Title of Workshop: *Under the Setting Sun*

Objectives:
- Ask questions about natural phenomena and demonstrate curiosity about the world
- Work through the steps of the scientific method and make conclusions from a set of information

Learning Outcomes:
- Understand the steps of the scientific method and how to apply them
- Make a hypothesis given background information
- Record observations and collect data
- Represent simple data using graphs
- Decide whether an experiment’s hypothesis was supported or not
- Discuss reasons for observing trend(s) in data

Target Audience: Grade 4-5 students

Duration of Workshop: About 1 hour per day for 7 days

Delivery Method: Experiment and online resources

Materials Required:
- Writing utensils
- Access to sunlight
- A watch or clock to tell the time
- A ruler or tape measure
- Printed copy of this activity

Allergy Risks/Safety Protocols:
You will be observing the size of shadow the sun makes at sunset. Make sure you don’t look directly at the sun during this activity!
Introduction:

Have you ever conducted your own experiment before? If so, awesome! If not, you’re in luck – that’s what this activity is all about. In science, before doing an experiment, there are steps to take in a certain order to make sure everything goes as smoothly as possible. These steps are called the scientific method. Today, you will be going through the steps of the scientific method and collecting your own data to analyze at the end of the week.

This experiment involves the time of day that the sun sets over the Earth. You probably know the general time of day that this happens – around dinnertime, usually before bedtime. But at what time exactly does the sun set every night? And does this time change, or does it stay constant? These questions bring us to the first step in the scientific method, which is asking questions we are curious about.

Step 1: Ask a Question

The first step of the scientific method involves asking questions, and they can be about anything! For this activity, the question we are asking is: **at what time does the sun set each night, and why does it set at this time?** We will be working through the next steps of the scientific method below. But first, take a moment to think of some other questions you have about sunsets and record them here:
Step 2: Make Observations and Do Some Research

Next, it is important to observe the object or event you are curious about and do some research if you don’t know much about it to begin with. In this section, we will do both.

a) Record some observations about sunsets that you can remember here. Try answering these questions to make the most detailed observations:
When do you observe sunsets?

Where do you observe sunsets?

What do sunsets usually look like? What colours have you seen?

What are some similarities between sunsets that you know of? What are some differences?

b) Now, usually a scientist would look in books, online, or other reliable resources for information about their question. For this activity, some information about our question, what time the sun sets and why, is provided. Read through this carefully and pay special attention to the words in bold!

Day and night are caused by the rotation of the Earth on its axis. During daytime in one half of the world, the Earth is rotated so that the Sun is shining directly on that half. The other half of the world is not getting sunlight, so in that half of the world it is nighttime. It takes about 24 hours for the Earth to rotate once around, so every day and every night lasts around 12 hours each.
A sunset is the moment the Sun disappears over the horizon. This could also be thought of as the time that day becomes night. Seasons change because while the Earth is rotating on its axis, it is also orbiting around the Sun. It takes about 365 days for the Earth to orbit the Sun, which is what we call a year.

Between **December 21** and **June 21**, the Earth revolves around the Sun to the position where the Northern Hemisphere is tilted towards the Sun. This means that the Earth gets more sunlight every day until June 21, and it tends to get warmer outside. **This also means that the time that the Sun sets is getting later every night, making each day longer.**
Between **June 21 and December 21**, the Earth revolves around the Sun so that the Northern Hemisphere is tilted away from the Sun. This means that the Earth gets less sunlight every day until December 21, and it tends to get colder outside. **This also means that the time that the Sun sets is getting earlier every night, making each day shorter.**

Around **December 21 and June 21**, the Northern Hemisphere of the Earth is tilted either the farthest away from the Sun or the closest towards the Sun, and it is about to change direction. This means that the amount of sunlight the Earth gets in the few weeks close to these days stays about the same. **This also means that the Sun sets around the same time these nights.**

A shadow is made when the light from the Sun is hitting an object at an angle. As the Sun sets, the angle at which sunlight is hitting an object decreases. This means that the shadow behind an object gets LONGER. The idea for this experiment is that the time of sunset can be measured by the length of the shadow cast by the Sun.

For the rest of the activity, it will be very useful to know what date it is. Write down the date here for reference later:
Step 3: Form a Hypothesis

Before starting the actual experiment, we still need to form a hypothesis. A hypothesis is an educated guess about what might happen during your experiment. From the above information, what do you think will happen to the time that sunset occurs each night? Write your hypothesis here:

(Hint: once you know what day it is, are days getting more sunlight, less sunlight, or is the amount of sunlight staying the same?)

