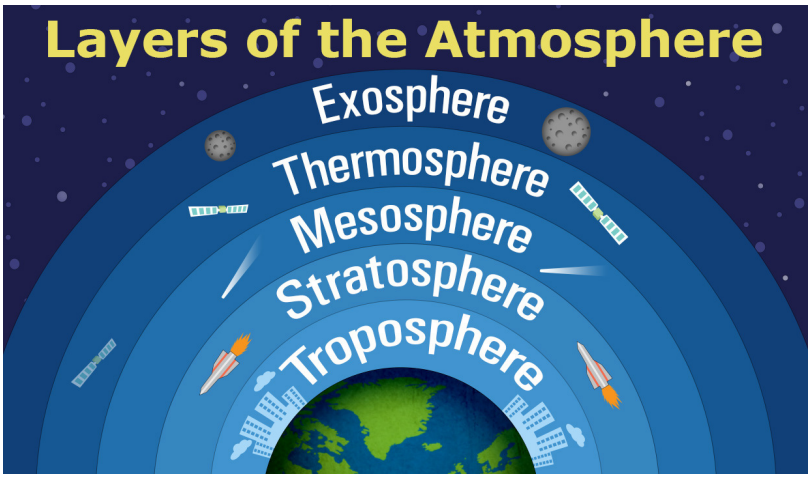
WEEKS 9-12:
THE ATMOSPHERE

INTRODUCTION

National City's 16 Weeks of STEAM is designed to offer families enrichment opportunities that focus on science, technology, engineering, art, and math with a special emphasis on conservation. As a city, we have partnered with organizations to provide a variety of resources, activities, and fun challenges that provide families with an awareness of our city's natural resources and ways to preserve them for future generations.

GRADE LEVELS

This program is designed for the whole family to get involved. We have made every effort to provide extensions and activities for children of all ages in grades K through 8th. Note that some children may need support to complete certain activities.



https://pixfeeds.com/images/13/382138/1280-382138-layers-of-the-atmosphere-in-order.jpg

ATMOSPHERE BASICS

Earth has many systems and the atmosphere refers to the envelope surrounding the Earth. Without the atmosphere, there would be no life on Earth! In this unit, we are going to focus on the first layer of the atmosphere, the troposphere. We are going to explore air pressure, clouds & weather, flight, and air pollution through a series of investigations and activities.

Our goal is to have your family have fun with experiments, crafts, music, and more while understanding how the Earth is a unique and special place.

VOCABULARY

- **Atmosphere**: The envelope of gasses surrounding the Earth.
- **Troposphere**: The lowest region of the atmosphere, extending from the Earth's surface to a height of about 3.7-6.2 miles.
- **Weather**: The state of the atmosphere at a place and time. This could include heat, dryness, sunshine, wind, rain, etc.
- **Barometer**: An instrument used to measure atmospheric pressure. Especially important for weather forecasting and determining altitude.
- **Flight**: The action or process of flying through the air.
- **Gravity**: The force that attracts the body toward the center of the Earth, or any other physical body having mass.

CONNECTIONS TO NGSS

- K: Earth Systems
- 1: Earth's Place in the Universe
- 2-5: Earth's Systems
- 6-8: Matter and Its Interactions; Earth's Systems

VISIT & INTERVIEW

Visit the *National City 16 Weeks of STEAM* website for related field trips and interviews with project partners.

DIGITAL RESOURCES

To access all the digital resources shared in the next four weeks, visit the *National City 16 Weeks of STEAM* website or scan this QR code.

FEATURED PARTNERS

FLEET SCIENCE CENTER

SAN DIEGO AIR & SPACE MUSEUM

NASA

WEEK 9

EXPLORING AIR PRESSURE

Introduction

The atmosphere is divided into 4 layers based on temperature. The lowest layer, which is closest to the Earth, is the troposphere. It varies in height throughout the world and the temperature drops rapidly the higher you go.

Most weather that we experience occurs in the troposphere. On Earth, we have something called atmospheric pressure, also known as barometric pressure, which is caused by gravity. As humans, we don't feel atmospheric pressure, but it does cause changes in the weather that we experience.

🤔 ***WONDER***

How does air pressure work?

WEEK 9
NATIONAL CITY
16 WEEKS OF STEAM

atmosphere

HOME LEARNING ACTIVITY

UNDER PRESSURE

Watch one of these videos!

