



STEM KIT

EDUCATOR GUIDE

TORNADO

CREATED FOR BOTH HOME AND SCHOOL



PERFECT FOR
THE CLASSROOM

DESIGNED BY TEACHERS FOR TEACHERS

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LESSON OVERVIEW

Class Information

In this exciting STEM lesson, students will explore tornadoes and the science behind extreme weather. They'll learn about the difference between weather and climate, the causes and effects of natural disasters, and the unique conditions that lead to tornado formation. The lesson will dive into the physics of tornadoes, focusing on concepts like vortices and air dynamics, to help students understand how tornadoes develop their powerful spinning motion. To bring the science to life, students will build their own DIY Tornado STEM Kit, creating a mini vortex that demonstrates the swirling motion of real tornadoes. This hands-on activity will reinforce key concepts, showing how air movement, pressure changes, and rotation come together to form these incredible natural phenomena.

CONCEPTS



Weather



Climate



Natural Disasters



Vortex



Air Pressure



Tornado Formation



LESSON OBJECTIVES

-  **Understand Weather and Climate:** Students will differentiate between weather and climate and explain how atmospheric conditions contribute to natural disasters like tornadoes.
-  **Explore Tornado Physics:** Students will describe the formation of tornadoes, focusing on vortices, air pressure, and wind dynamics.
-  **Investigate Air Dynamics:** Students will observe how changes in air movement and pressure create rotating systems, simulating a tornado's vortex.
-  **Apply Scientific Concepts Hands-On:** Students will build and test a DIY Tornado STEM Kit to demonstrate their understanding of tornado formation and the science behind vortices.

EDUCATIONAL STANDARDS

NGSS - Next Generation Science Standards

2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

INTRODUCTION

Hey, scientists! Have you ever seen a tornado in a video or maybe heard about one on the news? Tornadoes are powerful, spinning storms that can twist and turn with incredible force, like nature's very own giant vacuum cleaner in the sky! Today, we're going to become weather detectives, learning all about tornadoes, weather and climate, and how these swirling storms are formed. We'll discover what makes a tornado spin, what a vortex is, and how air pressure and wind dynamics create these amazing natural events. But the best part? We're going to build our very own DIY Tornado STEM Kit to create a mini tornado right here in class! Get ready to explore, experiment, and watch the science of tornadoes come to life!

VOCABULARY

Tornado – A rapidly rotating column of air that extends from a thunderstorm to the ground, often appearing as a funnel-shaped cloud. Tornadoes can cause significant destruction due to their intense winds.

Vortex – A spinning, circular flow of air, water, or another fluid around a central axis. Tornadoes, whirlpools, and hurricanes all exhibit vortex motion.

Weather – The short-term atmospheric conditions in a specific place at a specific time, including temperature, humidity, precipitation, wind, and pressure.

Climate – The long-term patterns of weather in a particular region over an extended period, typically measured over decades or centuries.

Natural Disaster – A catastrophic event caused by natural forces, such as tornadoes, hurricanes, earthquakes, floods, or wildfires, that can result in damage, loss of life, and environmental impact.

Air Pressure – The force exerted by the weight of air molecules on a surface. It is typically measured in units like millibars (mb) or inches of mercury (inHg) and affects weather patterns and altitude changes.

Wind – The movement of air from an area of high pressure to an area of low pressure. Wind can vary in speed and direction, influencing weather patterns.

Atmosphere – The layer of gases surrounding a planet, such as Earth's atmosphere, which is made up of nitrogen, oxygen, and other gases that support life and influence weather and climate.

Condensation – The process by which water vapor in the air cools and changes into liquid water, forming clouds, dew, or fog. This is a key part of the water cycle.

Updraft – A rising column of warm air, often found in thunderstorms and tornado formation. Updrafts help fuel storm development by lifting warm, moist air.

Storm – A material that blocks light completely, like wood or metal.

Weather and Climate

Understanding weather and climate is essential to grasping the world around us and how it impacts our daily lives. While these two terms are often used interchangeably, they refer to different aspects of our environment.

What is Weather?

Weather refers to the short-term atmospheric conditions in a particular area. These conditions can change from hour to hour and day to day, and they are typically influenced by several factors such as *temperature, humidity, precipitation, wind speed, and air pressure*. In simpler terms, weather is what is happening in the atmosphere at a given moment or over a short period of time.

For example, today you might notice that it's a sunny day. Tomorrow, however, the forecast may predict thunderstorms and cooler temperatures. This fluctuation in weather is caused by constantly changing atmospheric conditions that vary depending on many different factors, including the movement of air masses and the position of the Earth relative to the sun.

Meteorologists, the scientists who study weather, use various tools that allow them to measure temperature, pressure, wind speed, and other variables, which they then use to forecast the weather for a specific location over the coming days.



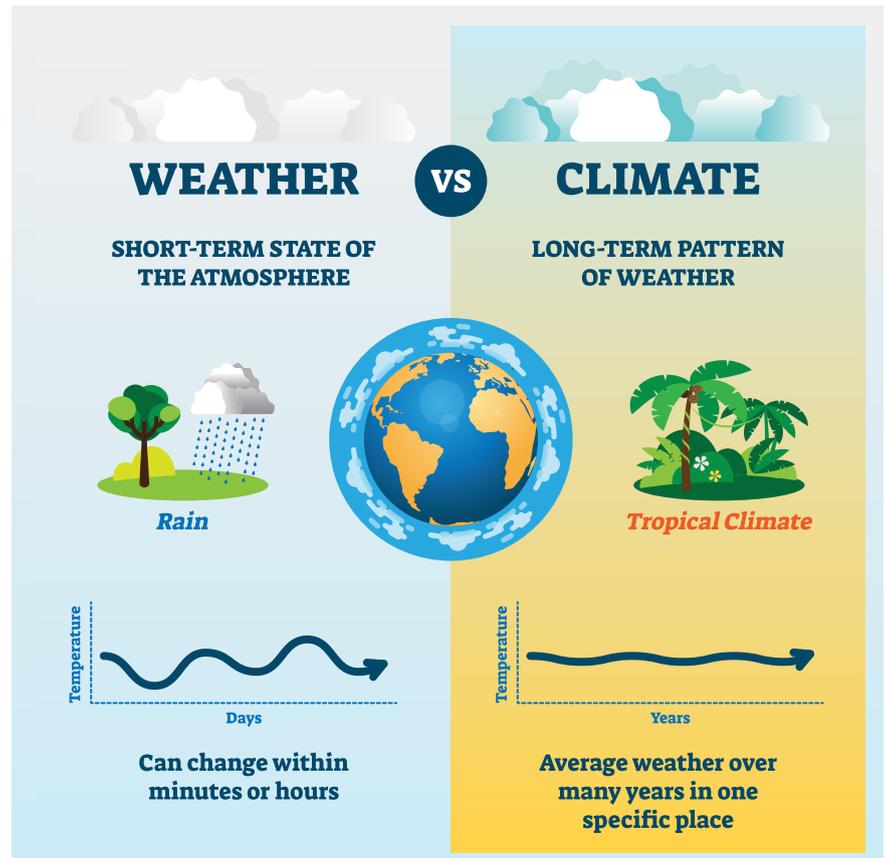
Some common types of weather include:

- **Clear skies:** When there are few clouds, and the sun is shining brightly.
- **Cloudy:** When the sky is covered by clouds, limiting sunlight.
- **Rainy:** When clouds are filled with moisture, and it falls to the Earth as rain.
- **Windy:** When the air is moving at higher speeds due to pressure differences.
- **Snowy:** When the air is cold enough for water vapor to freeze into snowflakes.

What is Climate?

In contrast to weather, climate refers to the long-term average of weather patterns in a specific region over a much longer period of time, typically over 30 years or more. While weather is concerned with short-term atmospheric conditions, climate looks at the broader picture of what the weather typically does in a given location over an extended period.

For instance, the climate of a region such as the Sahara Desert is dry and hot with very little rainfall, while the climate of a tropical rainforest is warm with frequent rain and high humidity. These long-term patterns of temperature, precipitation, and other weather variables are influenced by the geography of a region, the Earth's tilt and orbit, and ocean currents.



There are several types of climate zones around the world:

- **Tropical Climate:** Found near the equator, this climate is characterized by high temperatures and frequent rainfall, making it ideal for dense forests.
- **Desert Climate:** These areas experience very little precipitation and can have extreme temperature differences between day and night.
- **Temperate Climate:** Found in regions with moderate temperatures, where seasons are more distinct, and both summer and winter are experienced.
- **Polar Climate:** Found in the coldest regions of the world, such as the Arctic and Antarctic, where temperatures are consistently low throughout the year.

Climate influences not only the types of plants and animals that can thrive in a region but also how humans live. For example, people who live in colder climates might wear heavy coats and use heating in their homes, while those in tropical climates may wear lighter clothing and use fans or air conditioning.

Key Differences Between Weather and Climate

While both weather and climate are related to atmospheric conditions, they differ in the following ways:

- **Duration:** Weather is short-term, often changing from minute to minute, while climate is long-term and represents patterns observed over years or even centuries.
- **Scale:** Weather refers to specific conditions in a given place at a specific time, whereas climate describes the typical conditions in a larger area over a longer period.
- **Predictability:** Weather forecasts give us an idea of what to expect in the near future, usually a few hours to a few days. Climate, however, is more stable and can be predicted with more certainty over the long term.

