Sample Science Learning Plan

Big Idea/ Topic

Weather, moon phases, collecting data.

Standard Alignment

S4E4. Obtain, evaluate, and communicate information to predict weather events and infer weather patterns using weather charts/maps and collected weather data.

a. Construct an explanation of how weather instruments (thermometer, rain gauge, barometer, wind vane, and anemometer) are used in gathering weather data and making forecasts.

c. Ask questions and use observations of cloud types (cirrus, stratus, and cumulus) and data of weather conditions to predict weather events.

S4E2. Obtain, evaluate, and communicate information to model the effects of the position and motion of the Earth and the moon in relation to the sun as observed from the Earth.

b. Develop a model based on observations to describe the repeating pattern of the phases of the moon (new, crescent, quarter, gibbous, and full).

Instructional Design

This startup segment will allow students to begin the data collection of weather and moon phases. This segment will have students begin the process of collecting and analyzing weather data to predict the weather for their local area. Students will also begin collecting and recording observations of the moon phases to recognize the repeating pattern.

Use the handout Parent Letter or write your own to inform parents about the instructional segment and materials they can gather for their child to successfully participate in the activities and investigations.

Engage

Phenomenon: Work of the astronauts on the International Space Station and their life in microgravity conditions.

Ask students questions like

- What is it like to live in space?
- Would you float instead of walk?
- How would you sleep?

- What would you eat?
- What effects does *microgravity* or "weightlessness" have on human beings and other living things?
- How do plants grow in the conditions of space?
- Can engineers design new materials in space that are useful on Earth?

As a formative assessment use the handout Living in Space to find out student's preconceived ideas.

Plugged:

International Space Station The audio portion of this video uses a mechanized voice that is sometimes difficult to understand. The script is found here: Script for the video of the International Space Station You can show any portion of the video and read the script or have it available for questions.

Provide students with the resource: What is the International Space Station?

Have students complete the formative assessment Living in Space and upload their stories or drawings to the class website or email them to you to share with others in the class.

Show students how to upload questions they have about living in space to the class web page designated for the Driving Questions Board. Explain that it is a work in progress and that they can add questions throughout the year. Design the board so that each topic of study has a section. Add a section for unrelated questions so that students see the importance of questions even when the topic is not under study at that time. Students can discuss how their and other questions are answered as the year progresses.

Unplugged:

Have students read the following reading selection: What is the International Space Station?

Have students complete the formative assessment Living in Space. Challenge them to keep a page in their notebook of questions they have about living in space. Compile these to add to the class Driving Question Board. Take a picture of the Driving Questions Board to share in their next packet of materials. Explain that it is a work in progress and that they can let you know of any questions to add throughout the study. You can discuss questions with the student in a phone call or conference time as the year progresses so they can see how some questions are answered through study and all questions are important.

Following your district guidelines, schedule a designated time and place to pick up or have parents deliver their stories or drawings to share with others. Scan the work and upload it to the class website to share with others in the class.

Explore

Weather is another ongoing disciplinary core idea and is integrated throughout the year when "teachable moments" of weather events occur both locally, worldwide, and on a daily basis to aid students in predicting the forecast for the future and then checking for accuracy.

Students will also learn about moon phases this year. It will help students see the pattern of the phases as they observe what the moon looks like, where it rises, and when.

A sample handout My Observation Chart for students to record information is included. You can devise your own or have students designate a special section in their journal or notebook for

recording this information. As students learn the language of weather and moon phases, the teacher can expect them to begin using terms correctly. The students will become familiar with this chart before asking for more detailed and descriptive data such as moon phase names, temperature readings, rain gauge information, wind speed, and cloud types.

Introducing so many new ideas takes time so getting students familiar with the language and terms will help when they are working with the patterns of moon phases, understanding forecasts, using weather maps, and understanding these relationships.

Plugged:

Provide students with a virtual weather page on the class website. Teach them how to upload weather data and ideas as the topic of study progresses during the year. Have them designate a place in their notebook or journal for weather data and observations daily. Students will begin to notice weather patterns of interest like when they use another student's data to see that

- it rained in one part of town and not the other
- some students think it is warm and other students think it is cool or hot
- time of day makes a difference in what is recorded

Share websites and ways for them to get weather information online such as Weather.com.

Unplugged:

Have students designate a place in their notebook or journal for weather information. Tell them that you will be checking this section as the year progresses, but that they should note weather conditions daily.

