercoaster track using the wall as support that can transport a marble from the top to the bottom.

GUIDING QUESTIONS:
1. What materials can be used for the track?
2. How will you attach the track to the wall?
3. Does your track need to be continuous or can there be gaps?

ENDING QUESTION:
How is this "rollercoaster" different than rollercoasters at amusement parks?

EXTENSION!
Have a lot of materials? Form two teams and create two rollercoasters and race. Discuss why one design was better than the other?

5

6 SUSPENSION BRIDGE

POTENTIAL MATERIALS:
- Cereal box
- toilet paper tubes
- twine/string
- tape
- rubber bands

DESIGN CHALLENGE:
Create a suspension bridge that holds the weight of a toy car.

DESIGN ELEMENTS:
A suspension bridge is a deck (the road) with cables hanging from tall towers. Typically, there is a long cable suspended horizontally between the towers with vertical cables connected from it to the deck.

GUIDING QUESTIONS:
1. How will you affix the bridge to the floor?
2. How will you connect the cables to the deck?
3. Do your cables need slack or should they be taut?
4. How will your car drive onto the bridge?

HOW IT WORKS!
The weight of the deck is supported by the balanced forces of the two towers. The force pulling inwards is equal to that pulling outwards.

6

7 PENNY BOATS

MATERIALS:
- Foil
- Shallow Bin
- Pennies
- Water

DESIGN CHALLENGE:
Construct a boat from an aluminum foil square that can hold as many pennies as possible.

STEPS:
1. Cut the foil into a square that is between 4" by 4" and 12" by 12".
2. Shape your foil square into a boat. You can create your own design or use a specific boat as inspiration.
3. Fill your bin with at least 4" of water.
4. Make a prediction! How many pennies do you think your boat will hold?
5. Take turns placing one penny in the boat at a time until it sinks.

ENDING QUESTION:
How would your result change if your boat was bigger? Smaller?

CONCEPT EXPLORATION!
This activity looked at buoyancy and water displacement. See what you can learn about them!

8 EGG DROP!

POTENTIAL MATERIALS:
- egg
- sponges
- straws
- other household materials
- cardboard
- cotton balls
- tape

DESIGN CHALLENGE:
Have each family member create a container that will keep a raw egg safe when it is dropped from a height.

DESIGN ELEMENTS:
Keeping the egg safe means finding a way to pad its fall or slow it down enough so it won't crack. Many designs find ways to cover the egg so it doesn't make direct contact with the ground.

GUIDING QUESTIONS:
1. What items could be used as padding?
2. How will you secure the egg while it falls?
3. How could you slow down the egg when it is falling?
4. How might height affect this experiment?

CHALLENGE YOURSELF!
Do this activity again but with extra rules. Examples: Use the least amount of materials, design in 5 minutes, etc..

9 BALLOON CARS

POTENTIAL MATERIALS:
- cardboard
- balloons
- paper plates
- toilet paper tubes
- straws
- tape
- string
- glue

DESIGN CHALLENGE:
Each family member must create a car with wheels that roll and a balloon "engine."

DESIGN ELEMENTS:
The most important design aspects of the car are the wheels, axel, body, and the balloon.

GUIDING QUESTIONS:
1. How will you attach the axel/wheels so the car rolls?
2. Where is the best place to put the balloon? How will you attach the balloon?
3. What will you use for the wheels?
4. Where is the best place for you to race?

FUN FACT!
The average car has 1,800 separate parts and requires between 4,500 – 4,800 welds to fit together! How about your car?

10 BASKETBALL TOWER

MATERIALS:
- newspaper
- masking tape
- basketball

DESIGN CHALLENGE:
Build a tower out of newspaper and masking tape that will support a basketball.

DESIGN ELEMENTS:
The tower must be able to stand by itself and hold the weight of the basketball for one minute.

GUIDING QUESTIONS:
1. How will you get the tower to stand?
2. How will you get the basketball to balance on your tower?
3. How can you manipulate the newspaper to make it stronger?

EXTEND THE ACTIVITY!
Newspaper is a lot stronger than you think. See if you can design a newspaper stool that will hold your weight.

J DIY TRAMPOLINE

POTENTIAL MATERIALS:
- colander
- rubber bands
- tape
- plastic bag
- tooth picks
- binder clips
- ball
- fabric

DESIGN CHALLENGE:
Create a trampoline together that will be able to bounce a ball at least 8 inches.