Why is Understanding Weather and Climate Important?

Understanding both weather and climate is important for many reasons. Weather impacts our daily decisions, such as what we wear, whether we need an umbrella, or how we prepare for a trip. Knowing the weather forecast helps us plan activities, make travel decisions, and stay safe during extreme conditions.

Climate is also important because it affects how people live, what crops they can grow, and what types of animals can survive in different regions. For example, farmers in tropical areas may grow crops like bananas and sugarcane, while those in temperate zones may grow apples and corn. Additionally, understanding climate helps scientists predict how changes in the environment, such as global warming, may affect the planet's ecosystems, sea levels, and human populations.

In conclusion, while weather and climate are related concepts, they are fundamentally different in terms of time, scale, and predictability. By studying both, we can better understand the world around us, prepare for the future, and make informed decisions that improve our lives and the planet.

Natural Disasters

Natural disasters are sudden, catastrophic events that occur due to natural processes of the Earth. They can cause significant damage to the environment, human life, and property. Understanding natural disasters helps us better prepare for these events and take the necessary steps to reduce harm. In this section, we will explore what natural disasters are, the different types of natural disasters, and how they affect the world.

What are Natural Disasters?

A natural disaster occurs when a natural process or event causes significant harm to the Earth's surface, human structures, and living organisms. These events happen suddenly and are often unpredictable. While some natural disasters are caused by geologic processes within the Earth, others result from atmospheric or hydrological conditions. The impact of natural disasters can be devastating, leading to loss of life, displacement of people, and destruction of infrastructure. They may also disrupt ecosystems and cause long-term environmental changes.

Natural disasters can affect specific regions or be widespread, with global impacts. For example, a volcanic eruption may only affect a local area near the volcano, but a global event like a tsunami can impact multiple countries.

Types of Natural Disasters

There are several different types of natural disasters, each with its own causes, effects, and methods of preparation. Below are the most common types of natural disasters:

- Earthquakes
- Flash Floods
- Hurricanes and Typhoons
- Tornadoes
- Volcanic Eruptions
- Wildfires
- Tsunamis



The Impact of Natural Disasters

The effects of natural disasters are often far-reaching, affecting not only the environment but also the economy, health, and society. Some of the immediate impacts include:

- **Destruction of Infrastructure:** Natural disasters often damage roads, bridges, homes, and power lines, disrupting daily life and making it difficult for rescue teams to reach affected areas.
- **Loss of Life:** Many natural disasters cause injuries and fatalities, particularly in densely populated areas that may not be prepared for such events.
- **Economic Losses:** The economic costs of natural disasters can be enormous, as businesses may be destroyed, crops lost, and jobs displaced.
- **Environmental Damage:** In addition to physical damage to the landscape, natural disasters can cause long-term harm to ecosystems, such as deforestation from wildfires or soil erosion from floods.

Preparing for Natural Disasters

While we can't prevent natural disasters, preparation is key to minimizing their impact. Communities in disaster-prone areas often have emergency plans in place, including evacuation routes, shelters, and supplies. Educating the public about the risks of different types of disasters and how to stay safe is also crucial.

In conclusion, natural disasters are powerful events that can change lives in an instant. By understanding the types of disasters that may occur in different regions and how to prepare for them, we can reduce their destructive effects and save lives. Through early warning systems, effective planning, and global cooperation, communities can become more resilient in the face of these unavoidable events.

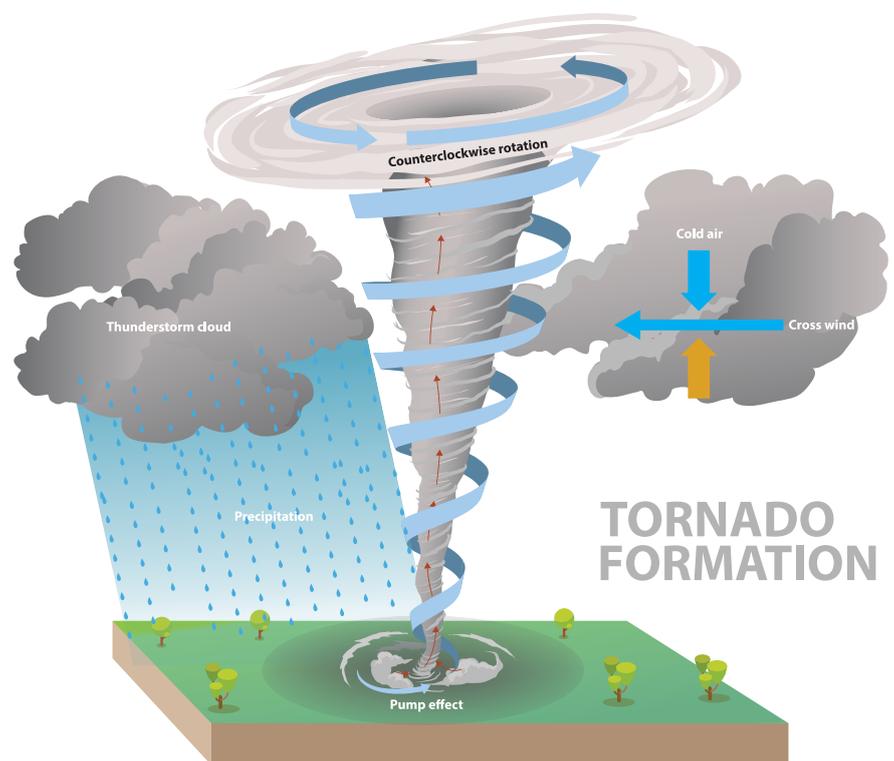
Tornado Physics

Tornadoes are among the most powerful and destructive weather phenomena on Earth. Understanding the physics behind tornadoes is essential to explaining how they form, why they are so dangerous, and how scientists study and predict them. In this section, we will explore the basic principles of tornado physics, including the atmospheric conditions that lead to tornado formation, the role of wind and pressure, and how the structure of a tornado influences its behavior.

What is a Tornado?

A tornado is a violently rotating column of air that extends from the base of a thunderstorm to the ground. Tornadoes are formed when warm, moist air meets cold, dry air, creating unstable conditions in the atmosphere. The difference in temperature and humidity causes air to rise rapidly, forming updrafts that can become strong enough to start rotating. Once this rotation is intensified, it can result in the formation of a tornado.

The tornado itself is essentially a vortex, which is a spinning column of air. The rotation of the air in a tornado is what gives it its signature funnel shape, with the narrow end reaching the ground and the wider end extending upward into the clouds. The winds in a tornado can reach speeds of over 300 miles per hour, making them capable of causing catastrophic damage to buildings, trees, and infrastructure.



The Role of Air Pressure and Wind

The physics of a tornado are heavily influenced by differences in air pressure and wind patterns. Tornadoes are typically created in regions where there are dramatic shifts in wind speed and direction. The key factors contributing to tornado formation include:

1. Wind Shear: Wind shear refers to the change in wind speed and direction with height in the atmosphere. In a tornado-producing storm, strong wind shear is present, meaning that winds at the surface may be coming from one direction, while winds higher in the atmosphere are moving in a different direction. This creates a horizontal spinning effect in the air. If the updrafts from a thunderstorm tilt this rotating air column vertically, it can become a tornado.

2. Updrafts and Downdrafts: Tornadoes are often associated with supercell thunderstorms, which are thunderstorms characterized by a rotating updraft called a mesocyclone. As warm, moist air rises in the updraft, it cools and condenses, creating a rotating mass of air. If conditions are right, this rotating air can get stretched vertically, leading to the formation of a tornado. Downdrafts, on the other hand, are downward currents of air that can push this rotation toward the ground, intensifying the tornado.

3. Pressure Differences: Tornadoes are created when a significant difference in air pressure exists between the inside of the tornado and the surrounding air. The center of the tornado, or the "eye," has very low pressure compared to the areas outside the tornado. This pressure difference contributes to the powerful winds inside the tornado. The air rushes toward the center of the tornado, causing it to spin faster and increase in intensity.

The Role of Coriolis Effect

The Coriolis effect is a phenomenon that arises due to the rotation of the Earth. This effect causes moving air (or any moving object) to deflect to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. While the Coriolis effect has a significant influence on larger weather systems like hurricanes, it has a lesser effect on tornadoes due to their small size and rapid formation.

The Structure of a Tornado

Tornadoes are complex structures, and their appearance and behavior depend on the specific atmospheric conditions in which they form. The structure of a tornado can be divided into several key parts:

- **The Funnel:** The funnel is the visible part of the tornado that we often see in pictures or videos. It is made up of a rotating column of air and debris. The funnel extends from the base of the thunderstorm to the ground and can vary in size and shape. Some tornadoes have a thin, rope-like appearance, while others are wide and destructive.
- **The Vortex:** The vortex is the rotating column of air inside the tornado. The winds inside the vortex are extremely powerful, sometimes exceeding 300 miles per hour in the most violent tornadoes. The rotation of the vortex is driven by the differences in air pressure and the dynamics of wind shear. This rotation causes the tornado to create its characteristic funnel shape.
- **The Updraft:** The updraft is the rising air within the thunderstorm that feeds the tornado's rotation. As the warm, moist air rises in the updraft, it cools and condenses, releasing energy in the form of latent heat. This energy helps fuel the storm's rotation and can contribute to the formation of a tornado if the conditions are right.
- **The Debris Cloud:** As the tornado moves along the ground, it picks up debris such as dirt, leaves, and even buildings. This debris is carried up into the funnel, forming a cloud of dust and debris around the base of the tornado. The debris cloud helps make the tornado visible from a distance, but it also indicates the extreme power of the tornado's winds.

