WEATHER AND WATER

Grades 7-8

STUDENT JOURNAL

This journal belongs to:

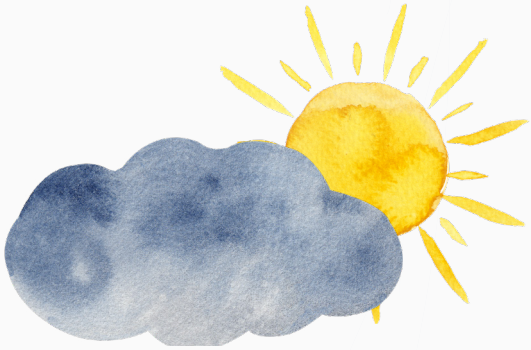
THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Weather and Water* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

The lesson extensions are also found here. These extensions are optional for older students (grades 7–8) to complete on their own. Each extension is accompanied by lined paper so the student can keep his or her work in one place.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.



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WONDERFUL WEATHER

Rank the topics shown below by your level of interest in each, writing a **1** in the box of the most interesting topic and an **8** in the box of the least interesting topic. Once you have completed ranking all the topics **1–8**, use the blank lines to write a question you have about each topic.

Tornadoes

Weather Fronts

Clouds

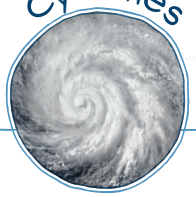
Rain

Lightning

Rainbows

Weather Forecasting

Cyclones



EXTENSION

Instructions:

1. Read each of the biographies below.
2. On the next page, write down three key facts about each of the scientists that you read about.

Meteorological Pioneers

Daniel Gabriel Fahrenheit

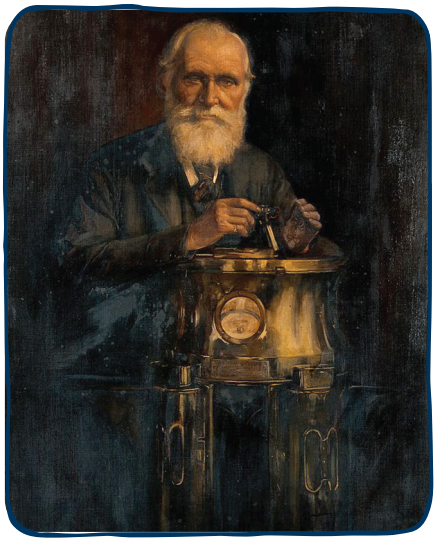
Born in Poland in 1686, Daniel Gabriel Fahrenheit was a Dutch physicist who made many contributions to the study of meteorology. He invented the alcohol thermometer in 1709 and created a revised version, the mercury thermometer, in 1714. The mercury thermometer was durable, inexpensive, accurate, and able to measure high temperatures. Fahrenheit is most known for the Fahrenheit temperature scale, which has a 32° freezing point and a 212° boiling point. The United States and its territories are the only places that currently use the Fahrenheit scale to measure temperature. Besides the temperature scale, Fahrenheit also discovered that water can remain in a liquid state below freezing and that the boiling point of water varies depending upon the atmospheric pressure.

Anders Celsius

Anders Celsius was born in 1701 in Sweden. He was born into a family of scientists and mathematicians, with both of his grandfathers and his father being professors at Uppsala University. Celsius studied and became an astronomer and eventually became a professor of astronomy at Uppsala University like his ancestors. He invented the Celsius temperature scale, which originally had a 0° boiling point and a 100° freezing point. He built Uppsala Observatory to continue and encourage the study of astronomy. Celsius studied the aurora borealis, or the northern lights, in great depth and published a collection of observations about his discoveries. After his death, the Celsius temperature scale was reversed to a 0° freezing point and a 100° boiling point. Today this temperature scale is used in almost every country in the world, except for a few that continue to use the Fahrenheit scale.

William Thomson

Although he was a Scottish engineer, mathematician, and physicist, William Thomson was born in Belfast, Ireland, in 1824. He became a professor of natural philosophy at Glasgow University and implemented the first physics laboratory in Britain. His interests varied from thermodynamics to electromagnetism and submarine telegraphy, for which his studies made him famous. He invented the mariner's compass, a tide machine, and depth-measuring equipment. Perhaps his most remarkable development was the Kelvin temperature scale. The most unique characteristic that sets it apart from both the Fahrenheit and Celsius scales is that it is not measured by degrees, but instead uses kelvins. Zero is the coldest possible temperature, which is also known as absolute zero, and it indicates a total absence of heat. This scale is primarily used by physicists and scientists to measure very precise temperatures. The scale was named after the Kelvin River, which is near Glasgow University. Thomson was knighted in 1892 and was given the title Baron Kelvin of Largs.



