

MAE AND GERTY
AND THE MATTER WITH MATTER
**EDUCATOR'S
GUIDE**

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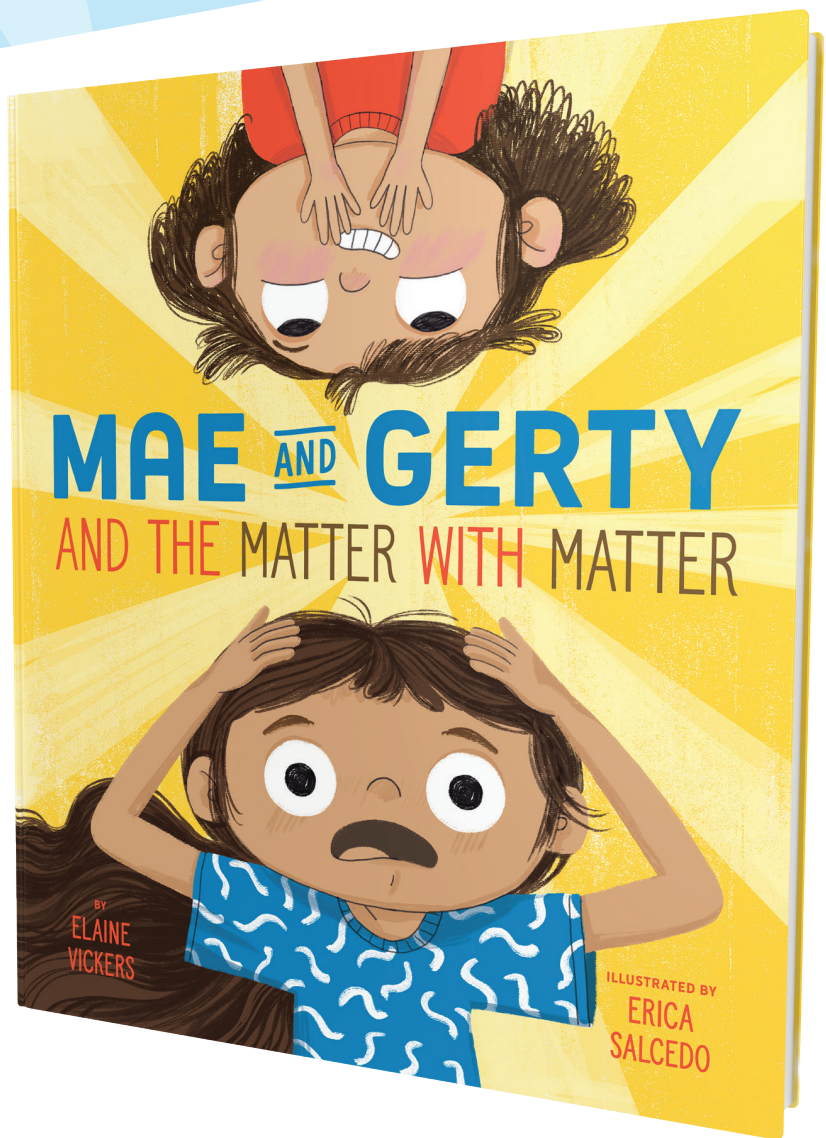
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PUSHING, PULLING, AND COLLIDING

MAGNETIC CARS

“Fantastic!” cried Dad. “Look at all the ways she can manipulate matter: pushing, pulling, and colliding!”

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Can you use a magnet to drive a car around a track using push and pull motions?

WHAT YOU NEED:

- Car
- Two magnets (heavy-duty will work best!)
- Tape or rubber band
- Racetrack or designated driving area

INSTRUCTIONS:

- Use tape or a rubber band to secure one magnet to the car.
- Use the other magnet to race the car along the track or designated driving area.
- Experiment with when you need to use the magnet to push or to pull the car along the track.

QUESTIONS TO EXPLORE LEARNING:

- When did you need to use the magnet to push the car? When did you use it to pull the car?
- Was driving a car with a magnet easy or hard?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Pushes, Pulls, Collisions, and Direction Changes: K.PS2.1, K.PS2.2

Motion and Stability: Forces and Interactions: MS-PS2-3

Motion and Stability: Forces and Interactions: MS-PS2-5

Additional Standards:

Math Standard 1.MD.4 - Take various data points, how far the cars traveled, how fast, etc. and use them to organize, interpret, and compare.

Math Standard 7.RP.A.2 - Using magnetic cars to solve problems involving distance, speed, and time.



