Science Learning Packet
Grade 6:
Weather Patterns, Lessons 1-3

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.
Weather Patterns

*Amplify Chapter 1, 1.2-1.4*

Student Name: ______________________________________________________________

School: ___________________________  Grade: _________________________________

Science Teacher: ___________________________________________________________

Date: ____________________________________________________________________
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 the first part in a series of district-aligned lessons about **Weather Patterns, a 6th grade life science unit 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 Grade 6.** 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 “6th Grade”
- Find the “Weather Patterns” videos section
- 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 Jane Addams Grade 6 Science Team & Seattle Public Schools Science Department
Lesson 1.2 (make sure you are following along with the video)

You will play the role of student forensic meteorologists. All meteorologists study weather, but a forensic meteorologist uses data to study weather that happened in the past. In the Amplify video, Dr. Kenji Emerson is a forensic meteorologist who plans to send a team of students to investigate and explain to the people of Galetown why the storms have become more severe.

Vocabulary Review from Previous Units:

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

Unit Question:
Why do some rainstorms have more rain than others?
Let’s warm up with a review of the water cycle. Look at this picture. What do you see? Can you follow the path of the water? Do you remember any vocabulary about how water moves from one place to another? Explain the diagram below. You can number places on the drawing if it helps with your thinking.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Now tell me a story, make a personal connection with the image. What does rain make you think about?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Water is an essential part of weather but what exactly is weather? Write down your definition.
VIDEO—If you have access to Amplify, go watch the video. It’s a report from channel 7 news about a severe storm in Galetown, and introduces Dr. Kenji Emerson, a forensic meteorologist, in charge of investigating the storm, as well as shares personal experiences of some of the townspeople and their thoughts about what caused the storm to be so bad.

**Investigation Question:** *What causes rainfall?*

Below are some claims about what is causing the more severe weather. But before we can decide which claim is the strongest, we need to understand what causes rain. This first chapter we will gather evidence to help us answer the investigation question.

What caused Galetown to have more severe rainstorms?

**Claim 1:** The lake that was built near Galetown caused it to have more severe rainstorms.

**Claim 2:** Warmer weather caused Galetown to have more severe rainstorms.

**Claim 3:** Stronger winds caused Galetown to have more severe rainstorms.

Using your existing knowledge of weather, which claim do you think is more likely to be true? Why?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Exploring the SIM

If you have access to Amplify, you can go into the Weather Patterns SIM and explore now. If you are watching the videos, you can choose to just watch her run the SIM.

Meteorologists use models to help them explain and predict weather. The Weather Patterns Simulation is a scientific model that will make it possible for you to change some factors that you are not able to change in real life. As you observe and analyze what happens as a result of the changes you made, you will better understand rainstorms.

Functions in the SIM

- You can move between Build, Run, and Analyze
- Sunlight and surface water sliders on the Build screen.
- Water vapor and temperature readout in the air parcel in Run.
- Yellow arrows that indicate energy
- Pause, Play, and Reset options in Run.
- Time slider in Analyze.

Water Cycle in the Sim

1. Launch the Weather Patterns Simulation.
2. Go to Regional Weather 1 mode.
3. Use the Sim to investigate how the amount of surface water can affect the amount of water vapor in the air.
4. In Build, set the level of surface water.
5. Decide on a level of sunlight (this should stay the same for both test 1 and 2).
6. Switch to Run, press Pause when the temperature turns red.
7. Record the amount of water vapor at that moment.
   (If needed, go to Analyze and use the time slider to rewind the Sim.)
8. Repeat with a different amount of surface water for test 2.

<table>
<thead>
<tr>
<th>Surface Level Water</th>
<th>Water Vapor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td></td>
</tr>
<tr>
<td>Test 2</td>
<td></td>
</tr>
</tbody>
</table>
How did the amount of surface water affect the amount of water vapor in the air?

__________________________________________________________________________

**Water Cycle Vocabulary**

- **evaporation**: the process by which a liquid changes into a gas
- **water vapor**: water as a gas
- **condensation**: the process by which a gas changes into a liquid
- **precipitation**: liquid water (rain, sleet, snow, or hail) that falls from the sky

Think about the SIM, did you notice anything similar to our warm-up activity about the water cycle? Did you use any of the vocabulary words in your explanation?

