C5ISR CENTER STEM@Home

Welcome to STEM@Home!

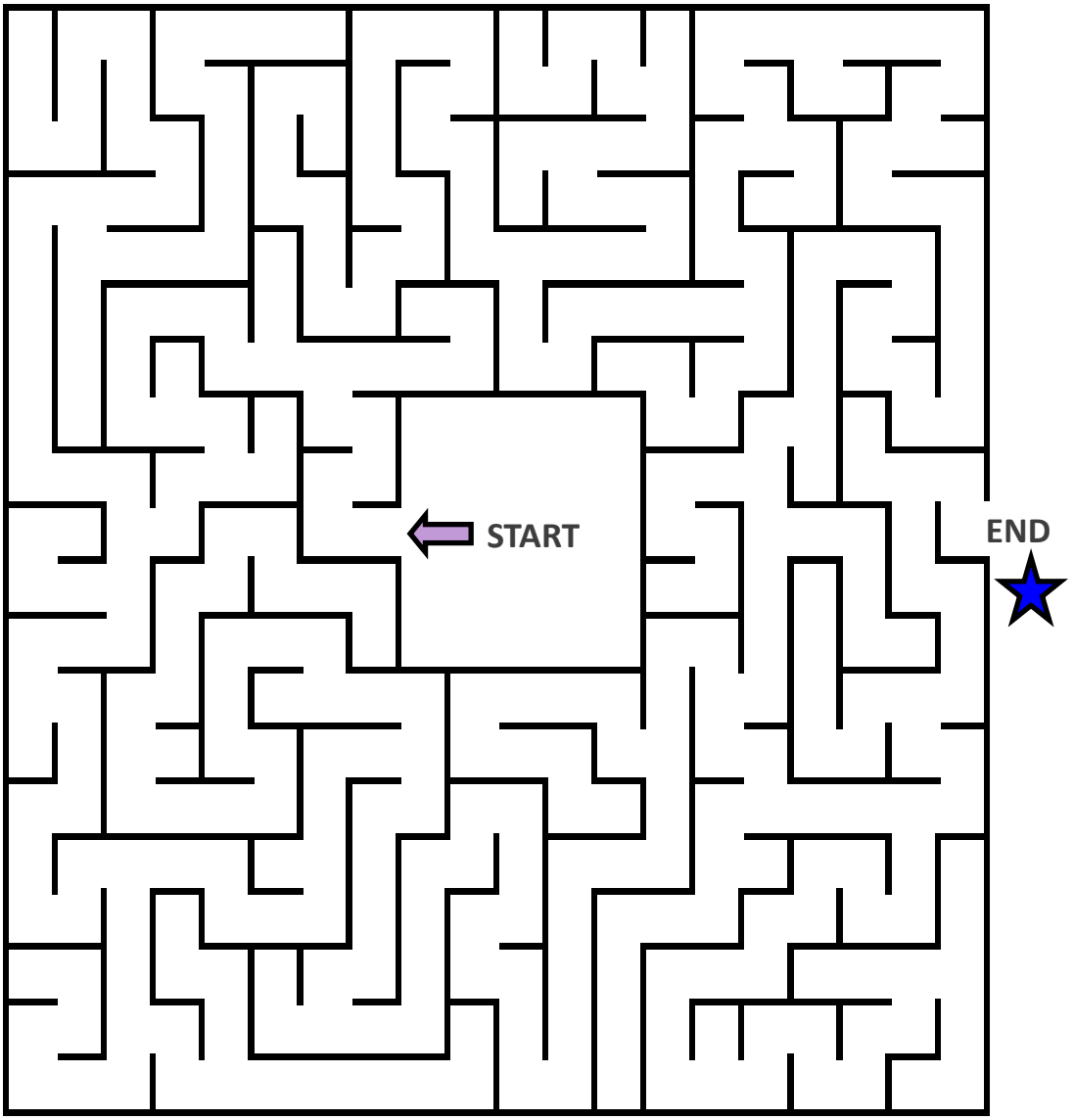
As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

In this Issue…

Issue 7

Maze Challenge



SHARE YOUR STEM…

Visit the C5ISR Center on Facebook to post a photo or video of one of the STEM@Home Activities.

https://www.facebook.com/CCDC.C5ISR/

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Precipitation Experimentation (Grades K-2)

Materials

Rain Cloud Experiment Materials:

- Clear jar or cup
- Cup of water (air)
- Shaving cream (clouds)
- Blue food coloring (rain drops)
- Teaspoon

Snowstorm in a Jar Materials:

- Jar with a lid
- White paint
- Baby oil
- Alka-Seltzer tablet broken into pieces
- Glitter (clear or white works best)
- Warm water

The science behind snowstorms:

Snow occurs when the temperature drops below zero, causing rain droplets to freeze and form snowflakes in a variety of different sizes and shapes. A blizzard is a large, long-lasting snowstorm, with snow moving rapidly like the glitter (snow) moves in your jar. Blizzards bring low temperatures, strong winds, and a lot of blowing snow. It is formed from the following three things: cold air, moisture from clouds and precipitations, and warm air rising over cold air.

