EXPLORE WEATHER

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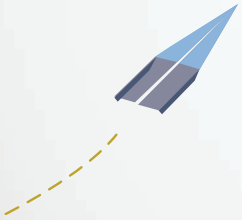
YOUR MISSION:

Get students excited about weather beyond the basics of rain or shine. You have a chance to motivate students to study the way weather shapes our world. A student you talk to today may uncover something cool from the distant past, or create new technology to save lives.

ADVICE ON VOLUNTEERING

SAFETY CHECK: Look for this symbol in the scripts. Our exhibits are hands-on, but **some require close supervision.** Make sure students explore safely (no running, no poking each other in the eye, etc.) and follow instructions from the facilitator.



ENCOURAGE EXPLORATION: Ask questions about what they see, hear, and feel and make sure everyone gets a chance to participate. A little positive feedback goes a long way.

GET EXCITED! You don't have to be an expert. Your curiosity and enthusiasm inspire kids to learn.

AREA OVERVIEW

REMEMBER BEN FRANKLIN AND HIS KITE? We want to inspire that kind of curiosity in kids (without the danger of electrocution). What is lightning made of? What does it feel like inside a cloud?

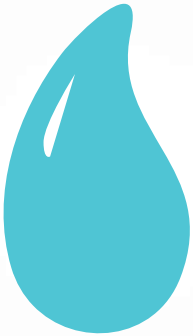
WHY DOES THE SUN SHINE IN AUSTIN WHILE IT'S RAINING IN DALLAS? Weather is caused by the movement of air and water. Because the Earth is round, the sun shines more directly on some areas (equator), and less on others (poles). This creates different temperatures, which create air currents that push water and air all around the world.

EXPLORE WEATHER

- About 2,000 thunderstorms rain down on Earth every minute.
- When a storm drops 1 inch of rain in Houston, that's 10.8 billion gallons of water, or enough to fill 272 million bathtubs!
- As the Earth gets warmer, the Amazon Rainforest is slowly turning into a desert, while the Sahara desert is getting greener.
- You can use pine cones to forecast the weather: the scales of most pinecones will close when rain is on the way.

GRAND CHALLENGES

If you could do one thing to make life on Earth better, what would that thing be? Here's a **GRAND CHALLENGE:** according to some of the world's smartest people, this is a challenge that humans will face in the next 100 years. **What would you do to help solve it?**



WATER, WATER, EVERYWHERE, BUT NOT A DROP TO DRINK

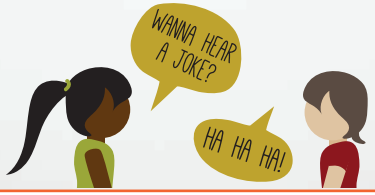
Water has lots of good uses, but only if it's clean. Some places don't have enough and others have too much. If you live near the ocean you have plenty of water, but ocean water is too salty to drink. Some water makes people sick with pollutants.

Can you help think of ways to provide access to clean water for all people?

JOKES

Why do you put on boots when it's raining cats and dogs?

Because you might step in a poodle.



How does a tornado see?

With its eye.

TORNADO TUBE

AREA: WEATHER

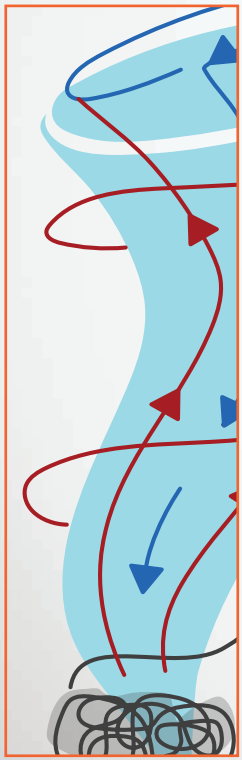
EXHIBIT: TORNADO TUBE

STUDENTS CAN TOUCH

SAFETY FIRST: HOW TO USE

- This exhibit may be skipped or shortened to be respectful of community experiences with tornadoes.
- Turn on the blower and leave it on throughout your shift. This shows how a tornado forms.
- Students can take turns holding the tornado bottles at the center, with the liquid on top, giving the bottles four good swirls in the same direction.

CONCEPT BREAKDOWN



- A tornado is a powerful whirlwind that happens when a mass of cool, dry air collides with a mass of warm, moist air.
- **Cool air** presses down.
- **Warm air** presses up.
- The pressure between cool and warm air creates unstable air between the areas.
- When a strong wind pushes this unstable air from the side, a rotating cloud, or funnel cloud, can form.
- The rising warm air creates an updraft.
- If the funnel cloud touches down to earth, it can create an upward pull strong enough to lift trees, animals, and buildings.
- It's a **funnel cloud** until it touches the ground. Then we call it a **tornado**.