Conclusion

The physics of tornadoes involves a complex interplay of factors, including wind shear, updrafts, air pressure differences, and the dynamics of rotating air. Understanding how tornadoes form and how they behave is crucial for predicting their occurrence and minimizing their impact. While tornadoes remain difficult to predict with perfect accuracy, advances in meteorology and weather technology have improved our ability to track and understand these powerful forces of nature. Studying tornado physics not only helps scientists predict and prepare for tornadoes but also allows us to develop better safety measures and building practices to protect communities in tornado-prone areas.

Vortexes

A vortex is a flow pattern in which a fluid (such as air or water) rotates around a central axis. The rotation can take the form of a spiral or whirlpool, where the fluid moves in a circular path around a central point. Vortexes are a key concept in fluid dynamics and can be found in many natural phenomena, including tornadoes, whirlpools, and hurricanes. In this section, we will explore the nature of vortexes, how they form, and the important role they play in the environment and various weather systems.

What is a Vortex?

At its core, a vortex is any spinning flow of fluid that revolves around a central axis. The shape of the vortex depends on the type of fluid, the strength of the rotation, and the forces acting on the fluid. For example, when you watch water drain in a sink or bathtub, you may observe it spiraling down the drain. This motion is an example of a vortex. A vortex can occur in many settings—both natural and man-made, and is often associated with intense forces of rotation.

In a vortex, the fluid moves in a circular pattern, with the flow of fluid speeding up toward the center of the vortex and slowing down as it moves outward. This creates a situation where the fluid is pulled inward, toward the center of rotation, which creates a low-pressure area at the center. This low-pressure zone is a defining characteristic of vortexes and plays a critical role in various meteorological and physical processes.

Types of Vortexes in Nature

There are many types of vortexes that occur in nature, each with its own distinct characteristics. Some of the most well-known types of vortexes include:

- Tornadoes
- Hurricanes and Cyclones
- Whirlpool
- Water Vortexes in Nature

How Do Vortexes Form?

Vortexes can form in a variety of ways, depending on the type of fluid and the forces at play. In general, vortexes form when there is a disturbance in the fluid flow that causes the fluid to rotate around a central point. There are several common mechanisms through which vortexes form:

- **Rotational Forces:** When fluid is subject to a rotational force or torque, it begins to spin. For example, if air is forced into a circular motion, it can begin to form a vortex. This can occur in the atmosphere when wind currents interact with various objects or weather systems, like tornadoes and cyclones.
- **Differences in Pressure:** When fluid moves from areas of high pressure to areas of low pressure, the movement can spiral as the fluid accelerates toward the lower pressure zone. This is often the cause of vortex formation in weather systems, such as the creation of a tornado. In these cases, the vortex forms because the low-pressure center draws in surrounding air, causing it to rotate.
- **Obstacles in Fluid Flow:** When a fluid encounters an obstacle (like a rock in a river or the walls of a sink), it can be forced into a circular motion around the obstacle, creating a vortex. This type of vortex is often seen in whirlpools or the flow around solid objects in a stream.
- **Thermal Effects:** Differences in temperature can also contribute to vortex formation. For example, when warm air rises and meets cooler air, this can create a rotating mass of air, especially when combined with wind shear. This mechanism is critical in the formation of tornadoes and other large-scale weather vortexes, like hurricanes.

Characteristics of Vortexes

Vortexes can vary in size, shape, and intensity depending on the specific conditions that cause them. Some important characteristics of vortexes include:

- **Rotational Motion:** The most fundamental characteristic of a vortex is its rotational motion. In a tornado, for example, the air moves in a tight, swirling pattern around a central axis, creating a funnel-shaped vortex. The rotation can vary in speed, with the fastest winds near the center of the vortex.

- **Low-Pressure Center:** The center of a vortex typically experiences lower pressure compared to the surrounding fluid. This is because the fluid is moving inward and upward, which causes the pressure to drop in the center. This low-pressure area is a defining feature of vortexes and is what allows tornadoes to form and intensify.

- **Fluid Dynamics:** The motion of the fluid in a vortex is governed by the principles of fluid dynamics. The speed of rotation increases as the fluid moves closer to the center of the vortex, a concept known as conservation of angular momentum. This is why tornadoes and hurricanes often have stronger winds near the center of their rotation.

- **Conservation of Energy:** Vortexes often maintain their rotational motion due to the conservation of energy. In a tornado, for example, the energy from the storm's updrafts is transferred into the rotation of the vortex, allowing it to persist and grow stronger as long as the atmospheric conditions remain favorable.

The Importance of Vortexes in the Environment

Conclusion

Vortexes play a crucial role in shaping the world around us. From weather systems to ocean currents, vortexes influence many natural processes and events. Tornadoes, hurricanes, and cyclones, for example, are all vortexes that are important components of Earth's climate system. They help regulate atmospheric pressure, distribute heat, and even influence the distribution of moisture around the planet.

STORM CHASER OVERVIEW

Alright, future storm chasers! Are you ready to create your very own mini tornado? Today, we're going to make a swirling, spinning vortex right here in class—no need to chase storms because the tornado is coming to us! Get your STEM kits ready, put on your thinking caps, and let's watch the science of tornadoes come to life in a super fun, hands-on way!

WHAT YOU'LL LEARN

- 1. How Tornadoes Form:** Students will understand the conditions needed for tornadoes to develop, including air pressure, wind, and temperature changes.
- 2. The Science of Vortexes:** They'll learn how vortexes are created and why tornadoes spin in a spiral motion.
- 3. The Role of Air Dynamics:** Students will explore how moving air, updrafts, and wind patterns contribute to tornado strength and shape.
- 4. Hands-On Weather Science:** By building their DIY Tornado STEM Kit, students will apply scientific concepts to create and observe their own mini tornado.

LEARNING QUESTIONS

1. What causes a tornado to form, and why does it spin in a vortex?
2. How does air pressure and wind movement affect the strength and shape of a tornado?
3. What did you observe when building your DIY tornado, and how does it compare to real tornadoes in nature?

SAFETY WARNINGS:

Please read all safety warnings before use:

Choking Hazard: Small parts not for children under 6 years or any individual who have a tendency to place inedible objects in their mouths.

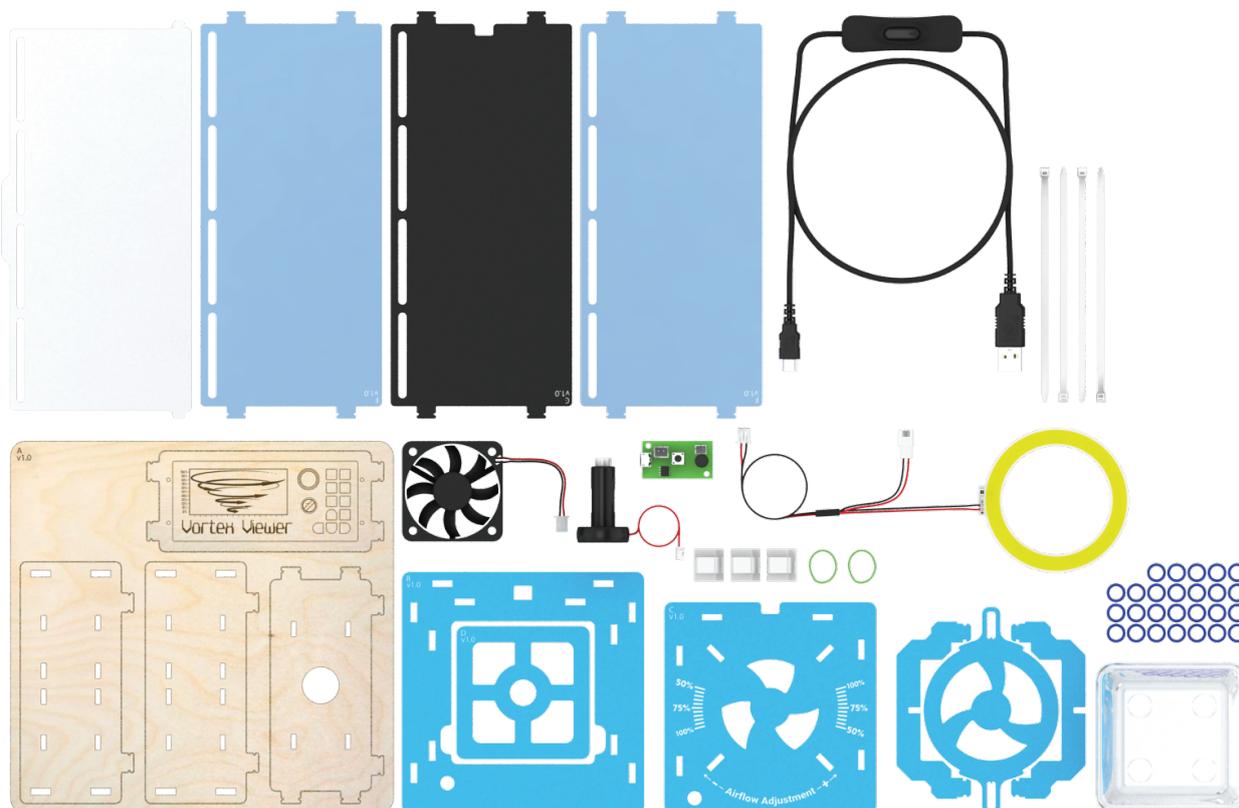
WARNING: Circuit board may be hot! Do not touch when unit is on. Make sure to allow for it to cool after use before handling.

