**Infrared Wavelengths- Thermal Mapping**

**Objective**:

Investigate how a satellite uses thermal energy to map the atmosphere or surface of a planet or moon.

**Engage**: Infrared: More than Your Eyes Can See (NASA). <https://youtu.be/2--0q0XlQJ0>

NASA’s Eyes: Juno Spacecraft Instrumentation. <https://eyes.nasa.gov>

Discuss: Look at an infrared map and discuss use of colors to depict differences in temperature.

 How can this be useful in understanding the surface of a distant planet or moon?

**Explore**: Use your “heat sensors” to map the surface of an exoplanet, and identify landforms and landing sites

Per group of 4:

1. Embed heat pads and cold packs into trays filled with packing peanuts or a similar material.
2. Cover tray completely with heavy-duty foil or paper. Lay coordinate plane on top.  Longitude / latitude also works!

1. Students in each group slowly run hands across pan, feeling temperature differences.
2. Color corresponding grid with colors representing temperature of the planetary surface, \*brightest color = hot, darkest color = cold
3. Using coordinates, map the warmest and coolest locations on the planet’s surface.

A fun addition:  Students can overlay a transparency with a topographic map on top of the grid.  Possible tasks:

* Identify possible landforms at various coordinates
* Evaluate locations of heat and / or cooling and discuss possible sources (ie. volcano)
* Where would your team choose as a possible landing site?  Why? (based on temperature and landforms)
* What are the coordinates of your landing site?

**Explain**

Team to explain (on paper and / or to class) their map, landforms, potential landing sites.

Quick write:  Explain how infrared and other wavelengths in the electromagnetic spectrum are useful in space exploration.

**Extend**

Coordinates can be used for calculating perimeter, area, scale, and other math concepts

**Evaluate**

Maps, Quick write, Questions and answers

*\*Lesson is modified from NASA’s Museum in a Box “Detecting clouds Using Infrared Energy”*

Laura Tomlin

Laura.tomlin@saladoisd.org

**Topics Covered:**

Science: Thermal energy:  Conduction / Convection / Radiation

Electromagnetic spectrum- Infrared wavelength

Solar System exploration and techniques

Landforms

Math: Coordinate planes

Social Studies:   Topographic maps, latitude and longitude

**Science TEKS, Grade 6 Learning Standards:**

* Plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology.[2A]
* Design and implement experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology.[2B]
* Collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers.[2C]
* Analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.[2E]
* In all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student.[3A]
* Use models to represent aspects of the natural world such as a model of Earth's layers.[3B]
* Identify advantages and limitations of models such as size, scale, properties, and materials.[3C]
* Investigate methods of thermal energy transfer, including conduction, convection, and radiation.[9A]
* Verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler until all the substances attain the same temperature such as an ice cube melting.[9B]
* Describe the history and future of space exploration, including the types of equipment and transportation needed for space travel [11C]

Laura Tomlin, 6th Grade Science

Salado Intermediate School

254-239-8095

Laura.tomlin@saladoisd.org