UNIT 1

Fluids

TEXTBOOK EVALUATION

I. Choose the correct answer.

1. The size of an air bubble rising up in water
   (a) decreases
   (b) increases
   (c) remains same
   (d) may increase or decrease

   Ans: (b) increases

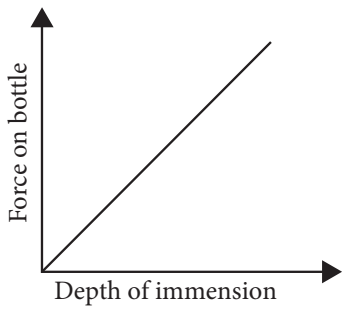
2. Clouds float in atmosphere because of their low
   (a) density (b) pressure
   (c) velocity (d) mass

   Ans: (a) density

3. In a pressure cooker, the food is cooked faster because
   (a) increased pressure lowers the boiling point
   (b) increased pressure raises the boiling point
   (c) decreased pressure raises the boiling point
   (d) increased pressure lowers the melting point

   Ans: (b) increased pressure raises the boiling point

4. An empty plastic bottle closed with an airtight stopper is pushed down into a bucket filled with water. As the bottle is pushed down, there is an increasing force on the bottom as shown in graph. Th s is because



   (a) more volume of liquid is dispaced
   (b) more weight of liquid is displaced
   (c) pressure increases with depth
   (d) all the above

   Ans: (c) pressure increases with depth

II.Fill in the blanks.

1. In a fluid, buoyant force exists because pressure at the _____ of an object is greater than the pressure at the top.

   Ans: depth

2. The weight of the body immersed in a liquid appears to be _____ than its actual weight.

   Ans: lesser

3. The instrument used to measure atmospheric pressure is _____.

   Ans: barometer

4. The magnitude of buoyant force acting on an object immersed in a liquid depends on _____ of the liquid.

   Ans: density

5. A drinking straw works on the existence of _____.

   Ans: atmospheric pressure

III. True or False.

1. The weight of fluid displaced determines the buoyant force on an object. **Ans: True**
2. The shape of an object helps to determine whether the object will float. **Ans: True**
3. The foundations of high-rise buildings are kept wide so that they may exert more pressure on the ground. **Ans: False**
4. Archimedes' principle can also be applied to gases. **Ans: True**
5. Hydraulic press is used in the extraction of oil from oil seeds. **Ans: True**

IV. Match the following.

Density	-	hρg
1 gwt	-	Milk
Pascal's law	-	$\frac{\text{Mass}}{\text{Volume}}$
Pressure exerted by a fluid	-	Pressure
Lactometer	-	980 dyne

Ans:

Density	-	$\frac{\text{Mass}}{\text{Volume}}$
1 gwt	-	980 dyne
Pascal's law	-	Pressuree
Pressure exerted by a fluid	-	hρg
Lactometer	-	Milk

V. Answer in brief.

1. On what factors the pressure exerted by the liquid depends on?

Pressure exerted by a liquid at a point is determined by,

(i) depth (h)

(ii) density of the liquid (ρ)

(iii) acceleration due to gravity (g).

2. Why does a helium balloon float in air?

✓ Hydrogen, helium and hot air are much less dense than ordinary air and this gives them buoyancy.

3. Why it is easy to swim in river water than in sea water?

✓ Salt water provides more buoyant force than fresh water. Because buoyant force depends as much on the density of fluids as on the volume displaced.

4. What is meant by atmospheric pressure?

Earth is surrounded by a layer of air up to certain height (nearly 300 km) and this layer of air around the earth is called atmosphere of the earth. Since air occupies space and has weight, it also exerts pressure. This pressure is called atmospheric pressure.

5. State Pascal's law.

Pascal's law states that the external pressure applied on an incompressible liquid is transmitted uniformly throughout the liquid.

VI. Answer in detail.

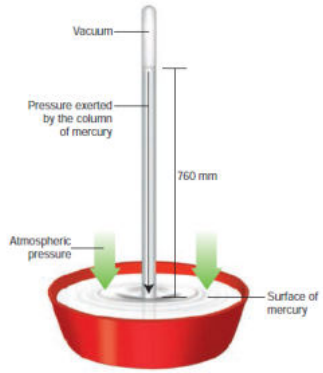
1. With an appropriate illustration prove that the force acting on a smaller area exerts a greater pressure.