WARNING: Do not turn on the Tornado STEM kit unless the humidifier is plugged into the circuit board. Also, wait at least 5 minutes for the humidifier's cotton swab to soak up water before turning it on.

WARNING: Circle light may be hot! Do not touch when unit is on. Make sure to allow for it to cool after use before handling.

Adult supervision required.

MATERIALS

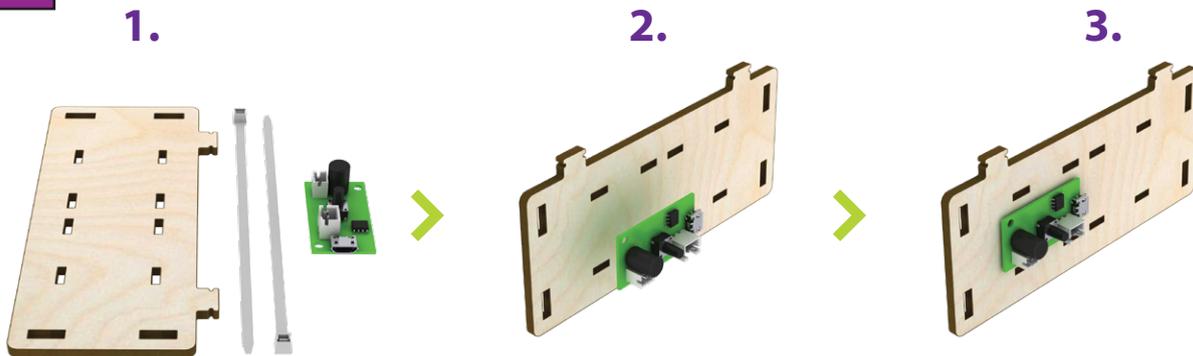


1



NOTE: If any wooden pieces are hard to remove, use a blunt tool to carefully punch them out, and ask an adult for help if needed. Use the sanding stick included in your kit (it looks like a small nail file) to smooth out any rough edges or spots where pieces don't fit together easily. Just find the tight spot and gently sand the edge until it fits just right.

2

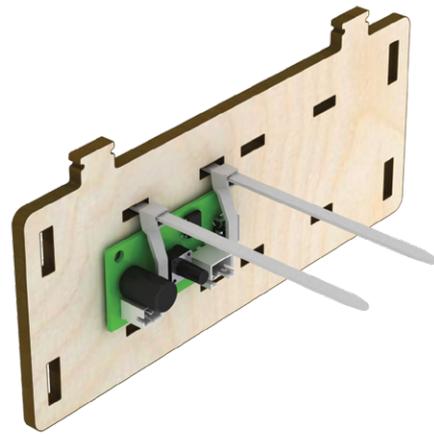
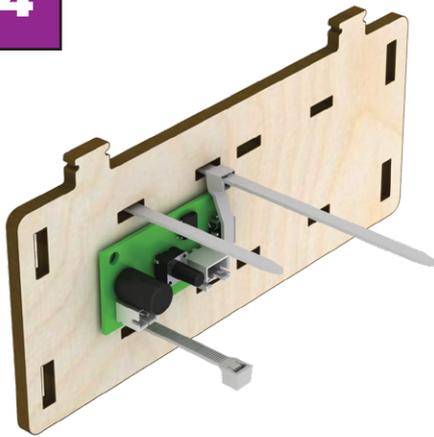


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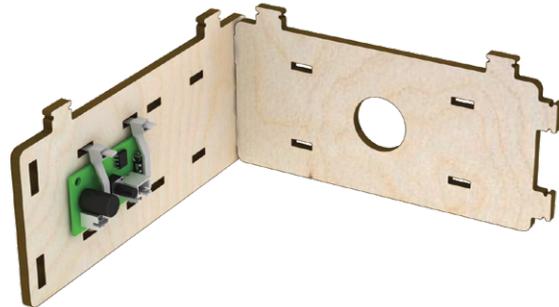
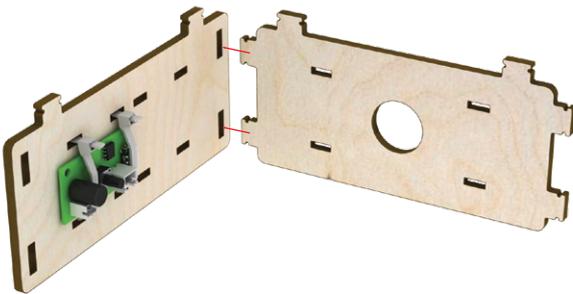
Attach the circuit board to the wooden panel using a zip tie.

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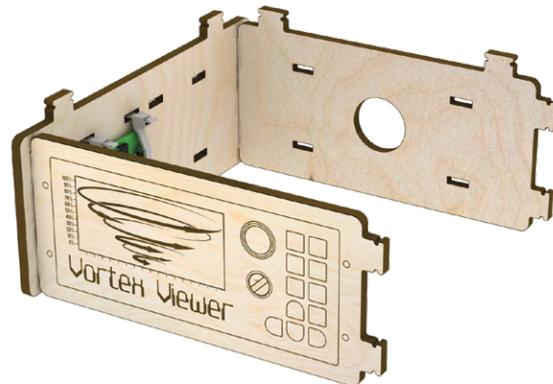
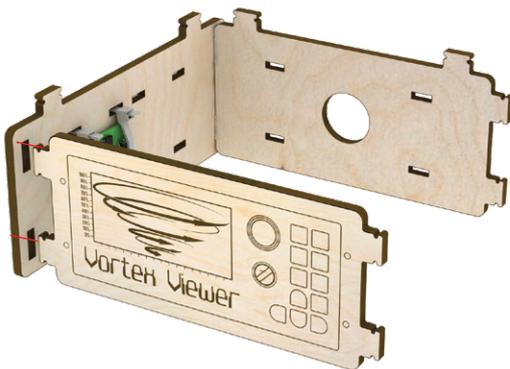


Carefully trim the ends of each zip tie using scissors.

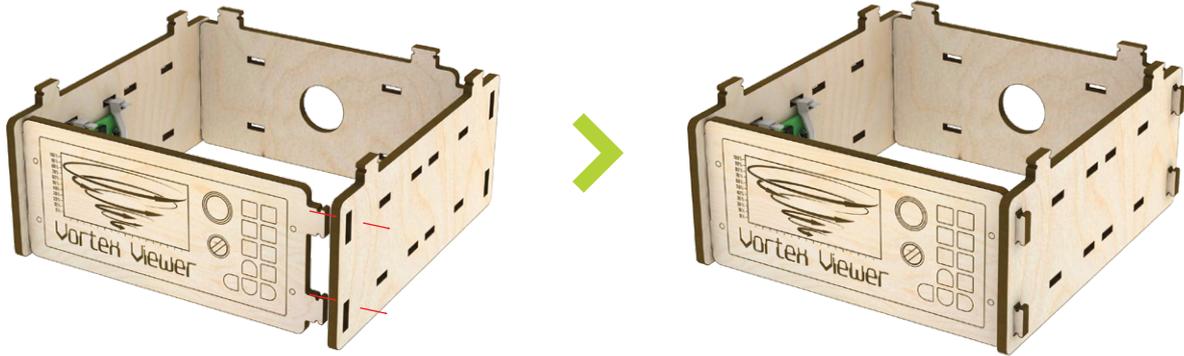
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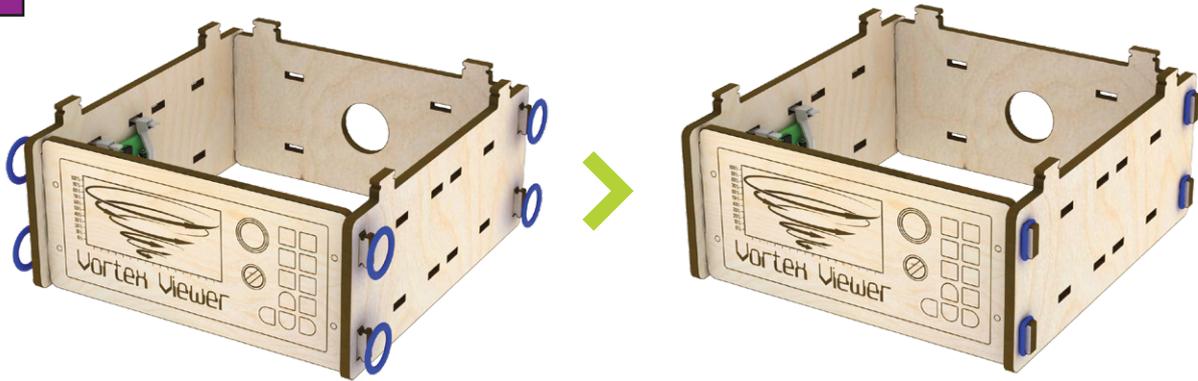
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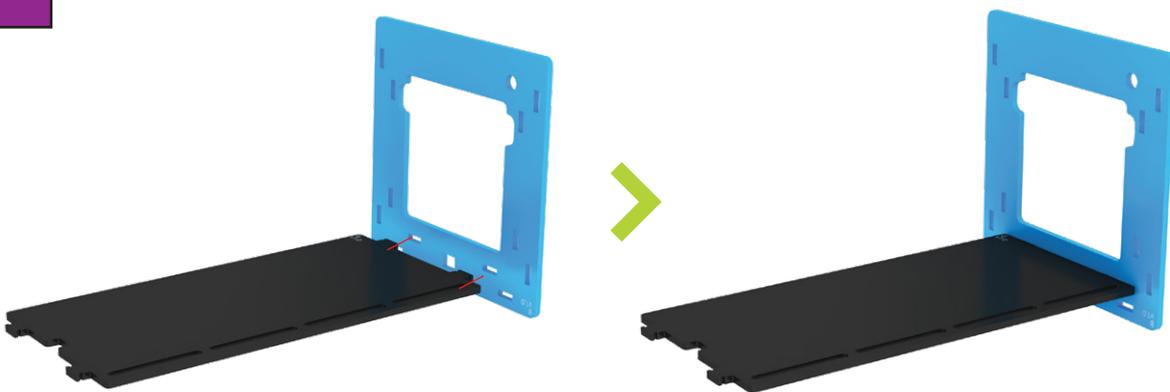


