

Very Short Answer Type Questions

[1 Mark]

Q. 1. What is a fluid?

Ans. A substance which has no shape of its own but takes the shape of the vessel containing it, is called a fluid.

Q. 2. What is specific gravity of a substance?

Ans. Specific gravity of a substance is defined as the ratio of density of a substance to the density of water (for solids and liquids) and hydrogen (for gases).

Q. 3. What do you mean by buoyant force?

Ans. It is defined as the upward force exerted by a fluid on a body immersed in it.

Q. 4. What is the SI unit of buoyant force?

Ans. Newton.

Q. 5. When an object is immersed in a fluid, name the two forces acting on it.

Ans. (i) Downward gravitational force and (ii) upward buoyant force.

Q. 6. Why does an egg sink in freshwater but floats in highly salty water?

Ans. Salty water is denser than freshwater, hence the egg experiences greater upthrust.

Q. 7. Do all bodies immersed in a given fluid experience the same buoyant force?

Ans. No, as they will displace different weight of the fluid.

Q. 8. What is the density of silver, given that its relative density is 10.5?

Ans. 10.5 g cm^{-3}

Q. 9. A body is fully immersed in water to a depth of 2m, 4 m and then 5 m, in turn. Will the loss in its weight be equal or different in three cases? If different, in which case will it be least?

Ans. The loss in its weight will be equal in all the cases.

Q. 10. The volume of a body of mass 50 g is 20 cm^3 . If the density of water is taken as 1 gcm^{-3} , will the substance float or sink in water? Why?

Ans. It will sink. The weight of the body is greater than the weight of water displaced by it.

Q. 11. The relative density of a body is 2. Will it sink or float in water? Give reason for your answer?

Ans. The relative density of a body is 2. It is greater than the relative density of water. Hence it will sink because it means that the upward thrust of water is less than the weight of the body.

Short Answer Type Questions – I

[2 marks]

Q. 1. What do you mean by thrust?

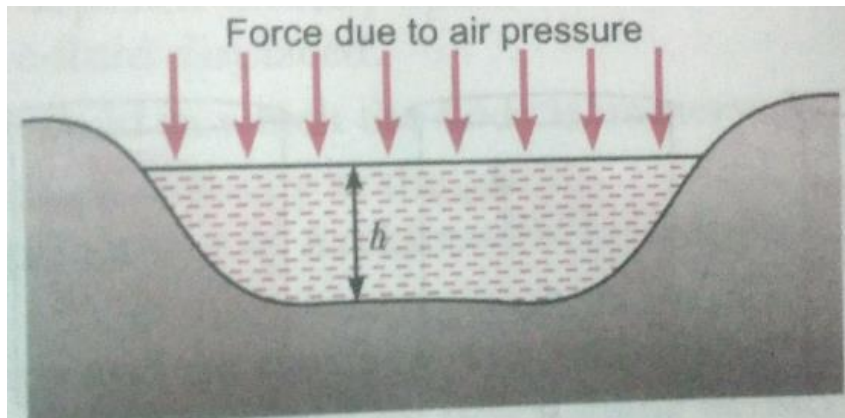
Ans. Thrust is the force acting on a body perpendicular to its surface. It has the units of force. The SI unit of thrust is newton (N). Effect of thrust depends upon the area over which it acts.

Q. 2. Give two practical daily life applications that make use of the concept of pressure.

Ans. Practical applications based on the concept of pressure:

(i) As we know, the area of a sharp edge is much less than that of a blunt edge. Thus, for the same force, the effective force per unit area, *i.e.*, the pressure is more for the sharp edge than the blunt edge.

(ii) Railway tracks are laid on large sized wooden sleepers, which spread the force due to the weight of the train on a larger area, thus reducing the pressure considerably.



Q. 3. During a period of hot weather, the atmospheric pressure on the pond shown in figure remains constant. Water evaporates from the pond, so that the depth h decreases.

What will be the force of the air on the surface of the pond?

