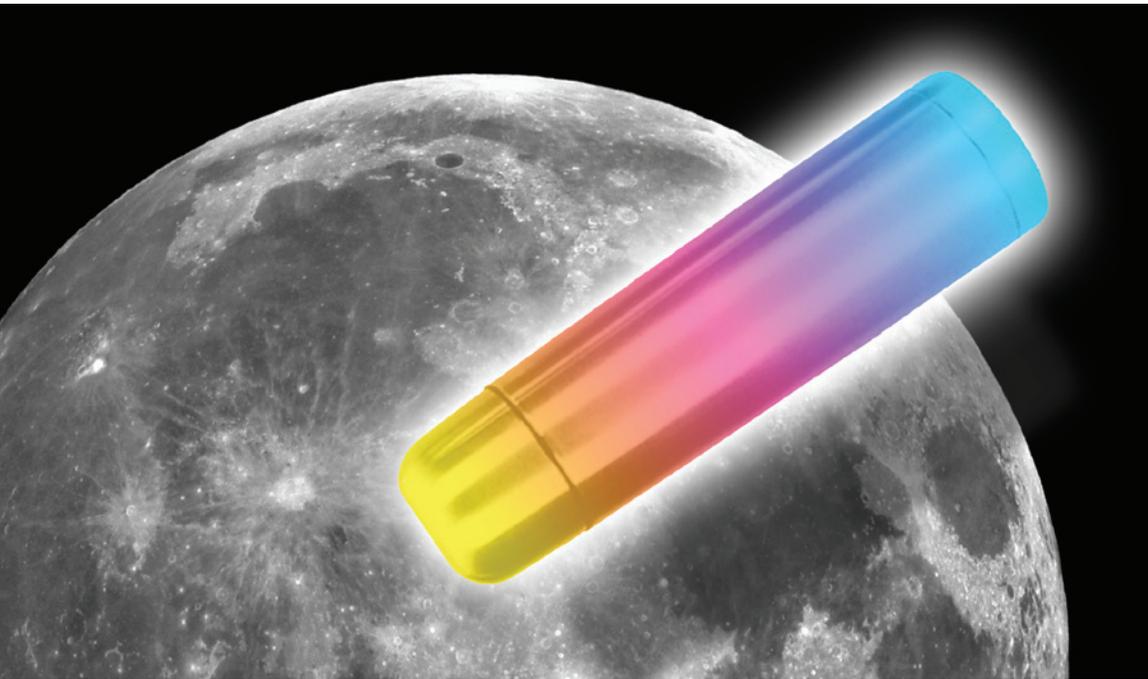


# Design a Lunar Thermos

## DESIGN challenge

To design an insulator for a cup of hot water and a cup of cold 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, graphing 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

Ask, Imagine and Plan

Experiment and Record

Quality Assurance Form

Fun with Engineering at Home

### 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. You will need to designate a place where students will get their hot and cold water for this experiment, or prepare the water for them ahead of time. Refresh as needed.

Please note: This activity may require two 60-90 minute sessions to complete.

## 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
- Place a glow stick in a clear cup of hot water and a clear cup of cold water, then turn off the lights. Ask the students to explain the difference between the two sticks and how that might relate to the movement of molecules (which ones move slow, which ones move fast).

## CREATE

- Challenge the students to devise an insulation system to keep water at a constant temperature.

## EXPERIMENT

- Have students follow the directions on the Experiment and Record worksheet to complete their experiment.
- If there are four team members, save time by having two students do the test with the hot water (experiment and control) while the other two students do the test with the cold water (experiment and control).
- Students should graph the temperature results as a line graph and analyze. Feel free to share the *BEST* graphing video with your students as a refresher on how to build a graph:

[svs.gsfc.nasa.gov/goto?10515](http://svs.gsfc.nasa.gov/goto?10515)

## IMPROVE

- Have students design other combinations of materials to reduce any temperature fluctuation found in their first design.

## CHALLENGE CLOSURE

Engage the students in a discussion with the following questions:

- *Does it matter whether the application of keeping my soup warm until lunch is as effective as keeping my body at roughly “body temperature” when on the Moon?*
- *Do you think the temperatures in the cup will reach the same temperature as the air in room? If so, predict how long this would take.*

## PREVIEWING NEXT SESSION

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? Why would you need to capture heat energy if we wanted to live on the Moon?

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Design  
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**Teacher page**