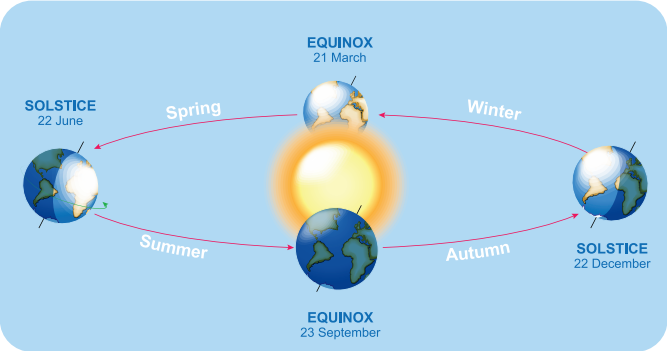
EXTENSION

Instructions:

1. Read the information below.
2. After studying the "Equinoxes and Solstices for the Northern Hemisphere" diagram at the top of the page, draw your own diagram showing the same information. Do your best to remember the names of each equinox or solstice and their appropriate dates and details. You may refer back to this page as needed.

Equinoxes and Solstices

Solstices and equinoxes are the results of the earth's tilted axis. If the earth's axis were perfectly vertical, the sun would always be above the equator, the amount of sunlight received by different parts of the earth would be unchanging, and there would be no seasons. We use solstices and equinoxes to mark the beginning of seasons.



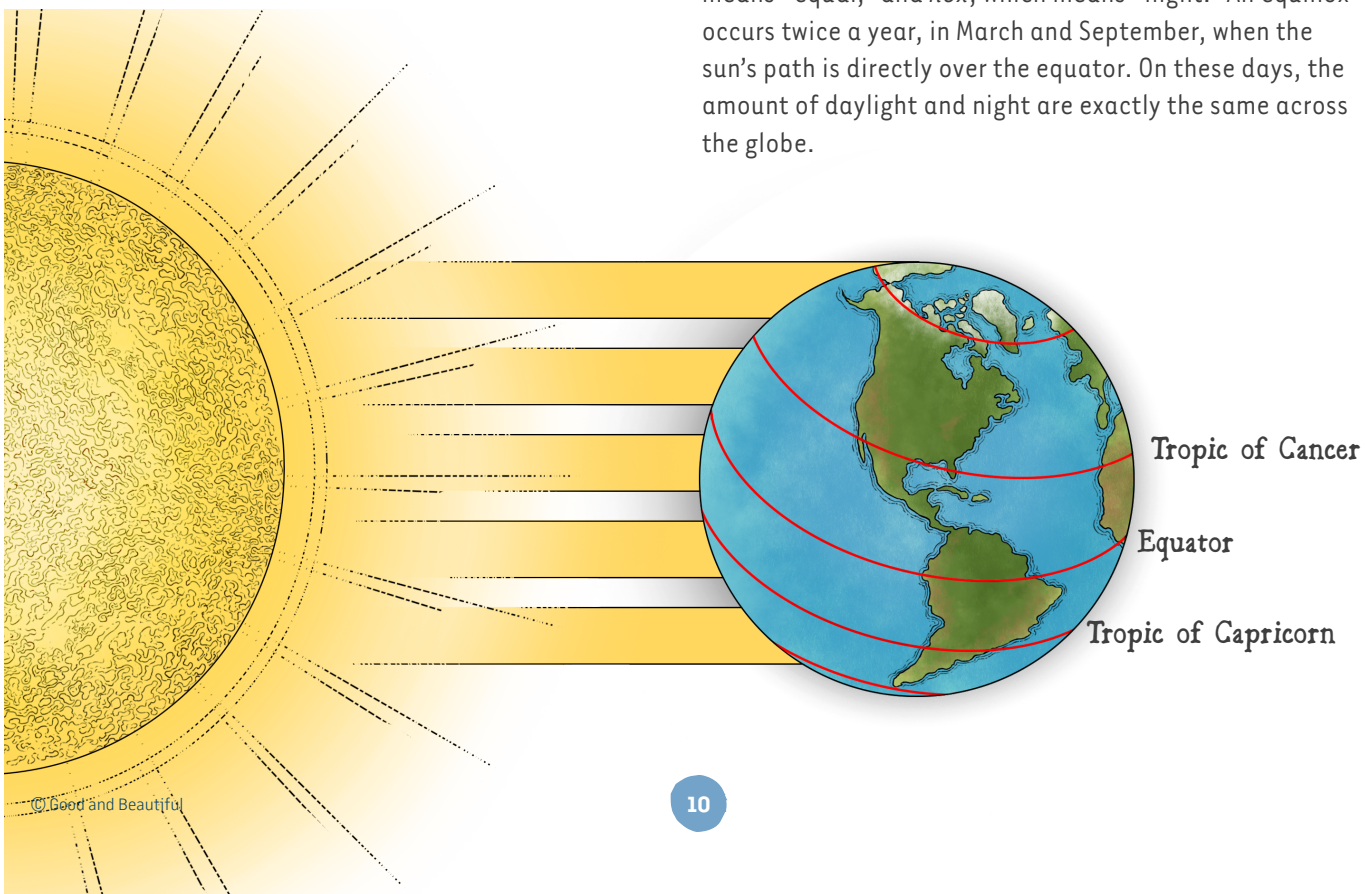
Equinoxes and Solstices for the Northern Hemisphere