Ans. We know that

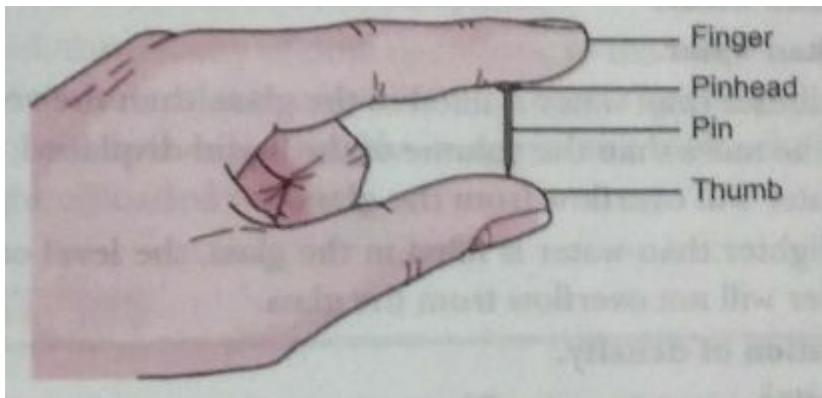
$$\text{Pressure (P)} = \frac{\text{Force(F)}}{\text{Area(A)}}$$

$$F = P \times A$$

$$F \propto A \quad (\text{pressure} = \text{constant})$$

As water evaporates from the pond, so area will be smaller. Hence, force will also be smaller.

Q. 4. A man squeezes a pin between his thumb and finger, as shown in figure.



The finger exerts a force of 84 N on the pinhead.

The pinhead has an area of $6.0 \times 10^{-5} \text{ m}^2$.

Explain why the pin causes more pain in the man's thumb than in his finger.

Ans. Pressure is the force per unit area. When a force acts over a large area of the object, it produces a small pressure. But if the same force acts over a small area of the object, it produces a large pressure. In this case surface area of pintip is less than the surface area of pinhead. So pressure is more in man's thumb.

Q. 5. State the laws of floatation.

Ans. A body floating freely in a fluid, must obey the following laws known as laws of floatation:

(i) A body floats only if its weight is equal to the weight of fluid displaced by its immersed part.

(ii) For the body to float in upright position, the centre of gravity of the floating body and the centre of buoyancy of the fluid displaced by the immersed part of the body must lie on the same straight line.

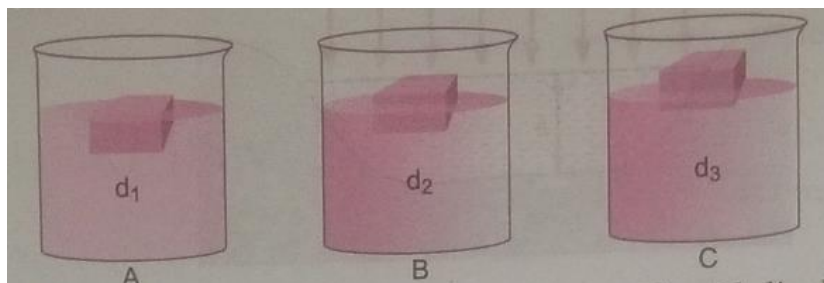
1st law stated above is necessary for the body to float whereas the 2nd law stated above is necessary for the body to float in upright position.

Q.6. Why does a camel walk easily on sand but it is difficult for a man to walk on sand though a camel is much heavier than a man?

Ans. It is because camel's feet have large surface area, the force of their weight is distributed over a large area of sand. The pressure produced on sand is small and hence, a camel's feet do not sink into the sand. On the other hand, a man's feet have a small surface area, the force of their weight is distributed over a smaller area of sand. The force per unit area or pressure produced on sand is large in this case due to which a man's feet sink into sand and it becomes difficult for him to walk on sand.

Q. 7. The following figure shows three identical blocks of wood floating in three different liquids A, B and C of densities d_1 , d_2 and d_3 respectively. Which of these has the highest

density? Give reason to justify your answer.



Ans. Liquid C has the highest density. This is because volume of liquid displaced is least in liquid C of density d_3 .

Q. 8. A piece of ice is placed gently on the surface of water in a glass so that when the ice floats, the water comes up to the brim of the glass. What will happen to the level of water when the ice melts? Will it overflow?

Ans. In accordance with the Archimedes' principle, when the ice melts, the volume of water so formed will be equal to the volume of the displaced water. So, the level of water in the glass will remain unaffected.

