

FUTURE U.

Ice Racing

Materials Store:

- 3" x 3" squares of the following:
 - Different colored paper (including black)
 - Cardboard
 - Posterboard
 - Aluminum foil
- Tape, to be dispensed in 1-inch pieces
- Paintbrushes
- Paint (several colors including black)
- Scissors
- Glue sticks
- Toothpicks
- Ice cubes in a cooler

Overview

Student teams will harness the power of the sun as they experiment with how to efficiently transfer heat from solar energy and melt ice cubes more quickly than their classmates.

Educator Prep

- Review the Introduction Video.
- Review the other pages included in this activity packet.
- Complete the classroom set-up below prior to the session.

Classroom Set-Up

1. Prepare at least three dozen ice cubes of the same size.
2. Create a ramp (or multiple ramps) outside for the ice racing. The ramp(s) should be:
 - in direct sunlight, if possible
 - be least one foot long
 - about 4–5 inches high*
 - at least three feet wide in total to allow room for each ice cube and the material underneath it

***Note:** To determine the exact height of the ramp, try to test how quickly it takes an ice cube to melt and slide down. Aim for between two and five minutes!
3. Set up and review the Materials Store. Ensure there is enough of each item for each team.
4. Set up the Teams Tables with each of the following:
 - Team Roles + Salaries sheet
 - Role Handouts
 - Engineering Planning Guide
5. Divide students into teams of five people. Each person will have a specific role. If you need to have teams of six, the team can have a second Engineer.

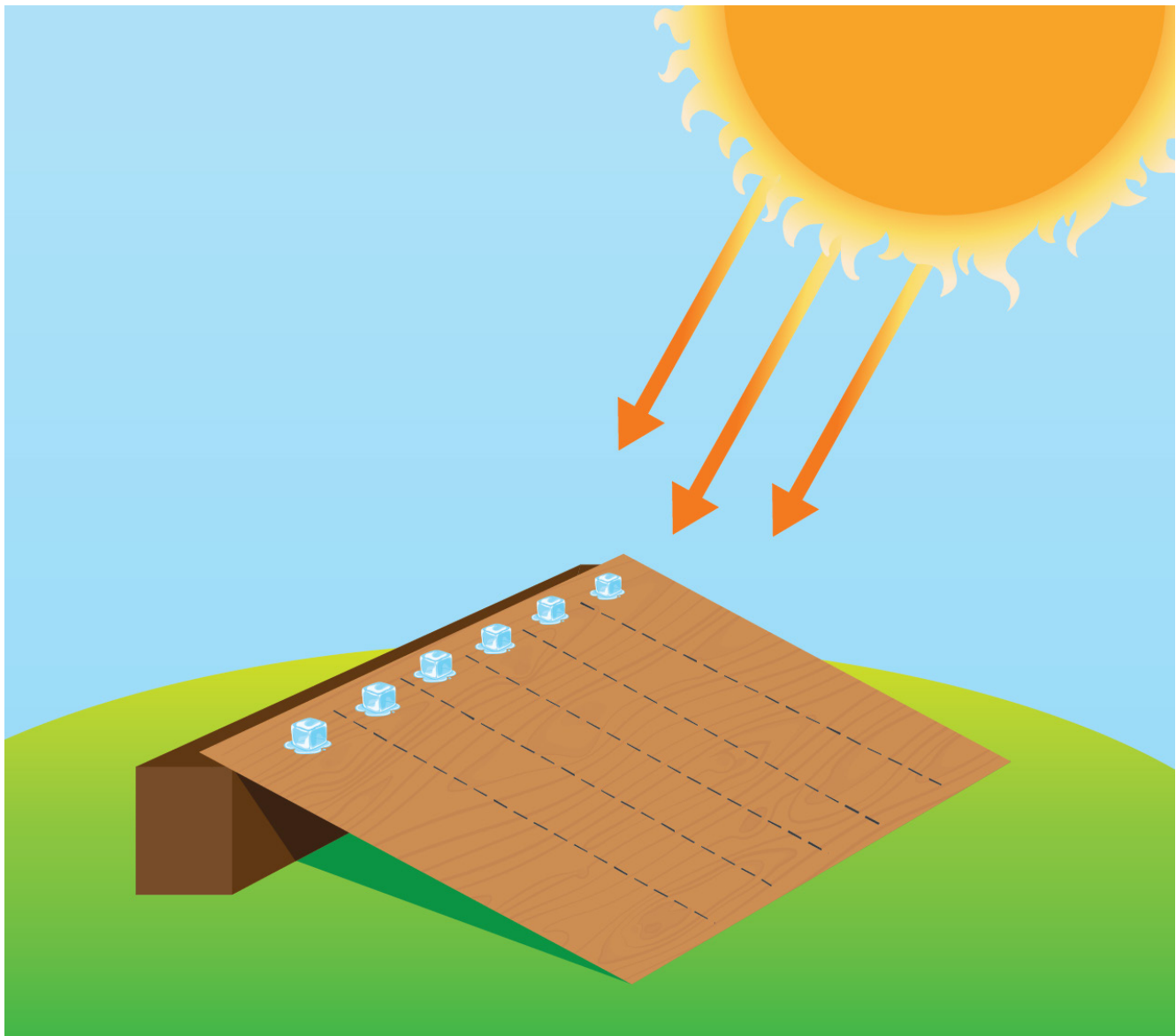
Example Team Roster

Finance Manager	
Materials Manager	
Engineer	
Engineer #2	
Mechanic	
Driver	

Student Introduction

In this activity, you will work in teams as you harness the power of the sun to melt an ice cube. After selecting a material (or multiple materials) on or in which to put your ice cube, you will place the material(s) and the ice cube at the top of a ramp in the sunlight. The first ice cube to melt and slide down the ramp wins!