DESIGN ELEMENTS:
Trampolines have a thicker, stretchy material, springs that attach it to a frame.

GUIDING QUESTIONS:
1. How do trampolines work? What is important to make sure your design has?
2. How will you connect your fabric to the frame?
3. What will you build your frame out of?

CONCEPT EXPLORATION!
Trampolines apply Hooke's Law of Physics. The law states the amount of force you exert on a spring, the equal amount will be returned. Learn more about it!

Q MISSION SPACE LANDER

POTENTIAL MATERIALS:
- index cards
- marshmallows
- other household materials
- paper
- straws
- dixie cups

DESIGN CHALLENGE:
Design and build a shock-absorbing lander to protect two "aliens" (marshmallows) as they crash from 2 feet in the air.

DESIGN ELEMENTS:
The space lander must have legs that allow it to stand when dropped and keeps the marshmallows contained.

GUIDING QUESTIONS:
1. How might you absorb the impact of the fall?
2. What will your structure look like? You can research what the Mars Rover looks like as inspiration.
3. What part does weight distribution play in your design?

LEARN MORE!
NASA Jet Propulsion Laboratory created a video to describe the challenges of landing the Curiosity rover on Mars. Google it!

K FOOSBALL TABLE

POTENTIAL MATERIALS:
- cardboard
- wooden dowels
- ping pong balls
- rubber bands
- other household materials
- straws
- paper
- pencils
- tape

DESIGN CHALLENGE:
Construct a functioning foosball table that has at least 12 players and 6 rods with a goal at each end.

DESIGN ELEMENTS:
Foosball tables have rods that push, pull, and turn to control the players which are secure so they don't fall off when they hit the ball. The player can hit the ball on either side.

GUIDING QUESTIONS:
1. What could you use for the rods?
2. How will you attach the players so they can move on the rod?
3. What material is strong enough to "kick" the ball?

FUN FACT!
The longest game of foosball ever took 61 hours and 17 minutes. That's over two days of playing!

greater cincinnati Stem collaborative

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- Game On!

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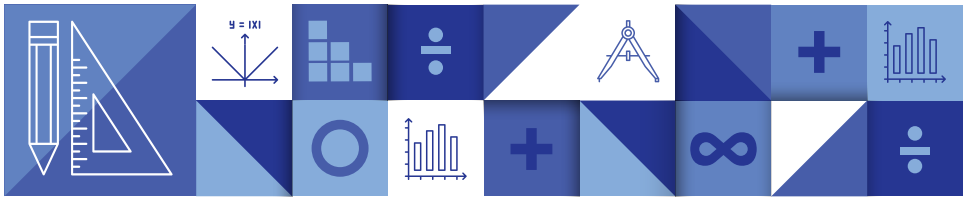
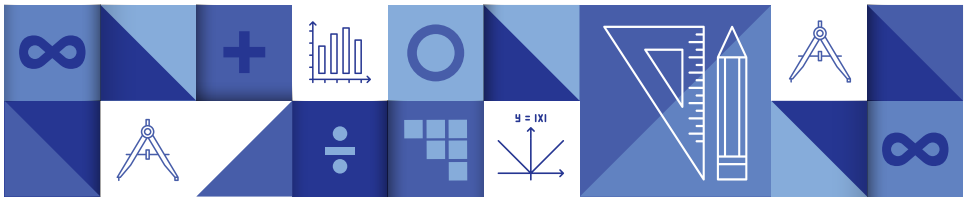


MATH



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SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

Welcome to your deck of Family STEM Cards! These cards are meant to be a way for the whole family to get involved in STEM and see that STEM happens everywhere!

HOW THEY WORK:
There are four "suits" of cards, just like a normal deck. In each suit you will find a different theme of activities – science, technology, engineering, or math

A-4 CARDS
students Pre-K - 2nd grade

5-9 CARDS
students 3rd – 5th grade

10- K CARDS
students 6th grade and older

Let us know what you think of them by contacting us and include pictures!

A TANGRAMS

MATERIALS:
- construction paper
- scissors
- ruler
- pencil

ACTIVITY:
Create tangrams to make pictures out of geometric shapes.

STEPS:
1. Using the materials create a variety of shapes (triangles, squares, rectangles) at least 4 of each.
2. Together pick a theme (space, ocean, outdoors, etc).
3. Each person should pick an object/thing within the theme (rocket, alien, UFO, etc).
4. Work together to create each person's object out of tangrams. *You could also Google tangram outlines and use those!*

ENDING QUESTION:
What shapes were you not able to make with the tangrams?