Tell them that they need to find a way to check weather information such as newspaper, radio, television, as well as by looking outside.

Explain

The instruction will begin with clouds even though students are also making observations about the moon. Continue to remind students and encourage them to continue to compile data about the weather and the moon viewing. Students can refer to their charts when the moon phase study begins and already have several entries to see the repeating pattern of the moon phases.

The science of forecasting the weather takes careful observation and time to recognize patterns. Have students begin by focusing on observing the clouds and the weather associated with those clouds. They can use their My Observation Chart information and their journal/notebook entries to make general statements such as "When the clouds were fluffy and white, we didn't have rain." Or "When the clouds turn real dark and build very high, we have thunderstorms." Or "Gray cloudy days when I don't see much blue sky seem cooler."

Have students collect data for several days since weather sometimes stays the same over several days. That is okay. It helps students recognize patterns in seasonal weather. After students are proficient at recognizing basic cloud types and have seen examples of each, you can continue with more data.

Plugged:

You can explain what information to collect when you meet with them. A video of samples will help students understand the depth of data. Students can use an online journal to upload photos of clouds and descriptions of what they see. They can compile cloud pictures in a power point presentation giving examples of the main types of clouds with descriptions and share to the class website.

Unplugged:

Provide students with the handout and expectations/samples of what information is recorded in their journal/notebook. Schedule a time and place for students to bring their notebook/journal so that you can check their progress and a time and place for them to collect their journal/notebook with the feedback you provide. You can ask them questions about what they are recording in their journals when you talk to them on the phone (be sure to consult district policy about communication with students prior to initiating phone conversations).

You can scan their entries onto the class website for sharing with the rest of the class.

Elaborate

As you see that most the students are collecting observations and you can discuss with them what they are noticing, begin to introduce cloud names. In fourth grade students will use the basic cloud names: cirrus, cumulus, nimbus, and stratus. Help them to realize that it is possible to see more than one of these in the sky at the same time.

Literature Links: Have students check out books about clouds or you can record as you read aloud from books.

After students are proficient at recognizing basic cloud types and have seen examples of each, it is time to continue with more weather data. Use quizzes, games, checklists, and assessments to gauge when to add additional observations as you instruct students in thermometer reading, rain gauges, wind speed, etc. Take each step and add it to the Observation Chart as you go so that students have a place to practice collecting data through the year. A sample chart for collecting this data is Data Chart—Weather.

Plugged: Encourage students to download the booklet, Take a Cloud Walk. This free booklet is a colorful explanation of the different clouds and their names. It is 34 pages long, so it is best that they save it as a resource instead of printing it.

Encourage students to observe clouds outside as they go on a cloud walk. They can describe and draw observations in their journal. A resource students can download for their files includes a cloud chart:

NOAA Weatherwise

Unplugged: Provide students with information about the different clouds they will see. NOAA Weatherwise is a colorful chart students can use to see photos of a clouds and information about each one.

Activity:

Have students make clouds in a clear plastic drink bottle. They can rinse out the bottle while leaving a bit of moisture inside and cap it tightly. If they hold the middle of the bottle in both hands and squeeze the bottle rapidly several times, when the pressure is released, the remaining water droplets will condense in the air inside to form a faint cloud. Tell them to hold it up to the light, squeeze hard and see the cloud clear. Then when they let the pressure off, the inside of the bottle will look foggy. Relate this to high pressure (holding a firm squeeze) means clear skies and low pressure (releasing the squeeze) means rainy skies.

Plugged: You can do this as a demonstration or as a video of you showing them how to do it and what to observe.

Unplugged: Have students write about their results and success in making the cloud. They can draw pictures of what happened with their explanations.

Evaluate Provide students with the handout Clouds. This handout has a part 1 and a part 2. Students begin by making observations about clouds in Part 1. They progress to Part 2 when they begin noticing the pattern of observing a specific cloud and relating it to the weather that occurs.

Promote discussion with reminding them that they had rain after seeing tall dark clouds roll in, or that it was fair weather when they saw high feathery clouds in the blue sky. Observe, question, and quiz about the clouds and their relationship to the weather.

Plugged: You can lead the discussion about the relationship between clouds and weather during a virtual meeting. Upload the Clouds handout for student access and provide examples by talking/videoing expectations. You can use an online quiz program that will give you data on their progress.

