

JUST RIGHT: SEARCHING FOR THE GOLDILOCKS PLANET

Just Right Temperature Activity



“Earth orbits in our solar system’s “habitable zone,” where a planet can have liquid water on its surface because its distance from the Sun keeps the planet’s temperature just right: not too hot (so all the water doesn’t evaporate) and not too cold (so all the water doesn’t freeze).”

–**Just Right: Searching for the Goldilocks Planet**

Just Right for Liquid Water & Life

Like Goldilocks’ porridge, there is a “just right” temperature for life as we know it. Life here on Earth depends on liquid water. Although we have water in the solid form of ice and the gaseous form of water vapor, plants and animals need liquid water to survive. Except for Earth, the surfaces of all the other planets, dwarf planets, and moons in our solar system are either so cold that any water is trapped in a frozen form, or so hot that the water probably boiled off as vapor long ago. Some planets may even have both situations depending on their temperature extremes. But that doesn't mean that scientists believe that Earth is the only possible place life might exist in the solar system. Liquid water probably exists underground on Mars, and some moons of Jupiter and Saturn are known to have oceans hidden under their frozen surfaces. That is why NASA is sending special missions to look for evidence of life in those places.


Observing Water in Solid and Vapor Forms

Here are some ideas to invite your students to observe the behavior of water at different temperatures with ice cubes and steam. Look for sample observation sheets on the following pages.

Note: At sea level on Earth, the boiling point of water is 212° F (100° C) and the freezing point is 32° F (0° C).

Ice: Place small amounts of ice in bowls in various locations to see how exposure to sunlight, or variations in temperature, affect the melting rate. Or you may wish to place a bowl of ice with each group of students and let them observe and time how long it takes for the ice to begin melting, or to melt completely (depending on the length of time available for the lesson).

Steam: For safety reasons, creating steam needs to be done carefully. It is possible to bring in a crock pot and turn the temperature up to create water hot enough to reach a gentle boil and form steam (especially if you leave the lid on, then raise it to let a cloud of steam escape). Students will need to be seated far enough away that the heat will not harm them and that they will not be able to knock the pot over. Or you could use an electric tea kettle and have students watch for the steam to escape the spout on the kettle.



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Observing Water in Solid and Vapor Forms (cont.)

Additional Observations: Use lettuce leaves to demonstrate the reaction of plants to water in a variety of temperatures - frozen, room temperature, or boiling - and record the results on the condition of the leaves.

Plant & Planet Predictions

If plants here on Earth are not able to survive when exposed to the extremes of water temperatures, can students predict how they would react to the even greater temperature ranges, and therefore the possible water temperatures, found on other planets? Record their predictions on a class discussion chart or K-W-L chart.

Temperatures in Our Solar System:

Mercury -279° F (-173° C) to 801° F (427° C)

Venus 864° F (462° C)

Earth -126° F (-88° C) to 136° F (58° C)

Mars -243° F (-153° C) to 70° F (20° C)

Jupiter -258° F (-161° C) in the clouds to 43,000° F (24,000° C) in the core

Saturn -288° F (-177.8° C) in the clouds to 21,092° F (11,700° C) in the core

Uranus -371° F (-224° C) in the clouds to 9,000° F (4,982° C) in the core

Neptune -392° F (-236° C) in the clouds to 12,632° F (7,000° C) in the core

Explore

“NASA: Solar System Temperatures” at <https://solarsystem.nasa.gov/resources/681/solar-system-temperatures/>

“NASA: Planet Compare” at <https://solarsystem.nasa.gov/planet-compare/>

Just Right Temperature Observations & Predictions

Name: _____ Date: _____

Just Right on Ice

Enter your observations about water in its solid form below. Note the location of where your ice cubes were placed - near a sunlit window, outdoors in full sun, outdoors in shade, etc. Where possible, note the temperature.

What is the condition of the ice cubes when first displayed?

What is the condition after 3 minutes?

What do you predict the condition would be after several hours?

Just Right Temperature Observations & Predictions

Just Right Way to Water Plants

Expose three pieces of similar-sized lettuce to various forms of water. Record what you observe about the lettuce leaves before, during, and after the ice, water, or boiling water (hot enough to produce steam) is applied.

	Water	Ice	Boiling Water
Before			
During			
After			

Just Right Predictions

What do you predict the results would be if plants were exposed to those temperatures on other planets? What if humans were exposed to those conditions? What sort of life forms do you predict might survive in extreme heat or cold?