**Evaluating the Evidence**

Investigative Question: *What causes rainfall?*

What evidence in the Sim shows evaporation occurred and how did it happen?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

What did you notice about this process when you changed the amount of surface water?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Identifying Water On Earth

1. In which images is water present? You can circle as many as you like.
   
   A   B   C

2. Where is the water in the images? You can circle as many as you like.
   
   Air    Lake    Clouds

3. Order the images from least water to most water.
   
   Least = ____
   Middle = ____
   Most = ____
Lesson 1.2 Wrap-Up

- Evaporation: the process by which a liquid changes into a gas
- Water vapor: water as a gas
- Condensation: the process by which a gas changes into a liquid
- Precipitation: liquid water (rain, sleet, snow or hail) that falls from the sky
- Condensed liquid water is the result of condensation
- Rain is a kind of precipitation
- Water is key to weather
- The amount of surface water available affects the amount of water vapor

No key concepts yet

Up Next: Lesson 1.3
- Investigating condensation
- Doing a hands-on experiment
- Using the SIM to model condensation
- The first key concept of the unit

Upcoming Vocab: air parcel
Lesson 1.3 – Part 1

Students will investigate how and when condensation happens in order to help answer the Investigation Question of: What makes rain happen? Students will look in depth at condensation by using the simulation and doing a hands-on experiment.

Unit Question:
Why do some rainstorms have more rain than others?

Chapter 1 Question:
What causes rain?

Vocabulary Review from Previous Lessons:
- evaporation: the process by which a liquid changes into a gas
- water vapor: water as a gas
- condensation: the process by which a gas changes into a liquid
- precipitation: liquid water (rain, sleet, snow, or hail) that falls from the sky

**Warm-up:**

**Thinking About Water:**

Water is an important part of weather. After a rainstorm, rainwater gathers on pavement, but soon after, it is gone.

Look at the images below and then answer the questions. Remember this is a warm-up so write down any ideas you have. There are no wrong answers here.

What happened to the water in the puddle? Why?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

When liquid water becomes ________________ it can ________________
and become ______________________ in the air. **ALL AIR CONTAINS WATER.**

**Vocabulary:**

**Air Parcel:** an amount of air that moves as a unit

an **air parcel** above the earth with a cloud in it

an **air parcel** in the *Weather Patterns Simulation* with a cloud in it

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We need to figure out how clouds are made. To answer this, we need to figure out why condensation happens. (because condensation in the water cycle leads to clouds as you can see below)
Hands-On Experiment:

Materials:
- two zip lock bags
- a marker
- a refrigerator or freezer

Set-up:
1. Use your marker to label one bag “cooler” and the other bag “room temp.”
2. Leaving part of the bag sealed, open the bag just enough to blow air into it.
3. Blow up each bag so that it is fully inflated and seal it closed right away.
4. Place the bag labeled “cooler” into your refrigerator or freezer for 20 minutes and leave the bag labeled “room temp.” somewhere next to you.

Prediction:
What do you think will happen to the air inside the two bags? Will the same thing happen in both or something different?
Results: (Come back to this after 20 minutes)

1. What is the difference between the “cooler” and “room temp.” bags?

2. Based on the results of this experiment, what do you think causes condensation (when water as a gas turns into a liquid) to happen?

Lesson 1.3 – Part 2 & 3
Simulation Exploration:

Goal: Use the simulation to examine the factors affecting condensation and the amount of energy transfer.

Instructions:

1. Launch the Weather Patterns Simulation in “Lab Mode”
2. Build Test 1 in the sim
3. Run the simulation and observe what happens to the air parcel
4. Analyze your results. Record data in the table below.
5. Repeat steps 2-4 for Test 2.
6. Answer the questions on the next page
Test 1: This test represents the air parcel at room temperature.
- Surrounding Air Temperature: 20°C
- Air Parcel Temperature: 37°C
- Air Parcel Water Vapor: between medium and high

Test 2: This test represents the air parcel in the cooler.
- Surrounding Air Temperature: 4°C
- Air Parcel Temperature: 37°C
- Air Parcel Water Vapor: between medium and high

