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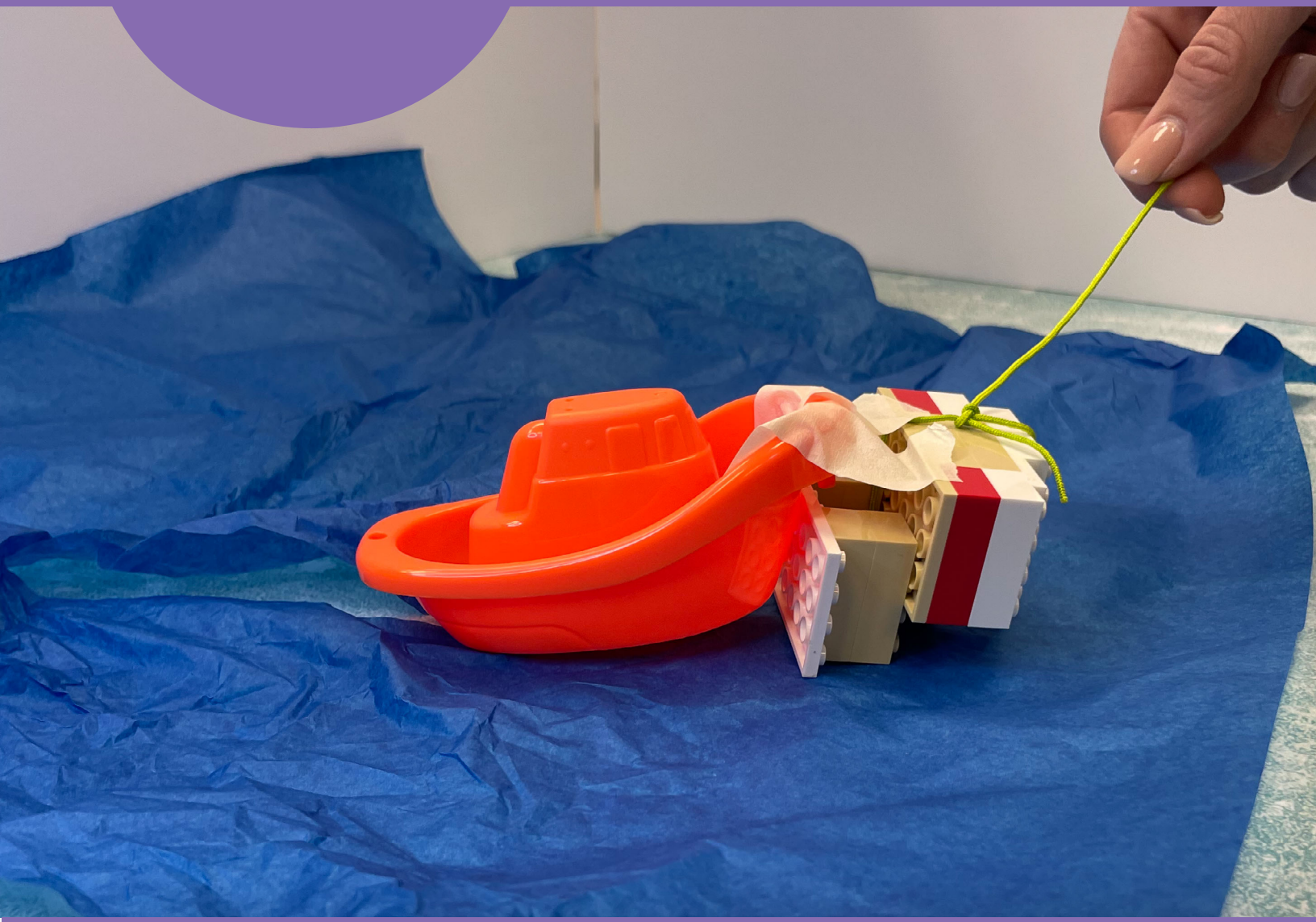
SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

#SeaworthySTEM

Break the Ice

Grades 3-5

Teacher Guide



Seaworthy STEM™ in a Box Series

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Break the Ice

Teacher Guide for 3-5

Seaworthy STEM™ in a Box Educator Kit description:

Seaworthy STEM™ in a Box activities are a Navy initiative to provide enhanced Naval-relevant, standards aligned, hands-on activities to K-12 teachers and students. Components of this program include, curated sets of classroom activities that aim to build deep conceptual understanding in Naval-relevant content areas. The kits also includes comprehensive lesson plans, material lists, scientific background information, STEM related literacy books, and student activity sheets. The Seaworthy STEM™ in a Box program is designed to support teachers as they select content, acquire materials, and implement more hands-on STEM activities in their classrooms. Increasing student access to hands-on STEM activities, also increases awareness of STEM career paths, engage students in STEM, and support development of student's abilities in STEM content.

The Seaworthy STEM™ in a Box kits were designed to guide students through the scientific inquiry-based theory and the engineering design process. The content and Naval-relevant activities are aligned with the Next Generation Science Standards. The topics and content covered within the lessons are connected and scaffolded based on distinct grade bands (K-2nd, 3rd-5th, 6th-8th, and 9th-12th).

