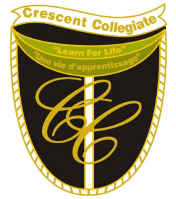
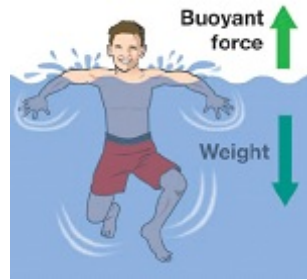


Science 8
Unit 2: FLUIDS
Topic 6: Buoyancy

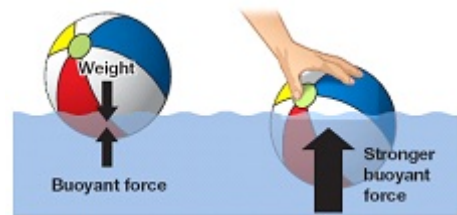


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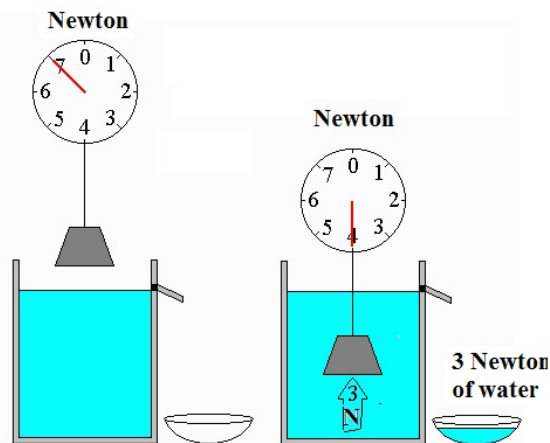
Buoyant force or Buoyancy refers to a force that acts upwards on an object, opposite of gravitational force, on a floating object



The strength of the buoyant force on an object in water depends on the volume of the object that is underwater. As you keep pushing downward on the ball, the buoyant force gets stronger and stronger because the volume of water displaced is greater.

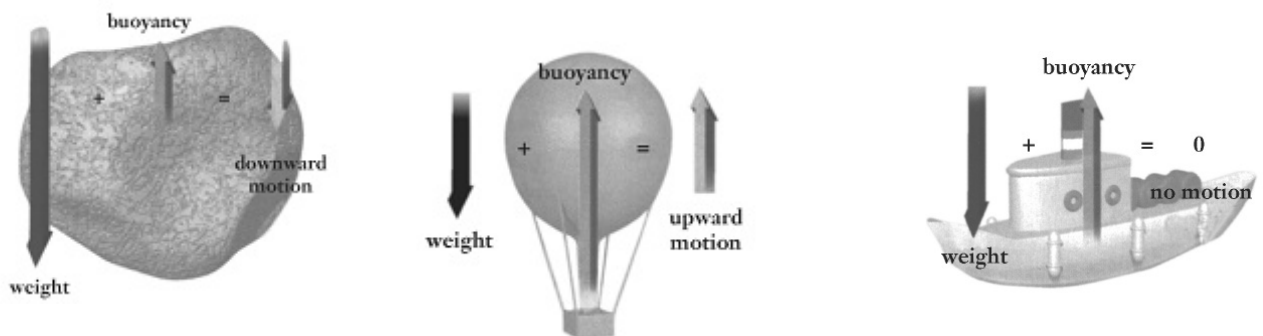


Archimedes' Principle: The buoyant force acting on an object equals the weight (force of gravity) of the fluid being displaced by the object.



If the force of gravity pulling down on an object is equal to the amount of buoyant force pushing up then the object is said to have neutral buoyancy; it will neither rise or sink.

The “push up” on the object (buoyant forces) needs to be greater than the “push down” pull of gravity on an object or it will not float.