DIVE DEEPER!
When you are creating your shapes, talk about the properties of each shape. How many sides, edges, vertices are there?

A

2 MATH MEMORY

MATERIALS:
- paper
- scissors
- marker

ACTIVITY:
Solve math problems while playing the memory game.

STEPS:
1. Decide how big you want your game board to be (5x5 – 9x9).
2. Fold your paper in half, on one side write an addition or subtraction problem, on the other side write the answer to create "cards".
3. Create as many problems as you need for your board. Cut out the "cards".
4. Place "cards" face down.
5. Take turns flipping over 2 cards at a time trying to find the matching problem and answer. *The person with the most matches wins!*

ENDING QUESTION:
What was the most difficult part of this game?

TOO EASY?
You can make the game harder by adding multiplication and division problems.

2

3 RACE TO A DOLLAR

MATERIALS:
- bag of coins
- 1 die

ACTIVITY:
Collect pennies and trade them for other coins to reach a dollar.

STEPS:
1. Roll the die and collect that many pennies.
2. Pass the die to each player.
3. At the beginning of your turn you can trade pennies for other ex. 5 pennies for a nickel).
4. Before each roll announce how much money you have. *Take turns until someone reaches a dollar*

ENDING QUESTION:
How could you adjust the game to play with dollar bills?

FUN FACT!
A numismatist is someone who studies and collects things that are used as money!

3

4 ROLL THE DICE

MATERIALS:
- pencil
- dice
- paper
- coin

ACTIVITY:
Practice addition and subtraction.

STEPS:
1. Assign addition and subtraction to the heads and tails of the coin.
2. Roll both dice, flip the coin.
3. Use the numbers of the dice and the coin to create a problem and solve on paper.
4. Pass to the next player and repeat *After 10 rounds, add together the answers of each problem, the player with the largest sum wins!*

Modifications:
Use 4 dice: *2 dice are tens place 2 dice are the ones place. Practice adding and subtracting double digit numbers.*
Use 2 coins: *1 coin is for addition and subtraction, 1 coin is for multiplication and division. Create two problems per turn.*

HINT!
Don't have dice at your house? You can make some! Make a cube out of paper and add the dots. You could even make dice with higher numbers!

4

5 AREA GAME

MATERIALS:
- graph paper
- 2 markers
- 2 dice

STEPS:
1. Divide the graph paper in half hamburger style.
2. Player one takes both dice and rolls them, one die is the width of the rectangle, the other is the length.
3. Player one draws a rectangle of those dimensions on their side of the board and writes the area inside.
4. Each player repeats steps 2 and 3, placing the new rectangles wherever they'd like on their side. Rectangles cannot overlap. *The player to fill up the most area wins!*

ENDING QUESTION:
How does the placement of your rectangles matter in this game?

GO FURTHER!
To find area, you multiply the length by the width. Try a game where you have to find the perimeter of each rectangle too!

5

6 TASTE THE MATH

MATERIALS:
- cereal/candies
- paper

ACTIVITY:
Using arrays to visualize multiplication.

STEPS:
1. Have two people say a number between 1-10.
2. Use the two numbers to make an array with the cereal/candy.
3. On the paper write the multiplication problem, repeated addition, and answer.
4. Repeat until you can't make any more arrays or resist eating the cereal/candy.

ENDING QUESTION:
What are some of the patterns you saw in your arrays?

TIP!
Arrays show that multiplication is repeated addition. 4 x 3 is four rows of three or 3+3+3+3.

6

7 LACY PLATES

MATERIALS:
- paper plates
- hole punch
- tape
- marker
- string/yarn

STEPS:
1. Punch 10 holes on the rim of the plate.
2. In the center write the number you want to skip count by (ex. 2).
3. At each hole write the numbers randomly (ex. 2,12,8,20,18, etc).
4. Starting with the smallest number, skip count and thread the string through the correctly numbered hole.
5. Tape the string in place at the starting number and mark the path on the back of the plate.
6. Unlace the plate and use it to practice skip counting! *Make as many lacy plates as you want!*

ENDING QUESTION:
Ending Question: How does skip counting relate to multiplication?

EXTEND THE ACTIVITY!
You can punch as many holes in the plate as you want to practice counting higher.

