

# Constructing a Warship - Simple Machines and Basic Science

Target Grade Level: 1st - 5th

Time for Lesson: 90 minutes

## Overview & Major Themes

USS *Constitution* was built as a fighting machine and utilized the six simple machines of science to accomplish the many tasks required of her. Students will identify and manipulate these machines to create inventions that would have made life aboard the Ship easier for sailors.

Objectives	Outcomes	Materials & Resources
<p>Students will be able to identify six simple machines: pulley, lever, wedge, inclined plane, screw, and wheel &amp; axle.</p> <p>Students will be able to explain how at least one of these tools was used to accomplish a task on USS <i>Constitution</i> during the War of 1812.</p> <p>Students will be able to think creatively about how simple machines can help solve problems.</p>	<p>Students will complete a scavenger hunt identifying simple machines around their school or town.</p> <p>Students will complete a prototype that utilizes one of more simple machines to accomplish a task sailors had on board <i>Constitution</i>.</p>	<ul style="list-style-type: none"> <li>• Picture of <i>Constitution</i></li> <li>• Photos of simple machines or if available, simple machine manipulatives available from educational resource sites</li> <li>• Copies of simple machine scavenger hunt, clipboards, &amp; pencils</li> <li>• Challenge Cards</li> <li>• Invention factory materials (pipe cleaners, cardboard, tape, machine parts, construction paper, etc)</li> </ul>

Time	Instructional Activity
5 min.	Introduce main theme: <i>Constitution</i> works because of simple machines that helped people do hard work. By looking through <i>A Sailor's Life for Me</i> , identify with students areas that hard work is being done, and places where machines are helping them.

Time	Instructional Activity
15 min.	<p>Simple Machines Overview</p> <ul style="list-style-type: none"> <li>• Break group into six teams seated at a table with at least one simple machine manipulative or picture. Ask teams to work together to: (a) try and accomplish the task assigned to the machine in front of them and (b) identify the machine from the list. (3 minutes) OR (a) hypothesize what type of tasks the machine in front of them might accomplish and (b) identify the machine from the list.</li> <li>• Ask a member of each team to report back to the group – what machine did your team have and what could you accomplish with it? (8 minutes)</li> <li>• Define simple machines: devices that make work easier for humans often by having us push or pull things over a distance.</li> </ul>
30 min.	<p>Scavenger Hunt</p> <ul style="list-style-type: none"> <li>• Prior to the lesson, walk through your school or an area nearby (neighborhood or town) and identify all six simple machines at work. Create a simple map with stars that direct their attention to the right location. Incorporate the questions below into your map to create a worksheet. Here are some common examples that might help get you started:</li> <li>• Pulley: flag pole, clothesline, curtain</li> <li>• Screw: furniture, door handle</li> <li>• Wheel &amp; Axle: cars, carts</li> <li>• Wedge: door stoppers</li> <li>• Inclined Plane: ramps, ladders</li> <li>• Lever: stapler, hole punch</li> <li>• Each team will be given twenty minutes to track down examples of the six simple machines on USS <i>Constitution</i> that can be found in their school or on a field trip through town.</li> <li>• Guidelines and rules: teams must stick together with a chaperone; elect a time keeper, a map reader, and a reader; answer as many questions as possible from the list below; spend no more than 5 minutes at each stop and at the end of 30 minutes meet back in the theater</li> <li>• If they have extra time, they can look for other examples beyond those found on the map.</li> </ul>
30 min.	<p>Invention Factory</p> <ul style="list-style-type: none"> <li>• As teams re-enter the classroom, assign them to an invention factory lab table</li> <li>• At each lab table, teams will find a challenge card asking them to solve the challenge and invent a prototype solution using at least one simple machine and the materials provided</li> <li>• Teams have 20 minutes to complete their invention prototype</li> <li>• Teach back: Each team has a few minutes to read their challenge card explain their invention to the rest of the group.</li> </ul>