RELATE TO REAL LIFE!

Texans reported more than 250 tornadoes in 2015. Why so many? It's because the warm, moist air from the Gulf of Mexico blows westward, hits the cool, dry air that forms over the Rocky Mountains, and comes tumbling backwards as unstable air.

Not all tornadoes cause damage. Some are funnel clouds that never touch ground, and some are small tornadoes that only touch down for an instant. But some tornadoes cause lots of damage. In May of 2011, a huge tornado hit Joplin, Missouri, killing 158 people and flattening everything in its path. **The tornado was a mile wide.**

AREA: WEATHER

EXHIBIT: TORNADO TUBE

TORNADO TUBE

QUESTIONS

NOTE: *These questions are optional and can be skipped to be sensitive to communities that have experience with tornadoes.*

How many of you have seen a dust devil? How about a funnel cloud?

Has anyone seen a tornado?

Where is the safest place to be during a tornado if you don't have a basement?

The safest place is an inside room without windows on the bottom floor, away from metal or glass.

Where does the word "tornado" come from?

It comes from the Spanish word "tronar," which means "thunder."

CAREERS

An **ATMOSPHERIC SCIENTIST** studies tornadoes, hurricanes, and other weather patterns – sometimes from inside comfortable laboratories, and sometimes outside in the middle of storms!

AVERAGE SALARY: $90,000

ADDITIONAL INFORMATION

A tornado in Oklahoma once picked up an entire herd of cows, carried them across the countryside, and then set them down unharmed.

Usually, a tornado's color matches the color of the ground it travels over.

PLASMA BALL

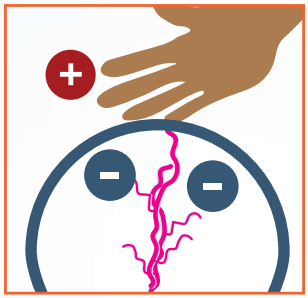
AREA: WEATHER

EXHIBIT: PLASMA BALL

SAFETY FIRST: HOW TO USE

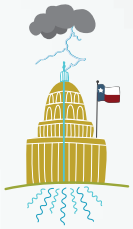
- Okay for students to touch.
- Invite students one at a time to move their fingers around the surface of the glass globe.
- Two students can put their fingers on opposite sides of the globe.

CONCEPT BREAKDOWN



- You're electric! When you touch the ball, you are conducting electricity through the water in your body.
- The reason that happens is that the human body is on average about 60% water, mostly salty water. And water is a really good **conductor** of electricity.
- The "lightning" you see is created by the attraction between **positive charges** (your hand) and **negative charges** (the electrons).
- This plasma ball is filled with gases and a high voltage electrode.
- When nothing is touching the ball, the current flows randomly.
- When you touch the ball, some of the current can flow through the glass and into you.

RELATE TO REAL LIFE!



What **aren't** you supposed to do in a thunderstorm? You're **not** supposed to run outside and stand in a field. You're also **not** supposed to stand under a tree. Why not? Have you ever seen a tree that's been hit by lightning? It's been damaged by electricity.

Lightning is electricity that follows an electrical circuit between a thundercloud and the ground. This circuit is made of the charged ions in the air. What happens if you stand in the middle of that circuit? Your body will conduct that electricity into the ground – and that's a very dangerous place to be.

AREA: WEATHER

EXHIBIT: PLASMA BALL

PLASMA BALL

QUESTIONS

What happens if lightning strikes a building?

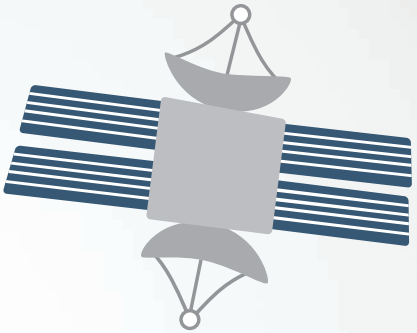
Most buildings use lightning rods to protect against damage from electricity. Lightning tends to strike anything that sticks up from the ground (like people or trees).

Lightning rods attract that charge and give it a path to travel safely down into the ground. This is called **grounding**.

What happens if you're in a car in a lightning storm?

The car's rubber tires act as insulators from electricity. If lightning hits the car, the rubber tires will break or ground the electrical circuit, protecting it and you from the lightning strike.

CAREERS



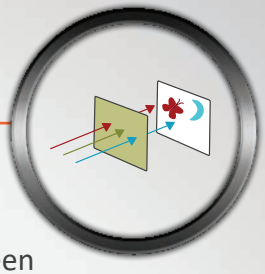
An **ELECTRICAL ENGINEER** might design cell phones, invent a bionic arm, build a satellite, or create special effects for movies!