Unplugged: Provide the handout Clouds with examples in the student packet. Let them know how and when you will check their progress. Have students take quizzes and tests in secure settings.

Charting Weather Data: *As students become more successful at recognizing the main cloud types and seeing the relationship to the weather, proceed with having students collect more data using weather instruments that are borrowed, or that they have. Students can find out more about weather instruments by focusing on weather reports in the news. This step is after this introductory portion of the sample, but the handouts Charting the Weather and Weather Forecasting are included so you can see the progression in the full instructional plan.*

This segment is not focused on students making their own weather instruments, but you can provide them with ideas if that is the only way they can use these measuring tools.

Once the actual lessons about "weather" occurs, the students will already have ample data for making informed predictions and a better understanding of weather patterns (fronts, highs, lows) and weather instruments for using weather maps to collect and read data.

Moon Phase Observations: *As the weeks progress, discuss noticeable patterns. Models of the phases are developed and explanations of how these phases occur are after several months of*

recording to see patterns. You can show students a sample lunar calendar of what will happen in the upcoming year of study: Lunar Calendar for United States.

Lesson Goals Checklist

Students will

- Get an introduction to the theme of the year: Life on the International Space Station and Its Mission.
- Collect, record, and analyze data on cloud observations.
- Collect, record, and analyze data using weather instrument data.
- Collect, record, and analyze data on moon phase observations.
- Use the data throughout the year as students become familiar with patterns and cause and effect relationships.

Handouts/Supplies

Supplies:

- Journal or notebook for data collection and recording observations
- Calendar for recording data such as moon phase
- Access to weather instrument information such as a local weather report in the news such as provided on the radio, in the newspaper, on a phone, weather website, or on television. It will be interesting if your child wants to compare the various reports for accuracy.
- A clear plastic bottle with a tight-fitting cap to make a cloud model
- Students can make weather instruments such as a rain gauge in a location outside or a wind chime/vane that shows air movement or an outside thermometer. The teacher will give details as the year progresses.

Evidence of Student Success

Student mastery is assessed throughout this unit using formative and summative components. Student discussion, explanations and products should reflect the understanding indicated in the Evaluate section above. Each activity in the segment functions as an assessment opportunity as well to plan targeted supports or provide extension items. Formative options using the self-evaluation checklist and the sorting activity at various points during the segment.

Student Learning Supports

The goal for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.
The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision we must support the inclusion of all students in science learning.

Some **general** strategies to include all students in the learning process of science are as follows:

- Provide consistent and positive feedback.
- Keep directions brief and clear.
- Make sure parents and students know schedules, due dates, requirements, expectations, and how assignments/tests are going to be collected.
- Share evaluation results in a timely manner to students and parents.
- Package assignments in a way that students know the sequence, what is required, when it is required, what is available as choice and what is for fun.
- Provide/encourage organizational strategies such as where to work, store work, when and where to turn in assignments, graphic organizers, etc.
- Provide reminders of important dates and requirements.
- Go over notebook and journal ideas and share your entries with students so they can see what you expect.
- Allow dictation and/or text to speech software programs and tools
- Check in with students by phone or online to answer questions, give reminders, and check progress.
- Provide parents with updates on progress and upcoming assignments. Communicate often.
- Provide resources that students can access offline.
- Allow students to give information orally or in drawings.
- Model expectations and demonstrations in video/online/phone.

Some strategies **specific** to this lesson are as follows:

- The teacher should consider using guiding questions to help students make connections with prior knowledge.
- The teacher should consider sharing spaces. Provide clear and consistent guidelines for students when sharing, listening, and discussing other student's work.
- The teacher should consider providing students with the script from the international space station. The teacher should also consider reading aloud the script so that students can hear what was said in a clearer format.
- The teacher should consider read aloud for any text assigned to students.
- The teacher should consider providing students and parents with a handout that contains instructions for uploading or sharing work. This makes the instructions stand out and helps the student and parent understand the expectations.
- The teacher should consider providing students with a format to record data, observations, and ideas. Some students will be overwhelmed when trying to create their own format.
- The teacher should consider sending home a handout with the weather forecast. Some students may not readily have access to the weather forecast and it may cause anxiety. Then students can compare the forecast to their observations.
- The teacher should consider sentence frames when asking students to write.
- The teacher should model data collection and provide students with clear expectations while collecting data.
- The teacher should consider providing students with information in multiple formats and give students a choice of multiple formats to share their knowledge.

