



## Demos, Labs, & Science Stations

Feature:

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

**EARTH SCIENCE - 5E** **NGSS · TEKS**

**EARTH'S ATMOSPHERE**

**Particulate Sampling**

**EARTH'S ATMOSPHERE**

Particulate sampling is a process used to collect and analyze small particles from the atmosphere. The atmosphere is not only composed of gas, but also contains solid and liquid particulates that lead to smog and acid rain. Some particles come from natural sources such as pollen, volcanic ash, dust, and smoke. Others come from man-made sources such as vehicle exhaust, smog, and acid rain. The concentration of particulates outside depends on the season, weather conditions and the amount of wind.

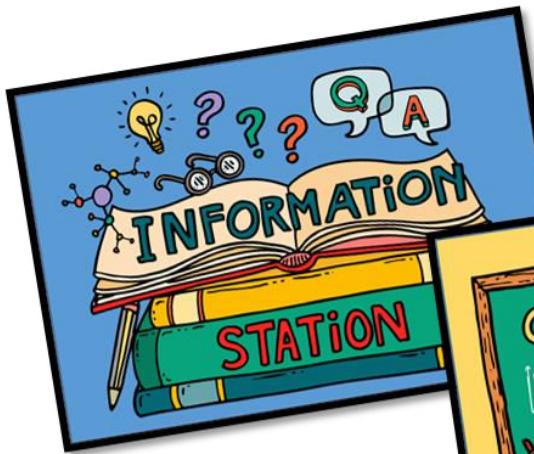
Microscope  
cent marker  
trip Collector  
c paper  
ge hole punch  
ipe  
iper Collector  
a  
ser

on which option and which location you want to use to collect particulate  
lector  
idstock 5 cm wide x 25 cm long.  
lunch to punch four or five circles in strip (a  
it the holes.)

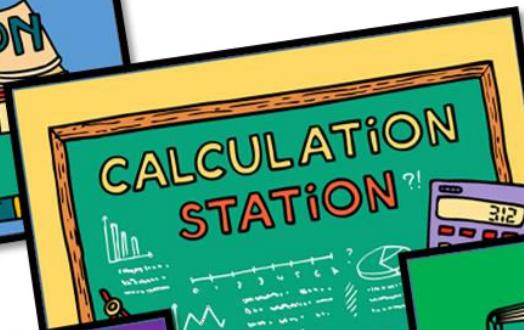
**DEMONSTRATIONS, LABS, & SCIENCE STATIONS**

**HANDS-ON · STEM · CRITICAL THINKING**

ENGAGING  
READING!



GRAPHING,  
WORD  
PROBLEMS &  
MEASUREMENT!



INQUIRY  
SKILLS &  
PROCESSES!



STEM CHALLENGES!



HANDS-ON  
INVESTIGATIONS!

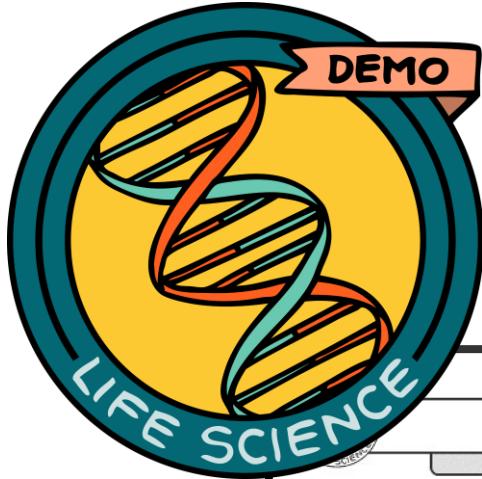


**ALL Station Signage Included!!**

Color & Black and White



NITTY GRITTY  
SCIENCE



**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:**

- Pour hot water into one pie tin and ice water into the other pie tin.
- Place a glass bottle in each pie tin – make sure students can see the bottles.
- Light a match and drop it in the bottle standing in hot water. Have students make observations.
- 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 cities where smog is formed – cars and trucks travel to work in the morning when the air is colder. The vehicles give off hydrocarbons of oil 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 colder, 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.