- Grades K-3: Layers Of Atmosphere | The Dr. Binocs Show
- Grades 4-8: What are the layers of the atmosphere?

Take these action steps to learn!

- Cover your workspace with a protective cover.
- Set up materials on the workspace.
- Pour water into a shallow dish.
- Mix in a couple of drops of food coloring.
- Place a small candle in the middle of the dish.
- Light the candle. (Ask for help from an adult if you need it.)
- Slowly bring the glass over the top of the candle until it rests on the dish.
- Observe what happens. Notice:
  - The burning candle heats the air above it
  - The burning candle will use up all the oxygen inside the glass
  - The candle will go out because it can't burn without oxygen
  - The air in the glass will cool
  - As it cools the air pressure will fall below atmospheric pressure
  - It will draw liquid into the glass until the pressure is equalized

Materials:

- **Glass**
- **Small Candle**
- **Matches**
- **Food Coloring (any color)**
- **Water**
- **Shallow dish with a rim to hold water**

HOME LEARNING EXTENSIONS

EXPLORE

*How do barometers work? Can they really tell us when a storm is coming? Click **HERE** to learn more.*

INVESTIGATE

Will the water stay at the level it rose to as the temperature changes?

WONDER

How does this activity relate to the weather?

VISUAL & PERFORMING ARTS ACTIVITY

SOAR TO NEW HEIGHTS

Impress friends and family with a magic trick that gets a little help from atmospheric pressure! Now that you understand a little more about atmospheric pressure, let's WOW your friends and family with a fun magic trick!

Watch this video to see how it's done!

Materials:

- **1 Medium-sized mason jar with a lid**
- **A small piece of window screen to cover the top of the jar.**
- **A small piece of poster paper or cardstock that will cover the jar opening completely**
- **Digital camera or Camera App on a smart phone to record the experiment**
- **Water**
- **Toothpicks**
- **A wide container to capture any overflow water**

Time to Make Magic!

- Find a place to work where it won't be a problem if things get wet or do this over a bucket. This is just in case there is a problem with your trick.
- Fill the mason jar halfway with water.
- Place the screen on the jar and screw on the lid to the jar minus the flat, center metal piece. Make sure it is on tight. You should be able to see through the screen to the water.
- Cut the screen so it isn't visible from the outside.
- Next, grab your cardstock. Cut it into a square that hangs over the edge of the jar.

- Place the card stock on top of the screen/lid combo and flip the jar upside down while firmly keeping the cardstock over the top of the jar.
- You can then remove your hand from the card stock and it will stick. What makes this trick possible? Well... **air pressure**, of course, causes the cardstock to stick.
- Pull the cardstock to the side (not straight down) and "fool" everyone when the water doesn't drip out but instead stays right inside the jar! The magic of **surface tension** has been created with the screen.

LEVEL UP

- Try sticking a few toothpicks through the screen and watch them rise to the top!
- When you're ready, tilt the jar to the side to watch water pour out.
- You might want to practice this activity a few times before you record so you can get your act down.
- After practicing, get your "act" together and film it to share with friends and family!

atmosphere

WEEK 10
CLOUD FORMATION

Introduction

Most weather happens in the **troposphere**, which is the closest layer of the atmosphere to Earth. In today's activity, we are going to see how clouds are formed using a few common household items.

A cloud is formed when water vapor attaches itself to particles that are in the air -- such as dust or pollen. Many of these particles exist in the troposphere. Let's explore how "hairspray" can act as the "particles" you would find in the troposphere.

WONDER

How are clouds made?

WEEK 10
NATIONAL CITY
16 WEEKS OF STEAM

atmosphere

HOME LEARNING ACTIVITY

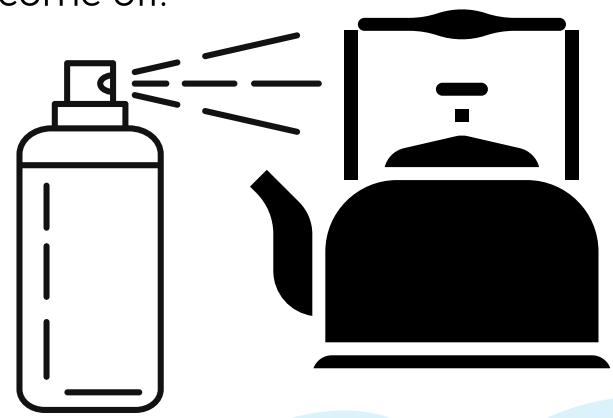
CLOUDS IN THE ATMOSPHERE

Watch one of these videos!

