

Does the Sun have Seasons?

Rich Task 1 Activity 6

Introduction:

The Sun is our nearest star and provides the conditions for life to exist on Earth. It's about halfway through its lifetime and acts as a nuclear reactor, giving us heat and light. It accounts for 99% of our solar systems' mass and one million Earth-sized planets could fit inside it. Within the Sun there are atoms of Hydrogen and Helium that are densely packed and collide violently with each other. The fusion of atoms that occurs in the Hydrogen core of the Sun generates light, which takes a hundred thousand years to escape the Sun's core and then travel for a further eight minutes to reach the Earth. Understanding the role the Sun plays in our lives is fundamental to understanding the Sun-Earth system (E & S LO 4).

This activity asks students to investigate the solar cycle (an 11-year cycle of periods of activity and periods of quiet on the Sun). Students will use a table of data, image prompts, and also graphing the solar cycle using Excel. This activity scaffolds the next ([Rich Task 1 Activity 7](#)), which brings [Rich Task 1 Activities 1 - 6](#) together to address the original hypothesis: Does the Sun have Seasons?

Preparation Required:

1. Printing
2. Computer access for students

Downloadable Materials:

- [Worksheet 1.6](#)
- [Expected Student Responses to Worksheet 1.6](#)
- [Excel data sheet 1](#)
- [Excel data sheet 2](#)
- [Excel data sheet 3](#)

Relevant Junior Cycle Learning Outcomes:

Students should be able to...

PW LO 3: Investigate patterns and relationships between physical observables.

NOS LO 4: Produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions.

NOS LO 3: Design, plan and conduct investigations; explain how reliability, accuracy, precision, fairness, safety, ethics, and the selection of suitable equipment have been considered

Teacher Resource

E & S LO 4: Develop and use a model of the Earth-sun-moon system to describe predictable phenomena observable on Earth, including seasons, lunar phases, and eclipses of the sun and moon.

NOS LO 2: Recognise questions that are appropriate for scientific investigation, pose testable hypotheses, and evaluate and compare strategies for investigating hypotheses.

NOS LO 7: Organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations.

Learning Intentions:

Students will be able to...

- Analyse visual and numerical data to investigate the solar cycle (Sun's "climate")
- Record their observations.
- Communicate their ideas in a small group and whole-class setting.
- Discuss their observations.
- Plot data using Excel
- Describe the solar cycle by utilising the graph, the images and table of numerical data.
- Identify the duration of the solar cycle and periods of high activity and low activity.

Prior Knowledge/Horizon Content Knowledge:

- Plotting graphs
- Basic Excel (plotting graph, labelling axes)
- Making and recording observations
- Noticing patterns or anomalies in data

Differentiation and Accessibility Suggestions:

This activity requires some prior knowledge. Students can decide the depth of questioning and discussion in the class.

All questions/activities can be completed in small groups, pairs, or individually depending on the classroom layout.

The teacher could share the pdf as a presentation and facilitate class discussion without the small group element.

The worksheet may be shared with the students as a pdf for viewing the images in Q1. on a device in the classroom. This will make it easier for students to zoom in and out to identify the changes in each image of the Sun over time. This also reduces the preparation time for the task.

The worksheet involves the use of an Excel Spreadsheet. There are three spreadsheets so that the students can work with a small dataset initially and notice the pattern. Students can then combine data sets in larger groups and notice the emerging pattern when the data is considered in its entirety in Q2. d) worksheet 1.6.

In the case of limited student access to computers, the students can plot the graphs by hand.

The graphing activity could be used for a cross-curricular lesson. If students are familiar with Sine functions from maths class the Teacher can use the solar cycle as an example of a process in nature that repeats periodically as a Sine wave.

Activity Outline:

Activity Name	Does the Sun have a climate?
Alignment to ISLE investigation	Investigating the hypothesis
Rationale	Investigating the pattern of behaviour of features of the Sun to aid investigation of whether or not the Sun has seasons. To provide an opportunity for students to work with numerical data and use Excel.
Activity Description	<p><i>(please see downloadable materials for the resources for this activity)</i></p> <p><i>(Q1. Worksheet 1.6)</i> Students can examine the images visualising the Sun's solar cycle without teacher guidance and note their observations. Students can sketch a rough graph of the pattern they can see in the images.</p> <p><i>(Q2. Worksheet 1.6)</i> Teacher can split the class into small groups and can assign each group an Excel Spreadsheet (1, 2 or 3). Students work in groups using the Excel spreadsheet alongside the worksheet. Students plot the daily average of visible sunspots against time in years and note the shape of the graph.</p> <p>In Q2. d) Teacher makes larger groups combining those working on each spreadsheet so that every group has access to a full data set. Students then plot the entire data set and compare it to their first graph, noting the pattern arising.</p>

	<p>Teacher can use the graphs and worksheet questions to prompt class discussion of whether or not the Sun has a cycle, the duration of the cycle, is it the same as a climate etc.</p>
<p>Link to other activities</p>	<p>Scaffold for Rich Task 1 Activity 7 and links back to Rich Task 1 Activity 1 and 2.</p>
<p>Link to current research in DIAS Dunsink Observatory</p>	<p>The Solar and Space Weather group at DIAS Dunsink consists of PhD students, postdocs and professors who study different aspects of the Sun and Space Weather.</p> <p>Through their research, scientists can get daily updates on the activity of the Sun (https://solarmonitor.org) and advise on precautions that can be taken to protect Ireland’s power grid from potential solar storms.</p> <p>More information on specific projects can be found here: https://www.dias.ie/solarphysics</p>
<p>Related Magnifying Science Podcast from DIAS Dunsink Observatory</p>	<p><u>Podcast Description:</u> An interview with Alberto Cañizares who studies energetic explosions on the Sun, at DIAS Dunsink Observatory. The podcast offers insight for students on the reason why the study of the Sun is important and how it is possible to move from one area of STEM to another, because of the versatility of STEM degrees. (engineering → physics)</p> <p><u>Podcast episode:</u></p> <p>Coming soon!</p>