

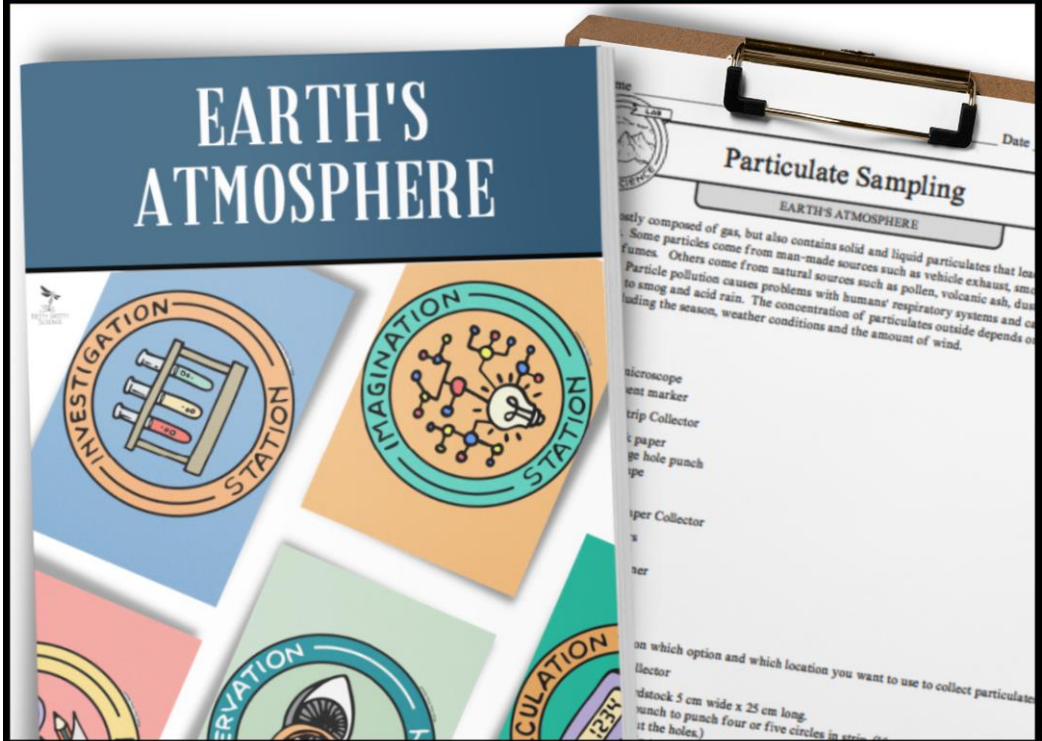


Demos, Labs, & Science Stations Feature:

- Hands-on Investigations
- STEM Challenge
- Scientific Literacy
- Inquiry Process Skills

EARTH SCIENCE - 5E

NGSS · TEKS



DEMOS, LABS, & SCIENCE STATIONS

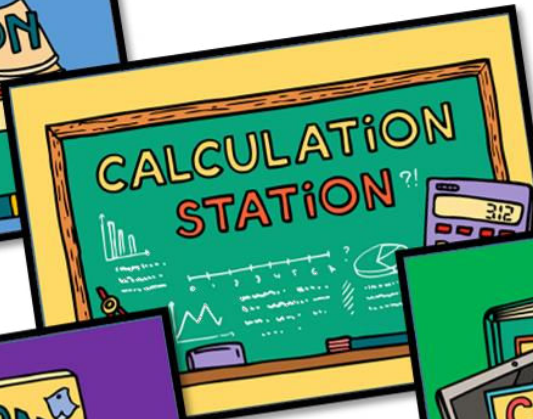
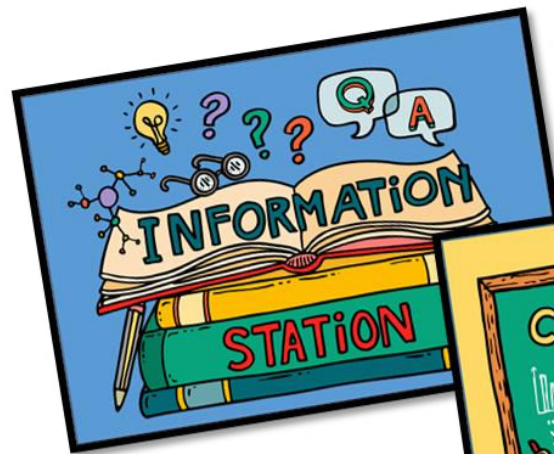
HANDS-ON · STEM · CRITICAL THINKING