- Grades K-3: **What are clouds made of?**
- Grades 4-8: **The making of a cloud**

Take these action steps to learn!

- Boil water in a tea kettle or in a microwave-safe container.
- Pour boiling water into an empty 16 oz jar (make sure you have adult supervision as boiling water can easily burn)
- Place lid on the jar and tighten
- Place ice on top of the lid.
- Let it sit for 1 minute.
- The next part has to be done fast. Open the lid and spray hair spray inside the jar then quickly tighten the lid back on.
- Leave the lid on to let the clouds fully form, approximately 1 minute. The longer you leave it on the more clouds you will have.
- Take off the lid and watch the clouds come off.



Materials:

- **Boiling water**
- **Empty mason jar with closing lid**
- **Hair spray**
- **Ice**
- ***Optional: Food Coloring***

HOME LEARNING EXTENSIONS

EXPLORE
Add food coloring to the water to see if it changes the clouds.

INVESTIGATE
What happens if you don't use ice or boiling water?

WONDER
Do humans have an impact on the formation of clouds (i.e. pollution)?

VISUAL & PERFORMING ARTS ACTIVITY

CLOUD ART - CHOOSE YOUR OWN ADVENTURE!

Get inspired and create some cloud art. Artists have been inspired by clouds and often use them in their artwork. We will give you some options to create your own representation. Try one or try them all!

CLOUD PAINTING

Materials:

- Thick paper
- Non-toxic paints in sky colors (blues, whites, and grays)
- 1-2 paintbrushes
- Video Tutorials:
  - How to Draw Clouds - Easy Step-by-Step for Beginners
  - Painting Clouds with Bob Ross
  - How to Paint Clouds in Watercolor for Beginners

Time to Create

- Gather supplies and set them up in an area that is approved by caregivers
- Watch a guided cloud painting video (see materials)
- Design and create your painting

NOTE: You may want to practice a few times!

2 CLOUD COLLAGE

Materials:

- **Paper**
- **Glue**
- **Scissors**
- **Pencil**
- **Items you can find that are white. Examples include:**
  - **Cotton**
  - **Yarn**
  - **Glitter**
  - **Crayons**
  - **Paint**
  - **Magazine Photos**

Time to Create

- Gather all your materials together and set up in a safe location.
- Draw cloud shapes on your paper or plan your artwork. You can make them large and small.
- Glue your items to the paper to make 3-dimensional clouds.
- Let your art dry.Title your artwork and share it!