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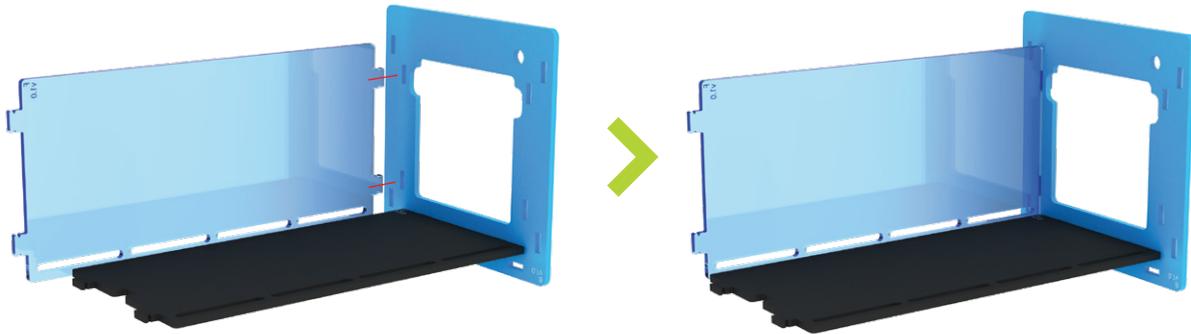


Place an O-ring fastener onto each slotted connector.

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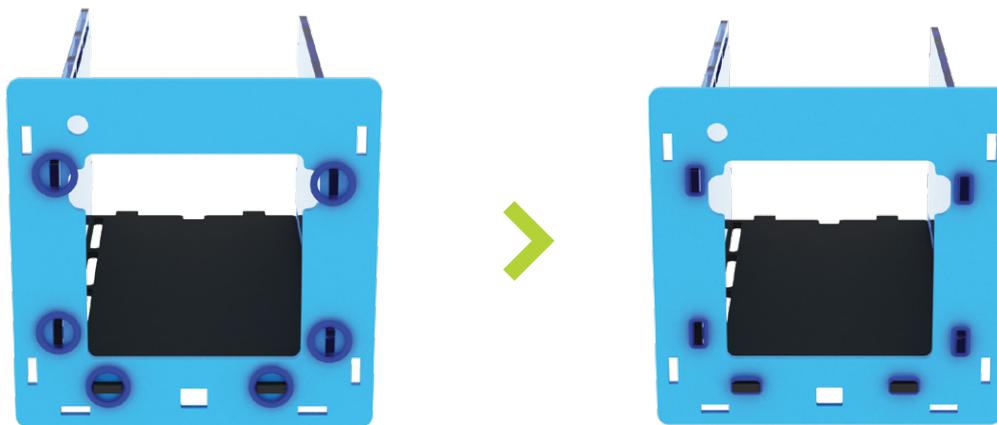
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Place an O-ring fastener onto each slotted connector.

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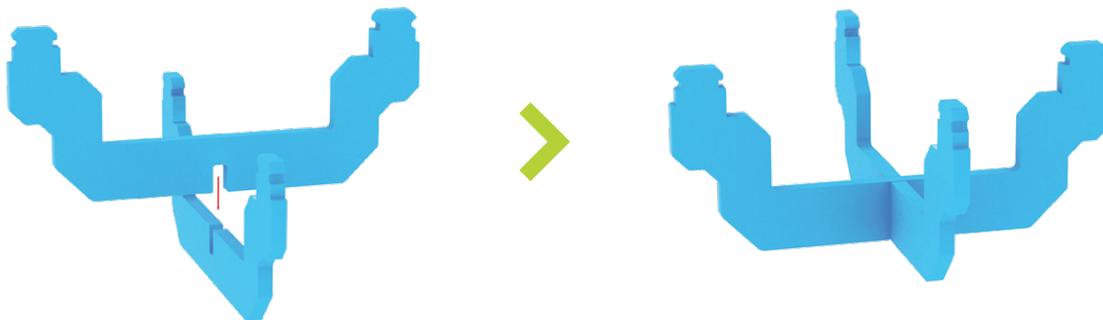


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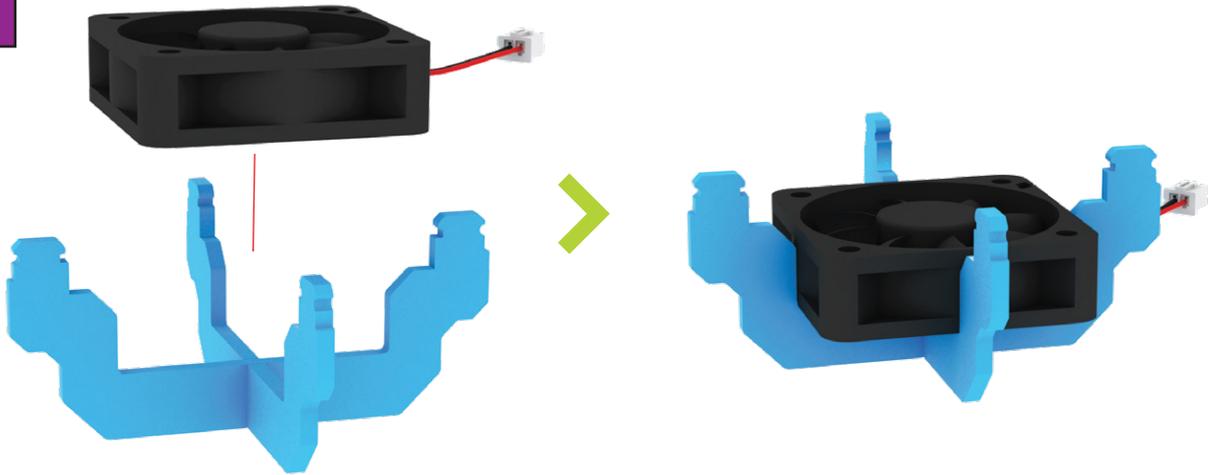