Solstice

A solstice happens twice annually and creates the longest and shortest days of the year. Between June 20 and 22, the North Pole of the earth is tilted toward the sun, and the Northern Hemisphere receives the most direct sunlight. The sun is as far north from the equator as it can go and is positioned directly above the Tropic of Cancer, as seen in the image below. This creates the longest day of the year, which we call the summer solstice, and is the official start of summer in the Northern Hemisphere. Between December 21 and 22 of every year, the North Pole is tilted farthest away from the sun, with the Southern Hemisphere's Tropic of Capricorn, also seen in the image below, receiving the most direct sunlight, and the sun's path through the sky is as far south as it can be. The winter solstice marks the beginning of winter for the Northern Hemisphere. In the Southern Hemisphere, these seasons are reversed, with the summer solstice in December and the winter solstice in June.

Equinox

The word equinox comes from the Latin words *aequi*, which means "equal," and *nox*, which means "night." An equinox occurs twice a year, in March and September, when the sun's path is directly over the equator. On these days, the amount of daylight and night are exactly the same across the globe.



AIR PRESSURE EXPERIMENT

My Predictions:

Experiment #1	Experiment #2	Experiment #3

My Results:

Experiment #1	Experiment #2	Experiment #3

JUNIOR METEOROLOGIST

It's time to test your meteorology skills! After reviewing the Beaufort Wind Scale chart on the next page, write the correct Beaufort number under each picture.

EXTENSION

Instructions:

1. Read the information below.
2. Look at the pictures on the page. Write numbers 1–5 on the next page (one digit for each photo below). Determine which phase of the water cycle (evaporation, condensation, precipitation, sublimation, or deposition) is occurring in each photo and write it next to the photo's corresponding number.
3. Write the definition of sublimation and deposition.

Sublimation & Deposition

As you have learned, the three states of matter are solid, liquid, and gas. We usually think of the states of matter in that order, moving from one to the next, but definitely not skipping one! Water can take on all three forms: ice, water, and water vapor. Ice (solid) melts into water (liquid) and evaporates into water vapor (gas). But did you know that water can actually skip from its solid state to its gas state without ever becoming a liquid? This process is called ***sublimation***, and it occurs when snow and ice change into water vapor without melting into water first.

Sublimation can happen when certain conditions occur, such as dry winds, low humidity, higher altitudes, and strong sunlight. Without the thermal energy from the sunlight, sublimation would not be possible.

Have you ever been to the mountains on a sunny winter day? If the conditions were just right, you might be able to look at the mountains in the distance and see what appears to be "smoke" rising from the mountains. But you actually would be witnessing the process of sublimation.

The opposite of sublimation is called ***deposition***. In deposition, water vapor changes directly into snow or ice, once again skipping the liquid state. For deposition to occur, the water vapor requires higher humidity and low temperatures. Another example of deposition is when frost forms on a window. The temperature of the exterior surface of the window is lower than the freezing point of water, and the air around the window is humid from the heat inside the home. The water vapor, which is gas, skips directly to a solid form by turning into frost.