Step 4: Design an Experiment

We are going to be recording observations during sunset every day for 7 days. This type of study is called observational, which means that we observe natural events and take notes on what we are interested in.

Instructions:
1) Find a place, indoors or outdoors, where you can easily see the shadow cast by the sun on the ground or on a table.
2) Hold a pencil or pen vertically (upright) on the table or ground. You should be able to see a dark shadow on the table or ground pointing in the direction away from the sun!

   OPTIONAL: Instead of using a pencil or pen, use your body! You will need someone to help you take measurements. Stand up, facing away from the sun. You should see your shadow in front of you. Then, ask someone to help measure the length of your shadow on the ground.

3) Using a ruler or tape measure, measure the length of the shadow cast by your pen, pencil, or body (in centimeters). You want to measure the shadow when it is the LONGEST. Record the date, length of the shadow, the time, and other observations in the following table (ignore the red square for now):
<table>
<thead>
<tr>
<th>Day</th>
<th>Today’s Date</th>
<th>Length of Shadow (cm)</th>
<th>Time when shadow is longest</th>
<th>Draw what the shadow looks like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Day 3</td>
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<td>Day 4</td>
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<td>Day 5</td>
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<td>Day 6</td>
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<tr>
<td>Day 7</td>
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</tr>
</tbody>
</table>

4) Repeat Steps 1, 2, and 3 until you have observed the sunset for 7 days (the table should be filled in). Make sure you use the same item to create a shadow every day AND use the same place to cast a shadow – consistency is key when it comes to the scientific method!
**Step 5: Analyze the Data**

Now, after Day 7, it is time to analyze the data we have collected. Graphs are a common way of showing data, and that’s how we will visualize our data in this activity.

Instructions:

1) Write the *Time when shadow is longest* from Day 1 (what you wrote in the red square in your table) on the red line in the graph below.

2) This graph is designed so that you plot the amount of time that the time of sunset changed by. The X-axis shows Days 1 through 7, and the Y-axis shows the amount of time the sunset changed by (in minutes). For each day, you will find the **difference in times between sunsets**.

   Day 1 has already been plotted for you because it will be the same time as you wrote on the red line, so the value plotted is 0.

   For Day 2, SUBTRACT the *Time when shadow is longest* from Day 1 from the *Time when shadow is longest* from Day 2. For example: If your Time from Day 1 is 5:30pm and your Time from Day 2 is 5:31pm, the difference in times between sunsets is 1 minute later. You would draw a point at 1 minute for Day 2, above the X-axis because it is LATER than Day 1.

   You will only use one side of the graph (the upper or lower half) depending on whether your times got EARLIER or LATER.

3) Continue filling in the graph using this method.
**Step 6: Make Conclusions**

The final step in the scientific method is making conclusions from the data we analyzed. The following are some questions that scientists usually ask themselves after an experiment:

1) **Does the data support your hypothesis?** To answer this question, remind yourself of the hypothesis you made at the start of the week. Now, look at the graph that you filled in. If your results match what you predicted would happen, congratulations! You have results that support your hypothesis. If your results don’t match what you predicted, that is okay too! Some of the best scientists in the world make predictions that don’t end up being true, and it’s another way of learning how things work. The next step is to figure out WHY your prediction and results differ.

2) **How much did the time of your sunsets change by (in minutes)?**

3) **Can you think of a reason why the time of sunsets changes, based on the information in this activity?**

   (Hint: it may be related to what time of year you’re currently in!)

4) **What other things could you study by taking observations every day?**
Extra Resources:

- If you’re a bit confused on the reason why we have different seasons, check out the following Bill Nye video!
  https://www.youtube.com/watch?v=KUU7IyfR34o

  This video from the California Academy of Sciences is informative as well:
  https://www.youtube.com/watch?v=WgHmqv-UbQ

- Check out the steps of the scientific method in more detail in the video below!
  https://www.youtube.com/watch?v=qAJ8IF4HI20

- There are countless experiments you can do by following the experimental method! If you can’t get enough of doing experiments, be sure to try these home-friendly science experiments involving only a few materials!
  https://www.kidsacademy.mobi/storytime/science-experiments-using-scientific-method/

- Consider printing out the following pages from
  https://littlebinsforlittlehands.com/using-scientific-method-experiments-kids/
  to practice the scientific method at home!
Make a Hypothesis
Try to predict the answer! A hypothesis sounds like an "if I do this, then this will happen." This being your experiment and outcome.

Set Up An Experiment
Design a test or experiment to see if your hypothesis is correct!

Record Data
Record what happens during the test or experiment.

Conclusions
Analyze or review your data to see if your hypothesis was correct!