Science Learning Packet

Grade 6: Ocean, Atmosphere, and Climate, Lesson 5

Science learning activities for SPS students during the COVID-19 school closure.

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Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Grade 6 Science Learning Activity
Ocean, Atmosphere, & Climate Unit
Lesson 5 Instructional Materials

Amplify Science

Ocean, Atmosphere, and Climate

Lesson 5: Currents and Air Temperature
Hello Families,

We hope you and your family are well and safe during this time. During this unprecedented out-of-school time, the SPS middle school science team will be offering instructional opportunities for students that align with the district’s adopted middle school science instructional materials.

This investigation packet is part of a series of district-aligned lessons for middle school science developed by AmplifyScience and adopted by SPS in 2019. While Amplify Science lessons are designed to be done in the classroom with peers, there are some activities that students can complete at home. In this packet you will find activities to accompany lessons in the unit. Accompanying lesson videos are posted on the SPS Science webpage under their corresponding grade level. These lesson videos, developed in collaboration between SPS teachers, Denver Public Schools teachers, and Amplify Science, feature teachers going through the information in the lessons. The work in this packet is intended to be completed alongside the viewing of the video of the corresponding videos. To find the correct lesson videos go to SPS Science webpage, scroll to your grade level, find the unit you are looking for, and select the video that matches the lesson you are completing that day.

For students who have access to the internet and the following devices and browsers may wish to log-in to their AmplifyScience account from home are welcome to do so. Chrome and Safari are the recommended browsers to use for full functionality of the Amplify digital tools and features.

Sincerely,

The Seattle Public Schools Science Department
Lesson 5
Buenos Aires and Cape Town are two coastal locations at the same latitude. Do you think the ocean surface temperature near each of these locations is the same or different? In Lesson Five we will collect evidence to answer this question. We will also wonder how different temperature ocean currents affect the air temperature of the locations they pass. We will conduct an experiment and use the Ocean, Atmosphere, and Climate Simulation to gather evidence about how ocean currents affect the air temperature of the two cities. By learning more about how the ocean can affect air temperature, you will be one step closer to figuring out why Christchurch’s air temperature is cooler than normal during El Niño years.

Vocabulary Review from Previous Lessons:
CLIMATE: General weather patterns over a long period of time
ENERGY: the ability to make things move or change
TEMPERATURE: a measure of how hot or cold something is; a measure of the average kinetic energy of the molecules of a thing
TRANSFER: to move from one object to another or one place to another
LATITUDE: the distance of a place north or south of Earth's equator
EQUATOR: the imaginary line that divides Earth into northern and southern hemispheres
OCEAN CURRENT: ocean water flowing in a continuous path
GYRE: a giant pattern of moving water that spans whole oceans and moves water from place to place in a circle

Unit Question: During El Niño years, why is Christchurch, New Zealand’s temperature cooler than usual?
Lesson 5 – Part 1: Ocean Temperatures at Different Locations

QUESTION: Do you think the ocean surface temperature near Buenos Aires is the same or different from the ocean surface temperature near Cape Town?

Look at the map, and then read Prediction A and Prediction B. Which prediction best answers our question “Do you think the ocean surface temperature near Buenos Aires is the same or different from the ocean surface temperature near Cape Town?”

**Prediction A:** Buenos Aires and Cape Town have the same ocean surface temperature.

**Prediction B:** Buenos Aires and Cape Town have different ocean surface temperatures.

Explain your choice.
Investigating Ocean Surface Temperature

Currents Near Buenos Aires and Cape Town

Compare the two ocean currents (A and B) shown on the map. Match the current with the phrase that best describes it.