Each team member will have a role to play as you experiment with different materials and surfaces to determine which one transfers heat from the sun the most efficiently. Once you have had 15 minutes to plan with your team and perform your roles, the ice race will begin!



Team Roles + Salaries



Finance Manager: \$2,500

Responsible for the budget



Materials Manager: \$2,000

Responsible for the purchasing and inventory of the supplies



Engineer: \$3,000

Leads the group through completing the Engineering Design Planning Guide



Mechanic: \$2,000

Builds the racing structure



Driver: \$3,000

Tests the ice cube and reports issues/suggested modifications



Materials Manager: Cost Sheet

Items	Cost
Test Ice Cube	\$7,000/each
3" x 3" square of colored paper	\$5,000
3" x 3" square of cardboard	\$4,000
3" x 3" square of posterboard	\$4,000
3" x 3" square of aluminum foil	\$5,000
Toothpicks	\$500/each
Tape, one inch	\$3,500
Paintbrush + one paint color	\$4,500
Additional paint colors	\$3,000/each
Scissors	FREE
Glue stick	\$5,000
First ramp trial run	FREE
Additional ramp trial runs	\$5,000/each

Finance Manager: Budget Sheet

Items	Starting Budget: \$55,000
Finance Manager Salary	\$2,500
Materials Manager Salary	\$2,000
Engineer #1 Salary	\$3,000
Engineer #2 Salary	
Mechanic Salary	\$2,000
Driver Salary	\$3,000
3" x 3" square of aluminum foil	
Toothpicks	
Tape, one inch	
Paintbrush + one paint color	
Additional paint colors	
Scissors	FREE
Glue stick	
First trial run on the ramp	FREE
Additional ramp trial runs	
Ending Balance:	\$ _____



Engineer Instruction Sheet

In this activity, your ice cube will melt as a result of the warm air around it *and* the heat it receives from the direct rays of the sun. Today, you and your team will focus on capturing and enhancing this solar energy as you race against the other teams to get your ice cube to melt the fastest.

Your role is to lead your team through completing the Engineering Design Planning Guide. You will work with your team members to select a material (or multiple materials) and/or design a structure for your ice cube to rest on at the very top of the ramp's incline. The goal of your selected material(s) and/or structure is for it to help your ice cube melt faster than the others. The first ice cube to slide down the ramp will win.

You may use any of the materials available to you as long as they are within your budget.



Mechanic Instructions Sheet

Work with your teammates to build and carry out a design that will enable your ice cube to melt faster than any others.

It is your job to help construct what the ice cube will sit on or in, analyze its performance during the test run(s), and repair, enhance, and tweak the design as needed until it is ready to race.



Driver Instructions Sheet

Work with your teammates to build and carry out a design that you believe will enable your ice cube to melt faster than any others.

It is your job to help test your design(s), provide feedback on the trial run(s), and place the final design on the race ramp before the race begins.

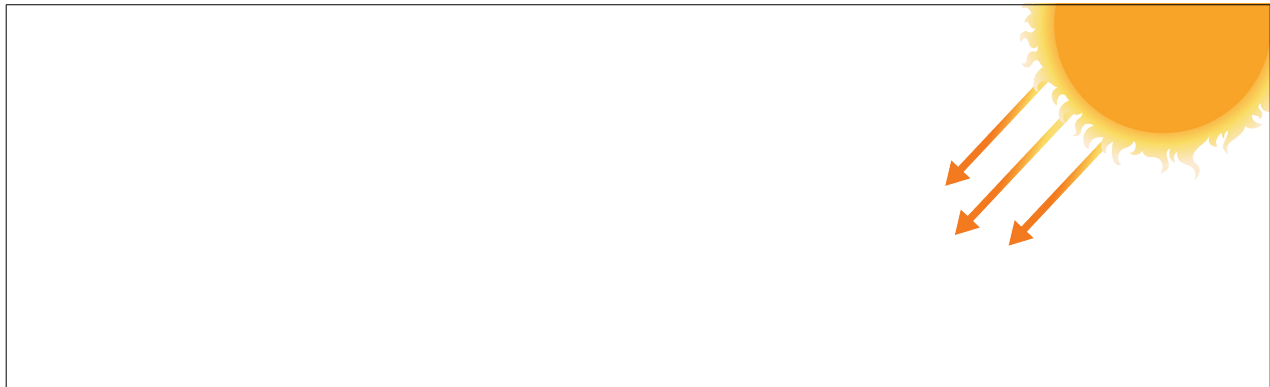
As the driver, be sure to remind your teammates of your starting position: Your ice cube and the material(s) that it will sit on or in will *not* be resting on a flat surface: They will be placed at the very top of the ramp on an incline.

Directions: Follow the steps below to prepare for the ice-racing challenge, and jot notes as you discuss your answers together.

▶ **Ask:** What is the problem we are trying to solve?



▶ **Imagine:** How could we solve this problem? Brainstorm solutions.



▶ **Plan:** Select one or two solutions you think will work best and explain how it will solve the problem.

▶ **Create:** Design and build your prototype.

▶ **Test:** What worked? What didn't work?

▶ **Improve:** How could you make your design better? Make these changes.

▶ **Share:** Be ready to discuss what you have learned!

