Discuss air

- Think about some of the extreme weather we saw in the videos and read about in the “Severe Weather” article. What are some weather phenomena that we’ve observed or read about?
Discuss air

• What is wind, and what is it made of?

Air plays a very important role in weather and wind.
Focus question

• What is air?

Record your first thoughts.
Introduce syringes

Use your syringe to answer these questions.

1. What happens to the air in the syringe when you push and pull on the plunger?
2. What can air do?
Distribute materials

Get a syringe and a flexible tube for everyone in your group.
Record notebook entries

Notebook sheet 2, *Air Investigation*
Record notebook entries

- Record three observations.
- Record three inferences or questions.

Write cause-and-effect statements such as:

- When I push the plunger, _______. Therefore, I think _______. I’m wondering _______.
Discuss air observations

Share your observations.

1. When you clamp the tube closed and push the plunger down, what happens to the air?

2. Is there more air, less air, or the same amount of air in the syringe when the air is pushed into a smaller space?
Discuss air observations

3. What did you feel as you pushed on the plunger?
4. What happens when you let go of the plunger after pushing it down?
Discuss air observations

1. What do you think happens to the air when it is pushed into a smaller space?

2. If you pull the plunger out, why does it move back into the syringe when you release it?
Discuss air observations

Draw a model in your notebooks to explain your thinking. Label your model and use arrows to show movement.
Introduce compression

When you push the plunger, the air is forced into a smaller space. We say the air is compressed.

The same amount of air is still in the syringe when it is compressed.
Compressed air pushes back with force equal to the force compressing it.

If the force on the plunger is released, the force of the compressed air pushes back on the plunger until the pressure inside and outside are equal.
Introduce compression

• If you pull the plunger out, why does it move back into the tube when you release it?
**Introduce expansion**

If you increase the volume inside the syringe, you are increasing the space filled by the gas, so you **expand** the gas.

When the gas expands, it has less pressure.
Introduce expansion

• What was the source of the pressure that pushed the plunger back into the syringe?
When you let go, the plunger is pushed back by pressure from the air outside the syringe. It moves until the pressure inside and outside are equal.

This is why, when you let go, the gas returned to its original, smaller volume.
Use a plastic bubble to gather more evidence that air can be compressed. Predict what will happen.

Pull the plunger out of the barrel, insert a bubble, insert the plunger about halfway, and clamp off the syringe. Then push and pull on the syringe.
Discuss observations

1. What happens to the bubble when the plunger is pushed in?
2. Why does this happen?
“Gas in a Syringe”

Click and drag the syringe plunger. What happens to:

- the number of gas particles?
- the volume of gas?
- the motion of the gas particles?

Compare the motion of the particles inside and outside the syringe.
Everything is made out of **particles**, including air.

The particles in gases are free to move throughout the volume of gas. There is a lot of space between the particles of air.
Discuss particles

Compressing a volume of gas into a smaller space pushes the particles closer together.

The number of particles is the same, they are just closer together.
Discuss particles

The size of the particles isn’t smaller, there is just less space between them.

Particles compressed into a smaller space bump into one another and the sides of the container more often.
Discuss particles

1. Why can’t you push the plunger all the way to the end of the syringe barrel when the tube is clamped off?

2. After you have pushed the plunger in, what causes it to move back out when you release it?

3. What causes the plunger to move back in after you have pulled it out?
Discuss particles

Update your models of the air in the syringe.

Add the concepts of particle collisions and air pressure.
Share questions about air

- You generated questions about air. After talking about particles, are there other questions you have about this model for air?
Compare mass and weight

Every object and substance in the world is made of matter. The three states of matter are solid, liquid, and gas. The amount of matter in an object is its mass.
Compare mass and weight

Mass is the measurement of the amount of matter in an object or a substance such as air. Mass is measured in grams.

One way to confirm that something has mass is to weigh it. Weight is the pull or force between Earth and the mass of the object or substance.
Compare mass and weight

• Does air have mass? Is there any matter in a volume of air?
Discuss an air experiment

Think about an experiment you can conduct to find out if air has mass.
Display available materials

These materials are available
• 2 L plastic bottle
• A plastic-bottle pump
• An electronic balance

Use these materials to refine your ideas.
Summarize the investigation with results and conclusions in your group.

Think about each step in the experiment.
Record findings

Summarize the investigation in your notebook.

We demonstrated that air has mass, because when we ______, we collected evidence that ______.
Review vocabulary

Spend a few minutes reviewing the vocabulary for this part. Update the vocabulary index and table of contents in your notebook.
Review vocabulary

- air
- compress
- expand
- mass
- matter
- particle
- pressure
- state
- weight
Revisit the focus question

- What is air?

Draw a line of learning under your first response and add new ideas.
Record big ideas

Title a new page “Weather and Water Big Ideas.” What are the big ideas that explain weather that we have learned about so far? Leave several pages for a list.
Can you find other ways to demonstrate that air has mass and takes up space?