

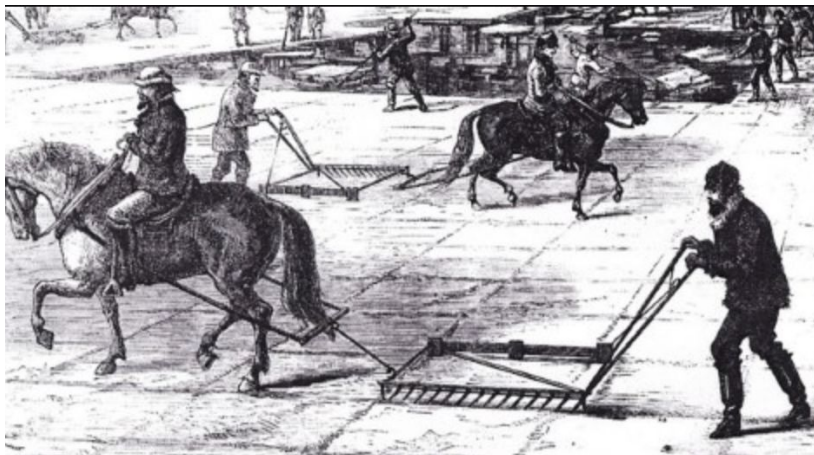


Name: \_\_\_\_\_

## Refrigeration on Ships Lesson

Refrigeration is the process of cooling a space or substance below environmental temperature. To accomplish this, the process at first removed heat through evaporation and then later in the 1850s with vapor compression that used air and ammonia as a coolant. Its inventor, Maryland farmer Thomas Moore, first introduced the term “refrigerator” in 1803, but the appliance we know today first appeared in the 20th century.

Before refrigeration became common, people used salt to preserve food. Containers like pork casks were half filled with water, salt, and saltpeter (potassium nitrate) to keep the meat fresh. Other forms of preservation included smoking and pickling, which was done on shore and the preserved provisions then taken aboard ship.



In 1805, moving ice long distances was impossible. A young Bostonian, Frederic Tudor, sought to solve this problem. Tudor’s first attempts to ship ice from New England to the U.S. South and the Caribbean failed, but he kept track of his ideas and observations. He also kept track of developments in related industries, and eventually built one of the first successful companies in what became a huge new industry. Watch the video linked below for more information and before your students start the experiment below.

Watch this video 'Keeping Ice Frozen Before Refrigeration' before beginning the experiment:  
<https://www.pbslearningmedia.org/resource/cb910689-2ace-4f48-9d5d-4e9f044d5586/title-keeping-ice-frozen-before-refrigeration-how-we-got-to-now-cold/#.WXDKhxMrKRs>

Experiment:

Discuss the insulation that Frederic Tudor used to ship and store ice. Then have students perform their own experiments to see which materials make the best insulators.

1. To begin, give each group of students ice cubes, a timer or clock, and a variety of materials to serve as insulation, such as newspaper, bubble wrap, Styrofoam, aluminum foil, paper towels, and cotton.
2. Next, have them choose four materials and form a hypothesis about which materials will insulate best.
3. Then ask them to wrap an ice cube in each material, leaving one unwrapped as the control.
4. Place all the ice cubes on a plate and observe them after 90 minutes.
5. Finally, have students compare the ice cubes and determine which melted slowest and fastest.