## Scavenger Hunt Questions

Stop	Questions
1 – Lever	<ul style="list-style-type: none"> <li>• What does the lever do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
2 – Inclined Plane	<ul style="list-style-type: none"> <li>• What does the inclined plane do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
3 – Wedge	<ul style="list-style-type: none"> <li>• What does the wedge do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
4 – Pulley	<ul style="list-style-type: none"> <li>• What does the pulley do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
5 – Wheel & Axle	<ul style="list-style-type: none"> <li>• What does the wheel and axle do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
6 – Screw	<ul style="list-style-type: none"> <li>• What does the screw do in this example?</li> <li>• Is there another simple machine that could do this same job? If so, which?</li> <li>• Are there any other simple machines at work at this station?</li> </ul>
BONUS	<ul style="list-style-type: none"> <li>• Choose one of the simple machines and as a team, look for as many examples of that machine as you can find in the galleries. Mark each location that you find one on the map with a star. Then write a description of it in the space below. Remember – you must stay together as a team!</li> </ul>

## Challenge Cards

**Challenge:** The gunpowder needed to fire the guns (or cannons) during a battle was stored in a cool dark place at the bottom of the ship called the magazine. During battle, it was the job of boys to pass bags of gunpowder from the magazine to the guns located at the top of the Ship. This was dangerous work! Build an invention that utilizes one or more simple machines to move gunpowder from the magazine to the spar deck.

**Challenge:** *Constitution* was often out to sea for many months at a time without stopping on any land. That means they needed to carry all the food and water that the sailors would need in barrels at the bottom of the Ship in an area called the Orlop deck. Barrels filled with water or food were very heavy and hard for a man to lift alone. Build an invention that utilizes one or more simple machines to move barrels from the orlop deck to the stove on the gun deck.

**Challenge:** Every sailor was assigned his own hammock to sleep in. In the morning, he was responsible for rolling up his hammock and storing it in the hammock netting. He only had a short amount of time to roll up his hammock before the officer in charge of him would get angry. If he could roll it up faster, he could sleep a little bit longer and still be on time to make his officer happy. Build an invention that utilizes one or more simple machines that rolls hammocks.

**Challenge:** Most sailors went to the bathroom at the front of the Ship in an area called the head where they balanced over holes open to the ocean below them. Officers had a little more privacy and went in chamber pots. These pots had to be carried from the back of the Ship to the front by a sailor to be emptied into the ocean, a very messy job! Build an invention utilizing one or more simple machines that carries full chamber pots to from the wardroom to the head, dumps them out, and returns them to the wardroom.

**Challenge:** One of the least enjoyed jobs on *Constitution* was that of holystoning, or scrubbing the decks with a big flat stone. Some holystones required many men to pull them across the deck. Build an invention utilizing one or more simple machines that makes it easier to pull a heavy holystone across the deck.

**Challenge:** On the top deck of *Constitution*, sailors kept a small chicken coop. It was the job of one of the sailors to collect the eggs that the chickens hatched to use in cooking for the officers. This could be a very stinky job! Build an invention utilizing one or more simple machines that could collect eggs from the chickens from a distance.

**Challenge:** The ropes around the masts of *Constitution* are called rigging and were used by sailors like ladders to reach the sails. They had to climb sometimes hundreds of feet into the air without anything but their hands and feet to keep them safe. Build an invention utilizing one or more simple machines that could lift a person safely into the air to set or trim sails.

**Challenge:** There was only one cook on board *Constitution* and he had to feed 450-500 men every day! That didn't give him a lot of time to cook a meal. One of the things he had to do was turn large pieces of meat around on the fire so that they would cook evenly. Build an invention utilizing one or more simple machines that would help the cook turn the meat over the fire faster.

**Challenge:** Sailors weren't always very good about keeping their clothes very clean. They didn't have a lot of time to do laundry, but officers often wanted to keep the crew looking clean. Build an invention utilizing one or more simple machines that would help sailors wash their clothes faster than doing it by hand.

**Challenge:** Long pieces of wood (like tree trunks) were kept on the Ship so that they could repair broken masts or yards when necessary. Moving these large pieces was hard work and required a lot of manpower. Build an invention utilizing one or more simple machines that would help sailors move these pieces of wood around the spar deck and up into the air to fix a mast or yard.