

Name: _____

Period: ____ Date: _____

Water Properties: Buoyancy

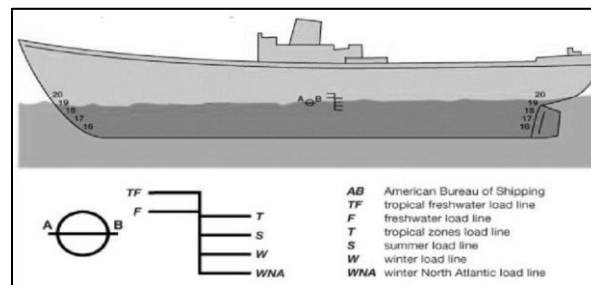
Read the following passage and answer the questions on the other side of this sheet.

Buoyancy is how well something will float. In order for something to float, its density has to be less than whatever liquid it is floating in. The less dense something is relative to the liquid its floating in, the more buoyant it is. Objects float on water because they have a lower density than the water itself, or their shape and surface area allow them to displace enough water to allow them to float. When you stretch out flat, more water pushes against you since your body is laid out flatter. When you curl up into a ball, less water is pushing against you. Additionally, some objects may look heavy but will float because they are filled with air (e.g. a hollow ball, large ships).ⁱ

Why do boats float? - Although a ship is very large and very heavy, the large surface area and hollow cavity allow it to float. When a boat is floating, it is because it displaces or “pushes” some water aside. The water surrounding the boat “pushes” back because of the air in the atmosphere pushing down on the water. If the water pushing upward on the boat is more than gravity pulling the boat down, the boat will float.

Ships float when the weight of the water that they push out of the way is the same as the weight of the ship. This explains why it is possible to make boats out of steel. As long as there are portions of the boat below the surface of the water that are hollow (i.e. contain air), the density of the boat is less than that of water, even though the real density of the material (i.e. the steel or concrete the boat is made out of) is greater. Also, submarines can both float and sink. They sink by filling their hollow center with water (increasing their mass, thus increasing their density) and float by forcing water out (decreasing their mass, thus decreasing their density).

The waterline is the line where the hull of a ship meets the surface of the water. Specifically, it is also the name of a special marking, also known as an international load line, **Plimsoll line**. This line indicates the legal limit to which a ship may be loaded for specific water types and temperatures in order to safely stay buoyant. Different water temperatures will affect a ship's line; warm water is less dense than cold water, providing less buoyancy. In the same way, fresh water is less dense than seawater and also provides less buoyancy.ⁱⁱ



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Questions

1. What needs to happen, with regards to density, in order for an object to float?
2. Explain why it is possible for large ships to float.
3. How are submarines able to both float and sink? Can you think of another example of this?
4. What is the Plimsoll line? How is this affected by the temperature and salinity of the water?

ⁱ "Water Story." Environment, Transportation and Planning Services Department, Region of Peel No date.
<https://www.peelregion.ca/pw/waterstory/pdf/activities/float.pdf>

ⁱⁱ "Waterline." *Wikipedia*, Wikimedia Foundation, 16 July 2018, en.wikipedia.org/wiki/Waterline.