Stand on loose sand. our feet go deep into the sand. we lie down on the sand. we will find that our body will not go that deep into the sand.

In both the cases of the above activity, the force exerted on the sand is the weight of your body which is the same. This f orce a cting perpendicular to the surface is called thrust. When you stand on loose sand, the force is acting on an area equal to the area of your feet. When you lie down, the same force acts on an area of your whole body, which is larger than the area of your feet. Therefore the effect of thrust, that is, pressure depends on the area on which it acts.

2. Describe the construction and working of mercury barometer.

The instrument used to measure atmospheric pressure is called barometer. A mercury barometer, first designed by an Italian Physicist Torricelli, consists of a long glass tube (closed at one end, open at the other) filled with mercury and turned upside down into a container of mercury. This is done by closing the open end of the mercury filled tube with the thumb and then opening it after immersing it in to a trough of mercury . The barometer works by balancing the mercury in the glass tube



against the outside air pressure. If the air pressure increases, it pushes more of the mercury up into the tub and if the air pressure decreases, more of the mercury drains from the tube. As there is no air trapped in the space between mercury and the closed end, there is vacuum in that space. Vacuum cannot exert any pressure. So the level of mercury in the tube provides a precise measure of air pressure which is called atmospheric pressure. This type of instrument can be used in a lab or weather station.

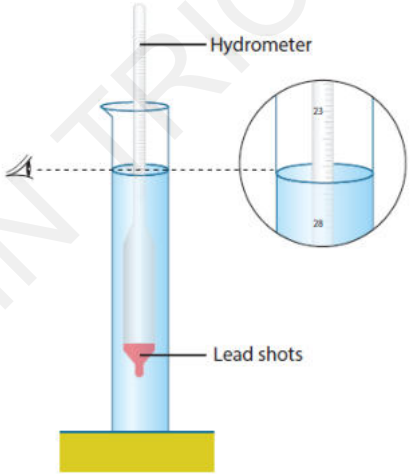
3. How does an object's density determine whether the object will sink or float in water?

Whether an object will sink or float in a liquid is determined by the density of the object compared to the density of the liquid. If the density of a substance is less than the density of the liquid it will float.For example a piece of wood which is less dense than water will float on it.Any substance having more density than water (for example, a stone), will sink into water.

4. Explain the construction and working of a hydrometer with diagram.

Hydrometer

A direct-reading instrument used for measuring the density or relative density of the liquid is called hydrometer. Hydrometer is based on the principle of flotation, i.e., the weight of the liquid displaced by the immersed portion of the hydrometer is equal to the weight of the hydrometer.



Hydrometer

Hydrometer consists of a cylindrical stem having a spherical bulb at its lower end and a narrow tube at is upper end. The lower spherical bulb is partially filled with lead shots or mercury. Th s helps hydrometer to fl at or stand vertically in liquids. The narrow tube has markings so that relative density of a liquid can be read directly.

The liquid to be tested is poured into the glass jar. The hydrometer is gently lowered in to the liquid until it floats freely. The reading against the level of liquid touching the tube gives the relative density of the liquid.

Hydrometers may be calibrated for different uses such as lactometers for measuring the density (creaminess) of milk, saccharometer for measuring the density of sugar in a liquid and alcoholometer for measuring higher levels of alcohol in spirits.

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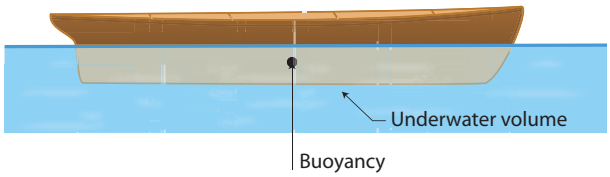
5. State the laws of flotation.

Laws of fl tation are,

1. The weight of a floating body in a fluid is equal to the weight of the fluid displaced by the body.
2. The centre of gravity of the floating body and the centre of buoyancy are in the same vertical line.