Q. 9. In the previous question, what will happen if instead of water the glass is filled with
(a) a liquid denser than water
(b) a liquid lighter than water.

Ans. (a) When the liquid denser than water is filled in the glass, then the volume of water formed by the melting of ice will be more than the volume of the liquid displaced, so the level of water will rise. Therefore, the water will overflow from the glass.

(b) When the liquid lighter than water is filled in the glass, the level of water in the glass will come down. So, the water will not overflow from the glass.

**Q. 10. (i) Give an application of density.
(ii) What are its units?**

Ans. (i) The density of a given substance (under specified conditions) remains constant and this helps us to determine the purity of the given sample.

(ii) *i.e.*, Relative density = $\frac{\text{Density of a substance}}{\text{Density of water at } 4^\circ\text{C}}$

As relative density is a ratio of two similar quantities, it has no units.

Short Answer Type Questions – II

[3 marks]

Q. 1. What are the factors which affect the pressure at a point in liquid?

Ans. Liquid pressure at a point depends on the following three factors:

- (i) Depth of point below the free surface
- (ii) Density of the liquid
- (iii) Acceleration due to gravity

The liquid pressure does not depend on the shape of liquid and area of its base.

Q. 2. State the laws of liquid pressure.

Ans. The laws of liquid pressure are:

- (i) The liquid pressure is same at all points lying on the same horizontal plane in a stationary liquid.
- (ii) The liquid pressure at a point inside the liquid is same in all directions.
- (iii) The liquid pressure at a point inside the liquid is directly proportional to the depth of that point from the free surface of liquid.
- (iv) The pressure of liquid at same depth is different for different liquids. It is directly proportional to density of liquid. That is, for same depth the liquid pressure is larger for liquid of larger density.

Q. 4. Give any three applications of Archimedes' principle.

Ans. It is used in

- (i) designing ships and submarines.
- (ii) Hydrometers, which are used for determining density of liquids.
- (iii) Lactometers, used to determine the purity of a sample of milk.

Q. 5. How is a submarine able to move on as well as go under water?

Ans. To move a submarine under water, water is admitted in its special tank, which causes a net increase in weight due to which the submarine goes down in water.

In the same manner, to bring the submarine up on the surface of the sea, the water from the tanks is ejected out by compressed air, due to which the net weight of the submarine decreases and it comes up on the surface of the water.

Q. 6. Loaded test-tube placed in pure milk sinks to a certain mark (M). Now some water is mixed with the milk. Will the test tube sink more or less? Explain.

Ans. When water is added, the density of milk decreases, so the weight of milk-water mixture displaced by immersed part of the tube also decreases and becomes less than the weight of

loaded tube. So the tube sinks more and will float only when the weight of this milk-water mixture displaced by the tube is equal to the weight of loaded tube.

Long Answer Type Questions

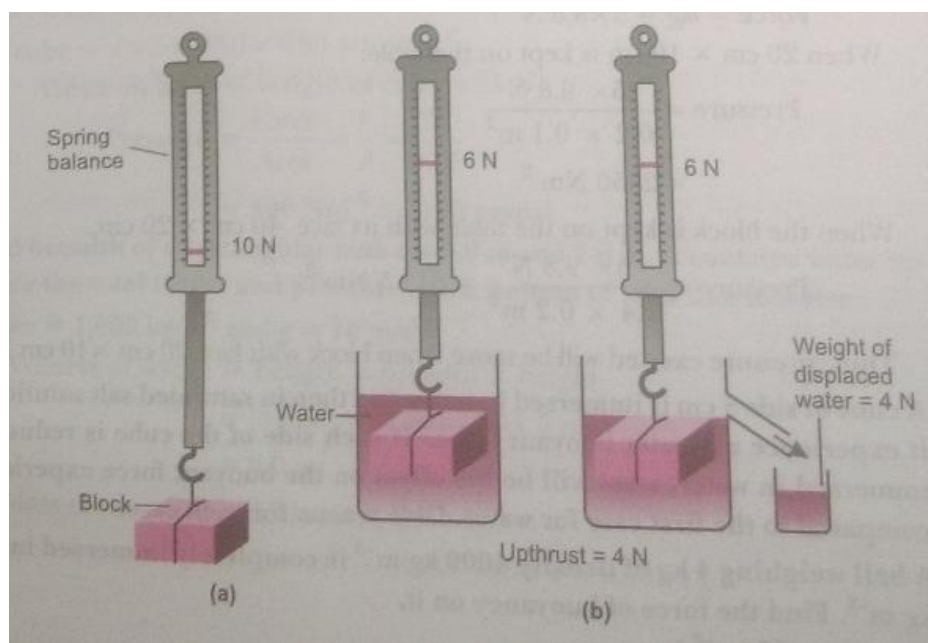
[5 marks]