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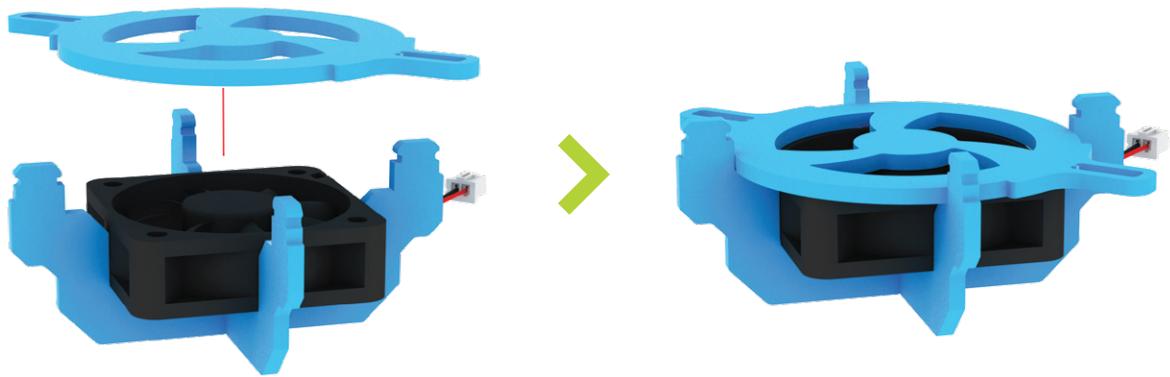
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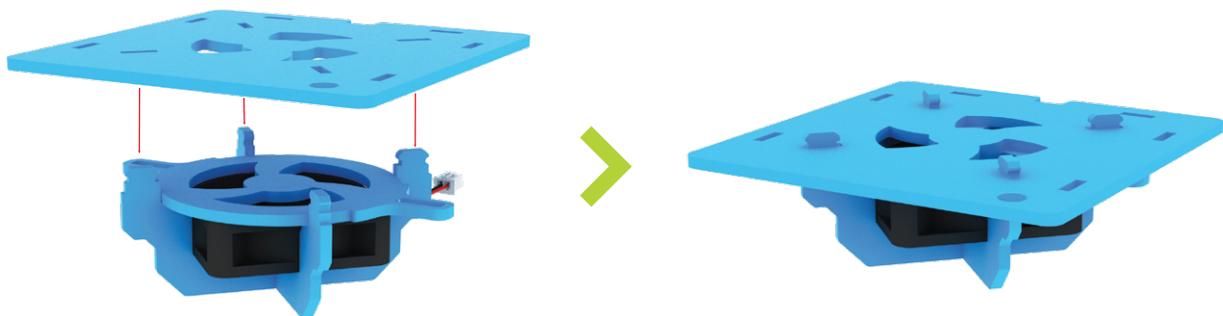
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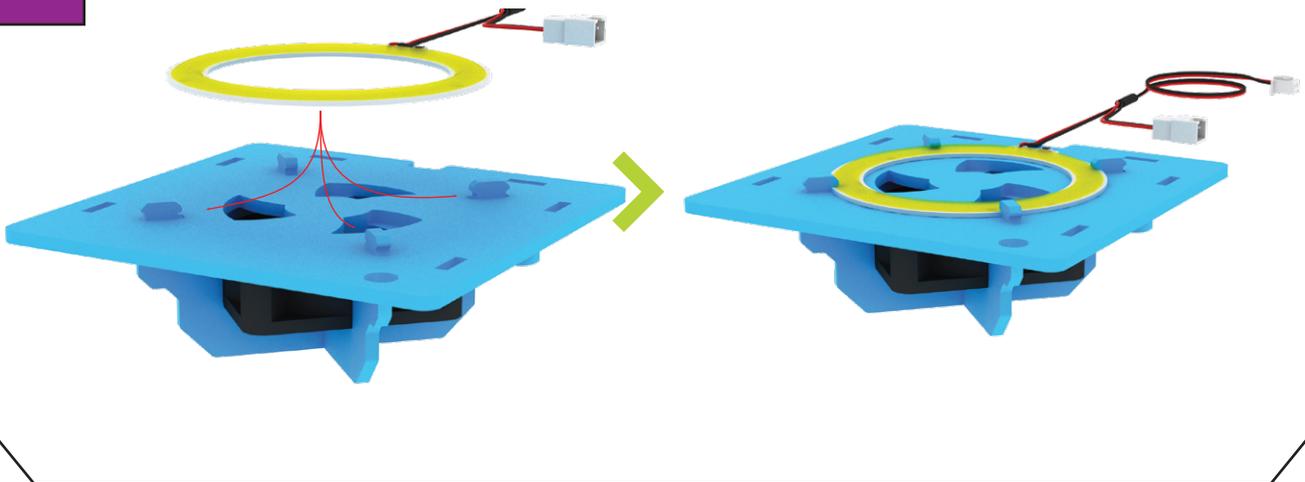
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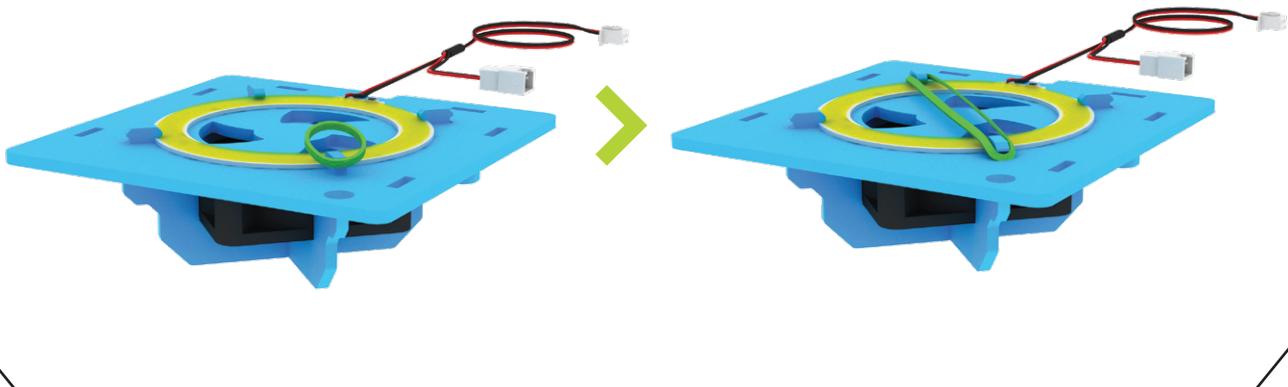
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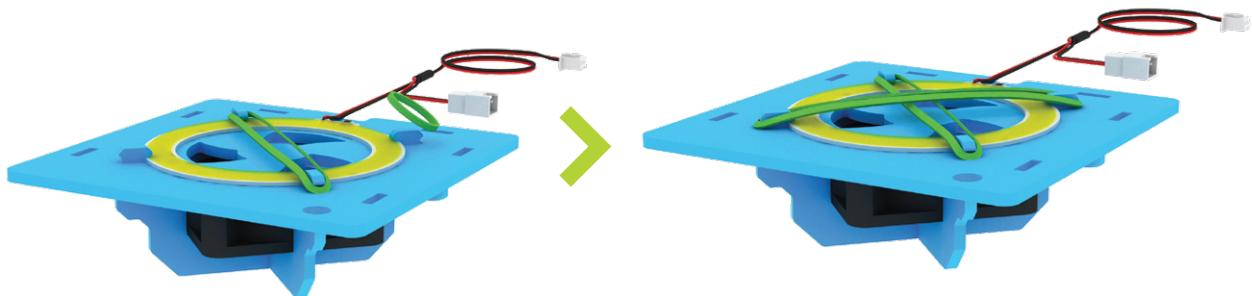
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20

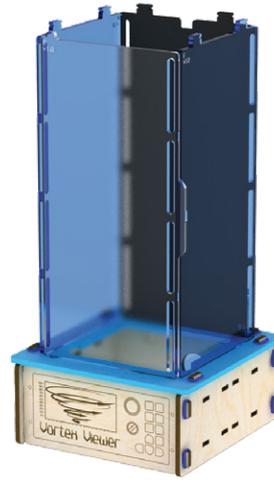


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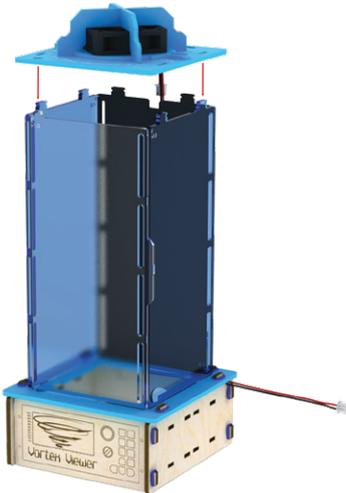


Once you finish Step 21, set the piece aside temporarily.

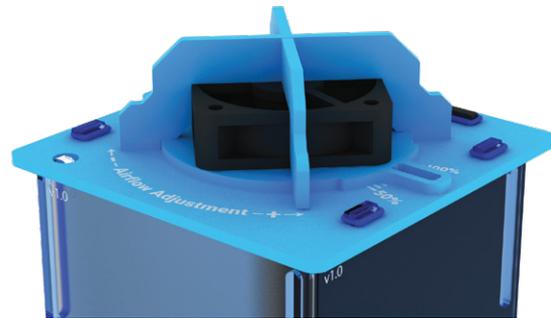
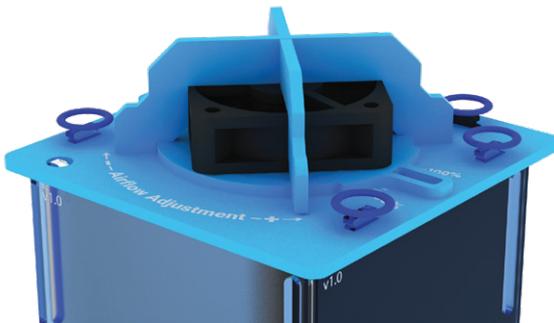
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23

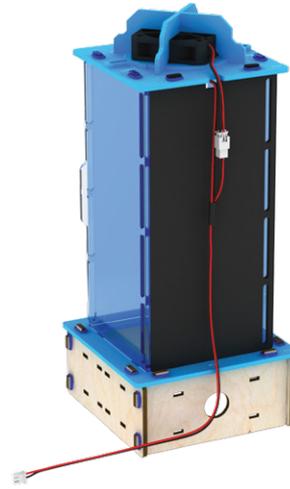


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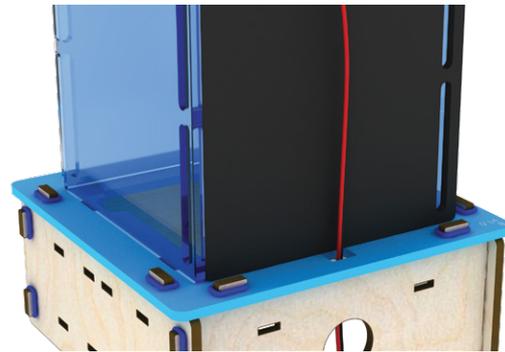
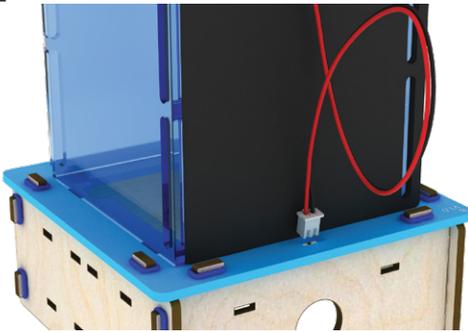
Place an O-ring fastener onto each slotted connector.