Engaging Families

- Additional resources to support this segment can be found at GPB: Georgia Home Classroom.
- Sample Learning Menu Strategies for K-12 Science
- Science Support for Families During School Closures

Dear Parent or Caregiver,

This instructional segment in science is about how to observe, collect and record data about the weather and moon. Students will use these data to analyze, interpret and predict future events such as weather patterns and moon phases. These skills are used throughout the year.

The investigations will involve observing moon phases, charting weather data, observing cloud patterns, and learning about weather instruments. Students will learn more about the International Space Station, the astronauts that live there, and the work they conduct.

It will help to find a specific location (two opposite windows, for example) for your child to observe from each day and evening. Observing from the same locations will help students observe the pattern of the moon rise and set as well as the direction clouds and weather patterns travel. A materials place (shoe box or tote bag) will help your child locate and store what is needed so you will not have to go searching during the class.

Here are the materials needed for this segment in science:

- Journal or notebook for data collection and recording observations
- Calendar for recording data such as moon phase
- Access to weather instrument information such as a local weather report in the news such as provided on the radio, in the newspaper, on a phone, weather website, or on television.
  It will be interesting if your child wants to compare the various reports for accuracy.
- A clear plastic bottle with a tight-fitting cap to make a cloud model.
- Students can make weather instruments such as a rain gauge in a location outside or a wind chime/vane that shows air movement or an outside thermometer. The teacher will give details as the year progresses.

Introduction to the International Space Station (ISS)

The International Space Station (ISS) is designed to answer these questions and many more. The ISS is not only an adventure in space living, it is also an adventure in science and engineering. The ISS is a little bigger than a football field; think of it as a small space city orbiting above the Earth. To make a place where humans can go and study space and the space environment over long periods of time, 16 countries from around the world work together. The space station is one of the greatest accomplishments of engineering, ever. It takes a lot to organize so many countries working together to make a small city, especially in space! The US and Russia take the lead on this project, but all of the 16 countries have contributed something, from the laboratories to the robotic equipment, that help us explore.

The primary mission of the ISS is to conduct research on the possibility of humans living in space in the future, research that also benefits life on Earth now. The ISS gives us a chance to look at how things are affected by an environment with very little gravity holding them down (called microgravity). Gravity is caused by the attraction between all physical matter, and it is one of the natural forces present in our everyday life. On Earth, we feel gravity pulling us down towards the ground because our bodies are attracted to the massive amount of rock, dirt, water, and everything that makes up our planet beneath our feet. In the ISS, there is a small amount of gravity exerted on the astronauts by Earth. (The amount of gravity on the ISS is 8.75 m/s/s versus 9.8 m/s/s on Earth.) The reason for microgravity is as the ISS orbits the Earth, it is also in a state of free fall. Still the direction of the gravitational force on the astronauts is *towards* the Earth. Right now, many research projects are conducted on the space station. Engineers and scientists are continually learning more about space and traveling in space, as well as how space affects materials, such as metals, plants, and the human body. From what is learned, engineers create better medical treatments, materials, and energy technologies (such as solar).

Living in space is very different from living on Earth. Can you imagine it? Astronauts must be strapped down to their beds to sleep (so they do not float around). On the ISS, each astronaut has his/her own room, called a "galley." The space station environment is kept at a comfortable 70˚F temperature and much has been done to make the astronauts feel at home. On board the ISS, astronauts wear the usual clothing they would wear on Earth, but they have special engineered clothing for travel to and from the ISS as well pressurized suits for space walks. The space station is equipped with special microwave ovens and refrigerators, so the astronauts can eat more typical types of food, including specially packaged fruits and ice cream.

Exercise is very important on the space station, since microgravity affects bones and muscles in space; without the force of gravity, astronauts lose bone and muscle mass. Astronauts use special exercise equipment designed by engineers to make sure they do not lose too much bone or muscle mass, which would be dangerous for them once they return to Earth.

In addition to serving as a classroom for understanding the effects of space travel on humans, the International Space Station also gives us the opportunity to look at the planets and our Earth from a different perspective. Astronauts on the ISS take daily pictures of the Earth to help us learn about how people affect the Earth with pollution and cutting down forests of trees, as well as how the Earth's surface is changing with volcanoes and earthquakes. Engineers and scientists have only just

begun to unlock the mysteries of what we can learn from living in space. Your generation will better understand space travel, our universe and even our Earth, because of what we learn from the experiments being conducted on the space station today.