Q. 1. (i) State and explain the experiment for verification of Archimedes' principle.

(ii) Name the devices based on Archimedes' principle.

Ans. (i) Archimedes' principle: The Archimedes' principle states that if a body is immersed in a fluid, wholly or partly, then it loses its weight equal to the weight of fluid displaced by the immersed part of the body,

Experimental verification: Take a solid body which is heavier than water and also insoluble in water. Suspend it from the hook of a spring balance to find its weight in air as shown in Fig.(a).



Let its weight in air be

W_1 .

Now take an overflow vessel filled with water up to the overflow mark and place a measuring cylinder below the overflow tube as shown in Fig. (b). Now suspend the given solid from hook to spring balance and lower the solid in the water till it is completely immersed in water. Note the reading of the spring balance. It gives the weight of solid body in water. Let it be W_2 .

\therefore Loss of weight in solid when immersed in water = $W_1 - W_2$.

The water which overflowed when solid was immersed is collected in the cylinder placed below the overflow tube. Measure this volume.

Let it be V .

$\therefore V =$ Volume of water displaced by the solid immersed in it.

Then weight of water displaced by solid = Vpg ,

where, p = density of water and g = acceleration due to gravity.

It is found that $W_1 - W_2$ loss in weight of solid when immersed in water is equal to the weight of the water displaced by the body. This verifies Archimedes' principle.

(ii) Devices based on Archimedes' principle: Design of all those devices which float in the fluid is based on Archimedes' principle. These devices such as hydrometers, lactometers, balloons, boats and ships, submarines, etc., work according to Archimedes' principle,

Q. 2. (a) Explain, with the help of an example the difference between the terms thrust and pressure. Which one of the two has same SI unit as that of Force?

(b) Consider a wooden block of mass 5 kg and dimensions 40 cm x 20 cm x 10 cm with its faces 20 cm × 10 cm and 40 cm × 20 cm kept on the table, in turn, in which case will the pressure exerted by the box on the table be more? Justify your answer by doing mathematical calculations.

Ans. (a) Pressing the flat end of a ball point pen against the hand with some force and pressing the pointed tip of the same pen against the hand with the same force. Pressing on pointed tip produces greater pain because the area on which same force acts decreases and the effect of this force increases.

The total force acting on an area is called thrust whereas the force acting per unit area is called pressure. Thrust has the same SI Unit, Newton as that of force.

$$\text{(b) Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Force} = mg \quad 5 \times 9.8 \text{ N}$$

When 20 cm x 10 cm is kept on the table:

$$\text{Pressure} = \frac{5 \times 9.8 \text{ N}}{0.2 \times 0.1 \text{ m}^2}$$

$$= 2450 \text{ Nm}^{-2}$$

When the block is kept on the table with its face 40 cm x 20 cm,

$$\text{Pressure} = \frac{5 \times 9.8 \text{ N}}{0.4 \times 0.2 \text{ m}^2} = 612.5 \text{ Nm}^{-2}$$

Thus, pressure exerted will be more when block with face 20 cm x 10 cm is kept on table.

Q. 3. (a) A cube of side 5 cm is immersed in water and then in saturated salt solution. In which case will it experience a greater buoyant force? If each side of the cube is reduced to 4 cm and then immersed in water, what will be the effect on the buoyant force experienced by the cube as compared to the first case for water. Give reason for each case.

(b) A ball weighing 4 kg of density 4000 kg m⁻³ is completely immersed in water of density 10³ kg m⁻³. Find the force of buoyancy on it.

