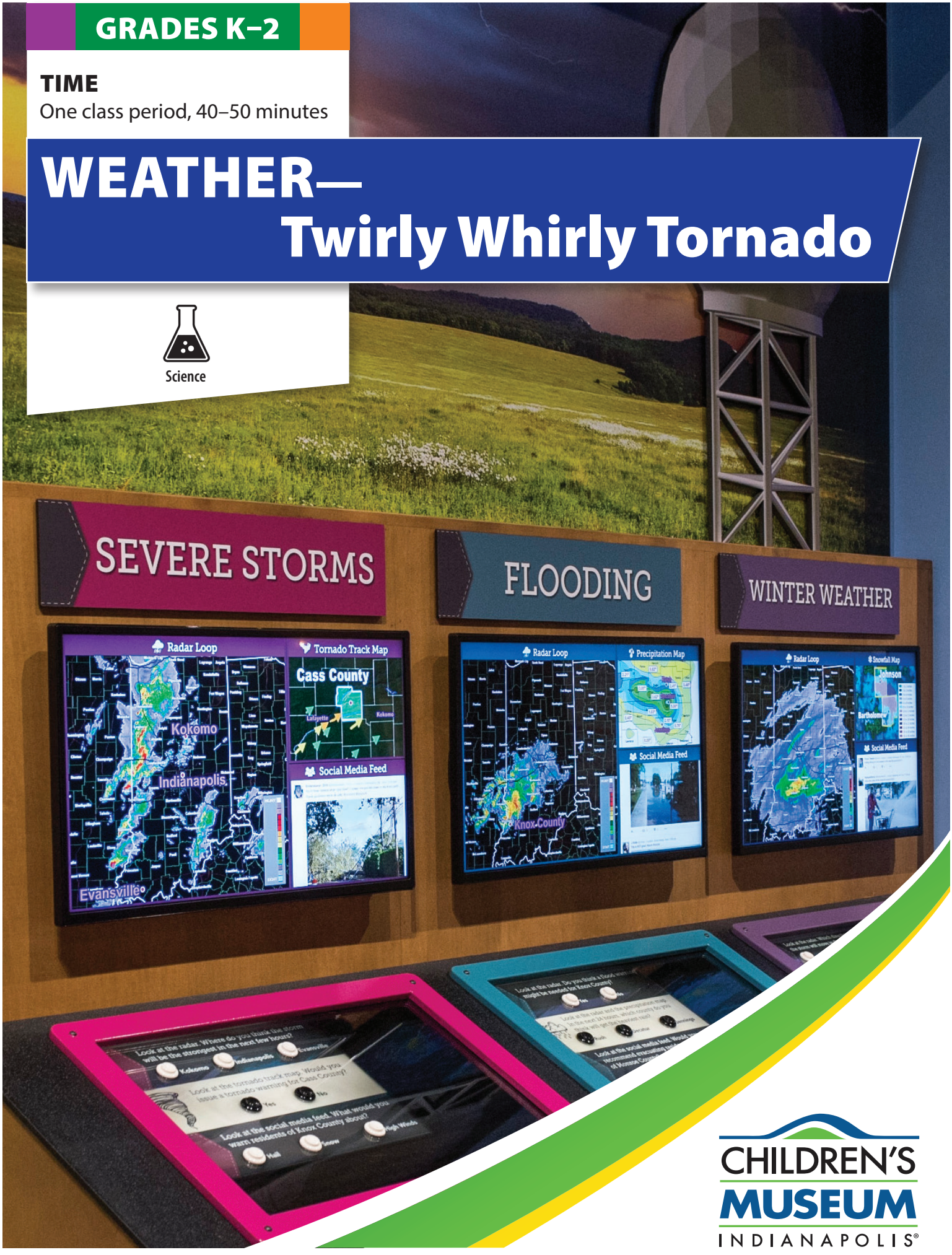
GRADES K–2

TIME
One class period, 40–50 minutes

WEATHER—
Twirly Whirly Tornado

Science



CHILDREN'S MUSEUM INDIANAPOLIS®

WEATHER–TWIRLY WHIRLY TORNADO

The Children's Museum's lessons are designed to weave classroom experiences and museum education together. All lessons are interdisciplinary and can be used as individual classroom experiences or in combination to create a cohesive unit. Lessons are optimized when used in connection with museum field trips.

One of the most common, and dangerous, weather events in North America is a tornado. When different sources of air collide, and the combination of moisture, wind, and air temperature are just right, a tornado can be formed.

A tornado is a twirling **vortex** of air that forms a funnel and includes dangerously strong winds. Meteorologists can predict conditions that might produce tornados by understanding the unique conditions needed for tornadoes to form. In this lesson, students will witness the creation of a funnel, observe how a funnel moves debris, and learn how a thunderstorm can create tornados.

INDIANA ACADEMIC STANDARDS

Science: K.PS.3, 2.ESS.2, 2.ESS.3, K-2.E.1, K-2.E.2

OBJECTIVES

Participants will:

- Identify components of a tornado
- Understand the science of tornado formation
- Design a model demonstrating a funnel
- Describe why monitoring weather is important

FOCUS QUESTIONS

- How is a tornado's funnel cloud formed?
- What important factors are needed to create a tornado?
- What happens to objects caught in a tornado's vortex?
- What makes a tornado dangerous?

MATERIALS

- Two 2-liter clear plastic bottles, empty and clean (Note: Any two same-size plastic bottles will work, but larger bottles will be more effective for the observation)
- Water
- Blue food coloring
- Large glitter
- Duct tape
- Small foam balls, leaves, etc. for debris (optional)
- Large nail or power drill

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Creating a Funnel

Read all instructions before beginning the lab activity. Remember to wear safety equipment at all times.

