

Solar System Weather Reports

Overview

In this activity, students create a weather report for an object in our solar system other than Earth. The report is like a newscast, written, and may be presented as a video. The objective is to consider how properties of objects in space including surface, atmosphere, gravitation, and distance from the sun affect their ability to sustain life. Throughout this guide, all information in italics is a “teacher tip.”

North Carolina Essential Science Standards

- 6.E.1.2 Explain why earth sustains life while other planets do not based on their properties (including types of surface, atmosphere and gravitational force) and location to the sun.

Background

Every planet, moon, and asteroid in our solar system has its own special characteristics, based on how it was formed, its size, its distance from the sun, etc. One way to consider how these characteristics affect the ability to sustain life is to think about their weather. Features of these objects to consider include:

- Rate of rotation – for example, some objects rotate much faster or slower than Earth, completing more than one full revolution or less than one full revolution in an Earth year. In this case, tomorrow’s forecast takes on special significance.
- Atmosphere - for example, Venus is covered with such a dense layer of clouds that it experiences a constant and extreme ‘greenhouse effect.’
- Barometric pressure - for example, the barometric pressure on Earth is a measure of the weight of our atmosphere that results from Earth’s gravity. The moon has gravity, but no atmosphere. Does it have barometric pressure?
- Tides - Are there tides on other planets if they have no oceans?
- Sunrise and Sunset - Do asteroids have regular sunrises and sunsets?
- Moon Phases - Is there always at least one full moon in the sky above Neptune?
- Storms - What about tornadoes on Jupiter?

In addition to textbooks, the following websites may be useful:

<http://solarsystem.nasa.gov/planets/>

<http://www.enchantedlearning.com/subjects/astronomy/planets/>

<http://www.nineplanets.org/>

<http://scijinks.jpl.nasa.gov/planetary-weather/>

<http://www.telegraph.co.uk/news/science/science-news/8744874/Whats-the-weather-like-on-other-planets.html>

http://www.slate.com/articles/health_and_science/science/2012/12/space_weather_tornadoes_dust_storms_hurricanes_acid_rain_on_other_planets.html

<http://www.faena.com/aleph/articles/the-weather-forecast-for-the-other-planets-in-the-solar-system/>

Materials

Materials for the whole class

- Computer access

Materials for individual students or small groups

- *Science notebooks
- *Presentation materials
- * *supplied by the teacher*

Procedure

1. Ask students to take notes on what gets presented during the evening news weather report or on a local TV station website. Ask what was said, if anything, about the following:
 - Temperatures (daily highs and lows, record highs and lows)
 - Humidity
 - Barometric pressure
 - Winds
 - Precipitation
 - Sunrise/sunset
 - Tides (if near the coast)
 - Full moon
 - Freeze warnings
 - Storm warnings
 - General forecast
2. Students' assignment is to create a weather report for some object in our solar system other than the Earth: the sun, Earth's moon, one of the planets, a moon of one of the planets, an asteroid, a comet, an artificial satellite orbiting Earth, etc.
3. Some of the information given in an Earth weather report will not be relevant to their chosen object. Conditions on their chosen object may be drastically different from any on Earth. (See the sample weather report below.)
4. Students might wish to include a weather map, a poster showing current conditions, and a second poster showing the forecast.

Reflection/Discussion

Conditions on other planets in our solar system are unlike those on Earth. Creating a weather report for discussion allows students to see how different they are.

1. For a class discussion, generate a class list of characteristics of non-Earth solar system objects that make them very different from Earth. Also generate a list of similarities the students may have found.

[As an example for your reference only, the following is an example of a weather report from Venus.]

Hi. Prometheus here from the Venusian Weather Center.

Well here's good news. It will officially be noon in a few hours, so nightfall is just 1,500 hours away! (For our esteemed Earth visitors, that's about 60 of your days.) Unfortunately, the cloud cover is expected to hold, so sunset probably won't be too spectacular.

High temperatures will be in the 860s °F since the greenhouse effect continues unabated. We suggest that you wear extra thermal protection, drink plenty of water, and, if you're working outdoors, take plenty of short breaks and don't over-exert yourself. Remember that your lead helmets will not be appropriate since lead melts at these temperatures.

The barometric pressure is holding steady at 2,700 inches.

Winds at the surface will be light and variable, with gusts to 3 mph.

Winds aloft will be averaging 200 mph from the east and northeast, so if you are flying west, you should have a quick flight, although periods of turbulence could be a problem.

The sky will be densely overcast as usual, so expect rather gloomy conditions. And there will be scattered acid rain showers, mostly sulfuric, on and off all day, so carry your buffering umbrella.

Our computer models all seem to show similar conditions tomorrow, but since that's still 4,500 hours from now, we are holding onto a glimmer of hope for some change.

And now here's Apollo with the latest in sports news. I hear that Mercury has won the Solar 100 again! What an amazing record. What's the story, Ap?]

2. Ask each student to visit one or more of the following web sites to learn about conditions that scientists believe are necessary for life to emerge on a planet:

<http://learn.genetics.utah.edu/content/astrobiology/conditions/>

<http://www.livescience.com/31788-why-earth-perfect-for-life.html>

<https://lcogt.net/spacebook/what-are-requirements-life-arise-and-survive/>

<https://astrobiology.nasa.gov/about/history-of-astrobiology/>

<http://www.space.com/26189-alien-life-requirements-exoplanet-search.html>

https://en.wikipedia.org/wiki/Planetary_habitability

3. When students complete this, ask them to return to their sources about their planet to add information about other conditions on that planet that are important for life. They will need to note, at least, chemistry, distance from the sun (habitable zone), and characteristics of the crust.
4. Ask them to combine weather information and the other conditions to speculate on whether they think life could arise on their planet. They must include reasons to back up their verdict (why, or why not).

Assessment

Students should turn in a written transcript of their ‘weather report,’ including a bibliography of their book and website sources.