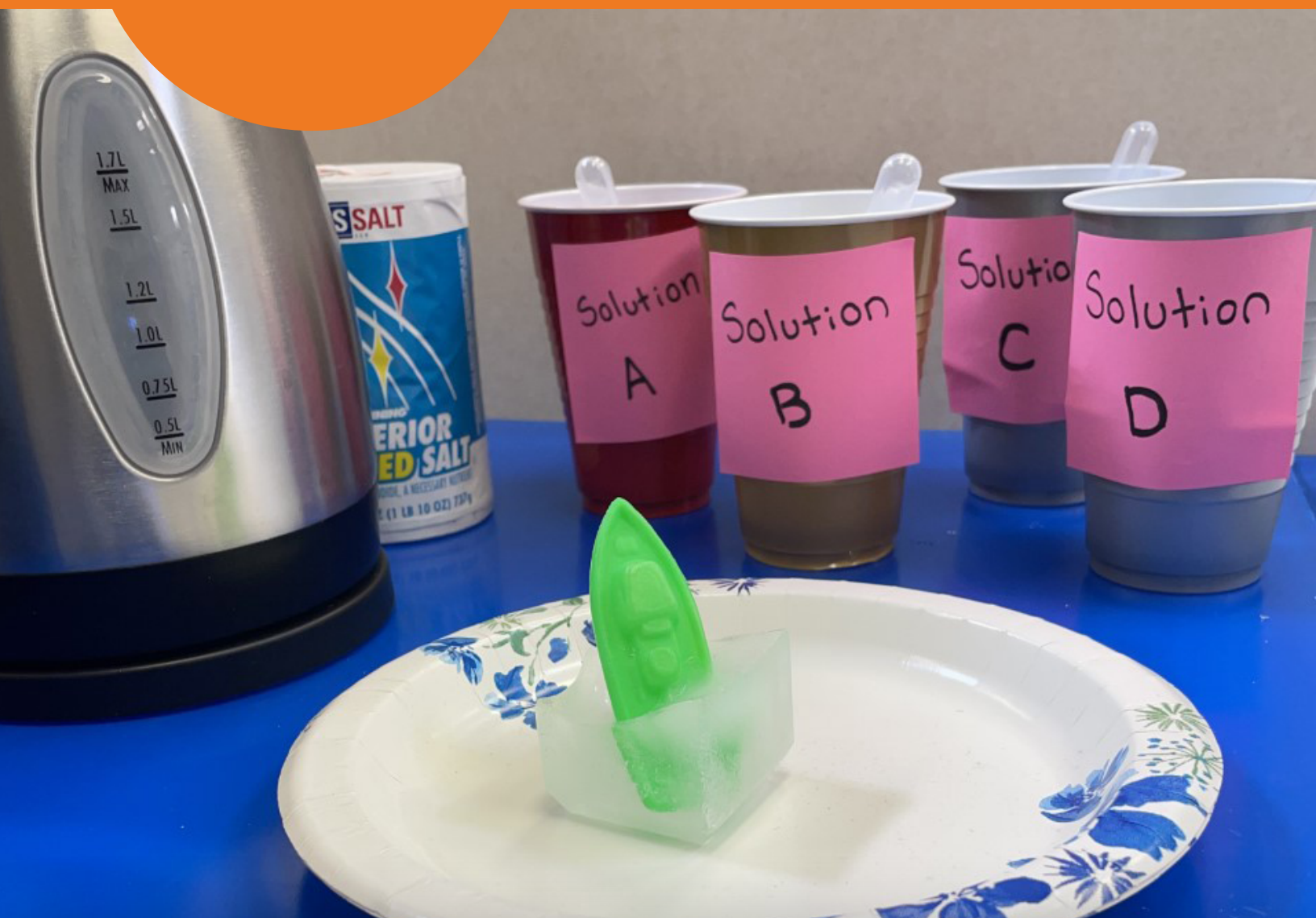




**Grades
K-2**

Save A Boat!

Teacher Guide



Seaworthy STEM™ in a Box Series

Save A Boat!

Teacher Guide for K-2



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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Lesson Title: Save A Boat!



Time:

45–60 minutes

Student Objectives:



Students will learn how a solid can change into liquid form by melting. Students will discover different melting points. Students will be challenged to use different solutions to observe which solution will melt the ice the fastest to save the boat. This activity touches on a real-life problem that engineers help solve in their role with the United States Navy.

Lesson Overview:

Students will be given a toy boat stuck in a block of ice. Students will have to save the toy boat out of the block of ice without using their hands. Students will be given a pipette and will use different water temperatures solutions to try and free the boat from the block of ice. Students will use their observations and experimentation to discover how the block of ice melts when using 4 different solutions. Students will discover what solution is best to use to recover the boat. Students will learn that salt lowers the freezing point of water. This activity was created to teach students about the melting point of ice and how salt can be a freezing point depressor for water. This activity was also created to show a visualization of matter changing from solid to liquid form.

Next Gen Science Standards (NGSS):

2-PS1-4.

2-PS1-2.

K-2-ETS1-1.

K-2-ETS1-2.

K-2-ETS1-3.