**ENGAGING
READING!**

**GRAPHING,
WORD
PROBLEMS &
MEASUREMENT!**

**INQUIRY
SKILLS &
PROCESSES!**

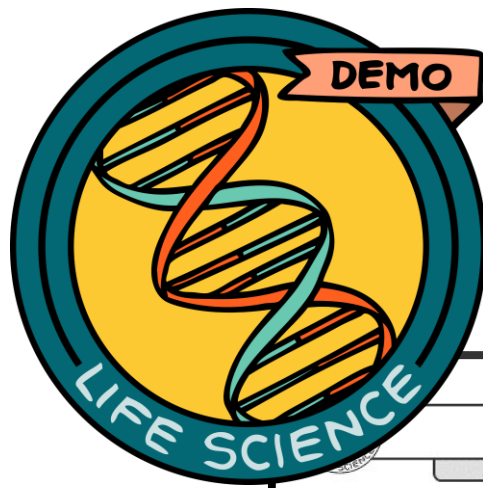
**HANDS-ON
INVESTIGATIONS!**



STEM CHALLENGES!

ALL Station Signage Included!!

Color & Black and White



Teacher guide and answer key
offered for every lab!

Easy-to-get materials!



Smog
Earth's Atmosphere

Activity: Students will see an example of how smog is formed.

Materials:

- 2 - small, clear glass bottles
- 2 - aluminum pie tins
- hot water
- ice
- matches

Procedure:

1. Pour hot water into one pie tin and ice water into the other pie tin.
2. Place a glass bottle in each pie tin - make sure students can see the bottles.
3. Light a match and drop it in the bottle standing in hot water. Have students make observations.
4. Light a match and drop it in the bottle standing in ice water. Have students make observations.

What's Happening?

The smoke stayed in the bottle full of cold air since it was denser than warm air. The dense air does not rise out of the bottle like the one with hot air. This relates to smog which is formed - cars and trucks travel to work in the morning when the air is cooler. The vehicles give off hydrocarbons after the fossil fuels are burned. The hydrocarbons and other air pollutants react with each other in the presence of sunlight from photochemical smog. Photochemical smog irritates respiratory systems, harms plants, and damages some man-made material.

Discussion:

Q: How does the smoke relate to air pollution?

A: Polluted air, like smog, will stay close to the ground when it's cooler, forming, causing health concerns and destruction of some man-made materials.

Q: How is most air pollution produced?

A: By burning fossil fuels from vehicles, factories, and plants.

©Kathy Orth, Science



Discussion questions and
teacher set-up included!

Particulate Sampling
Earth's Atmosphere

Name _____ Date _____

Air is mainly composed of gas but also contains solid and liquid particulates that lead to particulate pollution. Some particulates come from man-made sources such as vehicle exhaust, smokestacks, or chemical fires, while others come from natural sources such as pollen, volcanic ash, dust, and wildfires. Particulate pollution causes problems with humans' respiratory systems and contributes to smog and acid rain. The concentration of particulates outside depends on many factors, including the season, weather conditions, and the amount of wind.

Materials:

- Stereometer scope
- permanent marker

Option 1: Air Strip Collector

- cardstock paper
- 1-inch large hole punch
- packing tape
- string

Option 2: Filter Paper Collector

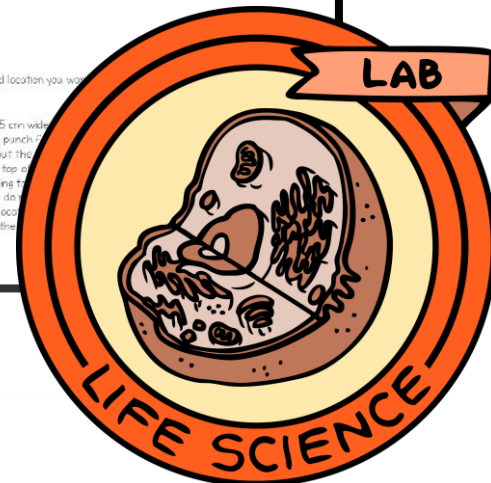
- coffee filters
- rubber band
- vacuum cleaner

Procedure:

1. As a group, decide which option and location you want to use.

Option A: Air Strip Collector


- a. Cut a strip of cardstock 5 cm wide.
- b. Use a large hole punch to punch a hole in the strip, trace a quarter and cut out the quarter.
- c. Punch a small hole in the top of the strip.
- d. Place a long strip of packing tape on the other side will be sticky - do not remove it.
- e. Determine the date and location of the sample. Then, hang the strip.





Group members will read a passage and then complete a task to help increase science literacy and deepen their understanding of the science concept.






It's a Bird, It's a Plane... No, It's Just Bacon

Ever since the successful launch of Sputnik in 1957, humans have constantly been launching objects into the stratosphere. In the beginning it was primarily for scientific purposes. Then animals such as dogs, monkeys, and even cats were sent up to study the effects of travel. Nowadays, with the permission of the aviation authorities and a high-altitude balloon kit, anyone can send practically anything up to the stratosphere.


