

CHALLENGE 3

FLOAT A BOAT - A Marine Engineering Challenge

Have you ever wondered how a ship made of steel can float? If you drop a steel bolt in a bucket of water, the bolt quickly sinks to the bottom. Then how can a steel ship float? And better yet, how can a steel ship carry a heavy load without sinking? Marine engineers design and build boats that can carry up to 25000 tons of load. About the weight of 35000 elephants!

Objective :

In this challenge, build a boat using a piece of aluminum foil that can carry at least 20 pieces of 20 cents coins while keeping afloat. Successfully complete the challenge and your entry will be entered into a draw where at random you stand to win either RM25, RM50 or RM100 in credit.

Challenge Rules :

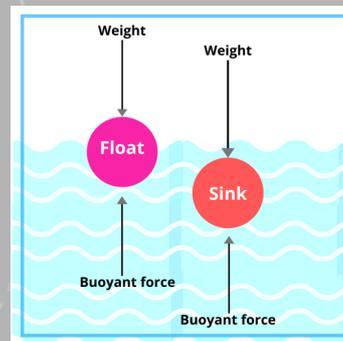
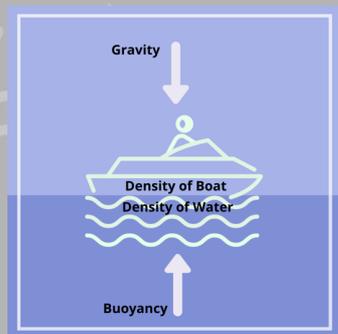
1. To form your boat, you may use a piece of aluminum foil that is no larger than 30cm x 30cm in dimension. You can use some tape to hold your boat together
2. Your boat should be able to hold at least 20 pieces of 20 cents coins while keeping afloat
3. To succeed in this challenge, make sure the base of your boat doesn't touch the base of your water filled container and no water should go into your boat for 10 seconds after loading at least 20 pieces of 20 cents coins onto your boat

Quick facts :

1. The earliest boats were constructed out of hollowed-out logs, grass and reed.
2. Ships developed primarily in the 21st century that exceeded 1000 feet in length are considered to be super ships

How Do Boats Float?

As a boat floats in the water it pushes aside water making space for the boat. This is called the displacement of water. The water then pushes back on the sides and bottom of the boat. The Archimedes principle states that if the weight of an object being placed in water is less than the weight of the water, the object will float. This is also called buoyancy.



Tips:

1. Explore ways in which a ship can be designed in order to have maximum buoyant effect. The size and shape of the boat affects its buoyancy, and how much weight your boat is able to carry.
2. You could make boats with pointed ends (like canoes) or you could make them square or rectangular (i.e. rectangular prisms).
3. Make sure your boat doesn't have holes in it to prevent water leaking into your boat. You can use some tape to conceal the holes if you find any

Questions Parents can ask their Child :

1. Children investigated the density of water, but what about the density of other liquids? Think of some other liquids (or semi-solids) that you would like to test the density of, such as cooking oil, liquid detergent etc. How do their densities compare to that of water?

2. You could repeat this challenge trying a wider range of shapes and sizes of boat. Do you get the same results if you use aluminium foil boats that have different shapes? You can also use other materials such as clay/playdough or milk carton
3. Why does a boat float and not sink? This is because the boat is experiencing positive buoyancy, where the boat is lighter than the amount of water it displaces.
4. How can you design a boat that can float? The boat needs to weigh less than the amount of water it displaces.

Learning outcomes :

Words to learn: density, buoyancy, weight and displacement.

1. What determines whether an object floats or sinks? It is the density (mass per unit volume) of the object compared to the density of the liquid.
2. What is buoyancy? There are 3 types of buoyancy.
 - Positive buoyancy occurs when an object is lighter than the fluid it displaces. The object will float because the buoyant force is greater than the object's weight
 - Neutral buoyancy occurs when an object's weight is equal to the fluid it displaces.
 - Negative buoyancy occurs when an object is denser than the fluid it displaces. The object will sink because its weight is greater than the buoyant force.
3. What is weight? Weight is how much the force of gravity acts on an object. The mass of an object will never change, but the weight of an item can change based on its location. For example, you may weigh 100 pounds on Earth, but in outer space you would be weightless.
4. What is displacement? Displacement is when an object pushes a fluid out of the way and takes its place. An example would be when you add ice into a drink the level of rises.

Items Needed:

1. A piece of aluminum foil (no bigger than 30cm x 30cm)
2. 20 pieces of 20 cent coins
3. Clear container – a plastic storage container big enough to fit your boat
4. Water
5. Paper
6. Pencil or other writing tools
7. Tape
8. Ruler

Steps:

1. Fill the clear container with water, almost to the top. It should be large enough to fit the boat you'll build.
2. Think about the design of your boat and create it with one sheet of the aluminium foil
3. Now put it to the test! Place your boat in the water and slowly add coins, one at a time
4. Did your boat sink? How many coins sank your boat? Make a note of how many coins it took.
5. Redesign the boat and make note of your changes. Try changing the shape or size of the boat. How many coins will sink it now?
6. Record your findings. Use the ruler to measure the thickness of the boat. Does that make a difference? Does boat length make a difference?