Notes

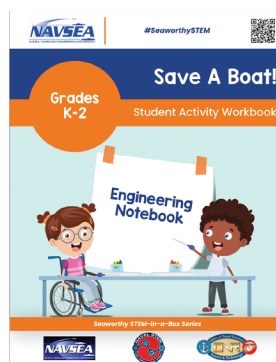


Materials and Equipment List:

- ✓ Heated water
- ✓ Room temperature water
- ✓ Ice cube tray
- ✓ Pipettes
- ✓ Cups
- ✓ Salt
- ✓ Mini toy boat
- ✓ Bowls
- ✓ Timing Device

Student Activity Sheets/Handouts:

Save A Boat Student Activity Workbook



Technology Tools:

Timing Device

Suggested STEM Related Literacy Book:

Fairy Science (Solid, Liquid, Gassy)
by Eli Balser



Pre-Activity Setup:

- 1 24 hours in advance:** Place a toy boat into each ice cube slot. Fill up each ice cube slot with water. Place the tray in the freezer and let the ice cubes set completely for activity. Place a plate on top of the boats to ensure that they all become frozen in a similar way.
- 2 Day of lesson:** Heat some water to 100 degrees F. The remaining water should be at room temperature, ~68 degrees F.
- 3** Each team will receive 4 cups for solution mixtures. Label each cup – Solution A, Solution B, Solution C and Solution D.
- 4** For solution A, pour the heated water into the cup.
- 5** For solution B, pour the room temperature water into the cup.
- 6** For solution C, pour the remaining heated water into the cup and add 2 tablespoons of salt. (Don't forget to stir!)
- 7** For solution D, pour the remaining room temperature water into the cup and add 2 tablespoons of salt. (Don't forget to stir!)
- 8** Place a pipette in each solution.

Procedure:

- 1** The teacher will go over the stages of change, (Solid-Liquid-Gas). The teacher can use the guided questions in the side panel to open a whole class discussion.
- 2** The teacher will go over the directions for the activity with students. The teacher will put students into teams and give each group the following materials:

Fun Fact!

When a ship is stuck at sea, the navy will use icebreakers to help clear the path. Icebreakers clear paths by pushing straight into frozen-over water or pack ice.

The teacher can ask these guided questions:

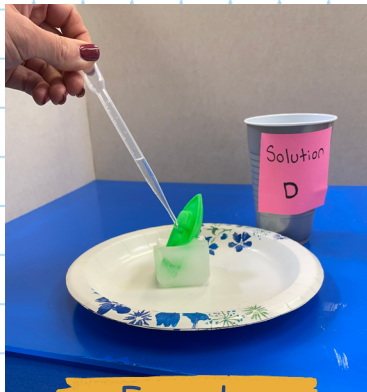
"What are three phases of water?"

"How can I change the water into a solid?"

"How can I change the ice cube into water?"

"How can I change the water into a gas?"





Examples



Check out these great examples of a student's observation!



Solution: B

Why: Solution B had salt in it. The solution was made of salt and warm water. Warm water will make ice melt faster than cold water.

- 4 solutions
- 4 pipettes
- 4 bowls
- 4 ice cubes w/ toy boat inside of the ice cube

3 The teacher will then give the following directions for:

1. Place 1 ice cube into a bowl.
2. Each student or team will be in charge of 1 ice cube and 1 solution.
3. The teacher will have each of their groups start a timer.
4. The student will use the pipette to place a few drops from the solution onto the ice cube.
5. The student will keep using the same solution till the designated time is over. If the group is able to free their boat prior to the teacher stopping the experiment, the group should stop their timer and record their time in their student workbook.
6. All four students or teams should be working independently and observing their own ice cube melting using the designated solution.
7. After the experiment time is over, have the 4 students or teams observe the 4 ice cubes and collaborate on which ice cube is most melted and which solution was the best to save the boat. Have students share their solutions and the amount of time it took to free their boat. If the ice didn't melt enough to free the boat, the class should show the boat in the ice cube to the class, so the students can compare the effectiveness of each solution.

8. Students will work together to complete the guided worksheet.

4 The teacher can guide students to clean up and can finish the lesson with the following guided conclusion questions below.

- “Did you save the boat?”
- “Which solution was best to speed up the process of melting?”
- “What do you think the solutions are made of?”
- “How did you work as a team?”

5 The teacher can use the suggested guided STEM literacy book as an extension or to conclude the lesson.

Fun Fact!

Brrrrr.... It's cold up here!
Did you know that the Navy has a research facility even in the Arctic! The International Cooperative Engagement Program for Polar Research (ICE-PPR) is a program located in the Arctic. The program is a collaborative partnership with other nations. It's purpose is to create strong cooperative relationships that preserve safe, stable and secure Polar regions for all countries involved.

Vocabulary Terms:

- Solid: An object with a fixed shape and volume
- Liquid: An object with a fixed volume, but without a fixed shape and can take the shape of its container
- Gas: An object without either a fixed shape or fixed volume which can take the shape of its container.
- Freezing Point: The temperature at which liquid water can turn into a solid
- Melting Point: The temperature at which frozen water turns from a solid into a liquid
- Evaporation Point: The temperature at which liquid water turns into a gas
- Dissolve: When a solid combines with a liquid to form a solution
- Solution: A mixture of two substances with the same distribution of particles throughout.

Misconceptions/ Science information:

Recently, there is more interest in the study of the Arctic within the Navy. However, the Navy must be careful in navigating in icy waters. Ship design engineers have created specialty boats that are well equipped to navigate within icy waters. These boats are called icebreakers and the design of the boat allows movability in ice-covered waters and also provides safe waterways for other boats. When water reaches its freezing point at 32 degrees Fahrenheit, the particles in water will settle into a stable arrangement forming ice. When particles are heated above 32 degrees Fahrenheit the ice will reach melting point and start to melt. The loosely bound particles will transition from a solid to a liquid. When students add the salt solution to the ice cube, the salt will first dissolve the surface of the ice cube and lower the freezing point of the ice cube. The ice cube in contact with salt water will melt, creating more liquid, which will dissolve the salt more and that will continue the melting process.

STEM Related Career:

- Biologist
- Marine Engineer
- Research Scientist

Reference Photo:

Check out this
Icebreaker ship!





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 pursue 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.



#SeaworthySTEM

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