

DIVING SUBMARINE

A. OVERVIEW

Subject	Science
Age	6-10
Duration	45 minutes
Content	Products of reactions; changing density and the buoyant force
Goals	Students will understand : 1. During chemical reactions the atoms in the reactants rearrange to form products with different properties. 2. Density is mass per unit volume. 3. The buoyant force on an object is an upward force equal to the weight of the fluid the object has displaced.
Objectives	Students will construct the diving submarine and see it dive and surface. They will discuss floating and sinking, how density affects buoyancy and how the materials in the submarine react to create gas.
Materials	Diving Sub kit Baking powder
Introduction	Background reading — Density, the buoyant force, chemical reactions Class discussion — Density, why things float, reactions
Practical	Students test a model submarine that dives and surfaces.
Extensions	Investigations and discussion points

B. BACKGROUND READING

Set the background reading as a homework assignment the day before the planned lesson.

Review

Start the lesson by reviewing the background reading. Make sure that students understand:

- Density is mass per unit volume
- That water pushes upwards on objects in it
- That chemical reactions create new products

Reading material

Density is a measure of the mass of a substance that fits into a certain space (or volume). Density is normally measured in grams per cubic centimetre or kilograms per cubic metre. The density of pure water is 1 gram per cubic centimetre.

Water pushes upwards on any object immersed in it. This effect is called buoyancy, and the force is called the buoyant force or up thrust. The size of the buoyant force on an object is equal to the weight of water that the object displaces (pushes out of the way).

If the buoyant force on an object is greater than the object's weight, the object will rise to the surface and float. Otherwise the object will sink. An object with overall density less than water will float. An object with overall density greater than water will sink.

Some chemicals react with each other when they are mixed together. The chemicals are known as reactants. During the reaction, the atoms of the reactants are rearranged to form new chemicals, called products. The products can have different properties (both physical and chemical) to the reactants.

Acids and bases are types of chemical.

C. CLASS DISCUSSION

Density

- What is density?
- How do we measure density?

Buoyancy

- What is buoyancy?
- What is the size of the buoyant force?
- Why do some objects float and some sink?

Chemical reactions

- What is chemical reaction?
- What are reactants and products?
- Properties of chemicals

D. PRACTICAL

Each group requires 1 kit, 1 instruction sheet and some baking soda.

Go through the safety warnings advised in the instructions with the class before assembly.

Check the progress of the each group.

E. EXTENSIONS

- What causes bubbles to appear from the sub?
- Do you know what the gas in the bubbles is?
- Discuss that there is an acid and a base in the powder, which react when dissolved in water. One of the products is carbon dioxide.
- Why does the sub sink? And why does it then surface again?
- How could measure the density of the sub?
- Steel is more dense than water, but a steel-hulled ship floats. Why?
- The air also makes things slightly buoyant. Can you think of an application of this?

F. INSTRUCTIONS

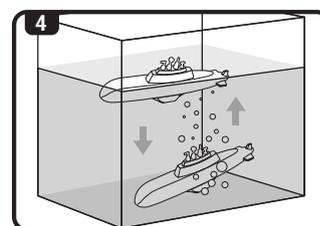
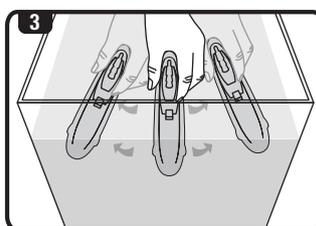
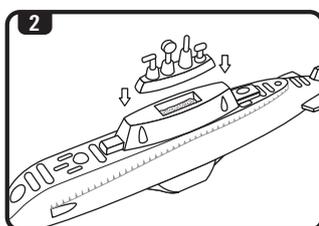
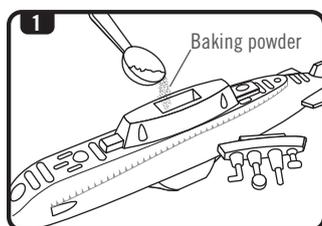
You may need to photocopy this section and hand out to each group of students if necessary.

THE AMAZING BAKING POWDER ENGINE

BAKING POWDER (NOT INCLUDED) IS REQUIRED TO PERFORM THESE DIVING TRICKS. DO NOT USE THIS PRODUCT IN A FISH TANK.

Follow the steps below to see your amazing submarine dive and surface.

1. Open the top cover of the submarine. Fill the chamber with baking powder. Gently tap the submarine on a hard surface to check that the chamber is half full.
2. Close the cover and remove excess baking powder from the outside of the submarine.
3. Immerse the submarine in water and shake it a few times under the water.
4. Let go of the submarine and watch it dive and resurface again and again. Refill the baking powder in the chamber for unlimited fun. If your Diving Sub will not dive, clear the chamber and half-fill it again with more baking powder. If your Diving Sub does not resurface but continues to move up and down at the bottom of the container, the chamber is probably too full of baking powder. Remove some of the powder and try again.



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