WORKSHEET 1

CHAPTER 6 – BUOYANCY AND ARCHIMEDES' PRINCIPLE

A. Tick (✓) the correct option.

1. The density of iron is 7.8×10^3 kg m^{-3}. What is its relative density?
   a. 78 b. 7.8 c. 7.8×10^3 d. zero
2. Two balls, one of iron and the other of aluminium, experience the same upthrust when dipped in water if
   a. both have equal weight in air.
   b. both have equal volume.
   c. both have equal density.
   d. none of these.
3. A piece of wood is held under water. The upthrust on it will be
   a. zero.
   b. equal to the weight of the wood piece.
   c. more than the weight of the wood piece.
   d. less than the weight of the wood piece.
4. The unit of relative density is
   a. g cm^{-3}. b. kg m^{-3}. c. kg f. d. it has no unit.
5. The relative density of silver is 10.8. Its density is
   a. 10.8×10^3 kg m^{-3}. b. 10.8. c. 10.8 kg m^{-3}. d. zero.

B. Fill in the blanks.

1. When a piece of wood is suspended from the hook of a spring balance, it reads 70 gf. The wood is now lowered into water. Then the reading on the scale of the spring balance will be _____
2. Apparent weight of a floating body is _____
3. The magnitude of upthrust _____ with the increase in volume of liquid _____ by a body.
4. A fish dives by squeezing out air from its _____
5. An iceberg floats with _____ of its volume below water.

C. State whether the following statements are true or false.

1. When a body is immersed in a liquid, it experiences an upthrust which is equal to the volume of the liquid displaced by it.
2. When a body floats, its weight is equal to the weight of liquid displaced by the immersed part of the body and therefore, its apparent weight is zero.
3. In floating position, the body is weightless and its apparent density and apparent weight is zero.
4. A hydrometer sinks deeper in a liquid of high density than in a liquid of low density.
5. A body will experience the same upthrust when immersed in water or alcohol.

Name: ..... Teacher's signature: .....

Class: IX Date: .....

D. Match the following.

1.	Upthrust (SI unit)	=	no unit
2.	Density (SI unit)	=	g cm^{-3}
3.	Density (CGS unit)	=	mass/volume
4.	Relative Density	=	newton
5.	Density	=	kg m^{-3}

E. Answer the following questions.

Very short answer questions

1. What is meant by buoyancy?
2. What do you understand by the term relative density of a substance? State its unit.

Short answer questions

1. State the principle of floatation.
2. An iron nail sinks in water while an iron ship floats on water. Why?

Long answer questions

1. A stone of density 3200 kg m^{-3} and of volume 0.0018 m^3 is completely immersed in alcohol of density 800 kg m^{-3}. Calculate:
   i. weight of stone in SI system.
   ii. upthrust on stone in SI system.
   iii. apparent weight of stone in alcohol.

   (Take g = 10 m s^{-1})
2. What fraction of an iceberg of density 980 kg m^{-3} will be above the surface of sea water of density 1260 kg m^{-3}?

ANSWERS

WORKSHEET 1

A. Tick (✓) the correct option.

1. b
2. b
3. c
4. d
5. a

B. Fill in the blanks.

1. zero
2. zero
3. increases, displaced
4. floating tube
5. $\frac{11}{12}$

C. State whether the following statements are true or false.

1. F
2. T
3. T
4. F
5. F

D. Match the following.

1. Upthrust (SI unit) = newton
2. Density (SI unit) = kg m^{-3}
3. Density (CGS unit) = g cm^{-3}
4. Relative Density = no unit
5. Density = mass/volume

E. Answer the following questions.

Very short answer questions

1. The phenomenon by which an upward force is exerted on an object which is partially or completely immersed in a fluid is called buoyancy.
2. The ratio of the density of a substance to the density of water at 4 °C is called the relative density of the substance.

   Relative density has no unit.

Short answer questions

1. The principle of floatation states that:

   i. When an object is immersed in a liquid then the weight of object acts downwards at its centre of gravity. This force has a tendency to sink the object.

   ii. The upthrust due to the displacement of liquid acts vertically upward at the centre of gravity of the displaced liquid, also known as centre of buoyancy.

   The upthrust due to liquid is always equal to the weight of the liquid displaced by immersed part of the object.

2. Nail is a compact solid and not hollow, so it does not displace sufficient water to balance its weight, therefore, the upthrust due to water is very small and hence, it sinks in water.

   On the other hand, ship is constructed in such a way, so that it can displace more water than its own weight, therefore, sufficient upthrust is exerted on the ship to keep it afloat.

Long answer questions

1. i. Mass of stone = $v \times d$

$= 0.0018 \times 3200$

$= 5.76$ kg

Weight of stone = mg

$= 5.76 \times 10$

$= 57.6$ N

ii. Volume of displaced alcohol = 0.0018 m^3

Mass of displaced alcohol = 0.0018×800

$= 1.44$ kg

Upthrust on stone = $m \times g$

$= 1.44 \times 10$

$= 14.4$ N

iii. Apparent weight of stone in alcohol

= Weight of stone – Upthrust on stone

$= 57.6 - 14.4$

$= 43.2$ N

2. Let, the volume of iceberg be 'x' and the volume of iceberg inside sea water be 'y'.

According to the law of floatation,

Weight displaced water by iceberg = Weight of iceberg

$$v_{water} \times d_{water} \times g = v_{iceberg} \times d_{iceberg} \times g$$

$$y \times 1260 \times g = x \times 980 \times g$$

$$y = \frac{x \times 980 \times g}{1260 \times g}$$

$$= \frac{980x}{1260}$$

$$= \frac{7x}{9}$$

Therefore,

the volume of iceberg inside sea water = $\frac{7x}{9}$

Or, the volume of iceberg above sea water = $\frac{x - 7x}{9}$

$$= \frac{9x - 7x}{9}$$

$$= \frac{2x}{9}$$

Fraction of iceberg above sea water = $\frac{2}{9}$ th