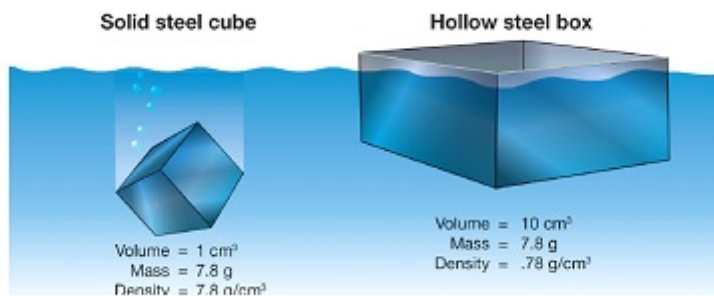
How does density of the fluid affect buoyancy?

Fluids with high density (particles are closer together) exert a greater buoyant force than fluids with low density (particles farther apart from each other).

Example: Salt water is more dense than fresh water, therefore, object in salt water will float better than in fresh water.

Why do objects sink or float?

Average density determines whether an object sinks or floats. Average density of an object is the total mass of all substances that make up the object divided by the total volume of the object.



An object with an average density GREATER than the density of water will sink.

An object with an average density LESS than the density of water will float.

PART A: MULTIPLE CHOICE

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

1. What is the buoyant force?
 - (A) The upward force that a fluid exerts on an object in the fluid.
 - (B) The downward force that a fluid exerts on an object in the fluid.
 - (C) The upward force that the object exerts on a fluid when it displaces the fluid.
 - (D) The downward force that the object exerts on a fluid when it displaces the fluid.
2. What is the unit of the buoyant force?
 - (A) Buoy
 - (B) Liter
 - (C) Kilogram
 - (D) Newton
3. Which of the following is true of the buoyant force?
 - (A) It acts in the downward direction.
 - (B) It acts with the force of gravity.
 - (C) It acts in the upward direction.
 - (D) It makes an object feel heavier.
4. The buoyant force on an object is dependent on
 - (A) The object's density.
 - (B) The submerged volume of the object.
 - (C) The mass of the object.
 - (D) The shape of the object.

5. Increasing the volume of an object can make it:
- (A) Fall faster
 - (B) Sink
 - (C) Float
 - (D) Balance out
6. Increasing the mass of an object will make it:
- (A) Fall faster
 - (B) Sink
 - (C) Float
 - (D) Balance out
7. What scientific rule states that the buoyant force on an object is equal to the weight of the fluid displaced by the object?
- (A) Archimedes' principle
 - (B) Pascal's principle
 - (C) Bernoulli's principle
 - (D) Newton's third law of motion
8. Buoyant force is an upward force that is equal to the weight of the fluid it _____.
- (A) Compresses
 - (B) Displaces
 - (C) Exfoliates
 - (D) Slows down
9. The buoyant force on an object equals
- (A) Weight in air - weight in liquid
 - (B) Mass of object - weight of water
 - (C) Mass (g) / volume (cm³)
 - (D) Force (N) / area (m²)
10. A piece of iron has a weight of 3.5 N when it is in air and 2.0 N when it is submerged into water. What is the buoyant force on the piece of iron?
- (A) 3.5 N
 - (B) 2.0 N
 - (C) 1.5 N
 - (D) 1.0 N