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Table of Contents

Lesson Title: Break the Ice

Time:
1 Class period (45-60 minutes)

Student Objectives:

Students will gain knowledge about ship design and about specialty boats such as Icebreaker ships. Students will plan and design their own Icebreaker ship. Students will work in teams and experiment their ship design by "breaking" the ice platform. Students will collaboratively design their ship so that it is able to break the "ice" while adding the least amount of mass to their ship.

Lesson Overview:

Students will learn about Icebreaker ships and how they are used to break the ice for voyages in freezing waters. Students will learn that the main purpose of icebreaker ships is to clear a pathway through the ice to help prevent other ships from getting stuck. Students will work in teams and use the engineering design process to create their own icebreaker ship. Students will be given the task to "break" the ice on their voyage. Students will have completed the task if the "ice" platform has broken due to the ship breaking the ice formation.

Next Gen Science Standards:

3-PS2-1
3-PS2-2
4-PS3-1
4-PS3-3

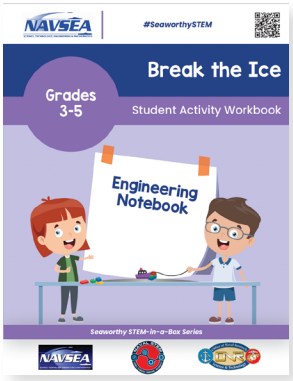
Notes

Materials and Equipment List (Per Team):

- [x] 1 Toy Boat
- [x] Lego tape or regular tape
- [x] Legos or other forms of blocks
- [x] 1 sheet of blue or white tissue paper
- [x] Scissors
- [x] String
- [x] Digital Scale
- [x] Ruler

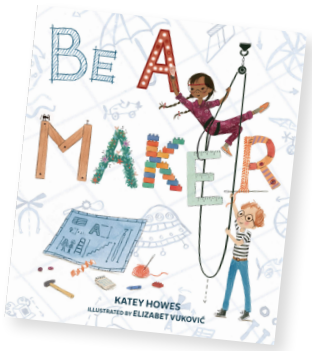
Student Activity Sheets/Handouts:

Break the Ice Student Activity Workbook



Suggested STEM Related Literacy Book:

Be a Maker by Katey Howes



Pre-Procedure:

1. Each team should set up two desks that are 2 ft. apart. Take the sheet of tissue paper and tape one end to the end of the desk. Then tape the other side to the end of the second desk. The tissue paper will act as the ice that is formed on top of the ocean.

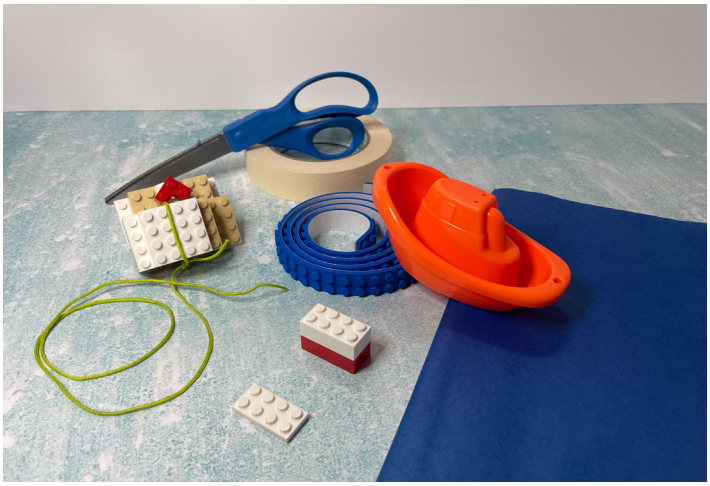
2. Each team will measure and cut 12 inches of string. Then tie the string to the front of the boat. The string will be used to pull the ship across the tissue paper.

Helpful tip:
Before taping down the tissue paper. Make sure to crinkle up the tissue paper to act as water/ice in the ocean.

Procedure:

1. The teacher will give students a brief introduction to the lesson about Icebreaker ships. The teacher will describe the importance of the hull being heavy enough to break the ice (tissue paper).

2. The teacher will split students into teams then give the listed materials to each team.

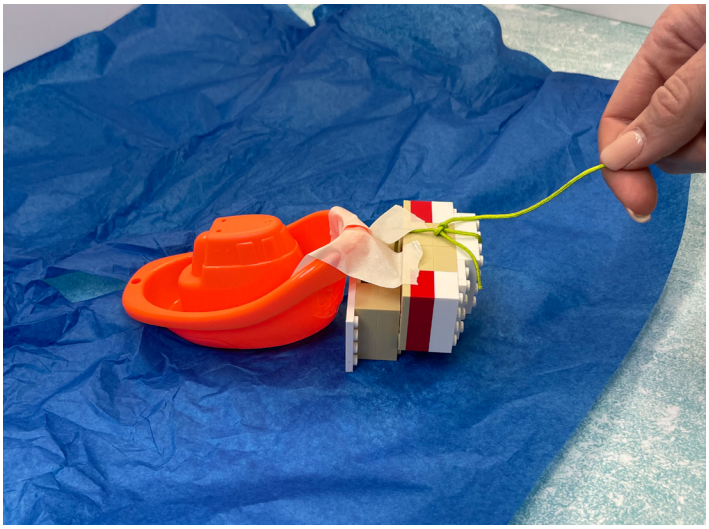


3. The teacher will model the activity and discuss the task and goal for each team. The teacher will demonstrate how to apply the Legos on to the hull of the toy boat.

