AERONAUTICS & AEROSPACE
ACTIVITY BUNDLE

For Grades K-2

Four hands-on STEM activities that introduce K-2 learners to Aeronautics & Aerospace careers through investigation, experimentation, and play.

STEM NEXT
OPPORTUNITY FUND

STEM Next Aeronautics & Aerospace Activity Bundle (K-2)

Welcome to the STEM Next Aeronautics & Aerospace Activity Bundle! This bundle is one of three bundles now available from the Earth & Space Learning Center of Excellence, powered by the Institute for a STEM Ready America.

Use the four activities below to inspire K-2 youth with hands-on science. Through these activities, youth will develop foundational STEM skills by engaging in hands-on investigations of aeronautics and aerospace concepts (meteorology, aerospace engineering, and Bernoulli's Principle), while building career awareness by exploring how professionals use science, technology, engineering, and math.

Interested in more resources like this from STEM Next? Check out our Tools in our online Resource Library.

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Lesson 1: Cloud Chasers

In this lesson, youth will be able to:

- Explain how clouds form in the atmosphere.
- Investigate the conditions needed for clouds to produce rain.
- Use the scientific method to make a hypothesis, complete an experiment, collect data, and draw conclusions.

Time needed: 60 minutes

Preparation

Materials	• Jar with a lid (1 for demonstration) • Ice • Water • Hairspray (any brand) • Clear, plastic cups (2 per youth group) • Sponges (1 per youth group) • Eye droppers (1 per youth group) • Food coloring (optional)
Setup	• Gather materials for cloud demonstration • Practice cloud demonstration • Gather materials for youth activity • Color water, if desired
Presentation	Slides

Facilitation

Overview:

In this activity, youth will investigate how clouds form and why they produce rain. Students practice making observations, testing predictions, collecting data, and discovering how meteorologists study clouds to better understand and predict weather.

Engage:

1. Show students a picture of a cloud (Slide 2-3) and ask: *What does this cloud look like to you? What animal, object, or character do you see?* Allow several students to share their ideas. Repeat with 2-3 different cloud pictures.
2. Explain: Clouds can look like many different things, but scientists look at clouds in a different way. They study their shapes and where they are in the sky to learn about the weather.

Investigate:

1. Ask the group: *Does anyone know what clouds are made of?* Allow guesses from the group. Do not tell the answer until after the demonstration. Explain that today we are going to make a cloud in a jar.
2. This is best done as a facilitator demonstration. Fill the jar ½ full of hot water. Swirl it around to warm up the sides of the jar. Turn the lid upside down and place it on the top of the jar. Place several ice cubes onto the lid, and allow it to rest on the top of the jar for about 20 seconds. Remove the lid, quickly spray a bit of hairspray into the jar, and then replace the lid with the ice still on top. Watch the cloud form.

3. Ask the group again what makes up a cloud. Allow new ideas to be shared. Explain (Slide 4): *When you add the warm water to the jar, some of it evaporates and turns to water vapor. The water vapor rises to the top of the jar where it comes into contact with cold air, thanks to the ice cubes on top. Water vapor condenses (turns from vapor to liquid) when it cools*

down. However, a cloud can only form if the water vapor has something to condense on to. In nature, water vapor may condense onto dust particles, air pollution, pollen, volcanic ash, etc. In the case of this activity, the water vapor condensed onto the hairspray.

4. Ask the group: *How much water can a cloud hold? What will happen when a cloud can no longer hold any more water? You are going to use a model cloud and determine how much water it can hold before it rains.*

5. Divide youth into groups of 2-3. Give each group a clear, plastic cup, a sponge, cup of water, and an eye dropper. To make the water easier to see, you may want to add a few drops of food coloring.

6. Demonstrate how to set-up the model cloud by placing the sponge over the top of the opening of the cup. Youth will fill their eye dropper with water and add the water to the sponge (Slide 5). Have the group guess how many drops it would take for the sponge to reach its maximum amount of water and start to rain. Record the guesses and keep to compare them to the actual number of drops at the end.

7. Have each group perform the experiment by filling their eye dropper with water and adding the water to the top of the sponge. Remind youth to count the number of drops they add. Keep adding water until drops begin to fall into the empty cup.

Wrap-up:

1. Once all groups have gotten their cloud to rain, have each group share how many drops it took. If there are large variance in numbers, discuss the different ways groups added water to the sponge. Did they add the water in the same place each time or did they spread the water over the entire sponge? Did they count drops or whole droppers full? Stress that these variances have an effect on the outcome.

2. To see how much water their cloud held before it rained, have each group squeeze the water from the sponge into their cup. Compare how much they started with with how much the cloud held.

Implementation

Extension:

- Cloud Identification: Distribute the NASA Cloud Identification Chart. Take youth outside to observe and identify the different types.