VIBRATIONS & SOUNDS

MARACAS

“Yes!” said Mom. “Sound can make matter vibrate, and vibrating matter can make sound!” Mae plugged her ears and stomped upstairs, but Gerty’s music made the whole house vibrate.

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With just a few simple supplies from the list below, and the help of an adult, you can explore vibrating matter with your very own maraca—complete with its own unique look, sounds, and vibrations!

WHAT YOU NEED:

- Disposable spoons
- Plastic eggs
- Uncooked rice, dried beans, or lentils
- Glue (hot glue will work best)
- Optional: Decorative tape

INSTRUCTIONS:

- Open a plastic egg and fill with a few spoonfuls of rice (or your choice of dried beans/lentils).
- Glue two spoons to either side of the egg, and glue the ends of their handles together. (Grab an adult to help you if you are using hot glue.)
- Let the glue dry.
- Optional: Place a strip of decorative tape around where the spoons are glued to the egg as well as where the spoons are glued together at the ends for an artistic touch.

QUESTIONS TO EXPLORE LEARNING:

- What happens when you shake the maracas?
- How do the maracas make noise?
- Do the rice, beans, and other lentils make different sounds when being shaken? Or if you used the same filling for all your eggs, did it matter how much or how little you put in?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Waves and Their Application in Technologies for Information Transfer: 1-PS4-1

Additional Standards:

Fine Arts Standard K.M.R.1: Use the maracas to explore creating a steady beat, repeating patterns, and expressive elements.

Fine Arts Standard 1.M.P.2: Explore dynamics by playing the maracas at various volumes, soft vs. loud, and create contrast.

Fine Arts Standard 4.M.P.2: Using the maracas (and possibly other instruments), allow students to explore various dynamic levels, tempos, etc.



VIBRATIONS & SOUNDS

SEARCH AND FIND EVERYDAY INSTRUMENTS

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What objects can you find in your house that would make good instruments? Can you find an object that makes a high-pitch sound when vibrated? Can you find an object that has a low pitch? Which objects that you found are the loudest? Which objects are the quietest?



CHANGING MATTER FROM ONE STATE TO ANOTHER STATE

HOMEMADE CRYSTALS

“Marvelous!” said her parents. “She’s changing matter from one type to another.”

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With some patience and the supplies below, you will end this experiment with unique crystals that come in a variety of shapes and sizes and can be used as decorations, jewelry, or gifts. The only limit is your imagination!

WHAT YOU NEED:

- Pipe cleaners
- Popsicle stick
- 4 cups boiling water
- 1 ¼ cup borax
- Glass jar with a wide opening
- Adult to help with the borax/water mixture

INSTRUCTIONS:

- Shape the pipe cleaner: swirl the center to look like a spiral, make a heart, a snowflake, or whatever shape you like.
- Attach the shaped pipe cleaner to the popsicle stick using another pipe cleaner. TIP: Attach the shaped pipe cleaner to the other pipe cleaner first, then wrap it generously around the popsicle stick.
- Grab an adult to help you boil the water and pour it into a glass jar. Then pour in the borax and mix until dissolved (do not move on to the next step until the borax is fully dissolved).
- Place the jar somewhere where it won't get disturbed.
- Place the pipe cleaner into the borax solution, with the popsicle stick holding it in place. TIP: Make sure it is fully submerged and not touching any edges of the jar.

- Leave the jar at least overnight—the longer the better! Plus, make sure it does not get moved.
- Once the crystals are formed, remove it from the solution and leave to dry. Marvelous!

QUESTIONS TO EXPLORE LEARNING:

- What happens to the borax when it is combined with water?
- How long did it take for the crystals to appear?
- What happens if you leave your object in the borax solution longer?
- What kind of shapes and textures do the crystals that formed create?
- Are the crystals colored, or is the color coming from the pipe cleaner?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Observe and Classify Different Properties of Matter: 2-PS1-1
Mixing Substances: Properties of Matter: 5-PS1-4

Additional Standards:

Fine Arts Standard 2.V.CR.2: Students can use the borax crystal-making to explore various types of materials used in art.

Fine Arts Standard 3.V.CR.3: Students can demonstrate using new and different art materials safely.

CREATE “DELICIOUS MATTER!”

ICE CREAM IN A BAG

They even experimented with chemistry and made some matter that was very delicious indeed.

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Did you know that ice cream is a liquid, solid, and gas all at once? It's true! It has solid ice crystals, liquid milk fat, and air bubbles, making it a perfect (and delicious) combination of all states of matter.

WHAT YOU NEED:

- 1 cup half-and-half
- 2 Tbsp. sugar
- ½ tsp. vanilla extract
- 3 cups ice
- ⅓ cup rock salt or kosher salt
- Sandwich size zip-close bag
- 1 gallon-size zip-close bag
- Plastic spoon
- Mixing bowl or pitcher

Makes one serving.