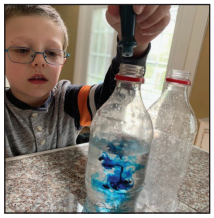
PROCEDURES

Preparation of materials:

- Clean the two 2-liter soda bottles and remove any labels.
- Place the bottle caps together on the top side and create a ½ inch hole using a drill or a large nail.
  NOTE: Adults should complete this part!

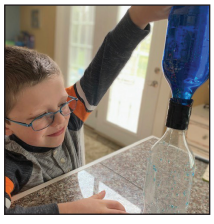
Part 1

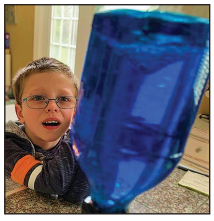
1. Ask students: What is a tornado? Discuss with students what they know about tornados and what they look like.
2. Introduce students to the characteristics the atmosphere needs for a tornado to form:
   - Warm, wet air mass near the Earth's surface
   - Dry, cool air mass sitting above the wet air
   - Rapid temperature drop
   - Rapid change in wind-speed
3. Clarify that air masses often collide without forming tornadoes. It takes circumstances being just right for the proper type of **instability** to result in rotation and tornadoes.
4. Ask students: Have you ever seen a large amount of water draining out of a sink or bathtub? How would you describe how that looked?
5. Share with students that when they see a vortex in water, the water is moving quickly towards the drain and the suction caused by the drain forces the water to form a spiraling formation.
6. Compare and contrast how the water drain vortex might be similar to a tornado funnel.
7. Recall with students that when the combination of moisture, wind, and air temperature are just right, a tornado can form similarly to the water vortex they have seen in the bathtub.
8. Explain to students that they will now see how water can create a vortex that is similar to a tornado.



Part 2

1. Fill one bottle two-thirds full with water.
2. Add blue food coloring and glitter (if you have decided to use any of the other optional debris, you can add that now too).
3. Secure the tops to both the empty bottle and the bottle containing water.
4. Tip the empty bottle upside down on top of the full bottle. The caps should be lined up so the holes in the caps are aligned. Secure the caps together by wrapping duct tape tightly around them.
5. Once the tape is secured, flip the bottles over so the full one is on top and the empty bottle is now on the bottom.
6. To create the vortex twirl the top bottle in a circular motion. This will simulate the instability between air masses created by moisture levels, wind speed, and air temperature.
7. Instruct students to observe the debris as the kinetic energy (energy of motion) changes the speed and size of the vortex.
8. Discuss with students their observations about the size of the vortex, the speed of the water, and what happened to the debris in the water.
9. Finally, have the students reflect on the type of damage that might be caused by a tornado in our community. Encourage them to use their observations of the glitter and debris from the experiment. Then, have them compare and contrast the destruction that could happen in the countryside versus in a neighborhood or a busy city.



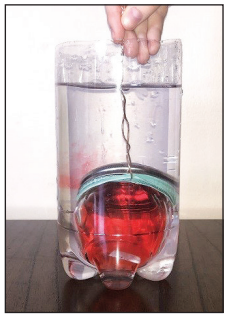


Demonstrating Instability

If students have trouble understanding what instability means, have them try this activity to demonstrate:

- Fill a bottle or pitcher with cold water and fill an old spice jar with hot colored water.
- Attach a wire or string to the spice jar (using a rubber band might help)
- Lower the spice jar of hot colored water into the bottle of cold water.
- Have students observe what they see happening between the two different temperature waters.

This activity will demonstrate to the students what instability looks like. Instability in the atmosphere is a key element needed for tornados. The warmer, less-dense water rises around the colder more-dense water. As the warmer water rises, it eventually cools, and comes back down. This type of circulation in air caused by heat transfer is called convection and it can create the instability needed to form strong storms that can lead to the development of tornados.



VOCABULARY

- **Vortex**
- **Instability**

DO YOU KNOW?

- The majority of tornados occur in April, May and June, when the temperatures are still cool, but the earth begins to warm.
- Tornados usually reach a speed of 25 to 40 mph. Some tornadoes can twirl up to 70 mph when the weather system is particularly volatile. The highest wind speed recorded inside a tornado has reached close to 300 mph.
- Many places across the globe have seen the occurrence of tornados; however, in frequency and intensity, North American holds the highest numbers.
- An average of 1,300 tornados touch down on United States' soil each year.
- The difference between a Tornado Watch and Warning can be explained by using a cupcake analogy! The recipe and baking ingredients represent a Watch where a cupcake (or tornado) could possibly be created from the ingredients (or tornado formed from atmospheric conditions present) and the iced cupcake represents a Warning that a cupcake has been baked (or a tornado has been spotted)!
- Created in 2007, The Enhanced Fujita Scale rates tornado damage on a scale from 0 to 5. The data used to rate the storms predicts the wind speeds, potential damage to structures, and gives meteorologist and the general public a better idea of the danger of the storm.

"CHASING THE STORM"

Movies, television, and other media often sensationalize people who seek adventure by following tornados. While there are many people that choose to follow tornados for various reasons, Meteorologist take the task of monitoring tornados very seriously and cautiously. They are not adventurers, but scientists, and these individuals are on the front lines of following tornados and severe thunderstorms to keep communities safe and procure data to increase understanding of tornado formation. Meteorologists primarily monitor weather with equipment that can collect data from a safe distance. As described by The National Severe Storms Laboratory, collecting data by going out into dangerous weather is rare and only professional meteorologist with degrees and research needs should do such activities under strict guidance.