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Teacher guide and answer key offered for every lab!

Easy-to-get materials!



**Particulate Sampling**

**Earth's Atmosphere**

**Name** \_\_\_\_\_ **Date** \_\_\_\_\_

Air is mainly composed of  $\text{N}_2$  gas but also contains solid and liquid particulates that lead to particle pollution. Some particles come from man-made sources such as vehicle exhaust, smokestacks, or chemical furnaces, while others come from natural sources such as pollen, volcanic ash, dust, and wildfires. Particle 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**

- stereomicroscope
- permanent marker

**Option 1: Air Strip Collector**

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

**Option 2: Filter Paper Collector**

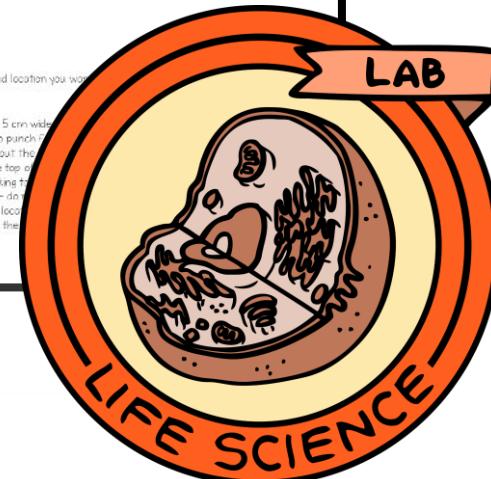
- coffee filters
- rubber band
- vacuum cleaner

**Procedure**

- As a group, decide which option and location you want.

**Option A: Air Strip Collector**

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



Discussion questions and teacher set-up included!



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 stale shelled bacon hamburger. It reached a height of 30 km and landed in a tree 20 km (120 mi) from the launch site. A seventh grader sent a silver rocket science project with a Hello Kitty rocket 28.1 km into the air. It took over 3 hours to find it where it landed by Tchibbo, an armchair with a camera on it, landed safely. Launched into the stratosphere roughly 305 km. The bacon rocket called bacon exploded.

One man sent the ultimate stratosphere, himself. On a Baumgartner launched him and jumped back to Earth. The world watched his ascent as he appeared to be spinning out of control and then fell at 39 km (24 mi) back to Earth in 17 minutes, with four minutes of it being in free fall. He reached a top speed of 1344 km/h. 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?

**C**

A. \_\_\_\_\_

B. \_\_\_\_\_

C. \_\_\_\_\_

D. \_\_\_\_\_

**D**

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

**A**

**B**

**C**

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 sheet.

**Part B: Air Pressure**

1. Use the rubber band to tightly secure the open 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 bag. 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 I: Mass of Air**

	Mass (g)		Observations
	Deflated	Inflated	
Balloon			

**Part II: Air Pressure**

Baggie	Observations
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 bag in terms of where the air pressure was higher in relation to the bag.  
\_\_\_\_\_

**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

**B**

A: visible light, infrared and ultraviolet

**C**

Identify heat transfer the three together the three

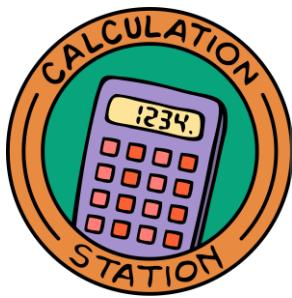
Name \_\_\_\_\_ Date \_\_\_\_\_

by this is global winds circle the globe.

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 absorbed radiation heats the gases in the air, forming a "blanket" around Earth that holds the heat in. This process is called the greenhouse effect.