25



Connect the fan wire to the light wire.

26



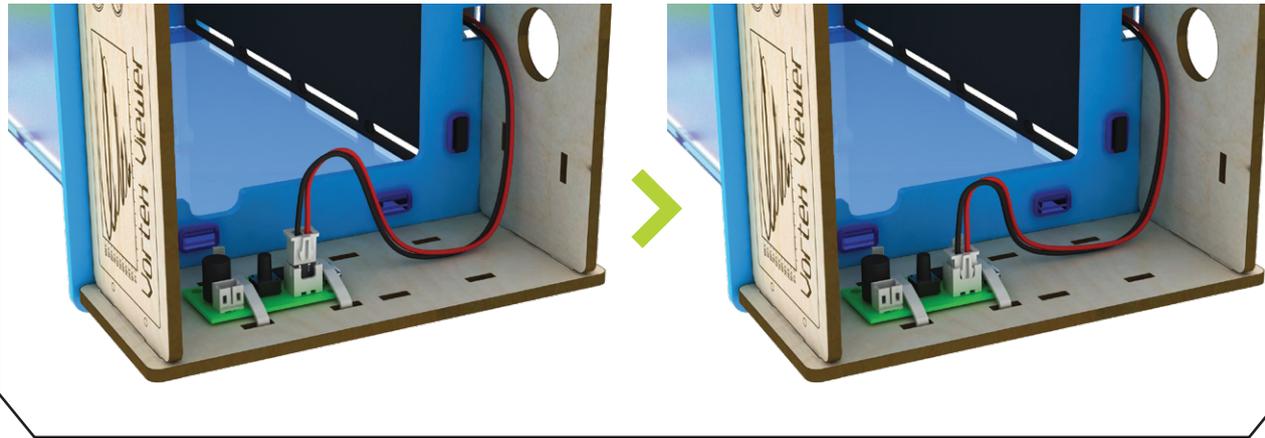
Insert the wire connector into the rear slot.

27

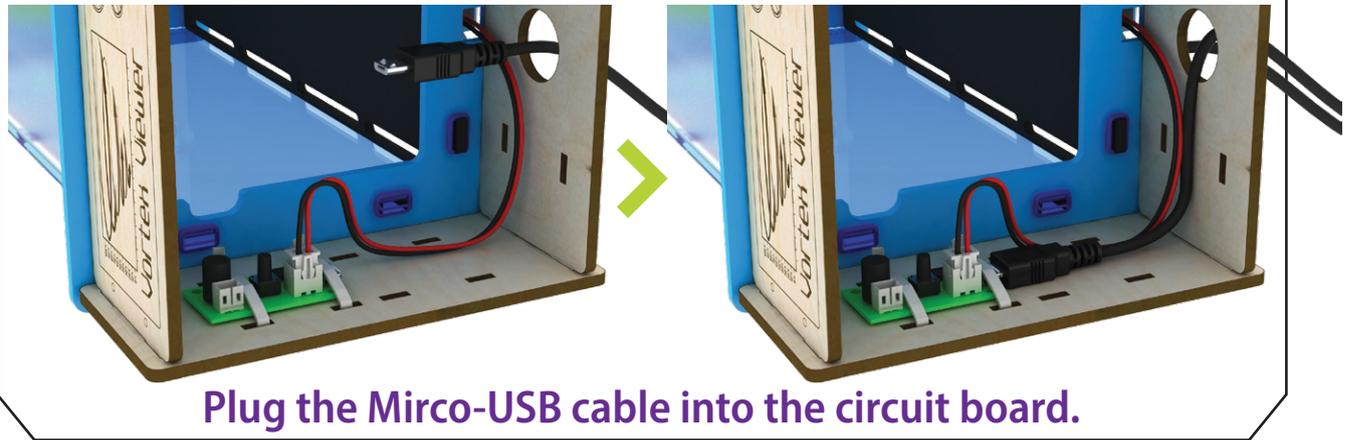


Peel off the paper backing and use the adhesive hooks to organize your wires.

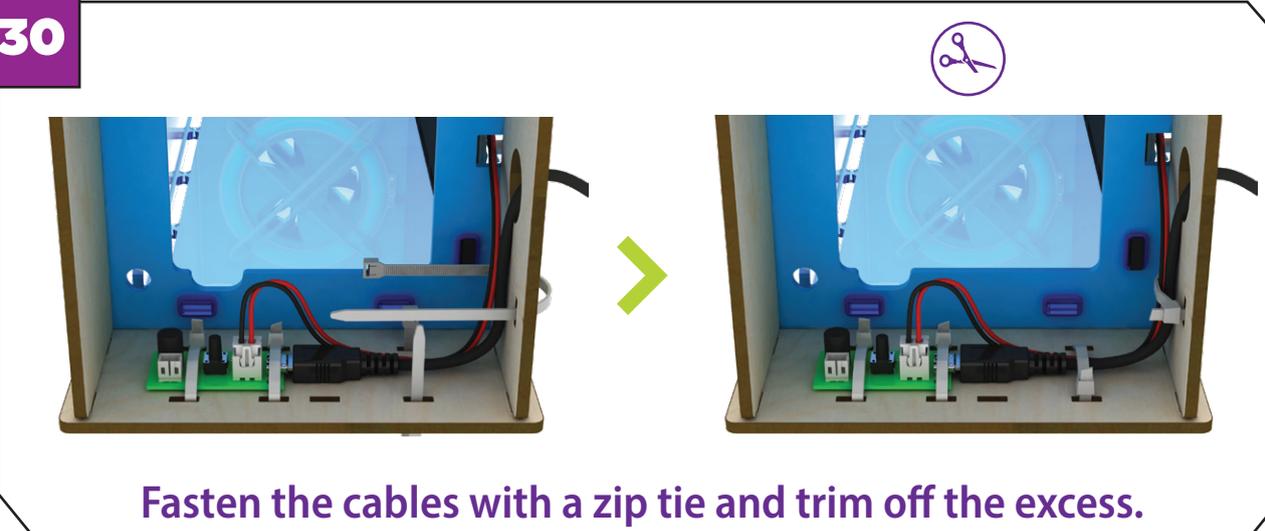
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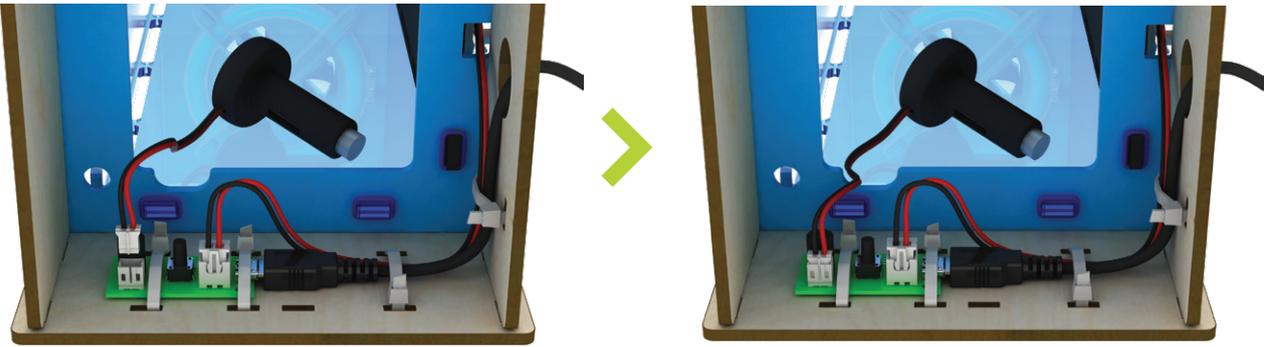
29



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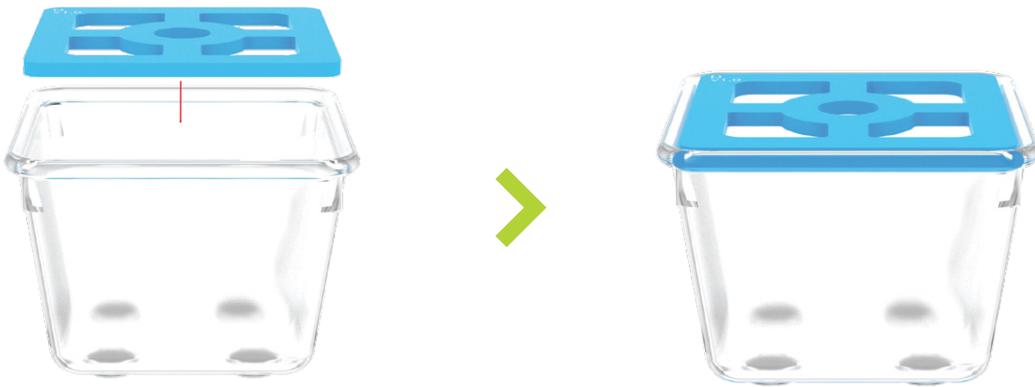


31



Plug the humidifier into the circuit board.

