



Anchors Aweigh!

Teacher Guide

Grades K-2



Seaworthy STEM[™] in a Box Series







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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 Navalrelevant, 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: Anchors Aweigh!



Time: 45 minutes

Student Objectives:



Students will learn how water vessels are able to remain stationary while on a body of water. Students will explore how anchors function and their importance to ships out on the ocean. Students will experiment with various shapes as well as the amount of weight to determine the effectiveness of different types of anchors.

Lesson Overview:

Students will work in teams to create an anchor for the given toy boat. Students will use iterative design as well as teamwork to create an anchor using a paperclip and different color beads. Students will have to experiment and collect data on the amount of beads needed to park the boat. The goal is for students to discover how many beads does it take to anchor the toy boat in water.



Next Gen Science Standards (NGSS):

K-2-ETS1-1 K-2-ETS1-2 K-2-ETS1-3





Materials and Equipment List (per group):

🚺 Water



🚺 Toy boat

🚺 Foil pan

- 💟 String (2-4 inches) per boat
- 🔟 Jumbo butterfly size paperclips
- V Putty
- **Different** color beads
- Marbles
- Yortable 3 speed fan

Student Activity Sheets/Handouts:

Anchor's Aweigh Student Activity Workbook



Suggested STEM Related Literacy Book:

The Girl with a Mind for Math by Julia Finley Mosca



Notes

Pre-Activity Setup:

- Place marbles in the foil pan. The marbles should cover the bottom of the foil pan. The marbles will act as the seabed. Place the fan by the end of the foil pan.
- 2 Fill the foil pan with water. The pan should be half full with water.

Procedure:

- The teacher will give a brief introduction of the importance of an anchor. Students will learn about the crucial role of the anchor's design and weight. The teacher can use the guided introduction questions in the side panel to open a whole class discussion.
- 2 The teacher will pair students into teams and hand-out materials.
- 3 Each group will receive 1 toy boat, 1 piece of string, 1 paperclip, variety of beads, and a piece of putty.
- ¹ The teacher will model the activity for students and give students the challenge goal for the activity. The teacher will model the following set up of the design:
 - Attached a piece of string to the toy boat, tie a knot to secure the string.
 - Attached a paperclip to the other end of the string, tie a knot to secure the paperclip.



The amount of water is crucial for the anchor to

touch the bottom of the pan.



"How does a boat "park" in the water?"

"Why would sailors and crew members need to stop in the water?"

"Do you think an anchor is heavy? (Why or why not?)"

 Experiment on the amount and size of beads needed on the paperclip. • Place a piece of putty at the end of the paperclip to prevent beads falling off the paperclip. Place boat in the water and turn on the fan. Observe if the boat stays parked in the water. If the boat is still moving, repeat steps 4 and 5. 5 During the activity, students will use the guided worksheet to complete their math data. 6 To conclude, the teacher can guide students in a whole group discussion. The teacher can use the following guided conclusion questions below. • "How many beads did it take to anchor your boat?" • "Did you have to use different size and color beads?" "What were some challenges you Check out these had with building your anchor?" great examples of a student's The teacher will guide students into clean-up procedures. The teacher can use the reading observation! resource as an extension to the activity. 8 Extension: Have the students manipulate the shape of the anchor to determine if they can park their boat using less weight (beads). If so, add a teacher conversation prompt about discussing failures/successes of specific designs (a round table share out) prior to the final drawing. 4 + 4 + 6 = (14

Vocabulary Terms:

- Anchor: A heavy object attached to a rope or chain and used to moor a vessel to the sea bottom
- Fluke: The part of an anchor that fastens in the ground
- Rode: Is what connects your anchor to the boat
- Force: A push or pull on an object
- Resistance: An opposing or slowing force

Misconceptions/ Science information:

An anchor is a device that is attached to a ship by cable or chain. The anchor is lowered to reach the bottom of the seabed and to hold the boat in a particular place without drifting in the ocean. When the anchor is dropped in the water, the heavy mental anchor will sink to the bottom of the seabed. The reason an anchor is shaped in a "U" with two flukes is to dig into the seabed and when the boat pulls the anchor chain, also known as the rode, it digs deeper into the surface which creates resistance. To retrieve the anchor, the boat will be positioned directly over the anchor and will retrieve the anchor by pulling out the rode. When the flukes are pointing upward, there will be less resistance. This will allow less force needed to pull the anchor out of the seabed. This activity was created to give students an introduction of anchors and the job of an anchor.

STEM Related Career:

- Ship Design Engineer
- Ship Captain
- Structural Engineer

Fun Fact!

Contrary to what many people assume, it is not the ANCHOR that stops a vessel moving, but in fact the cable connecting the two. Due to it's length and weight, it forms a natural 'catenary' (curve), which acts as a 'spring' to absorb shocks.

> Fun Fact! The word anchor is Greek in origin, meaning "crooked" or "hook."

Reference Photos:







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 STEMcentric 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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