In 2012 five students from Harvard decided to send a shale shellacked hamburger. It reached a height of 30 km and landed in a tree 204 km (126 mi) from the launch site. A seventh grader sent a silver rocket science project into a Hello Kitty space 28.5 km into the air. The book, *Up & Away*, by Joshie, an armchair balloonist, was launched into the stratosphere roughly 30.5 km. The balloon rocket called bacon explosion.

One man sent the stratosphere, himself. On Baumgartner launched his and jumped back to Earth. It was watched his ascent a breath. At one point during appeared to be spinning out of control and open his of 394 km (244 mi) back to Earth in 16 minutes, with four minutes of it being in free fall. He is reaching a top speed of 1.3 a few records were broken.




A

List some items that have already been sent to the stratosphere.




B

From what you know about the stratosphere, why was Baumgartner's stunt dangerous?



D

If you could send any object to the stratosphere, what would it be?



A. _____

B. _____

C. _____

D. _____



A



B





C



Name _____ Date _____

A1. _____

A2. _____

B1. _____

B2. _____

C1. _____

C2. _____

1. Identify each of the clouds in the image above.

2. Clouds are classified by shape and height.

1. The meteoroids in the image above are in which layer of the atmosphere?


2. Identify the four main layers of the atmosphere from lowest to highest. How are they classified?

Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic.



Group members will work with one another to explore the concept through hands-on activities, so they may practice specific inquiry process skills as they learn.





Properties of Air

Problem! What properties of air are there that we cannot actually see?

Materials:

- balloon
- triple beam balance
- heavy-duty rubber band
- plastic baggie
- wide-mouth jar

Procedure:

Part A: Mass of Air

1. Use the balance to find the mass of the deflated measurement on the answer sheet.
2. Blow up the balloon and tie the neck closed.
3. Find the mass of the inflated balloon. Record on sheet.

Part B: Air Pressure

1. Use the rubber band to tightly secure the opening of the wide-mouthed jar.
2. Gently try to push the bag into the jar. Record sheet.
3. Remove the rubber band.
4. Line the inside of the jar with the plastic baggie, jar's opening with the rubber band.
5. Gently try to pull the bag out of the jar with your observations on your answer sheet.




Name _____ Date _____

Directions: Complete the data tables.

Part A: Mass of Air			Observations
	Mass (g)		
	deflated	inflated	
Balloon			


Part B: Air Pressure		Observations
Boggie		
Push into jar		
Pull out of jar		

1. Did the mass of the balloon change after it was inflated? What conclusion can you make about air and mass?
2. Explain your observations with the plastic boggie in terms of where the air pressure was higher in relation to the boggie.




A

Describe one characteristic of each of the four main layers of the atmosphere.




B

Compare and contrast the three forms of radiation



A


A: Answers will vary - troposphere is where weather occurs.



B

A: visible light, infrared radiation and ultraviolet

Name _____
Date _____

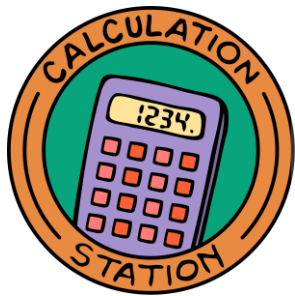


Identify heat transfer the together the tr

warm air is less dense and rises in convection currents


winds circle the globe.

There are three different options for this station: interviews, videos, or group essay. Depending on the option you choose, group members will communicate what they know by answering questions in creative ways.



Group members use their math skills to complete the station challenge. Skills may include graphing, analyzing data, using models, measurement, and calculating formulas or word problems.





Absorbing Solar Energy

Earth's surface absorbs solar energy. The energy heats the land and water. When Earth's surface is heated it radiates some heat back into the atmosphere as infrared radiation. The energy from the atmosphere radiates back down to the surface, warming it. This process is called the greenhouse effect.

Materials:


- 2 - thermometers
- thermometer holders (optional)
- 2 - large cups
- water
- sand


Procedure:

- Fill the cups to the top with water.
- Arrange the cups in the sun.
- Place a thermometer in each cup.
- Adjust the cups so they are at the same angle to the sun.
- Record the temperature of the water in each cup.
- Make a prediction about which cup will heat up faster.
- After 30 minutes, record the temperature of the water in each cup.
- Graph your data. Make sure to mark the axes.

Directions: Record data in table below. Graph data when complete.

Light ON		30	100	150	200	250	300	350	400	450	500
°C	Water										
Light OFF		5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00
°C	Water										






Wind Speed

Challenge: Design and build a cup anemometer.

An anemometer is an instrument that measures wind force and velocity. A cup anemometer uses three or four cups mounted on the ends of blades or spokes that spin on an axle. The cups capture the wind, turning the axle and allowing a person to measure wind speed. The image on the right is a cup anemometer invented in 1846 by John Robinson.



