

Unit: WEATHER

Lesson 14: Wind

Summary

We typically think of air as an amorphous gas that moves randomly. Or, we may not think much about air at all because it is invisible. But if we think about air in terms of air masses that are colder or warmer, and moister or drier, we can understand the **causes** for winds, precipitation in certain places and not others, and even storms versus mild rains.

In this lesson, students do a card sort and put together a sequence of events that lead to the movement of air masses, and therefore wind, and possible precipitation. They will create a **model** to demonstrate their understanding of this **weather** phenomena by drawing a frame by frame cartoon.



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Goal: Students will create a model that demonstrates their understanding of the effects that temperature and water content have on wind.

Vocabulary

air mass

Materials

- ★ Moving Air Masses Card Sort (1 per pair)
- ★ scissors (1-2 per pair)
- ★ envelope (1 per pair)
- ★ way to project or draw the needed diagrams for students
- ★ unlined paper and color pens or pencils for students to make their cartoons (optional)

- ★ Lesson 14 READING: What to Know About Weather (assign for homework)

- ★ **Tech option** In the Explain section, students will be making a cartoon to show the sequence of events as one air mass rises and another air mass takes its place. If software is available, students can make an animation instead.

Preparation:

If you want to save class time, cut up the Moving Air Masses cards and place them in an envelope for each pair of students. If you like, you can laminate the cards for future reuse.

Engage/Elaborate (15 min.)

OPENER

These are the **air** temperatures on a beach and on a boat.

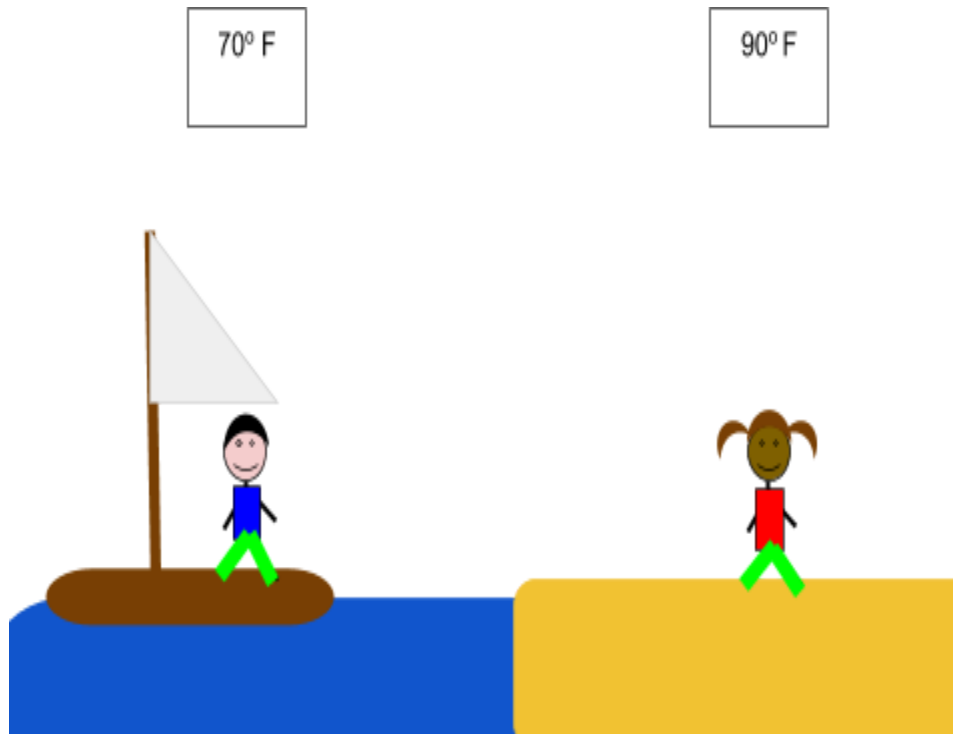


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- ❖ What causes the air temperature difference? **Sand warms up faster than water in the sunlight and it warms the air above it.**
- ❖ Which air mass will have more water vapor in it? **The one above the water.**
- ❖ What will happen to the air mass above the land when it gets warm enough? (Hint: Think about the density of the air mass.) **The density of the air mass will decrease until it floats up.**

→ If students have trouble with the first question, remind them of Lesson 9: Surface Heating lesson. Then ask how the surface affects the temperature of the air above it.

SLD You may need to be explicit in saying, “Remember what heats up quicker, water or soil and sand?” If they can remember this data, they can make a connection between what they learned in Lesson 9 and the Opener in this lesson. You may also need to ask, “How do you think ground or water temperature affects the air above them?”

- **ESS2.D: Weather and Climate** Define air mass. An **air mass** is a mass of air with a certain temperature and humidity. You can think of it like a large balloon of air, except that there is no balloon. In this lesson, students will see how air masses create the weather.