- Citizen Science: GLOBE Clouds is a citizen science program that allows everyone to observe and record cloud conditions in their area, then submit their data to scientists around the world. By collecting information about cloud type, cloud cover, and sky conditions, participants help researchers better understand weather patterns, climate, and how clouds affect Earth's atmosphere.

Career Connection:

- Meteorologist
    - Inspire Science Grade K-2: Learn About Meteorologists
    - Help families prepare for tomorrow's weather! Observe a cloud (Slide 6-9). Predict the weather that is likely to occur soon. Share one piece of advice (bring a raincoat, wear sunscreen, etc.).
    - Science Trek: Weather Games: Have youth play an array of games connected to weather and meteorology.

Lesson 2: Slow it Down

In this lesson, youth will be able to:

- Identify and describe the four forces of flight.
- Use the engineering design process to solve a problem.

Time needed: 60 minutes

Preparation

Materials	• 5 sheets of copy paper (per group of 2-3 youth) • Scotch tape • Index card (1 per group of 2-3 youth) • 4 paper clips (per group of 2-3 youth) • Scissors • Pencil
Setup	• Gather all materials
Presentation	Slides

Facilitation

Overview:

In this activity, youth will explore the forces that impact flight through a movement-based investigation and an engineering design challenge. Youth apply their understanding of lift, thrust, gravity, and drag to design, build, test, and improve a parachute that uses drag to land as slowly and accurately as possible.

Engage:

1. Find a space that will allow for youth to run freely, outside or a gymnasium is ideal for this activity. Have the group play the “Human Airplane Game”.
    - Tell youth to spread their arms like wings, gently flap, and run around the open area. After a minute, have youth stop and ask how that felt. Tell the group: *You experienced LIFT- air pushing upward.*
    - Have the group run forward as fast as they could from one end of the area to another. Ask what they felt. Tell the group: *You just experienced THRUST- air pushing the plane forward.*

- Have youth jump as high as they can and land softly for 5 times. Ask what pulled them down. Tell the group: *You just experienced GRAVITY- the Earth's invisible pull downward.*
- Lastly, have youth find a partner. Have one partner try to slowly walk forward. At the same time, have their partner hold onto their shoulders and try to gently hold them back. Tell the group: *You just experienced DRAG- resistance to motion. These are the four forces that determine if an object can fly or not. In order for a plane to fly, these four forces must be balanced.*

2. To extend learning and solidify new vocabulary, shout out each one of the new words (Lift, Thrust, Gravity, Drag) individually and have youth act out each force.

Investigate:

1. Return inside or to a space where youth can build (Slide 2). Ask youth: *Which force was associated with the upward motion of a plane? What force was associated with the downward motion?* Tell youth: *When designing jets, rockets, and other aircraft, aeronautical engineers work to overcome drag, but when designing parachutes or hot air balloons, they use drag to slow descent in order to land gently in a specific location. In this activity, you will design a parachute that uses drag to land as slowly as possible onto a target.*
2. Ask the group: *What kinds of objects fall slowly? What characteristics of these objects help them fall slowly? What kinds of shapes fall slower than others?* This is a good time to demonstrate a flat paper versus a balled up piece of paper, a cylinder of paper versus one that has wings, folded paper versus flat sheet. (Slide 3)
3. Explain the challenge to the group: Design an aircraft that uses drag to land as slowly as possible onto a target. Share the constraints and criteria. (Slide 4)
    - Criteria
        - Your aircraft must be dropped from a height of at least six feet.
        - It must land within the target area that this marked on the floor.
    - Constraints
        - You may only use the materials that your group is provided.

4. Divide students into small teams. Distribute the materials. Allow 5-10 minutes for groups to plan and/or sketch ideas to help determine their best design. Remind youth that the group must agree on one design.

5. Allow 15-20 minutes to build a prototype. During this time encourage youth to build, test and redesign as needed. As youth work, you should circulate and assist by asking groups some guiding questions such as: *How might you fold your paper to slow its fall? How do the locations of the paper folds make a difference? Does your aircraft drop more slowly or quickly if it is designed to spin? How can you use paper clips to stabilize the falling aircraft's pathway into the target?*

Wrap-up:

Bring the group back together to share their designs and demonstrate how slowly their aircraft can land. After groups have demonstrated, discuss the designs of the slowest crafts and what they had in common. Ask each group how they think they could make their craft even better.

Implementation

Career Connection:

- Aerospace Engineer
    - I Can be Anything I Want to be A to Z
- Aerospace Technician
    - Surprisingly STEM

Lesson 3: Magic or Science?

In this lesson, youth will be able to:

- Explain how air pressure can exert force on objects and influence their movement.
- Describe how Bernoulli's Principle helps create lift and allows objects to levitate.
- Use the scientific method to make a hypothesis, complete an experiment, collect data, and draw conclusions.