<table>
<thead>
<tr>
<th>Test</th>
<th>Surrounding air temperature</th>
<th>Air temperature in the bag</th>
<th>Energy transferred out</th>
<th>Liquid water (cloud)</th>
<th>Liquid water (rain)</th>
<th>Total liquid water (cloud + rain)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>20°C (room temperature)</td>
<td>37°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 2</td>
<td>4°C (in the cooler)</td>
<td>37°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which test had more condensation (water vapor turning to liquid)? (check one)

☐ Test 1 (room temperature)
☐ Test 2 (cooler)

In which test was there more energy transferred out? (check one)

☐ Test 1 (room temperature)
☐ Test 2 (cooler)

Think about the different factors in the two tests and the data you recorded. What do you think caused one to have more condensation than the other?
Vocabulary (review):

- Energy: The ability to make things move or change
- Temperature: a measure of how hot or cold something is
- Transfer: to move from one object to another or one place to another

What happens to water vapor in an air parcel as it cools?

**Key Concept**

When water vapor in an air parcel cools it can ________________ into liquid water which can form a ________________ and fall as rain

Homework: read the prompt and circle the bolded words in the paragraph below
One morning, Alisha work up and opened her curtains and couldn’t see out her window. Her window was covered with liquid water droplets like the image below. She wondered why this happened.

The air in Alisha’s house is just like an air parcel. The reason liquid water formed on her window is because the temperature of the air inside her house is (warmer than / colder than / the same as) the temperature outside. The water vapor in the air in her house (condensed / evaporated / stayed the same) and became liquid water drops on her window. Energy was transferred from the air inside / outside her house to the air inside / outside.

Lesson 1.3 Wrap-Up

- **Air Parcel:** an amount of air that moves as a unit
- Scientists study air parcels so they can focus on smaller sections of air instead of trying to look at the entire sky at once
- Water evaporates when it gains energy
- All air contains water
- Energy transferred from the air parcel to the surrounding air causes the air parcel temperature to get colder
- The more that water vapor cools, the more energy it loses and the more condensation it creates

**Key Concept:** When liquid water becomes warmer, it can evaporate and become water vapor in the air. All air contains water.
**Key Concept:** When water vapor in an air parcel cools it can condense into liquid water which can create a cloud and fall as rain

**Up Next: Lesson 1.4**
- Investigating cloud formation
- Active reading to learn about clouds
- Build on our understanding of water, clouds, condensation, evaporation and energy

**Upcoming Vocab:** none yet!
Lesson 1.4

Today we are reading an article “What are Clouds?” to help us answer our Chapter one question “What causes rainfall?” Before we do that, let’s review what we learned over the past couple of days!

**Vocabulary:**

**AIR PARCEL:** An amount of air that moves as a unit

**CONDENSATION:** The process by which a gas changes into a liquid

**ENERGY:** The ability to make things move or change

**EVAPORATION:** To move from one object to another or one place to another

**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

**WATER VAPOR:** Water as a gas

**WEATHER:** Conditions such as rain, clouds, wind at a particular time and place

Let’s review our key concepts that we have learned so far in this chapter. See if you can fill in the blanks below to make the statement true and complete.

**Key Concept 1:** When liquid water becomes ______________________ it can become water vapor in the air. All air contains water.

Let’s try another!

**Key Concept 2:** When water vapor in an air parcel ____________, it can condense into liquid water which can form a cloud and fall as rain.
Lesson 1.4 - Warm Up

Before image showing:
(Sentence starter: The before image is showing...)
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

After image showing:
(Sentence starter: The after image is showing...)
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What does the yellow arrow show?
(Sentence starter: The yellow arrow is showing...)
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Reading: “What Are Clouds?”

Active Reading Strategies

☐ Use red pencil (or other color: ) to underline evidence
☐ Use green pencil (or other color: ) to circle unit glossary words and unfamiliar words
☐ Write definitions above circled words
☐ Write in the margins to identify questions, impactful ideas, and “a-ha!” moments

Looking Up at the Sky

Dr. Joanne Simpson became fascinated with clouds at an early age. Simpson would grow up to study clouds and become the first woman to earn a PhD in meteorology—but as a child, she simply loved how they looked. When she was a young girl, walking around her town and sailing on the nearby ocean, she noticed all kinds of unusual clouds. She saw clouds that looked like towers looming high, bunches of hanging grapes, and even UFOs! She wondered what they were made of and how they formed so many different amazing shapes.

