Chapter 9: Forces influence the motion and properties of fluids

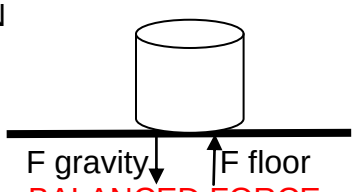
Force:

is anything that causes a change in the motion of an object.

Ex: making something MOVE

Making something STOP

Making something CHANGE DIRECTION



Balanced force

Forces that are

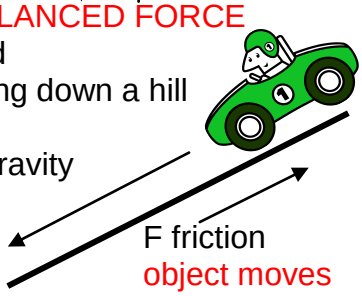
equal in STRENGTH

opposite in DIRECTION

BALANCED FORCE

Ex: See saw with equal size people on each end

or the force that prevents a wagon from rolling down a hill



Unbalanced forces

forces that :

are **not equal in STRENGTH**

are **not balanced**

This force causes a **change in the speed, or direction of an object.**

Example: those **forces that cause an object to MOVE**

Difference between mass and weight.

Mass units: grams (g)

the **amount of matter in an object.**

The **mass of an object remains** the **same** anywhere in the universe.

Weight **units: Neutons (N)**

the **measure of the pull or force of gravity acting on an object.**

- **Weight changes depending on the gravitational force.**
- You weigh less on the moon than on earth because there is less gravitational force on the moon, but you have not lost any mass.

The forces that a fluid exerts or puts on an object are important in determining whether an object will sink or float.

Buoyant force or buoyancy:

the upward force on objects submerged in or floating on fluids.

REMEMBER:

Gravity will push you **towards** the center of Earth.

Buoyant force will push **upwards** , away from the center of the earth.

Q: If you sink when placed in water which force is greater, gravity of buoyant forces?

What is the connection between weight, buoyancy and sinking or floating?

See Figure 9.5A and 9.5 B on page 337

If the duck weighs more than the volume of water displaced then the force of gravity is stronger and the duck will sink. Unbalanced forces

When the duck displaces a volume of water that has the same weight as the entire duck, the forces of gravity and buoyancy are the same and the duck will float. Balanced forces

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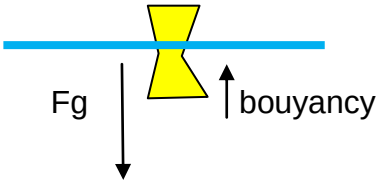
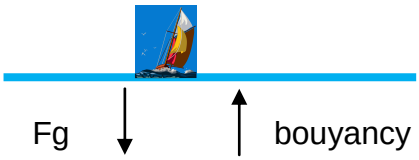
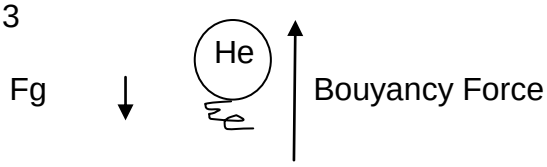
The buoyant force acting on an object	EQUALS	the weight of the fluid displaced by the object

neutral buoyancy.

When buoyancy and the force of gravity are the same (balanced)
It FLOATS.

Object rise or float

If an object weighs less than the displaced water

Ex 1 water 	RESULT: Rock SINKS Why? Fg > buoyancy force
Ex. 2 	RESULT: Boat FLOATS Why? Fg = buoyancy force
Ex. 3 	RESULT: Balloon RISES Why? Fg < buoyancy force

When swimming why you do sink when you roll yourself into a ball, but you float when you lie flat on your back?

- When in a ball you weigh more than the water you displaced.
- As you lie back a larger **volume** of water is **displaced**
- The weight of the displaced water is now greater than your weight and you float.

Examples of materials that may sink or float

1. wooden boat vs. water logged stick?
2. metal block vs. metal boat?
3. a sealed empty plastic bottle vs. a plastic bottle full of water?

Density of a fluid and buoyancy: How they are related:

- Salt water is denser than fresh water.
  Its particles are more closely packed together.

- So 1 liter of salt water weighs MORE than 1 liter of fresh water.
  density 1.03 g/mL density 1.00 g / mL
- If you displace 1 liter of salt water it has a greater buoyant force and can support more weight than fresh water. See figure 9.7 page 339.

An object will float is it is less dense than the fluid in which it is put (Styrofoam in water)

An object will sink if it is denser than the fluid in which it is put (metal marble in water)

Why does a person with a life jacket float but if he did not have it he would sink?

With the jacket he must have a density that is less than water but without it he is denser than water. In fact, average density of the person and the jacket is less than the density of water. So he floats.

Average Density = the total mass of all substances that make up the object / the total volume.

Using the concept of average density, why does a submarine float or sink, depending on the Captain command?

See figure 9.10 on page 341.

QUESTION:
Explain how a submarine:
A) Sinks.
B) Floats. ;-)

QUESTION : which floats on top:

Vegetable oil	density 0.9 g.mL
Water	density 1.00 g/mL

Hydrometer: page 343 See figure 9.12
A device which measures density of a liquid

HOW a Hydrometer works:

- The hydrometer has a certain mass
- It sinks in a liquid until it has displaced a mass EQUAL TO its own mass.
- A scale shows how far it has sunk in the fluid.
- The GREATER the fluids density, the LESS the hydrometer sinks.