Time needed: 60 minutes

Preparation

Materials	• Paint stirrer or ruler • Paper (any kind) • Plastic or paper straw, bendy type work best (2 per youth group) • Scotch tape • Scissors (1 per youth group) • Ping-pong or similar sized paper ball, foil ball, or foam ball (1-2 per youth group) • Circle Template (1 per group)
Setup	• Gather materials • Copy Circle Template
Presentation	Slides

Facilitation

Overview:

In this hands-on investigation, youth explore the concept of air pressure and Bernoulli's Principle. Youth observe how pressure affects objects, then build and test a simple device that uses moving air to levitate a lightweight ball.

Engage:

1. Review the vocabulary words from Slow it Down Activity (Slide 2). Tell youth: *Another important factor that affects flight is PRESSURE- a force that is pushing on you in all directions.* Show an empty aluminum can. Have youth predict what will happen if you were to stand on the can. It will crush due to the increase in pressure above the can being greater than the pressure inside the can (Slide 3).

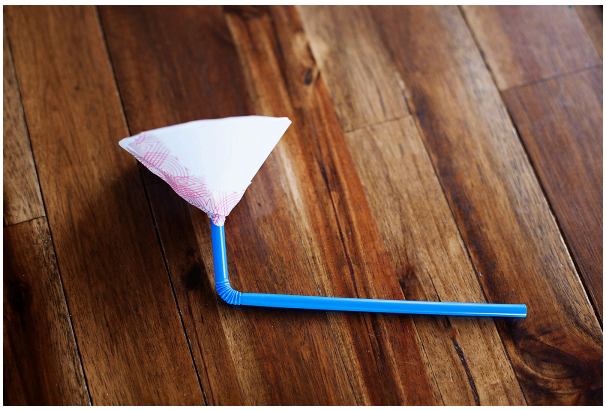
2. Demonstrate pressure by placing a paint stirrer or similar piece of wood on the edge of the table so that it is hanging about halfway off the table. Place several pieces of paper (4-5) to cover the piece of wood that is on the table. Quickly do a karate-type motion on the piece of wood that is exposed outside the paper.

3. Explain to youth: *Since the pressure is greater above the paper on the table, it holds the stick in place, allowing it to break. This is an example of Bernoulli's Principle, which provides an explanation as to why planes can fly. "As a fluid increases in speed, it exerts less pressure."* (Slide 4)

Investigate:

1. Tell the group that they are going to investigate Bernoulli's principle to see if they can levitate a ball with air only.

2. Divide the group into pairs. Give each pair 2 straws, a copy of the Circle Template, tape, and scissors. Demonstrate how to make the paper funnel, connect the straw with the tape. Blow gently through the straw to levitate the ball.



3. Allow 5 minutes for each youth to make their own levitating ball.
4. Ask the group if the size of the straw or the size of the circle will affect if the ball will levitate or not. Allow youth 5-10 minutes to experiment by making different sized funnels and straws.

Wrap-up:

Bring the group back together and ask: D*id any results surprise you? Which size of funnel worked best? Which length of the straw worked best?* Explain how the levitation works (Slide 5). *We create an area of low pressure around the ball by blowing into the straw. When you blow in a fast, thin stream (because the straw makes it thin), the fast air is able to move around the sides of the ball instead of simply pushing it upward from below.*

Implementation

Career Connection:

- Pilot
    - Ready to Fly: Have youth conduct a pre-flight inspection of an airplane.
- Drone pilot

Lesson 4: Would You Rather?

In this lesson, youth will be able to:

- Evaluate their preferences of different tasks associated with aerospace and aeronautics careers.
- Associate different careers with some common tasks.

Time needed: 20 minutes

Preparation

Materials	• Would you Rather Slide Deck
Setup	• Clear a space for youth to move from one side of the room to another

Facilitation

Overview:

In this review activity, youth play a version of the game, Would You Rather. The game introduces participants to aviation and aerospace careers by having youth choose which activity they would rather do and explain why.

Engage:

1. Have youth stand in the middle of the room. Ask: *Has anyone ever played Would You Rather?* Have someone who has played explain the rules.
2. Display the slide deck and read each "Would You Rather?" question. After reading the question, have youth move in the direction of the arrow based on their answer choice. Once all youth have moved to one side of the room or another, ask a few youth to share why they made their choice.
3. After a few explanations, share the careers associated with each activity. The careers will be displayed on the next slide in the deck.
4. Continue in this way until all the questions have been asked.

Wrap-up:

After all the questions have been shared, ask: *Is anyone surprised by the careers you chose? What career interested you the most? If that professional was in our program today, what question would you ask them about their career?*