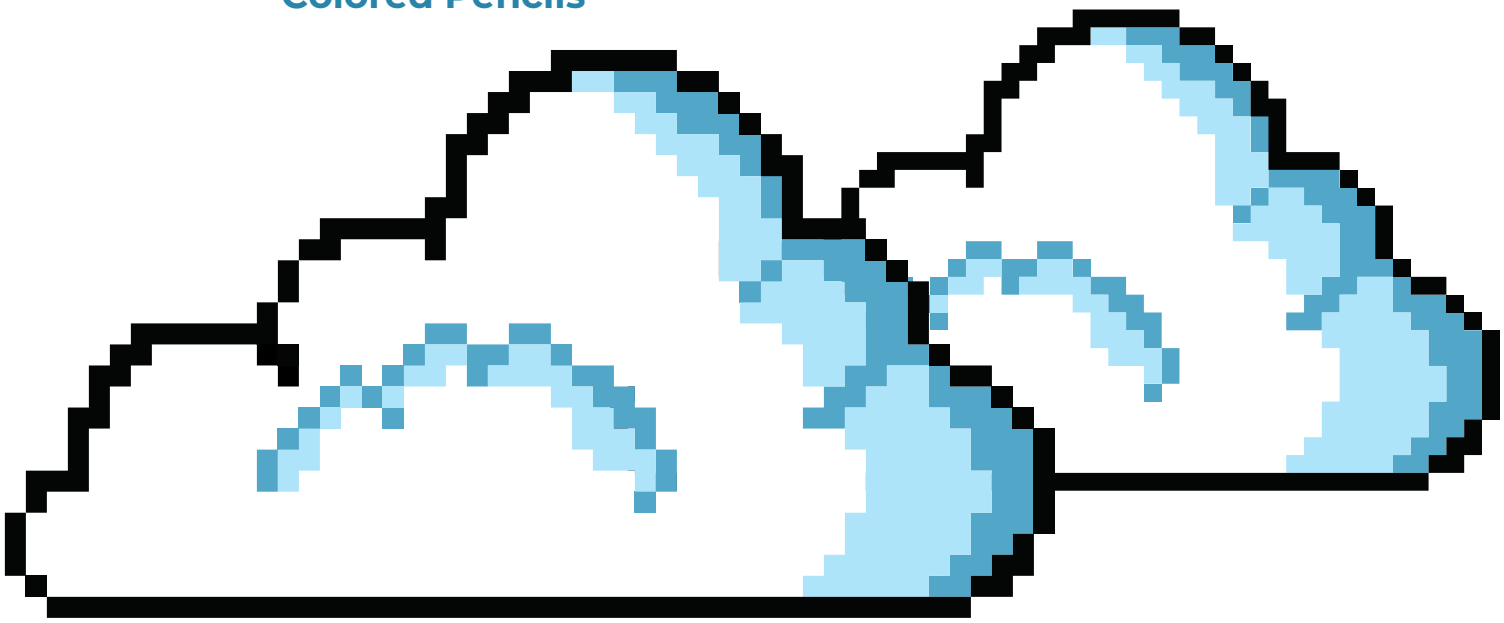
3 CLOUD PIXEL ART

Materials:

- **Digital Options:**
  - **Pixel Art**
- **Digital Pixel Art Template**
- **Non-Digital Option:**
  - **Graph Paper**
  - **Crayons, Markers, or Colored Pencils**

Time to Create

- Draft your cloud design.
- Use the pixel art tool to design the same cloud design one pixel/cell at a time.
- Title your art and share it!



WEEK 11
THE SCIENCE OF FLIGHT

Introduction

You may have designed a few paper airplanes in your life, but have you ever thought about what can impact the flight path of your plane? Real airplanes fly in the atmosphere, mostly the troposphere, although some fly higher and are impacted by a number of factors. Impactful conditions in the atmosphere include wind, temperature, water levels, and atmospheric pressure. Airplanes often fly at higher altitudes to find more favorable atmospheric conditions.

It is important to note that aircraft are energy-intensive and as a result, they release emissions into the atmosphere causing climate impact. We will look at atmospheric pollution in our next activity.

WONDER

How do airplanes fly? What factors impact flight and how can I design the best paper airplane? What helps a plane glide as far as possible?

WEEK 11
NATIONAL CITY
16 WEEKS OF STEAM

atmosphere

HOME LEARNING ACTIVITY

FLY HIGH INTO THE SKY!

You will design paper airplanes and test which design will fly as far as possible. There are four factors that impact the flight of a paper airplane (these are the same for a real aircraft):

- Lift
- Thrust
- Drag
- Gravity

Watch one of these videos!

- Grades K-2: **What Makes Airplanes Fly?**
- Grade 3-6: **The Science Behind Paper Airplanes**
- Grades 4-8: **How This Guy Fold & Flies World Record Paper Airplanes**

Take these action steps to learn!

- Gather your paper and find a table to design your paper airplanes.
- Go to the ***10 Paper Airplanes website*** and choose at least 3 paper airplane designs to build. NOTE: Click on the picture online and follow the directions provided.
- Once you have built 3 paper airplanes, head out to an open space to test them out. NOTE: You will want to find a spot that is relatively free from wind or other atmospheric disturbance.

Materials:

- **Paper**
- ***10 Paper Airplanes* website for design tips**
- **Open area to test flights**
- ***Flight Data Worksheet***
- **Measuring Tape (optional)**

- Place some markers to judge distance. You can measure the distance OR you can place an item on the ground like a stick or rock to mark the distance.
- Launch each paper airplane at least 3 times and record the results on the ***Flight Data Worksheet***.
- Determine which design performed best and why.

HOME LEARNING EXTENSIONS

EXPLORE

Design a new airplane or modify one you already made based on what you have learned with this experiment.

