



**Grades
K-2**

Sailor Knots

Teacher Guide



Seaworthy STEM™ in a Box Series

Sailor Knots

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: Sailor Knots



Time:

1 Class period (30–45 minutes)

Student Objectives:



Students will learn about different rope knots that are used on boats. Students will learn the importance of different type of rope knots for sailors and other naval careers at sea. Students will work together or independently to develop fine motor skills with hands-on learning.

Lesson Overview:

Students will receive a brief introduction on the importance of tying knots. Students will receive two different color shoe laces. Students will learn 3 different types of rope knots used on boats. (Please be advised, depending on age-level the rope knots are listed below from beginner to advanced.) Students can work in pairs and use the guided step-by-step visual aid in the student engineering notebook.

- Beginner – Half Hitch
- Beginner/Intermediate – Double Half Hitch
- Intermediate/Advanced – Square Knot



Next Gen Science Standards (NGSS):

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





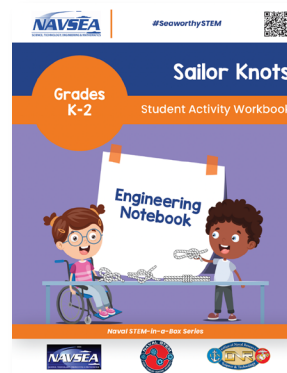
Materials and Equipment List (Per Team):

- ✓ Shoe laces, (2 colors)
- ✓ Clip board or cardboard
- ✓ Zip ties (optional)
- ✓ 2" C clamp
- ✓ 12 inch ruler

Helpful hint:
These are a great option
in the classroom!

Student Activity Sheets/Handouts:

Sailor Knots Student Activity Workbook

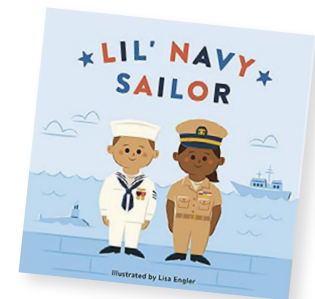


Helpful hint:

Look around your surroundings to come up with your own clever solution. In the provided student activity worksheet, we used a C-clamp on a work surface to create a quick and easy "handle" for our knot tying. Share your setup with #SeaworthySTEM"

Suggested STEM Related Literacy Book:

Lil' Navy Sailor by Anne Miranda

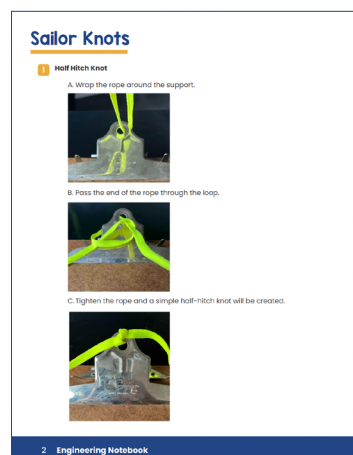


Pre-Activity Setup:

If needed, cut out two holes 4 inches apart in the middle of the cardboard. Using a zip tie, loop it around the two holes creating a handle. This is for students to be able to tie the knot onto something. The teacher can use door handles inside the classroom as well.

Procedure:

- 1 The teacher will go over the importance of knots used in everyday practical situations. The teacher will guide students in whole group discussion using the introduction questions on the side panel.
- 2 The teacher will have students work in pairs or individually, depending on grade level ability. The teacher will hand out the listed materials: 2 shoe laces that are different colors and some type of handle to tie the knots on.
- 3 Students will start with the first knot using the guided step-by-step directions and guided help from the teacher.
 - Have students use the ruler to experiment with different lengths of rope material.
 - Have students create knots and test the strength of knots made of different materials (i.e. fishing line)."
 - Guided directions from the Student Activity Workbook:



The teacher can guide students through the following questions:

"What is a knot?"

"Why do we use knots?"

"What causes a knot to stay in place?"

"Why would a sailor or other related careers need to know how to tie different knots on a boat?"

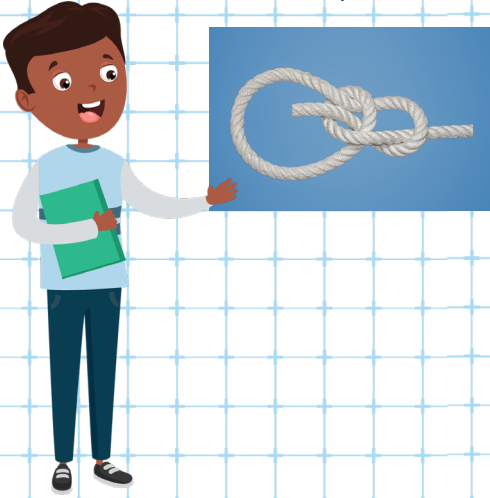
"What holds a knot in place?"
*This would be an appropriate time to discuss how friction helps knots stay in place.

"If you had a longer rope do you think you could tie a stronger knot? Why? Why not?"



Fun Fact!

The bowline is the king of sailing knots. It has been in use by sailors continuously for at least 500 years. Simply put, the bowline is way of turning the end of your line into a loop.



4 Students will check work with the teacher and will repeat step #3 with the next level knot.
(Please be advised due to fine motor skill ability/ age level, students may only be able to do 1 type or all the knots. Teacher will use discretion.)

5 When completed, the teacher will conclude the lesson by asking the following guided questions.

- "What knots were you able to complete?"
- "Did you get frustrated or have a difficult time?"
- "What helped you overcome those feelings?"
- "What knot was your favorite to try? (Least favorite?)"

Vocabulary Terms:

- Friction: a force that acts between two objects that are in contact with one another

Misconceptions/ Science information:

Different types of knots have been used to help maintain a boat and sail(s) when in use. The following knots are mainly used in sailing. Sailors should learn different types of knots to be able to lift, moored, and hitch the boat and/or sail. Sailors have used these common knots for many years and each knot has a particular use on the boat. Each knot maybe used for a different function. Any type of knot is held together by the friction at the center of the knot. The strongest knots tend to be the most complicated because the more turns within the knot will create more friction.

STEM Related Career:

- Sailor, Crew-member
- Deck Officer
- Ship Captain

Reference Photos:



Fun Fact!

The monkey's fist is a bit of a bonus knot and even though it sounds silly can be an important tool to use at sea! The monkey's fist is used as a weight at the end of the line so it can be thrown from bow to stern or vessel to dock.



Glanny Knot



Surgeon's Knot



Two Half Hitches



Figure Eight Knot



Stevedore Knot



Bowline



Overhand Knot



Double Overhand



Square Knot



Running Knot



Sheet snot

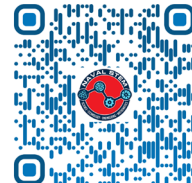


Square Knot



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.



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