AVERAGE SALARY: $95,000

ADDITIONAL INFORMATION

HOW HOT IS A LIGHTNING BOLT? About 54,000 degrees Fahrenheit. The surface of the sun is 10,000 degrees Fahrenheit, so a lightning strike is more than 5 times hotter!

FORECAST THE WEATHER



AREA: WEATHER

EXHIBIT: FORECAST THE WEATHER

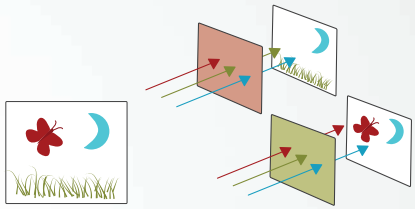
SAFETY FIRST: HOW TO USE

- Students should not touch the computer.
- Give each student a chance to stand in front of the green screen and see themselves on the monitor. Ask: what do you see when you hold up the green fabric?

CONCEPT BREAKDOWN

- When you see a meteorologist on TV, they are standing in front of a map. But guess what? The map isn't really there.
- The meteorologist is actually standing in front of a **green screen**, not in front of a map. The map is added with computer technology.
- Green screen technology is used by meteorologists – and in the movie business – to create imaginary worlds.
- How does a green screen work?
  - Light is made up of a spectrum of colors. Together, all of these colors make white light. Separately, each of these colors has a different wavelength. The **blue molecules** in light, for instance, have a shorter wavelength than **red molecules**.
  - Scientists can use the different wavelengths to **filter** light by color. Filters block some wavelengths and allow others through.
  - Because **green is the color that's furthest away from human skin tones**, a person is most visible against a green background.
  - A video technician uses **filters** to remove the green background and replace it with a map of the weather, monsters, an imaginary city, or anything else!

RELATE TO REAL LIFE!



Color filters, like the ones used in green screens, are used in all kinds of places.

Every time you put on **sunglasses**, you're using a color filter. The lenses in your sunglasses are designed to block out some wavelengths of light and allow others to pass through to your eyes. "**Blue-blocker**" sunglasses block the blue part of the light spectrum, so what you see is mostly **yellow-toned**.

Movie-makers and photographers use color filters to create different effects. If you've ever used a filter setting on a smart-phone camera, you've already got experience as a visual effects editor!

AREA: WEATHER

EXHIBIT: FORECAST THE WEATHER

FORECAST THE WEATHER

QUESTIONS

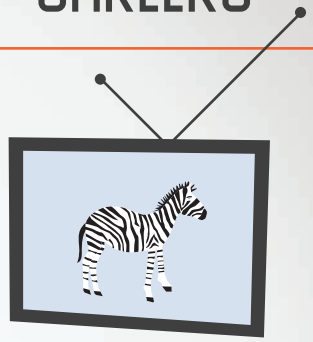
Why is the sky blue?

- The short answer is, **it's not blue!** But the sky does appear blue for most of the day. Why?
- The sun gives off a whole spectrum of light.
- That light then hits the Earth's atmosphere, which is made up of nitrogen and oxygen gas molecules that act as a filter for sunlight.
- Longer-wave particles pass through the gas molecules pretty easily, but shorter-wave particles hit the gas molecules and get scattered around.
- Since **blue light** has the shortest wavelength, its particles are scattered the most. So when you see a blue sky, you're really looking at lots of filtered and scattered light particles.

Why is the sky red at sunset?

Because the sun is lower in the sky at sunset, the light has to pass through more of the atmosphere. That means more water vapor and dust particles to filter the sunlight. The more of these particles in the air, the more the **blue** light is absorbed away, leaving **reds** and **oranges** visible.

CAREERS



VISUAL EFFECTS EDITORS use computers, puppets, animation, and more to create and edit visual effects (VFX) for film and TV.

AVERAGE SALARY: $75,000

ADDITIONAL INFORMATION

WHAT MAKES A RAINBOW?

A rainbow is sunlight refracted in water droplets in the air. That's why you see rainbows right after a rain.

Light enters the water droplet and bends out into all the different wavelengths separated out. A rainbow is actually all the different wavelengths of light stretched out next to each other – with the shortest wavelength (**violet**) on the bottom and the longest (**red**) on the top.

THANK YOU!

Thank you for inspiring students and encouraging them to explore careers in STEM. We could not do this work without you, and we truly appreciate your support.

If you took photos today and plan to post to social media about your experience, please consider tagging the TAME State Office. We would like to recognize your hard work and may share images and stories on TAME.org or with our corporate partners who help bring this experience to different communities around Texas.

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