Float or Sink? The Science of Buoyancy

Whether an object **floats** or **sinks** depends on its **density compared to water.**

$$D = \frac{m}{V}$$

If $D_{object} < D_{water} \rightarrow$ it **floats**   **or**   If $D_{object} > D_{water} \rightarrow$ it **sinks**

Water's density: 1.0 g/mL = 1000 kg/m³

The **fraction of an object submerged** in water equals: $\frac{D_{object}}{D_{water}}$

1. A cube of pine wood has a mass of **120 g** and a volume of **200 cm³**. _____
Will it float or sink in water?

2. An aluminum block has a **mass of 540 g** and a **volume of 200 cm³**. _____
Does it float or sink?

3. An ice cube has a mass of **9.2 g** and a volume of **10 cm³**. _____
What is its density? Will it float in water?

4. A boat has a total volume of **400 m³** and a mass of **280,000 kg**. _____
Find its average density in kg/m³ and determine if it will float.

5. A rock has a density of **2.8 g/cm³**. _____
How many times denser is it than water?

6. An object has a **density of 0.8 g/cm³**. _____
What fraction of its volume will be underwater when it floats?

7. A student drops three objects into a tank of water:

Object A: 0.6 g/mL   **Object B:** 1.2 g/mL   **Object C:** 1.0 g/mL

Which float, sink, or remain suspended? _____

8. The density of seawater is **1.03 g/mL**. An object has a density of **1.00 g/mL**.
Will it float higher, lower, or the same as it would in freshwater? _____

9. A piece of wax has a mass of **24 g** and displaces **30 mL** of water. _____
What is its density, and does it float?

10. Challenge Question: A ship floats with **80% of its volume underwater**. _____
What is the ship's average density in g/mL?