Living in Space

We will spend the year together learning about the similarities and differences of living on Earth and living in space. Think about these questions.

- What is it like to live in space?
- Would you float instead of walk?
- How would you sleep?
- What and how would you eat?
- What effects does *microgravity* or "weightlessness" have on human beings and other living things?
- How do plants grow in the conditions of space?
- Can engineers design new materials in space that are useful on Earth?
- What does the International Space Station have in common with the moon? They both orbit the Earth! What do you think the astronauts see when they look at the Earth and the Moon? Do they see moon phases like we do?
- What about Earth's weather as seen from the International Space Station? What do you think the astronauts can see from so far away?

Write a story or draw pictures to show what it would be like for your family to live in space. Choose 4 questions to use as the focus of your story or pictures. Label your pictures or underline in your story the ones that you chose.

My Observation Chart

This is a sample of how you can fill out this chart in your notebook or journal. As we learn more about moon phases, weather instruments and readings, we will change some of the ways we report each day and use science words. If you cannot report a day or forget one of the days, just write what happened in the boxes.

The important thing is that you get used to keeping the information each day. Data collecting is necessary in weather reporting and seeing the pattern of the moon phases.

Date	Time	Weather Observation	Temperature Range	Clouds	Wind	Precipitation	If you saw the moon, what did it look like?
July 4	*p.m.*	*It is partly cloudy.*	*Warm in the morning and hot in the afternoon*	*Big tall puffy clouds that are white on top and gray on the bottom*	*A slight breeze because I can see the leaves moving on the tree outside*	*None*	*At night, round and bright*
July 5	*X*	*I forgot because I had family visiting me.*	*x*	*x*	*x*	*I remember that it was rainy in the p.m.*	*It was too late at night for me to see it.*

We will begin learning about cloud names and you can include the actual names if you know them, but descriptions are also good.

Clouds are a way to forecast the weather and recognize the patterns of weather after seeing a type of cloud. Sometimes you will see the moon in the daytime, sometimes at night, and sometimes it is past your bedtime or too cloudy to see it. Just record the information. We will begin to learn the names for the different parts of the moon we can see in the moon phases.

Clouds

There are three main forms of clouds: cirrus, cumulus, and stratus. All other cloud names are combinations of these basic names. These names came from weather studies conducted by Luke Howard. He used these names to describe the main forms of clouds and presented his names and writings to the science community before other scientists.

Cirrus clouds are the high wispy clouds that are formed of ice crystals. They usually signal a change in the weather. Cumulus clouds are the fluffy clouds we see during fair weather. Sometimes they look like animal shapes in the sky. When they become flat on the bottom and dark, they signal rain or storms. We call storm clouds cumulonimbus. They can build into massive mountains of dark clouds. Stratus clouds are low and gray. They form a layer of cloud cover that sometimes sits on the ground as fog.

Scientists can use clouds to forecast the weather since some clouds are only seen during certain conditions. Become a Cloud Watcher and see if you can find the patterns of clouds giving clues to the weather that follows.

Part 1: Cloud Journal

Date	Cloud type	Location	Current Weather	Next Day's Weather

What did you notice about the clouds you saw during this week?

Did you notice a pattern of weather and clouds?

Part 2 Forecasting with Clouds

Now try your hand at watching the clouds and see if you can notice the pattern of the cloud formation and the weather you see the next day or so.

Date	Cloud type	Location	Current Weather	Prediction of Next Day's Weather	How did you do?

What did you find out as you watched the clouds and predicted the weather?

Are cloud observations enough to accurately predict weather conditions? What would help your accuracy?

Part 3: **Charting Weather Data**

Let us add some weather instrument readings to help us with our forecasting.

Date	Cloud	Location	Temperature	Air pressure	Wind speed	Precipitation	Current weather

Do you see any patterns in your data? Did the weather instrument data change what you know about the weather?

Part 4: Weather Forecasting

Using what you know, try predicting the weather by using all of what you know about weather instrument data and cloud observations. Remember to look for patterns and relationships.

Date	Cloud	Location	Temperature	Air pressure	Wind speed	Precipitation	Prediction for tomorrow	How did you do?