Current A (near Buenos Aires) __________________. (circle one)
carries no energy  carries more energy  carries the same energy  carries less energy

Current B (near Cape Town) __________________. (circle one)
carries no energy  carries more energy  carries the same energy  carries less energy

Discuss the following questions with your partner or think about them on your own and record your ideas:

• What does the map show?
• Does the map provide evidence that the currents near Buenos Aires and Cape Town cause the ocean surface temperature at each location to be the same or different?
After examining the map and either discussing or thinking about your ideas, which claim do you think is better supported by the evidence presented in the map? (circle one)

**Claim 1:** Buenos Aires and Cape Town have the **same** ocean surface temperature.

**Claim 2:** Buenos Aires and Cape Town have **different** ocean surface temperatures.

How does the map support the claim you selected? Try to use all these words when you respond.

**Word Bank**

<table>
<thead>
<tr>
<th>equator</th>
<th>energy</th>
<th>current</th>
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Lesson 5 – Part 2: Water and Air Temperature Experiment

The goal of this activity is to plan and carry out an investigation to help you answer the investigation question: **How do ocean currents affect the air temperature of the locations they pass?**

**Information about some of the available materials:**

- Your investigations will model currents and the air at locations they pass.
- Hot water can be used to represent warm currents.
- Cold water can be used to represent cold currents.
- The air directly above the hot and cold water represents the air of the locations that currents pass.

Conduct an experiment to gather evidence about how water temperature affects air temperature. Follow these instructions:

1. Insert one thermometer through the slot of each lid and measure the initial air temperature of Cup 1 and Cup 2 **before adding any water to the cups.**
2. Record your data (the initial air temperature of Cup 1 and Cup 2) in the data table on page 8 of this packet.
3. Pour **hot water into Cup 1** and **cold water into Cup 2**. The cups should be about half full.
4. Replace the lids and thermometers, making sure the thermometers do NOT touch the water in either cup.
5. Wait 2 minutes and measure the final temperature of the air in Cup 1 and Cup 2. Record this data in the table below.

**Setting Up the Experiment:** Insert thermometers through lids so they stay positioned above the water. If thermometers touch the water, results will be inaccurate. If you only have one thermometer you can do the cups one at a time.

**Safety Note: Hot Water**
Handle hot water with care. If spilled, it could burn your skin.
Data Table to Record Your Temperature Measurements from the Experiment:

<table>
<thead>
<tr>
<th></th>
<th>Initial air temperature (°C)</th>
<th>Final air temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cup 1 (Hot Water)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cup 2 (Cold Water)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What happened to the air temperature in the cup where **hot water** was added? (circle one)
- the air temperature increased
- the air temperature decreased
- the air temperature stayed the same

What must have happened to **the energy** in the water and air when **hot water** was added?

____________________________________________________________________________________

____________________________________________________________________________________

What happened to the air temperature in the cup where **cold water** was added? (circle one)
- the air temperature increased
- the air temperature decreased
- the air temperature stayed the same

What must have happened to **the energy** in the water and air when **cold water** was added?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

How do you think ocean currents affect the air temperature of the locations they pass?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
Lesson 5 – Part 3: Gathering Evidence in the Sim

Open the *Ocean, Atmosphere, and Climate Sim*. Follow the instructions to gather evidence about how ocean currents affect the air temperature of the locations they pass. After you complete the activity, answer the three questions.

1. Select **Current Map mode**.
2. For **Temperature View**, select **Surface**.
3. Place Location Sensors at 4 and 5.

4. Record the air temperature of these two locations.
5. Press play. Observe the motion of the currents and in Side View, **observe how energy is being transferred between water and air**.
6. After temperatures stabilize (about 2 minutes), record your data.
   - Record the air temperature of both locations.
   - Indicate if the location was near a cold current or a warm current.
If you have access to the Ocean, Atmosphere, and Climate Sim, do this activity on your own and skip to the next page record your own data.

If you do not have access to the sim, use the following data:
Because both sensors are at locations at the same latitude, the air at both locations will be about the same temperature before the currents begin to move.