EL Because students may know of ‘mass’ as a measurement, explain that a ‘mass’ can also be a large body of matter with no absolute shape.

- Show students the **Air Masses diagram**. Point out the warm air mass (90 degrees) and the cooler air mass (70 degrees).

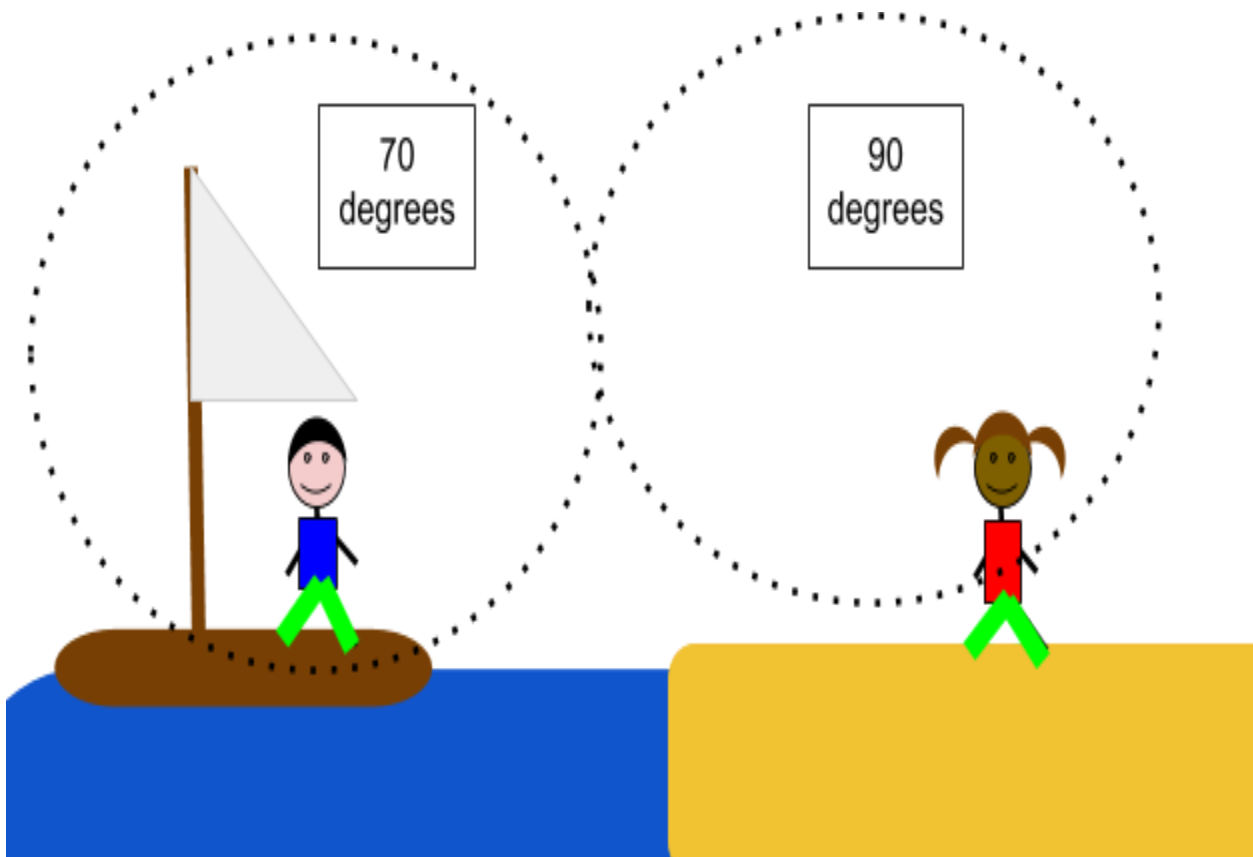


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- For the third question, ask students to explain what is happening in terms of density and why.
- **Cause & Effect Ask:** What do you think will happen next? Why does this happen? **The cooler air mass will replace the warm air mass that was on the beach. Once the warm air mass is gone, pressure decreases and the cold air mass rushes in to fill the space. (Remind students of the syringe—when you pull the plunger out, air rushes in to fill the syringe barrel.)**
- How will a person on the beach experience this? **There will be a cool wind blowing from the sea onto the land.**

EL Include the following sentence starters if needed:

The temperature is different above the land and water because

_____.

The air mass that is above the _____ will have more water vapor in it because _____.

When it gets warm enough, the density of the air mass above the land will _____ because _____.

Explore (20 min.)

- Hand out the Moving Air Masses Card Sort and scissors to each pair of students, and have them cut up the cards.
- Check after a few minutes to be sure partners put the 4 cards from Set A in the right order.