Sublimation and deposition do not happen often, but when they do, they are two further examples of the magnificent properties of water!

Lesson 9

MAKING RAIN EXPERIMENT

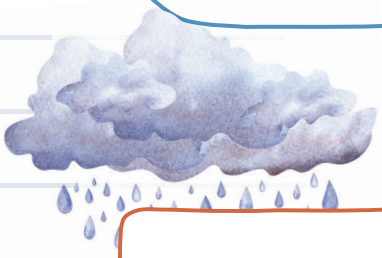
Start Time: _____

Procedure:

1

2

3



Conditions:

Time It Started Raining: _____

About how long did it take for it to rain? minutes

PRECIPITATION MATCH

Freezing rain occurs when snow melts or partially melts in the air but does not refreeze until after it reaches the ground or a surface.

Sleet occurs when snow melts or partially melts in the air, then freezes again before reaching the ground.

Hail, being a solid mass of ice, can cause significant damage to homes, vehicles, and other buildings. The largest hailstone recorded fell in Nebraska and was 18 cm (7 in) in diameter!

Freezing rain can accumulate and add weight to tree branches and power lines, causing them to snap or break.

Hail forms when water droplets carried by moving air in a cumulonimbus cloud shoot up high inside the cloud and freeze around a dust particle, then fall back to the bottom of the cloud, where they collect more water before being blown back up high into the cloud to refreeze. The process repeats until hailstones become too heavy and fall to the ground.

Sleet can be measured the same way snow is measured—by sliding a ruler directly downward into the sleet until the ruler reaches the ground.

EXTENSION

Instructions:

1. Read the information below.
2. Write down three of Bentley's character traits. Record how those traits enabled him to be a good scientist.

Snowflake Bentley

Of all the things in the world, what do you love to capture with a camera? Perhaps it is family, a pet, flowers, the sunset, mountains, or the beach. To a young, humble Vermont farm boy living in the late 1800s, his favorite thing was a snowflake.

His name was Wilson A. Bentley, and he later became known as the Snowflake Man. Born in 1865 in Jericho, Vermont, he grew up in the snowbelt. Vermont winters were harsh and faced an average annual snowfall of 3 m (120 in). Because of this, he hardly attended the one-room school near his home. Instead, he was educated by his mother, who had previously been a school teacher.

An inquisitive and curious boy, Bentley was always fascinated with nature, especially butterflies, leaves, and spiderwebs. Bentley loved to learn, which he attributed to his mother, and read her entire encyclopedia set. For his 15th birthday, his parents bought him a microscope, and it was at this point that his love for snowflakes blossomed.

While others dreaded winter, Bentley looked forward to it, for it meant snowflake season. Catching a snowflake to view under a microscope was no easy task. He could not bring the snowflake indoors, as it would quickly melt, so he set up his microscope and worked in a cold room by the farmhouse. He made multiple attempts to draw what he saw, but they were just not adequate. Inspired by the encyclopedia he read, he obtained a camera from his parents to take a picture of these frozen crystals. He spent over a year experimenting with the microscope and camera to master snapping an image through the microscope. Over and over again, he faced failed attempts, but his resolve was such that he could not be conquered. He was patient and persistent, with his mind fixed on his goal.

On January 15, 1885, his hard work and determination finally paid off; he photographed his very first ice crystal and would go on to capture 5,000 more. He would wait for that perfect snowflake to land. Using a feather, he would move it to a microscope slide, and after waiting a minute and a half for the right light exposure, he would capture his snowflake. He had to wait to develop his photos until the spring brought warmer temperatures.

Within his lifetime, Bentley made incredible discoveries. He learned that no two snowflakes are the same. In 1904, he decided to donate 500 of his images of snowflakes to the Smithsonian Institute for safekeeping—making a treasured scientific and historic record. In 1931, working with physicist William J. Humphreys, he published a book called *Snow Crystals*, which contained 2,300 of his photos.

Bentley had a way with words and poetically recorded his feelings about the elegance of what he observed. It was one of his greatest desires for people to experience what he saw—the beauty in nature. He has inspired many scientists, scientific photographers, and those who simply appreciate nature, and his photos preserve the scientific study of his day—frozen in time.

AROUND THE WORLD

As your parent or teacher reads aloud the information about each location, use the word bank to write in the correct phrase in each orange box below.

Crater Lake

Niagara Falls

Grand Canyon

Cenote in Yucatán

EXTRA NOTES