INVESTIGATE

Research different strategies and practices for the longest paper airplane flights.

WONDER

Based on your data and observations, what are the key elements to making a plane fly the furthest?

VISUAL & PERFORMING ARTS ACTIVITY

SOAR TO NEW HEIGHTS

In this activity, you will design a paper airplane mobile. You will need to look for items and materials that will help you make your mobile unique.

Time to Build

- Gather all your supplies
- Plan out your mobile by looking at examples and determine what goes best with your supplies. You might want to create a drawing of it first.
- Build your paper airplanes. Build as many planes as you want and consider adding other elements like clouds, birds, or rainbows.
- Hole punch each item and attach the item to the string by tying the string through the hole.
- Attach the strings that hold your planes and other elements to your base.
- Hang your mobile up and enjoy your design! NOTE: You might need to ask a tall person to help you hang it up.

Materials:

- **Paper Ideas**
  - **Origami folding paper is a great option**
  - **Look for colors that are bright**
  - **You might choose a few colors or just one color**
  - **Newspaper or old book pages**
  - **Comic book pages**
- **String Ideas**
  - **Fishing line**
  - **Thin yarn or rope**
  - **Dental floss**
- **Base (You will hang the planes from this)**
  - **Hangar**
  - **Sticks**
  - **Unsharpened pencils**
  - **Unused Chopsticks**
- **Hole punch**

WEEK 12

AIR POLLUTION AND IT'S IMPACT ON OUR COMMUNITY

Introduction

It is often very hard to “see” pollution in the air. We assume the air is clean because we don’t see brown cloudy gasses. But, we have to remember that the atmosphere is made up of mostly invisible gas. Most pollution is also invisible. So how can we know if our air is clean? Scientists use very complex tools to measure the pollution in the air.

In today’s experiment, we will make a sensor to detect particulate matter (any objects floating on the wind) in our air.

🤔 ***WONDER***

How can you measure air pollution? Can you make a sensor that will pick up particulate matter?

WEEK 12

NATIONAL CITY 16 WEEKS OF STEAM

atmosphere

HOME LEARNING ACTIVITY

HOW CLEAN IS OUR AIR?

Watch one of these videos!

- Grades K-2: Air Pollution
- Grade 3-6: What causes air pollution?
- Grades 4-8: Air Pollution 101

Take these action steps to learn!

- Find a place where you will conduct the test outside. Look for a place that will be free from foot traffic or animals, and avoid a covered patio or corner where you might not have full, open access to the outside air. NOTE: Your goal is to find a location with good air circulation, so look for a place that is higher up than ground level. (i.e. on top of a large rock or fence)
- Be sure to check the weather forecast before conducting the experiment. It is best not to do this during rainy or super windy days.
- Coat the top of the white or clear plastic with petroleum jelly.
- Secure the plastic to a wood block, brick, or other weighted object using duct tape.

Materials:

- **A piece of sturdy plastic, white or clear**
- **Petroleum jelly**
- **Duct tape**
- **A wood block or brick**
- **Blank white paper**

- Let the plastic-covered block sit undisturbed for at least 24 hours.
- After 24 hours, collect the plastic-covered block and bring it inside. Be very careful to not touch the surface.
- Carefully remove the plastic from the block and place it on a flat surface with good lighting.
- Examine the top of the plastic for any particles collected. You can take a photo on a cell phone and then zoom in. NOTE: You can even use the photo to share your findings with others.
- Make a list of the particles you find and discuss how you can go about protecting the air around you.

HOME LEARNING EXTENSIONS

EXPLORE

Place more than one home-made sensor outdoors in similar conditions and compare and contrast the findings.

INVESTIGATE

What do you think could cause the release of these particles?

WONDER

What factors could change the collection of particles?

VISUAL & PERFORMING ARTS ACTIVITY

SAVE THE EARTH 3D POSTER

Students will create a poster showing how their family and community can help combat pollution.

- Gather all materials.
- Determine the main message of your poster and come up with a slogan. Find inspiration here.
- Sketch the basic design your poster.
- Find, draw, or print items and words that represent how you and your family can help combat pollution.
- Glue and/or draw items.
- Share your poster with friends and family!