32



33



Fill the water reservoir with water.

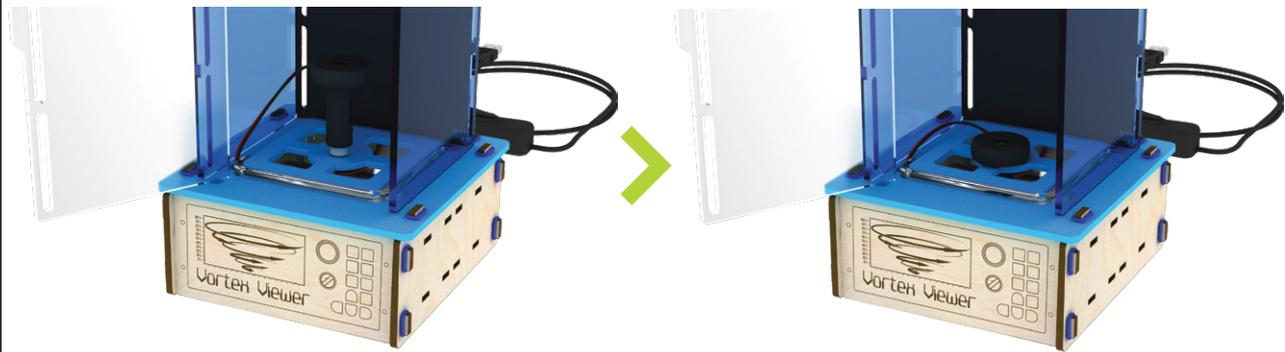
34



Make sure the humidifier is placed above the water reservoir.

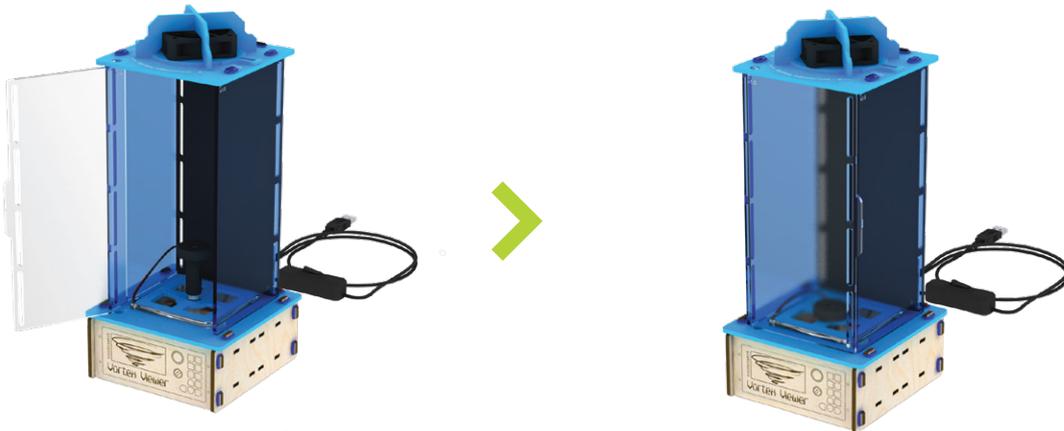
35

Note: Make sure the humidifier has a cotton swab.



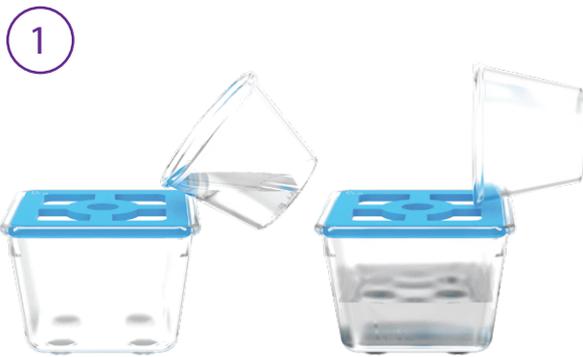
Place the humidifier into the center hole.

36

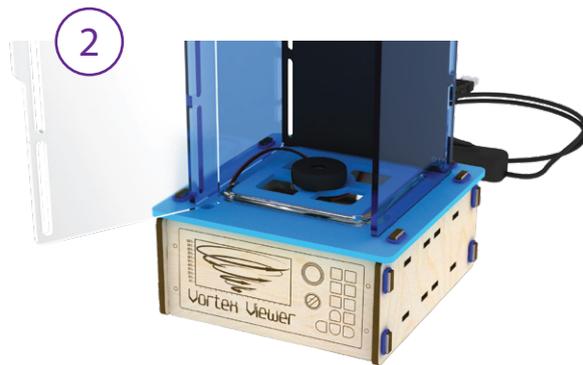


Close the clear front door.

HOW TO USE



1. Make sure the water reservoir has water.



2. Set the humidifier into position.



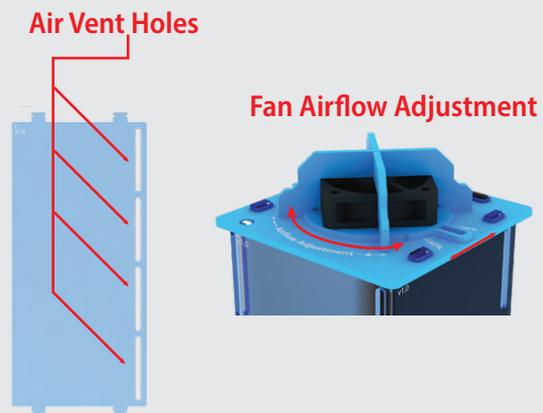
3. Wait 5 minutes for water to absorb



4. Plug-in and Turn on

EXTENSION

Experiment by covering some of the air vents in the chamber or adjusting the fan's airflow to see how it changes the vortex. Start by using tape to cover the lower vents, then try covering only the upper vents. Next, try lowering the fan's airflow, then increasing it again.



If you enjoyed this STEM Kit, check out some of our other Kits!



EARTHQUAKE



SOLAR OVEN



WIND TURBINE



AND
MORE!

CLASSROOM ACTIVITY: Tornado Strength Challenge

Objective:

Students will explore how changes in air dynamics affect the strength and speed of their mini tornado.

1. Form small groups with their DIY Tornado STEM Kits.
2. **Experiment with Variables:** Have each group change one variable at a time, like the size of the air holes, or the amount of water.
3. **Observe and Record:** Students will observe how each change affects the vortex. Does it spin faster? Is the vortex tighter or wider?
4. **Tornado Strength Chart:** Each group creates a simple chart to record their observations, noting which conditions made the strongest, fastest, or longest-lasting tornado.
5. **Class Discussion:** Groups share their findings, discussing what factors had the biggest impact on their mini tornado's strength.



Activity 1 Worksheet: Tornado Strength Challenge

Name(s): _____

Date: _____

Part 1: Make a Prediction: What do you think will happen if you change how fast you spin your tornado or adjust the size of the air holes?

Part 2: Experiment and Observe

Work with your group to test the following variables. Record your observations in the chart below.

Variable Changed	What We Did	What We Observed
Spin Speed (fast/slow)		
Air Hole Size (large/small)		
Amount of Water (more/less)		

Part 3: Analyze Your Results

1. Which change created the strongest or fastest tornado?

2. Why do you think that change made a difference?

3. What surprised you during this experiment?

Part 4: Reflection

What did you learn about tornadoes and how they form in nature after doing this activity?

Activity 2 Worksheet: Exploring Airflow continued

Name(s): _____

Date: _____

Part 1: Make a Prediction

- What do you think will happen to the tornado if the airflow intake is wide open?
- What do you think will happen if the airflow intake is partially closed?
- Will the tornado look stronger, weaker, taller, shorter, or less stable?

Part 2: Experiment and Observe

Work with your group to test the tornado chamber using three different dial settings:

- Fully open (maximum airflow)
- Halfway closed (medium airflow)
- Almost closed (minimal airflow)

For each setting, observe and record:

- Tornado height (tall / medium / short)
- Tornado shape (narrow / wide / broken / stable)
- Tornado strength (strong / weak / disappears quickly)

Airflow Dial Setting	Height of Tornado	Shape of Tornado	Strength/Movement	Notes
Fully Open				
Halfway Closed				
Almost Closed				

Part 3: Reflection

What did you learn about how air movement and airflow affect tornado formation?

How is this similar to real tornadoes in nature, which depend on warm air rising and cool air moving in?