It's Raining… It's Pouring...

Where does precipitation come from? Precipitation is the release of a liquid or frozen water that falls from clouds and reaches the ground. It comes in many forms: rain, snow, sleet, and hail. Clouds are made of tiny water droplets, and when the droplets get heavy enough, they fall to the earth. If the temperature is above freezing, the droplets will fall as rain. If it is colder and the atmospheric temperature is below 32 degrees Fahrenheit (zero degrees Celsius), the rain droplets will freeze and fall as snow. Try these experiments to explore precipitation.

Rain Cloud Experiment

- Fill the jar or cup ½ full with water. This will be your "air."
- Spray shaving cream on top of the water, forming the "clouds."
- Make a prediction of what you think will happen when you add the blue food coloring (your "raindrops").
- Make the raindrops by adding drops of food coloring onto the shaving cream.
- Use a teaspoon to add drops of water onto the shaving cream to make more raindrops.
- Observe what happened and draw a picture of your clouds before and after it rained.

Why does this work?

As the colored water fills the cloud (shaving cream), it makes the cloud heavy. The cloud is not able to hold all the water, so the rain (blue food coloring) begins to fall.

Snowstorm in a Jar:

- Fill ¾ of the jar with baby oil.
- Mix the white paint with ½ cup of warm water. Add just enough to turn the water white.
- Pour the white water into the jar, on top of the baby oil.
- Add glitter and allow it to settle on the bottom.
- Place a piece of the Alka-Seltzer tablet into the jar.
- Observe your snowstorm!

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Rain Gauge (Grades 3-5)

Materials:

- Empty 2-liter plastic bottle
- Scissors
- Plastic ruler
- Permanent marker
- Tape
- A few handfuls of gravel, pebbles, or marbles

How it works:

Most of the rain that falls to the ground drains away, while some of it falls in the gauge. The rain gauge allows you to collect rainwater that falls in an area, which is the circular opening at the top of your gauge. If you had a rain gauge with an opening twice the size, it would collect twice as much water, but the depth of the water collected would be the same because the area of the bottom part of the rain gauge would also be double. Scientist and meteorologists are not the only ones who benefit from using rain gauges to study the weather. Farmers often use them to keep track of how much rain their crops are getting.

Rain Rain Go Away...

Have you ever wondered how much it rains where you live? Rain gauges are used by both scientists and meteorologists to study weather. Meteorologists measure and compare rainfall over time to look for patterns in the weather, which allows them to predict when there may be heavy rain or if a drought is on the way. This information is very important to farmers and gardeners so they can prepare for the incoming weather. Keep track of the rain in your community by creating your own rain gauge.

Directions:

- Use the marker to draw a straight line around the circumference of the bottle, about 4 inches down from the top.
- With help from an adult, carefully cut along the line to separate the bottle in 2 parts.
- Put the gravel or pebbles in the bottom part of the bottle to weigh down the rain gauge.
- Place the top of the bottle upside down in the bottom part of the bottle, creating a funnel into the bottom half. Line up the cut edges and tape them together so that the top part is secure.
- Use a long piece of tape to make a straight vertical line from the top edge of the bottle to the bottom.
- Use your marker to draw a line on the vertical tape just above the pebbles or gravel. That is your 0 mark.
- Place your ruler up against the vertical line starting at the 0 mark. Write every quarter inch along the piece of tape. Make sure to label the inches from bottom (smaller numbers) to top (larger numbers).
- Pour water into the bottle until it reaches the bottom mark where the 0 mark starts.
- Place your rain gauge outside away from building or trees. Pay attention to the forecast on a day that is supposed to rain to make sure that the water does not evaporate below the 0 mark.
- After it rains, go outside to check the water level and make a note of how much rain has fallen.

Bonus Challenge:

Collect/record the rainfall for a whole week and calculate the average rainfall for that week. To do that, take your total amount of rainfall and divide it by the number of days.

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Air Mass and Weather Fronts Exploration (Grades 6-8)

Did You Know?

A cold front is a boundary between two air masses, one cold and the other warm, moving so that the colder air replaces the warmer air.

A warm front is a boundary between two air masses, one cool and the other warm, moving so that the warmer air replaces the cooler air.