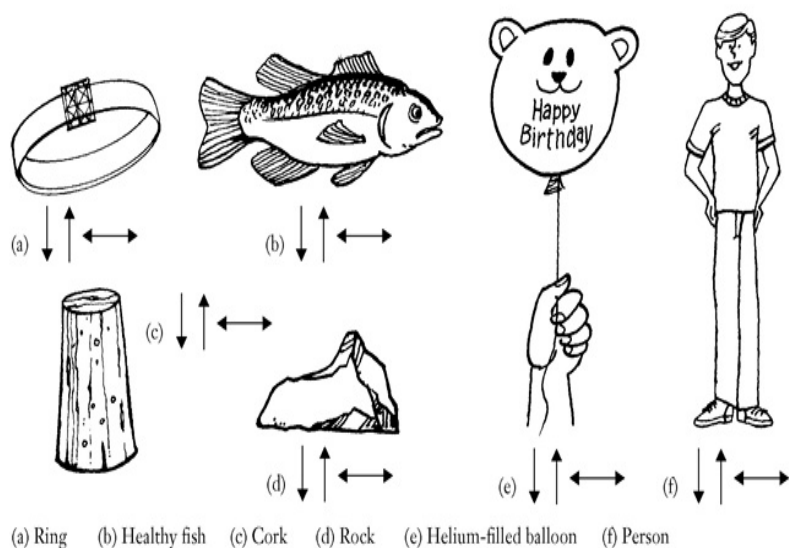
11. If the force of gravity on a diver is 700 N, what should the buoyant force be if the diver wants to rise to the surface of the sea?
- (A) 0 N
 - (B) Equal to 700 N
 - (C) Greater than 700 N
 - (D) Less than 700 N
12. A helium balloon will rise if you let go of it. Which of the following is true about the balloon?
- (A) There is no gravity acting on it.
 - (B) There is a buoyant force acting on it from the air.
 - (C) There is no buoyant force acting on it because it is not in a fluid.
 - (D) It is moving, so you cannot calculate what forces are acting on it until it stops moving.

13. Buoyant force contributes to which of the following?
- (A) Atmospheric pressure
 - (B) Pollen floating in the air
 - (C) The mass of a boat
 - (D) The pressure inside a balloon
14. Objects _____ if their weight is greater than their buoyant force.
- (A) Equalize
 - (B) Float
 - (C) Sink
 - (D) Suspend in the water
15. A ship stays afloat as long as the buoyant force is
- (A) Less than the ship's weight.
 - (B) Equal to the ship's weight.
 - (C) Less than the ship's speed.
 - (D) Greater than the ship's speed.
16. When will an object sink in a fluid?
- (A) When the force due to gravity is equal to the buoyant force on the object.
 - (B) When the force due to gravity exceeds the buoyant force on the object.
 - (C) When the force due to gravity is less than the buoyant force on the object.
 - (D) When the force due to gravity equals the downward pressure on the object.
17. The property that most determines whether or not an object will float in oil is the object's
- (A) Weight
 - (B) Mass
 - (C) Density
 - (D) Volume
18. Which of the following substances is less dense than air?
- (A) Water
 - (B) Helium
 - (C) Ice
 - (D) Gold
19. Why do objects float more easily in salt water than in fresh water?
- (A) The density of fresh water is greater than that of salt water.
 - (B) The density of salt water is 1.00 g/mL.
 - (C) The density of salt water is greater than that of fresh water.
 - (D) The particles of fresh water are packed together more tightly than those in salt water
20. Which of the following would NOT affect the level at which a canoe floats in a pond?
- (A) The depth of the pond
 - (B) The number of people in the canoe
 - (C) The shape of the canoe
 - (D) The density of the canoe's material
21. Oil has a smaller density than water. Therefore, an object that will float in oil will
- (A) Float in water, with more of the object submerged.
 - (B) Float in water, with the same amount of the object submerged.
 - (C) Float in water, with less of the object submerged.
 - (D) Not float in water.

22. When water fills a submarine's flotation tanks, the overall density of the submarine
- (A) Decreases.
 - (B) Stays the same.
 - (C) Increases.
 - (D) Reduces the buoyant force.
23. Which of the following explains why a ship made of steel (density = 9.0 g/cm^3) can float?
- (A) Steel has high average buoyancy.
 - (B) Steel has a high buoyant force when compared to water.
 - (C) Steel has a density less than water.
 - (D) The ship has an average density less than water.

PART B WRITTEN RESPONSE

1. When an object is placed in water, it may sink, rise, or remain in place. What will happen with each of the following objects? Circle the appropriate arrow.



2. Would it be correct to circle more than one arrow for (f)? Why?

3. A student places a piece of wood in a glass of water and finds that it floats. A few days later it has sunk to the bottom of the glass. Explain