8 BOWLING FOR GRAPHS

MATERIALS:
- 20 plastic cups
- paper
- markers
- tape
- ball

ACTIVITY:
Create a graph based on how many cups are knocked down.

STEPS:
1. Tape 2 cups together where the mouths meet. Continue until you have 10 "pins".
2. Set up "pins" in the same way bowling pins are set up.
3. Stand at least 10 ft away and use the ball to "bowl".
4. Use the paper and marker to record how many pins are knocked down.
5. After each person takes 10 turns, create a bar graph to show which number of pins was knocked down the most.

ENDING QUESTION:
What other graphs could you make to show data collected?

TIP!
If you don't have that many plastic cups, search around your house for other items you could use as pins.

9 FACTOR GAME

MATERIALS:
- 2 different colored writing utensils
- paper

ACTIVITY:
Determine the factors of numbers when multiplied.

STEPS:
1. On the paper write the numbers 1-30.
2. Player 1 chooses a number and marks it with a circle.
3. Player 2 then marks all remaining factors of Player 1's number with a square.
4. Player 2 then chooses a number. Player 1 marks remaining factors.
5. Repeat until are numbers have a mark.

Scoring: *Player choosing the number receives points equal to the number they choose (i.e. 21 = 21 points). Player marking factors gets points equal to all of the remaining factors (i.e. 3 + 7 = 10 points).*

ENDING QUESTION:
Why do some numbers have more factors than others?

HINT!
A factor is a number you multiply to get another number. 2 x 3 = 6, the factors of this equation are 2 and 3.

10 SWEET FRACTIONS, DECIMALS AND PERCENTAGES

MATERIALS:
- 1 pack of Skittles or M&Ms
- crayons/colored pencils
- paper
- pencil

ACTIVITY:
Determine the fraction, decimal and percentages for each color of candy.

STEPS:
1. Pour 20 candies out of the bag and separate by color, assign each family member a color.
2. On the paper, create a section for each color and label.
3. Starting with the first color, count the number of candies and write a fraction.
4. Calculate the fraction as a decimal.
5. Turn the decimal into a percentage.
6. Calculate the number back into a fraction. *Repeat steps 3-6 with each color.*

ENDING QUESTION:
What is a graph you could make using the data collected?

TIPS!
Fraction to decimal - divide the numerator by the denominator. Decimal to percent - move the decimal two places right. Percent to fraction - put the percent over 100 and simplify.

J BLOCKO

MATERIALS:
- paper
- 12 Legos (or other small object) per player
- pencil
- 2 dice

ACTIVITY:
Explore experimental probability.

STEPS:
1. Create a game board with 11 columns numbered 2-12.
2. Give each player 12 Legos and place them on any number (you can place more than one on a number).
3. Roll two dice and announce the sum of the dice.
4. If there is a Lego under that number on the game board it is removed (only one at a time).
5. Make a tally for each sum rolled. *The first player to remove all their Leogs wins!*

ENDING QUESTION:
Using the tallies on the game board, what was the experimental probability of rolling each sum?

HINT!
Experimental probability is the ratio of the number of times an event occurs to the number of trials the event was repeated for.

Q DEAL OR NO DEAL?

MATERIALS:
- Store ads
- pencil
- paper
- glue

ACTIVITY:
Finding the unit price of items to determine the best value.

STEPS:
1. Pick an item and gather 6-10 different prices.
2. Label your paper "picture", "unit price" and "best deal".
3. Glue the pictures and price of items in the first section.
4. In the second section, determine the unit price by putting the price over the unit.
5. Complete for each pictured item.
6. After, determine the best deal and mark it. *Remember, if your items aren't in the same unit you will need to convert (i.e. cups and oz).*

ENDING QUESTION:
What unit price would be the most helpful for your family to know?

TIP!
If you don't have any paper ads at your house you can use a grocery store app or online store.

K STAINED GLASS

MATERIALS:
- graph paper
- markers
- ruler

ACTIVITY:
Graph linear equations by solving for coordinate points.

STEPS:
1. Prep the graph paper by creating an X,Y axis in the middle (use both positive and negative numbers).
2. Create twelve linear equations.
3. Solve each linear equation by selecting at least 3 values.
4. After solving each equation, plot the coordinate points.
5. Use the ruler to create your lines, color in between the lines to create the stained glass.

ENDING QUESTION:
How does changing your equations adjust how your lines plot?

HINT!
y= 2x +1, 5x = 6+ 3y, y/2 = 3 –x are all examples of linear equations.

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