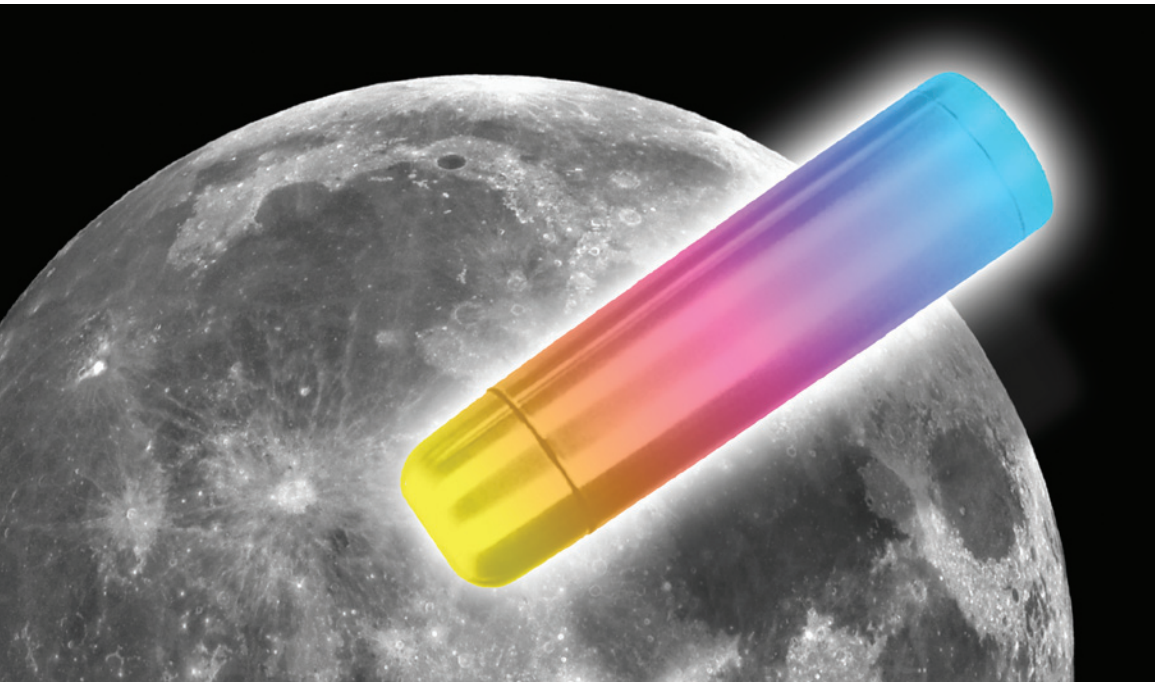


# Design a Lunar Thermos

## DESIGN challenge

*To design an insulator for a cup of warm water to maintain water temperature relatively constant. To apply the understanding of how things get warmer and cooler heat transfer.*



### OBJECTIVE

*To demonstrate an understanding of the Engineering Design Process while utilizing each stage to successfully complete a team challenge.*

### PROCESS SKILLS

*Experimental design, measuring, and data analysis*

### MATERIALS

*Glow sticks (2)*

*Thermometers*

*Stopwatches*

*Graduated cylinders*

*Plastic cups*

*Insulating materials  
(e.g. bubble wrap, paper, cloth,  
sand, water, foil, Styrofoam, etc.)*

### STUDENT PAGES

*Design Challenge*

*Ask, Imagine and Plan*

*Experiment and Record*

### PRE-ACTIVITY SET UP

*While the students are using the EDP to create an insulator, they will also be conducting a scientific experiment that requires a control. While the students test their cups, place a cup of hot water and a cup of cold water at the front of the room, un-insulated, each holding a thermometer. Set a timer for every 30 seconds and record the data to share with the students so they may compare their data.*

## MOTIVATE

- Ever wonder what is involved in designing today's spacesuits? Check out this interactive site to learn about NASA's spacesuits:

[www.nasa.gov/audience/foreducators/spacesuits/home/clickable\\_suit.html](http://www.nasa.gov/audience/foreducators/spacesuits/home/clickable_suit.html)

## SET THE STAGE:

# ASKIMAGINE &PLAN

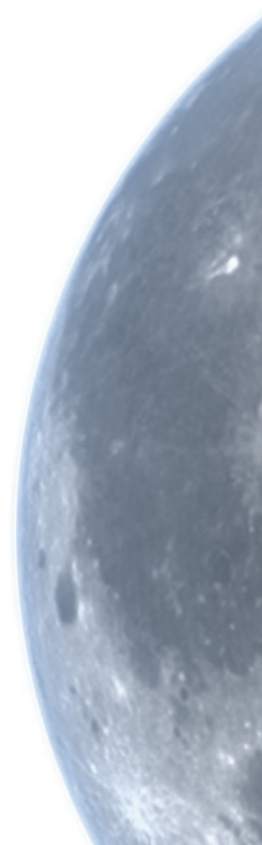
- Share the *Design Challenge* with the students
- Let students pretend to be molecules. First have them stand still and close together. Then have the students wiggle and then walk and move around to demonstrate more heat energy entering the system. Have them move faster and jump up and down as even more energy enters the system. Then have the students stop to notice where they are standing. (Note: They should be much farther apart and should feel much warmer than they were originally.)
- Place a glow stick in a clear cup of hot water and a clear cup of cold water, then turn off the lights. Using the knowledge they just acquired from the earlier activity, ask the students to select the glow stick with more molecular movement.
- Remind students to ask questions and brainstorm ideas, then break into teams to create a drawing of a lunar thermos. All drawings should be approved before building.

## CREATE

- Have students practice measuring temperature on the thermometer.
- Challenge the students to devise an insulation system to keep warm water at a constant temperature.

## EXPERIMENT

- Have students follow the directions on the Experiment and Record worksheet to complete their experiment.



## IMPROVE

- Have students design other combinations of materials to decrease any temperature fluctuation from their first design.

## CHALLENGE CLOSURE

Engage the students in the following questions:

- *How much did the temperature of the water change in your Lunar Thermos?*
- *How does your experiment's data compare to the control experiment your teacher conducted at the front of the room?*

## PREVIEWING NEXT WEEK

During this session, you explored designing insulation to reduce temperature changes, much like protecting humans from the extreme temperature swings on the Moon's surface. What if you needed to capture heat energy instead?

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Design  
a Lunar Thermos  
**Teacher page**