Location 4
Location 5

Sensor 4 is near a cold current with colder water moving down from the pole
Sensor 5 is near a warm current with warmer water moving up from the equator
Once you press Play, you should notice that Sensor 5 has higher air (and water) temperatures than Sensor 4.

Data Table to Record Your Temperature Measurements from the Sim:

<table>
<thead>
<tr>
<th></th>
<th>Starting Air Temperature (°C)</th>
<th>Final Air Temperature (°C)</th>
<th>Current: Cold or Warm?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor 5</td>
<td></td>
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</tr>
</tbody>
</table>

At which location does the **energy transfer from water to air**? (circle one)

- Sensor 4
- Sensor 5

At which location does **energy transfer from air to water**? (circle one)

- Sensor 4
- Sensor 5

Why is the temperature shown on Sensor 4 different from Sensor 5, even though they are at the same latitude?
Using what you learned in this lesson, circle the words that will complete the following sentences.

In Buenos Aires, the (ocean / air) transfers energy to the (ocean / air).

In Cape Town, the (ocean / air) transfers energy to the (ocean / air).

Use evidence from the Sim and the Water and Air Temperature Experiment to make a claim that compares the air temperature of Buenos Aires and the air temperature of Cape Town. Circle the words that will complete your claim.

**Question:** How do ocean currents affect the air temperature of Buenos Aires and Cape Town?

**Claim:** The ocean currents near these cities cause the air temperature of Buenos Aires to be (the same as / different from) the air temperature in Cape Town.
Partner Discussion
Talk to your partner about the evidence that supports your claim. Use evidence from the maps, the experiment, the sim and the diagrams in this packet.
Try to use all the vocabulary words we’ve learned so far.
Writing a Report to the New Zealand Farm Council

Now that you understand what affects a location’s air temperature, you will use the evidence you collected to explain what affects Christchurch’s air temperature in normal years, and then share your ideas about why Christchurch’s air temperature might be cooler during El Niño years.

This map shows the ocean currents that move past the coast of Christchurch, New Zealand during a normal year. Carefully examine the map and answer the questions below.

A. During normal years, the ocean currents moving past the coast of Christchurch, New Zealand start at the (equator / pole).

B. The temperature of the ocean currents that move past the coast of Christchurch, New Zealand would be (warmer / cooler) than the air in Christchurch, New Zealand.

C. During normal years, the (ocean / air) transfers energy to the (ocean / air).

Partner Discussion

What ideas do you and your partner have about why Christchurch, New Zealand’s air temperature might be cooler during El Niño years?

Try to use all the vocabulary words we’ve learned so far. It’s okay if you aren’t sure yet.
Lesson 5 Wrap-Up

• During the experiment we learned:
  ✓ The temperature of the air in Cup 1 increased. A higher temperature means more energy, so the energy must have increased too. The water transferred energy to the air.
  ✓ The temperature of the air in Cup 2 decreased. A lower temperature means less energy, so the energy must have decreased. The air transferred energy to the water.
• Using the sim we learned:
  ✓ The air at Sensor 4 was near a cold current and was warmer than the water, which caused energy to transfer from air to water, decreasing the temperature of the air.
  ✓ The air at Sensor 5 was near a warm current and was cooler than the water, which caused energy to transfer from water to air, increasing the temperature of the air.
• Warm currents transfer energy to cooler air and warm air transfers energy to cooler currents.

KEY CONCEPT: Energy transfers from warmer substances to colder substances. Warmer currents transfer energy to cooler air and warmer air transfers energy to cooler currents.

KEY CONCEPT: When an ocean current comes from the equator, it brings warmer-than-expected water to the places it passes, and that water is warmer than the nearby air. When an ocean current comes from a pole, it brings colder-than-expected water to the places it passes, and that water is colder than the nearby air.

Up Next: Lesson Six
• What determines the direction of ocean currents?
• Use a currents tank model to simulate how currents move in the same direction as prevailing winds in some, but not all places in the ocean

Upcoming Vocab: prevailing winds