The point through which the force of buoyancy is supposed to act is known as centre of buoyancy.



Centre of buoyancy

VII. Assertion and Reason.

Directions: In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false.

(d) If assertion is false but reason is true.

1. **Assertion:** To flat, body must displace liquid whose weight is equal to the actual weight.

   Reason: The body will experience no net downward force in that case.

Answer: (a) If both assertion and reason are true and reason is the correct explanation of assertion.

2. **Assertion:** Pascal's law is the working principle of a hydraulic lift

   Reason: Pressure is thrust per unit area.

Answer: (a) If both assertion and reason are true and reason is the correct explanation of assertion.

3. **Assertion:** The force acting on the surface of a liquid at rest, under gravity, in a container is always horizontal.

   Reason: The forces acting on a fluid at rest have to be normal to the surface.

Answer: (d) If assertion is false but reason is true.

4. **Assertion:** A sleeping mattress is so designed that when you lie on it, a large area of your body comes in its contact.

   Reason: Th s reduces the pressure on the body and sleeping becomes comfortable.

Answer: (a) If both assertion and reason are true and reason is the correct explanation of assertion.

5. **Assertion:** Wide wooden sleepers are kept below railway lines to reduce pressure on the railway tracks and prevent them from sinking in the ground.

   Reason: Pressure is directly proportional to the area in which it is acting.

Answer: (c) If assertion is true but reason is false.

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VIII. Comprehension type.

1. While passing nearby a pond, some students saw a drowning man screaming for help. They alerted another passerby, who immediately threw an inflated rubber tube in the pond. The man was saved. Respond to the given questions using the information provided above.

a. Why the passerby did use inflated rubber tube to save the drowning man?

The buoyancy force of an inflated rubber tube is height and it.also capable of balancing the weight of that drowning ma

b. Write the principle involved here in.

Archmedes principle

c. Which qualities shown by the students and the passerby do you identify that helped in saving the drowning man.

1.Helping Tendency

2.Knowledge about the fluids.

2. A balloon displaces air and it results in buoyant force. Th s buoyant force is more than the weight of the balloon and hence the balloon moves up.

a. As the balloon moves up what happens to the density of it?

Density of the balloon never change.

b.Write the condition for floating of balloon.

i) Weight of the balloon is equal to the weight of the air displaced.
ii) The density of the balloon lesser than the density of circles that place

c. Buoyant force depends on the density of

———— **Ans: Air**

3. Two different bodies A and B are completely immersed in water and undergo the same loss in weight.

a. Will the weight of the body A and body B in air be the same? **Ans: Equal**

b. If 4 kg of material occupy 20 cm^3 and 9 kg of material be occupy 90 cm^3, which has greater density A or B?

Density of the object A

Mass of the object A = 4kg

Volume of the object A =20Cm^3

= 20 x $10^{-5}m^3$

Density of the object A = mass/Volume

= 4/2 x 10^{-5}

= 2 x 10^5Kg m^{-3}

Density of the object B

Mass of the object B = 9kg

Volume of the object B =90cm^3

= 90 x $10^{-5}m^3$

Density of the object B = mass/Volume

= 9/9 x 10^{-5}

= 1x 10^5Kg m^{-3}

∴ The density of the object A is high.

c. What vertical height of mercury will exert a pressure of 99960 Pa? (Density of mercury = 136000 kg m^{-3}).

P =99960 Pa

density (ρ) = 13600Kg m^{-3}

g = 9.8ms-2 P = hρg

h =P/ρg

= 99960/13600 x 9.8

= 0.75m (OR) **= 75 cm**

IX. Numerical Problems.

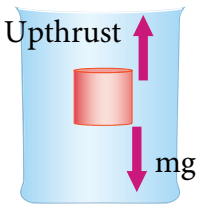
1. A block of wood of weight 200 g fl ats on the surface of water. If the volume of block is 300 cm^3 calculate the upthrust due to water.

Weight of the wooden block =200g

= 0.2 x 9.8

= 1.96N

Volume of block = 300cm^3



Since block is floating

W = upthrust

Upthrust = Weight

=1.96N