**Materials:**

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

**Procedure:**

- Fill the cups to 1/2 full.
- Arrange the cups.
- Place a thermometer in each cup.
- Adjust the cups so some of sand or water is exposed.
- Record the temperatures.
- Make sure the thermometers are in the same place.
- After 30 minutes, record the temperatures again.
- Graph your data. Make sure to mark the time.

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

	30	60	90	120	150	180	210	240	270	300	330	360	400	430	500
Light ON															
°C															
Water															
Light OFF															
°C															
Water															

Graph paper is provided for plotting the data.

**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 cups
- cardboard
- pencils
- push pins

**System Requirements:**

- As a group, design a
- Build the anemometer
  - one cup must be used.
  - anemometers
  - anemometers
  - anemometers
- When the anemometer group name and set

**Testing:**

Take anemometers outside times the anemometer spins made by the wind answer sheet.

**Wind Speed Data Table:**

Trial	Rotations/Min	Observations
1		
2		
3		
Average		

**Questions:**

- Would the area you tested with your anemometer be a good place for a weather station that measures wind factors? \_\_\_\_\_
- 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.

Describe what would happen if there was no atmosphere.

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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!

**Drip, Drop, Splat!**

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

**Materials:**

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric rule
- 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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**Hypothesis**

**Drop Height (cm)**

5	25	50	75	100
Colored Water				
Colored Syrup				

**Height of Drop vs. Splatter Size**

Legend

- Water
- Syrup

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**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

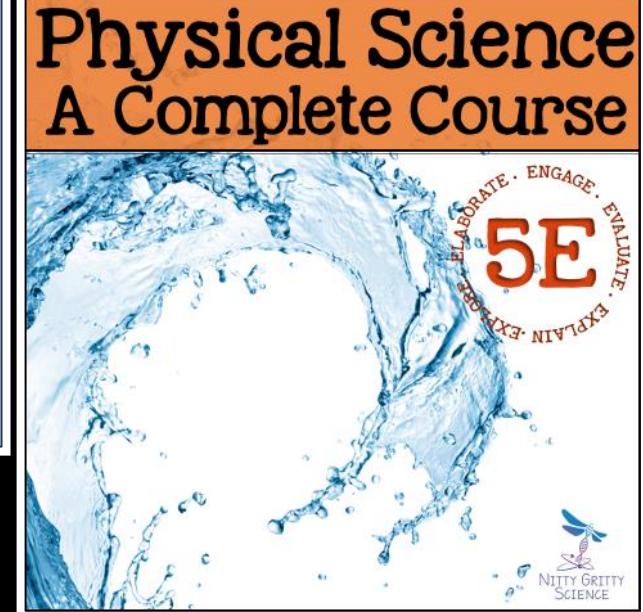
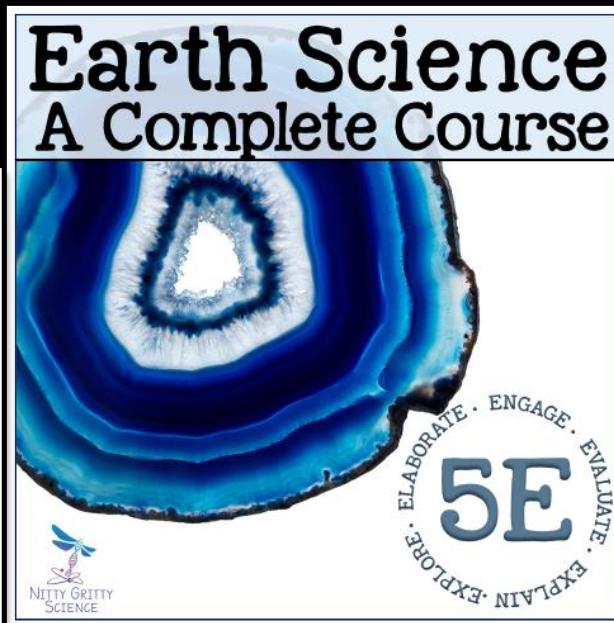
 Guided Inquiry Lab

 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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