SLD Student may confuse the properties of convection with what they are learning about air masses. While it's true that warm molecules rise, eventually it gets cooler in the atmosphere. Students may think it would get warmer because the air mass is getting closer to the sun, but it actually starts to cool because the molecules in less dense air are further apart and allow heat to escape.

It also might be easier for students to make a cartoon with 9 frames (1 for each step).

1. Start with the 4 cards that say “Set A.” Put these in order with your partner. Agree on the correct order. Then compare with other partner pairs at your table.

Set A in order:

- There is a warm air mass over the land.
- Warmer air rises.
- Pressure drops.
- The cold, moist air moves in to replace the warm air mass.

2. Take out the 5 cards that say “Set B.” Decide which of these comes after Step 4 (from Set A), and so on. Put the 5 cards in order.

Set B in order:

- The land warms the cold, moist air mass. It becomes a warm, moist air mass.
- The warm air mass rises.
- When air rises it cools because it's colder higher up.
- If air cools enough and the pressure drops, the water vapor in it condenses into clouds.
- If it gets cold enough and the pressure is low enough, it might rain.

3. Now turn the 9 cards into a cartoon story in 3 or 4 frames with the air masses as characters. With your partner, decide what the frames will be. Then draw your cartoon on your own paper. You can use speech bubbles and thought bubbles.



Explain (5 min.)

- Debrief the questions. Make sure both partners can explain why they chose that order for Set B.
- *Developing and using models* Stress that **air moves from areas of high pressure to areas of low pressure** until the pressure is equal. As an example, blow up a balloon but don't tie it. Then let the balloon go, and watch it fly around the room. **Ask:** What is causing that to happen? **The air is rushing out of the balloon (which is a high-pressure region) until the pressure inside the balloon is the same as it is outside of the balloon. In the same way, when an air mass floats up leaving an area of low pressure, another air mass moves in until the pressure is equal—at least temporarily, until something changes again.**

SLD One way to explain air pressure is to have students think about a group of acrobats who perform the stunt of sitting on each other's shoulders. The acrobat near the floor will have the highest pressure because she has the most people on her shoulders, pressing down. The acrobat near the top will have the least pressure because no one is on her shoulders. In the same way, air has more pressure near the surface of the earth and less pressure as elevation increases.



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- Return to the list of ideas and questions that students generated in Lesson 2. **Ask:** Do you have any new ideas or questions we can add to the list? Have any of our questions been answered?

Extend

EXTENSION

- ❖ After sunset, sometimes the wind starts to blow from the land toward the sea. Why? **The land cools, and sometimes it becomes cooler than the water, especially in places where the sea is warmer. So the process of the air mass movement reverses—the warmer air over the water**

rises; cool, dry air over the land replaces it; and so on.

Evaluate (5 min.)

EXIT CARD

- ❖ The air above lakes is usually calmer in the morning. But in the afternoon on a sunny day, it can become windy. Why? **In the morning, the water and land are approximately the same temperature. By afternoon, the land warms up more than the water, and the wind picks up.**

Homework

HOMEWORK

- ❖ Think about the air masses moving. When did the air pressure drop on the beach? Why? **When the warm air mass rose; there was less air left**
- ❖ What happened next? **Another air mass moved in to take its place.**

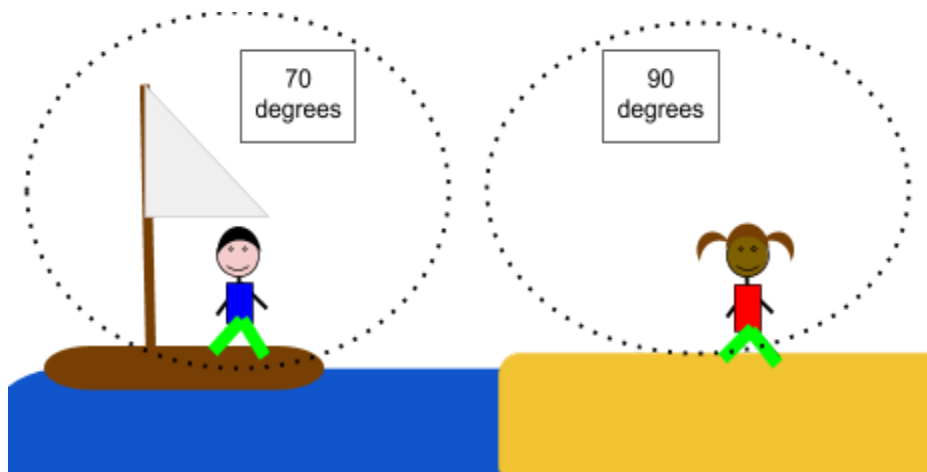


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