Materials:

- small paper cups
- plastic card
- cardboard
- pendle
- push pins

System Requirements:

- As a group, design a cup anemometer.
- Build the anemometer.
 - one cup must be used
 - the anemometer must be made of cardboard
 - the anemometer must be made of plastic
- When the anemometer is built, test it. Record the wind speed and direction.

Testing:

Take anemometers outside. Time the anemometer spins made by the wind. Answer sheet.

Name _____ Date _____

Complete the data table.


Trial	Rotations/Min	Observations
1		
2		
3		
Average		

- Would this area you tested with your anemometer be a good place for a weather station that measures wind factors? Explain.
- Do you think your anemometer accurately measured all the winds you encountered? Explain.
- Do you think that if you tested your anemometer on different sides of the school building, you would get different measurements? Explain.

Group members will work together to solve a STEM (Science, Technology, Engineering, Math) challenge by creating models or designs that demonstrate their understanding of the science topic being taught.



This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.




Without an Atmosphere

Directions: Use your imagination to answer the statement below.

IMAGINE the atmosphere didn't exist on Earth.

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Drip, Drop, Splat!

Problem: How does the density of a liquid and drop height effect the size and shape of liquid splatters?

Materials:

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric ruler
- meter stick

Procedure:


- Make a hypothesis of how density of a liquid will effect splatter size on your lab sheet.
- Place the piece of paper down on the lab table in order to catch splatters.
- Measure the heights listed in the data table using a meter stick. Place meter stick with end starting at zero on paper and move up stick when increasing height of drop.
- Use the eye dropper to drop ONE drop of colored water and ONE drop of colored syrup. Make sure to drop on different places on paper.
- Measure the size of the splatter in MILLIMETERS. Record in data table on answer sheet.
- Repeat for each height.
- Use the collected data to graph the splatter size versus drop height for each liquid.

Analyze and Conclude

- Was your hypothesis correct? Explain.
- What were two controls in your experiment that helped you collect the most accurate data possible?

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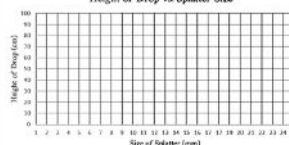
Date _____



Hypothesis

	Drop Height (cm)				
	5	25	50	75	100
Colored Water					
Colored Syrup					

Height of Drop vs. Splatter Size



Legend

☐ Water

☐ Syrup

Analyze and Conclude:

- _____
- _____

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USER-FRIENDLY PAGES:
Students easily recognize which answer sheet to use at each station by matching station icons located on each page!

TEACHERS SAVE TIME:
Laminate station pages and reuse for each class and for years to follow!

Inquiry and Process Skills

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Demo

Guided Inquiry Lab

Science Stations

Inquiry-Based Science Unit: Earth's Atmosphere	Classifying	Communicating	Compare & Contrast	Creating Models	Gather/Organize Data	Generalizing	Identifying Variables	Inferring	Interpreting Data and Graphs	Making Decisions	Manipulating Materials	Measuring / Calculating	Observing	Predicting
Smog	X	X	X			X		X		X			X	
Particulate Sampling		X	X	X	X		X		X		X	X		X
Information Station: It's a Bird, It's a Plane					X	X		X						
Observation Station: Images & Questions	X		X		X	X		X					X	
Investigation Station: Properties of Air	X		X		X		X		X		X		X	
Calculation Station: Absorbing Solar Energy					X		X			X		X		
Communication Station: Questions	X	X				X				X				
Creation Station: Wind Speed		X		X	X				X	X	X	X	X	X
Imagination Station: Without an Atmosphere		X		X						X				X

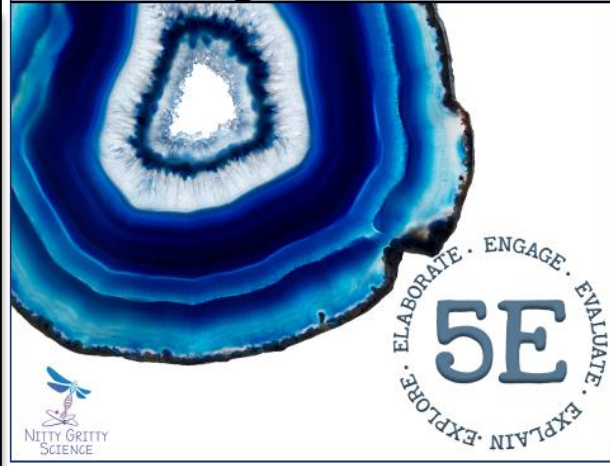
NGS promotes scientific inquiry throughout the curriculum. Students become more confident and effective learners while developing problem-solving and critical thinking skills. Process skills, such as planning, organizing and evaluating, help students to complete projects and assignments. These skills allow students to independently gather information, analyze it, and draw their own conclusions.

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