    A. **The Task:** Each team will create an icebreaker using the blocks to create a heavy hull.
    B. **The Goal:** The hull will be heavy enough to rip the tissue paper.

4 Give students the following guided student directions on page 9 and allow students time to build and test their designed icebreakers.

5 Once design is complete, have students apply their icebreaker ship by using the string to pull the ship across the tissue paper. The goal is for the boat to tear the tissue paper by the weight of the hull, (Legos).



6 If a team does not complete the goal then the team will need to redesign and apply an improved hull.

7 When completed, teams will clean up their station.

Fun Fact!

Did you know that the Navy doesn't operate the icebreakers fleet but the U.S. Coast Guard does! The Coast Guard currently has only two operational icebreakers in its fleet actively working with the Arctic Ocean.

Student Directions:

1. As a team, draw and plan the design for the Icebreaker ship.
2. Place the tape on the front of the ship.
3. Place Legos on the front of the ship. Your design and Icebreaker model should align.
4. Place the boat at the start of the tissue paper.
5. One team member will drag the boat across the tissue paper using the string to pull across.
6. Students should observe if the icebreaker ship is "breaking the ice" by tearing the tissue paper as it crosses over.
7. If the boat does not break the ice. The team will have to redesign the boat and try again.
8. Once the students' boat has broken the ice they should put their Legos on a digital scale to find the mass of their build. They should then record the mass in their student activity workbook.

Fun Fact!

For a ship to be considered an icebreaker, it requires three traits that other ships do not have. To be an icebreaker the ship must have a strengthened hull, an ice-clearing shape, and the ability to push through the sea ice.

Vocabulary Terms:

- Antarctica or Polar Region: A continent around the South Pole, situated mainly within the Antarctic Circle and almost entirely covered by ice sheets.
- Arctic Ocean: A sea that surrounds the North Pole and lies within the Arctic Circle. Much of the sea is covered with pack ice throughout the year.
- Hull: A hull is the watertight body of a ship or boat.
- Propeller: A mechanical device for propelling a boat or aircraft, consisting of a revolving shaft with two or more broad, angled blades attached to it.

Scientific Background:

Icebreakers are designed to break through the thickest ice in the Atlantic Ocean, mostly in the Polar Regions. Icebreaker ships are designed to break through the ice by the strength of the hull. The bow on the hull of the ship is usually round so that it can ride over the ice and make it break due to the weight of the vessel. The rounded bow hull helps the icebreaker ship to go over the thick layers of ice as the friction is much less than trying to cut through the ice. The heavy weight of the hull is crucial to break the ice. The weight of the ship crushes the ice as it glides over it. The smooth design of the hull ensures that the ice gets pushed out of the way. This will allow other ships to be able to pass through the same route as the Icebreaker leads the way.

STEM Related Career:

- Ship Design
- Marine Transportation Specialist
- Navy Seaman

Reference Photos:

Notes

The Seaworthy STEM™ in a Box curricula was developed through collaborative efforts of a team of individuals at the Naval Surface Warfare Center Carderock Division and Albert Einstein Distinguished Educator Fellows via an inter-agency agreement with the U.S. Department of Energy for the Albert Einstein Distinguished Educator Fellowship (AEF) Program. We are grateful to the following Content Specialists who contributed their knowledge and expertise by researching and writing on selected topics: Suzanne Otto, Stephanie Klixbull, and Thomas Jenkins. We'd also like to acknowledge the contributions of AEF participant Ms. Deborah Reynolds, the inaugural AEF Educator at Carderock that helped inspire the design of Seaworthy STEM™ in a Box content. With the help of Albert Einstein Fellow, Melissa Thompson, and Carderock Outreach Specialist, Ashlee Floyd, special additions to the curriculum such as career portfolios, workforce trading cards, and in-house short story publications are included that reflect the diversity of NAVSEA Sites.

It is the goal of the SeaWorthy Curriculum to embrace NAVSEA technologies from sites nationwide to empower the youth of our nation to purse STEM-centric career pathways. The views and opinions of the Content Specialists expressed herein do not necessarily state or reflect those of the AEF Program, the U.S. Department of Energy, or the U.S. Government. Reference herein to any specific commercial product, process, or service by trade name, trademark, service mark, manufacturer, or otherwise does not constitute or imply endorsement, recommendation, or favoring by the AEF Program, the U.S. Department of Energy, or the U.S. Government.

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