

CCT Weekly Practice (Science)

UNIT: - Archimedes Principle

According to principle of floatation, an object will float in a fluid, if its density is less than that of the fluid.

When an object is partially or fully dipped into a fluid, the fluid exerts force on it. At any small portion of the surface of the object, the force by the fluid is perpendicular to the surface and is equal to the product of the pressure at the surface and surface area. The resultant of all these contact forces is called **buoyant force (upthrust)**.

Archimedes Principle states that "**Any object partially or completely submerged in a fluid is buoyed up by a force equal to the weight of the fluid displaced by the object.**"

The buoyant force depends on the submerged volume of the object, be it partly or wholly immersed. The volume of the object immersed is same as the volume of the liquid displaced.

Therefore, Buoyant force = $V\rho g$ where,

V = volume of fluid displaced, ρ = density of fluid, g = acceleration due to gravity

Or, Buoyant force = weight of fluid displaced.

QUESTIONS-

1. An object weighs 36 g wt. in air and has a volume of 8.0 cm^3 . What will be its apparent weight when immersed in water?
 - i) 36 g wt.
 - ii) 30 g wt.
 - iii) 44 g wt.
 - iv) 28 g wt.
2. A piece of metal weighs 9.25 g in air, 8.20 g in water, and 8.36 g when immersed in gasoline. What is the density of the metal?
 - i) 8.20 g/cm^3
 - ii) 9.25 g/cm^3
 - iii) 8.81 g/cm^3
 - iv) 8.36 g/cm^3
3. What is the density of the gasoline?
 - i) 0.89 g/cm^3
 - ii) 0.85 g/cm^3
 - iii) 1.05 g/cm^3
 - iv) None of these

4. The density of water is 1g/cm^3 . Which of the following substance will float in water?

Substance	Mass	Volume
1	6 g	3 cm^3
2	8 g	4 cm^3
3	10 g	2 cm^3
4	2 g	4 cm^3

- i) Substance 1
 - ii) Substance 2
 - iii) Substance 3
 - iv) Substance 4
5. An object is immersed in two liquids A and B in succession. The extent to which the object sinks in liquid B is less than in liquid A. What conclusion can be derived from such an observation?
- i) Density of liquid A is more than liquid B.
 - ii) Density of liquid B is more than liquid A.
 - iii) Upthrust exerted by liquid B is more than exerted by liquid A.
 - iv) Both ii) and iii).

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Answers –

1. iv) 28 g

When immersed in water, the object is buoyed up by the mass of the water it displaces, which the mass of water displaced = $8 \text{ cm}^3 * 1 \text{ g/cm}^3$ (the density of water = 1 g/cm^3). The upward (buoyancy) force is 8 g wt.

The apparent weight will be $36 \text{ g wt.} - 8 \text{ g wt.} = 28 \text{ g wt.}$

2. iii) 8.81 g/ cm^3

When immersed in water, the metal object displaces $(9.25 - 8.20) \text{ g} = 1.05 \text{ g}$ of water whose volume is $(1.05 \text{ g}) / (1.00 \text{ g cm}^3) = 1.05 \text{ cm}^3$. The density of the metal is $= 9.25 \text{ g/ } 1.05 \text{ cm}^3 = 8.81 \text{ g cm}^3$.

3. ii) 0.85 g/ cm^3

The metal object displaces $(9.25 - 8.36) \text{ g} = 0.89 \text{ g}$ of gasoline, whose density must therefore be $(0.89 \text{ g}) / (1.05 \text{ cm}^3) = 0.85 \text{ g/ cm}^3$.

4. iv) Substance 4

Density = $M/V = 2/4 = 0.5 \text{ g/ cm}^3$ which is less than density of water. So it will float.

5. iv) Both ii) and iii)

More upthrust is exerted by liquid B, hence it is more denser than liquid A.

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