Materials:

- Clear large bowl or small bin
- One blue ice cube
- Warm water
- Red food coloring
- Blue food coloring

Vocabulary

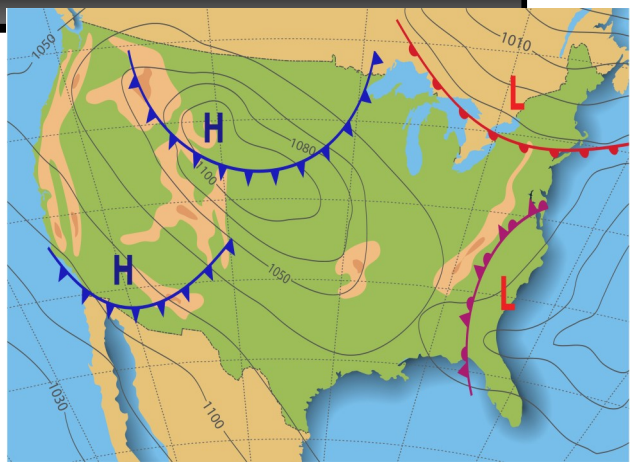
Air masses: bodies of air with uniform temperature, pressure, and humidity.

Cold front: when a colder air mass meets and pushes a warm air mass up.

Warm front: when a warm air mass takes over a cold air mass.

Density: amount of matter contained in a given space.

What is a Storm Front?



What happens when warm and cold air masses meet? They form a large weather front. One type of air, with different temperatures and different levels of humidity, is usually denser than the other. Cold fronts typically come with extreme weather and move faster than warm fronts because the cold air is denser. Warm fronts usually show up on the tail end of precipitation and fog, and they move slowly because they are less dense than cold air fronts.

Try the experiment below to see what happens when a cold air and warm air mass meet.

Procedure: In this experiment, a blue ice cube is placed into warm water to represent warm and cold air masses meeting at a front.

1. To make a blue ice cube, add blue food coloring to water and freeze it in a mold the night before you do the experiment.
2. Fill the bowl about 2/3 full of warm water.
3. Gently place the blue ice cube in the water on one side.
4. Add 3 drops of red food coloring in the water away from the ice cube.
5. Observe what happens.

Questions:

What do you think the blue ice cube represents?

What does the red water represent?

What happens to a cold air mass when it meets a warm air mass?

What happens when a warm air mass meets a cold air mass?

Why does this work?

Liquids and gases are both fluids that can expand or become less dense and rise when heated. This allows us to use water to show the difference between warm and cold air masses. In the experiment, the blue ice cube makes the warm water around it cold, and it sinks because the cold water is denser than the warm water.

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Greenhouse Effect Experiment (Grades 9-12)

Materials

- One piece of plastic wrap
- Two large glass bottles or jars of the same size
- One rubber band
- Four ice cubes of the same size
- Two thermometers (optional)

Why does this work?

The greenhouse effect works the same way a greenhouse traps heat. The jar that has the plastic wrap allowed the light to enter the jar, but the heat couldn't move around as easily as the open cup, so the ice melted faster in the covered cup. This is similar to the way the greenhouse gases trap heat in the atmosphere.

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What is the Greenhouse Effect?

The greenhouse effect is a rise in temperature that the Earth experiences because certain gases in the atmosphere absorb heat from the sun and radiate it back towards the Earth's surface. This is a natural process, and without these gases, the Earth would be a lot colder. The burning of fossil fuels has led to greenhouse gases building up at a faster rate. The increase in greenhouse gases causes the Earth's temperature to rise, which is known as global warming. To address global warming, engineers and scientist must understand the greenhouse effect and its causes. Use this experiment to get a better understanding on how the greenhouse effect works.

Procedure:

- Place two ice cubes and the optional thermometers in each jar. If you are using the thermometer, record the temperature.
- Cover the top of one of the jars with the plastic wrap and use a rubber band to hold it in place. Leave the other jar open.
- Make a prediction of which ice cube will melt faster in a sunny spot.
- Place the two jars near each other in the sun.
- Observe each jar and time how long it takes the ice to melt in each jar and record the temperatures.

For Consideration:

- If you were going to develop a technology to help reduce global warming, what would it be?
- What materials would you us and why?

Standards: C5ISR Center STEM Outreach Activities Align with the Next-Generation Science Standards/Common Core Math Standards.
ACTIVITY ONE: K-ESS2-2: Ask questions to obtain information about the purpose of weather forecasting to prepare for and respond to severe weather. K-ESS2-1 Weather and Climate: Use and share observations of local weather conditions to describe patterns over time.
ACTIVITY TWO: 3-ESS2-1 Weather and Climate: Represent data in tables and graphical displays to describe weather conditions expected during a particular season. CCSS.MATH.CONTENT.3.MD.B.4
Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

ACTIVITY THREE: MS-ESS2-6 Earth Systems: Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determines regional climates. MS-ESS2-5 Earth's Systems**:** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

ACTIVITY FOUR: HS-ESS3-5 Weather and Climate: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associate future impact to Earth's systems. HS-ESS3-4 Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.