INSTRUCTIONS:

- Mix the half-and-half, sugar, and vanilla extract together in a pitcher.
- Pour the mixture into the zip-close bag.
- Fill a gallon-size zip-close bag about half full of ice and then add ⅓ cup rock salt or kosher salt
- Place the small sealed sandwich bag into the gallon-size bag. Seal the gallon-size bag firmly. (If creating more than one serving of ice cream, you can place up to two small sandwich bags in each gallon-size bag.)
- Shake, roll, or toss the bag; feel free to pause every 7–10 minutes and observe the changes taking place within the mixture.

QUESTIONS TO EXPLORE LEARNING:

- What did you notice as the liquid solution changed to a solid?
- How long did it take?
- When and where did you observe the three states of matter?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Structure, Properties, and Heating and Cooling of Matter:
2-PS1-4

Particles of Matter and Mixing/Creating New Substances:
5-PS1, 5-PS1-4

Additional Standards:

1st and 2nd Grade Writing Standard 1: Write an opinion piece on the experiment/taste of homemade ice cream.

5th Grade Writing Standard 3: Write a narrative using descriptive details and clear event sequence about how your experience of making homemade ice cream went.

ART PROJECTS WITH MATTER

FIZZY PAINTING

.....

Create an abstract painting while exploring states of matter through the combination of baking soda and vinegar. This art project is great for at home or learning in the classroom.

WHAT YOU NEED:

- Small tray (aluminum foil works great)
- Droppers
- Food coloring
- Jars or cups (one for each color)
- Vinegar
- Baking soda

INSTRUCTIONS:

- Pour half a cup of vinegar in each jar or cup.
- Put 2–3 drops of food coloring into vinegar and mix together.
- Place one dropper in each jar/cup.
- Spread baking soda out across the bottom of your entire tray.
- Use the droppers to drop the colored vinegar mixture onto the baking soda, to “paint.”
- Observe what happens when the liquid and solid mix together.

QUESTIONS TO EXPLORE LEARNING:

- What happens when the liquid and solid mix together?
- What new colors can you create using the colors you already have?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Chemical Reactions: Can the changes in matter be reversed? 2-PS1-4



ART PROJECTS WITH MATTER

MELTED CRAYON ART

Do you know what happens to matter when heat is added? Have fun as you combine science and art to complete this project!

WHAT YOU NEED:

- Canvas (any size works - the smaller it is, the fewer crayons you will need; the bigger it is, the more crayons you will need)
- Crayons, with the outside wrapper taken off
- Hot glue
- Blow-dryer
- Plastic sheet or wax paper, or foil that can be ruined

INSTRUCTIONS:

- Lay the crayons across the top of your canvas so they are touching to see how many you will need.
- Then get an adult to help you hot glue the crayons into place.
- Set the canvas up so the crayons are at the top and your plastic sheet is underneath the canvas.
- Take your blow-dryer and heat up the crayons so they begin dripping down the canvas to create your abstract crayon art.
- Blow-dry until you get your desired results!

QUESTIONS TO EXPLORE LEARNING:

- What states of matter did you notice during this experiment?
- What happens when heat is added to matter?
- How did your masterpiece turn out? Can you spot any abstract objects or items in your completed art project?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Heating and Cooling Matter: 2-PS1-4



THREE STATES OF MATTER ACTIVITIES

THREE STATES OF MATTER SCAVENGER HUNT

Go on a walk around the house, school, or outside. While walking, see how many different states of matter you can spot. Can you spot liquids? Can you spot solids? Can you see gasses? Now can you spot five or ten or twenty of each? See if you can make a record with most states of matter spotted! You can also make a list, draw pictures, or collect samples of the states of matter that you spot.

QUESTIONS TO EXPLORE LEARNING:

- What properties did you notice about each liquid, solid, or gas?
- Are there any similarities between the different types of matter? Differences?
- Which state of matter did you observe the most on your scavenger hunt?
- Can you graph your findings?

EDUCATORS – CONNECTION TO STANDARDS:

Next Generation Science Standards:

Observe and Classify Different Properties of Matter: 2-PS1-1

Observe and Identify Matter: 5-PS1-3

Additional Standards:

Math 3.MD.3: Draw a scaled picture graph and bar graph to represent data with several categories. Have students graph the number of liquids, solids, and gasses they observed on their scavenger hunt.

Math 2.MD.D.10: Draw a picture graph and bar graph to represent data with up to four categories.