Materials:

- **Poster Paper**
- **Pencil**
- **Options: Markers, crayons, colored pencils**
- **Options: Magazine Pictures, Photos from the internet**
- **Items to represent sources of pollution: Trash, plastic, etc.**
- **Glue or tape**

atmosphere

RECOMMENDED BOOKS

This book list is designed to pair with the Atmosphere 4-week unit. We have curated books for grades K-8th. Reading at home is critical to developing interest and knowledge. You can find these books and similar books like these at the Public Library and online.

TIPS

- If you don't find these titles, ask/search for titles on the Water Cycle
- Set aside a daily time to read to, with, or have your child read independently
- Help your child explore new types of books (it is okay for older children to read picture books!)
- Have older siblings read to younger children
- Discuss the stories and information together

Picture Books (All Ages - Picture Books are Great for the ENTIRE Family)

- **Iqbal and His Ingenious Idea: How a Science Project Helps One Family and the Planet, by Elizabeth Suneby, Rebbecca Green (Illustrator)**: It's monsoon season in Bangladesh, which means Iqbal's mother must cook the family's meals indoors, over an open fire. The smoke from the fire makes breathing difficult for his mother and baby sister, and it's even making them sick.
- **Air by Israel Felzenszwalb & David Palatnik:** You will get to know the different forms of its presence in nature and how it is important and does us good. You will discover many reasons to respect and take care of the air. In doing so, you will preserve the healthy and harmonious life in our planet.

- **Tomie dePaola's, The Cloud Book:** In this unique picture book, Tomie introduces some of the most common types of clouds, as well as the myths and legends inspired by their shapes. Simple, whimsical illustrations show the variations in shape and color that herald changes in the weather.

Non-Fiction

- **Grades K-5: Weather, DK Eyewitness Series by Brian Cosgrove**: From whirling tornadoes to freezing blizzards, weather is a constantly changing force that affects everything around us. Explore the history and elements that make up the environment around us in DK Eyewitness Books: Weather.
- **Grades 3-8: The New 50 Simple Things KIDS Can do to Save the Earth by Earthworks Group & Sophie Javna:** What makes this book stand out, though, is that it doesn't just inform kids, it encourages them to make a difference by providing them, their friends and their families the tools to take action.
- **Grades 3-8: The Klutz Book of Paper Airplanes by Klutz**: Folding a single sheet of paper into a high performance, blow-the-competition-away flying paper machine has never been easier. The package includes clear instructions for folding 10 impressive kid-doable planes and 40 sheets of custom-designed paper in a variety of groovy patterns.

Fiction

- **Grades 2-6: Science Comics, Wild Weather by MK Reed & Jonathan Hill**: Furious floods, looming landslides, terrifying tornadoes, ferocious forest fires! Is Mother Nature trying to tell us something?

SUGGESTED MUSIC PLAYLIST

This music playlist is designed to pair with the Atmosphere 4-week unit. We have curated ambient songs, soundscapes, popular music tracks, and instructional songs for grades K-8th. Listening to music deepens emotional connections to the learning and can create a mood for exploration.

We have linked to all these songs inside Spotify or you can search for them on YouTube.

TIPS

- Set aside a daily time to listen to the music & sounds with your child or have him/her listen independently.
- Help your child explore new types of sounds at different times of the day & during different activities.
- Discuss the sounds and lyrics together as a family -- How do they make you feel? How do they connect to the learning theme and topics?

SOUNDSCAPES / AMBIENT TRACKS

- Wind Sounds for Sleep and Relaxation Volume 2 (Album) -- **Track 1: Breezy Cottonwood Tree Leaves Sound**
- 50 Sweet Spa Sounds for Kids (Album) -- **Track 11: Whispering Wind**
- Airplanes (Album) -- **Track 2: Airwaves**
- Soothing Melodies for Absolute Peace & Tranquility (Album) -- **Track 44: Clouds**

INSTRUCTIONAL / HISTORICAL TRACKS

- Brain On! Science podcast for Kids (Podcast) -- **How do Airplanes Fly?**
- Little Songs, Big Science (Album) -- **Track 2: Air Pressure**
- Mindful Moments for Kids (Album) -- **Track 12: Clouds**
- Songs About the Weather for Kids! (Playlist) -- **Clouds**
- Eco Friendly Frenzy for Kids with Sienna (Podcast) -- **Air Pollution: Episode 13**