Clouds take different shapes depending on the temperature of the air around them.
When Simpson went to college in the 1940s, nobody thought clouds were important for scientists to study. However, Simpson’s professors encouraged her to study clouds because she was a woman and they didn’t think women could be serious scientists. Clouds seemed to them like a good unimportant subject for a woman to study. Simpson went on to prove her professors wrong about both clouds and female scientists.

Determined to succeed despite sexism, Simpson continued her study of clouds and cloud formation. She collected data as she flew in airplanes high above Earth’s surface, taking notes and sketching in her field journal to document the cloud formations she saw. Most interesting of all to Simpson were the gigantic clouds she called hot towers. These cumulonimbus clouds looked like skyscrapers sticking up above the clouds around them. Simpson wanted to know why hot towers were so unusual, so she set out to study them. She collected data about the temperature, wind conditions, and amount of water vapor in these unusual cloud formations. Eventually, she was able to explain that hot tower clouds form when warm air with lots of water vapor in it rises quickly from Earth’s surface into the troposphere, the layer of the atmosphere closest to the Earth, cooling as it goes. Based on her research about hot towers and other kinds of clouds, Simpson is considered one of the most important weather scientists in the history of meteorology.

What All Clouds Share

Research by meteorologists like Simpson shows that all clouds, even the most unusual types, have a lot in common. Meteorologists use a helpful concept, the idea of air parcels, to study all kinds of clouds and track them as they move through the troposphere. An air parcel is an amount of air that moves as a unit.

All clouds form when the water vapor in air parcels comes into contact with colder surrounding air. When it meets the colder air, the water vapor in each air parcel becomes liquid in a process called
condensation. In fact, all clouds are made of the same basic ingredient: visible droplets of water floating in the troposphere. If it’s cold enough, the water droplets can freeze into tiny ice crystals. How does water vapor get into the troposphere in the first place? It comes from liquid water on Earth’s surface. When liquid water gets warm enough, it turns into water vapor through a process called evaporation. The water vapor becomes part of the air and is ready to become part of a cloud when the conditions are right.

Cloud Formation and Energy

Cooling is an important cause of rainfall—cooling air parcels can cause clouds to form and rain to fall. What causes an air parcel to cool? The process is driven by energy. When a warm air parcel is surrounded by colder air, the energy from the warm air parcel is transferred to the colder air until the temperature of all the air is equal. While an air parcel is losing energy, the temperature of the air parcel decreases. The energy transfer that causes the warm air parcel to cool can also cause the water vapor in the parcel to condense into liquid water. This liquid water is what forms a cloud. The more energy the air parcel loses, the more it cools and the more liquid water it forms, making more rainfall possible. When the droplets of liquid water in the clouds become big enough, they fall to the ground as rain.

Joanne Simpson’s Legacy

Joanne Simpson started her career focused on the beautiful shapes she saw in the sky, wondering how and why the amazing clouds that she saw might form. Simpson’s curiosity as a child led her to a pioneering career in the field of meteorology. Her work helped us understand how energy, evaporation, and condensation form the clouds that we see in the sky. Meteorologists today still make use of Simpson’s work as they study the weather.
This diagram shows how energy is transferred during cloud formation. As energy is transferred out of an air parcel, its temperature drops. When the air parcel has lost enough energy and become cold enough, water vapor in the parcel condenses, forming a cloud.
Lesson 1.4 - Modeling

Goal: Make a model that shows how condensation happens.

Do:

Use the words in the Modeling Tool Key underneath the pictures to fill in the three boxes in the After model.

Condensation

Goal: Make a model that shows how condensation occurs.
Lesson 3 Wrap-Up

- Asking deeper questions is an important reading strategy.
- Every cloud, no matter its shape or size, is condensed water that was once gas.
- Energy transfer is an important part of cloud formation.
- Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination, and creativity.

**KEY CONCEPT 1:** When liquid water becomes warmer, it can become water vapor in the air. All air contains water.

**KEY CONCEPT 2:** When water vapor in an air parcel cools, it can condense into liquid water which can form a cloud and fall as rain.

Up Next: Lesson 1.5

- Further investigation of rainfall on the SIM
- 2 new key concepts

**Upcoming Vocab:** change and stability