(Given $g = 10 \text{ ms}^{-2}$.)

Ans. (a) The cube will experience a greater buoyant force in the saturated salt solution because the density of the salt solution is greater than that of water.

The smaller cube will experience lesser buoyant force as its volume is lesser than the initial cube.

(b) Buoyant force = Weight of the liquid displaced
= Density of water \times Volume of water displaced $\times g$
= $1,000 \times \frac{4}{4,000} \times 10 = 10 \text{ N}$

HOTS (Higher Order Thinking Skills)

Q. 1. Why does a sharp knife cut better than a blunt knife?

Ans. A sharp knife has a very thin edge to its blade. A sharp knife cuts objects better because due to its very thin edge, the force of our hand falls over very small area of the object producing a large pressure. And this large pressure cuts the object easily. On the other hand, a blunt knife has a thicker edge. A blunt knife does not cut an object easily because due to its thicker edge, the force of our hand falls over a larger area of the object and produces lesser pressure. This lesser pressure cuts the object with difficulty.

Q. 2. Why are railway tracks laid on large sized concrete sleepers?

Ans. When the train passes over a railway track, the whole weight of the train acts on the railway line beneath it. Due to large sized concrete sleepers, the force of weight spreads over a larger area and the pressure is less. As a result, the railway track can bear it.

Q. 3. While drawing water from a well, the bucket of water appears to be heavier as it comes out of the water.

Ans. As long as the bucket is inside the water, its effective weight is less in accordance with Archimedes principle. When the bucket comes out of water, there is no upthrust due to water now. So the weight of bucket appears heavier.

Q. 4. Why is the tip of the needle sharp?

Ans. The tip of a sewing needle is sharp so that due to its sharp tip, the needle may put the force on a very small area of the cloth, producing a large pressure sufficient enough to pierce the cloth being stitched.

Q. 5. Why is the pressure on ground more when a man is walking than when he is standing?

Ans. When a man is walking, then at one time only his one foot is on the ground. Due to this, the force of weight of the man falls on a smaller area of the ground and produces more pressure on the ground. On the other hand, when the man is standing both his feet are on the ground. Due to this, the force of weight of the man falls on a larger area of the ground and produces lesser pressure on the ground.

Q. 6. Why is depression much more when a man stands on the cushion than when he lies down on it?

Ans. When a man stands on a cushion then only his two feet are in contact with the cushion. Due to this, the weight of man falls on a small area of cushion producing a large pressure. This large pressure causes a big depression in the cushion. On the other hand, when the same man is lying on the cushion, then his whole body is in

contact with the cushion. In this case, the weight of man falls on a much larger area of the cushion producing much smaller pressure. And this smaller pressure produces a very little depression in the cushion.

Q. 7. Why is it easier to walk on soft sand if we have flat shoes rather than shoes with sharp heels?

Ans. This is because flat shoes have a greater area in contact with the soft sand due to which there is less pressure on the soft ground. Due to this the flat shoes do not sink much in soft sand and it is easy to walk on it. On the other hand, a sharp heel has a small area in contact with the soft sand and so exerts greater pressure on the soft sand. Due to this greater pressure, the sharp heels tend to sink deep into soft sand making it difficult for the wearer to walk on soft sand.

Q. 8. Why do snow shoes stop you from sinking into snow?

Ans. The snow shoes have large, flat soles so that there is less pressure on the soft snow and stop the wearer from sinking into it.

Q. 9. Why does a ship made of iron and steel float in water whereas a small piece of iron sinks in it?

Ans. Ship is not a solid block of iron and steel. A ship is a hollow object made of iron and steel which contains a lot of air in it. Air has a very low density. Due to the presence of a lot of air in it, the average density of the ship becomes less than the density of water, therefore, a ship floats in water.

Q. 10. A boy gets into a floating boat.

(a) What happens to the boat?

(b) What happens to the weight of water displaced?

(c) What happens to the buoyant force on the boat?

Ans. (a) The boat floats lower in water.

(b) The weight of water displaced increases.

(c) The buoyant force on boat increases.

Q. 11. Why does the diver wear metallic cover while going into the sea?

Ans. The pressure increases with increase of depth of water. The increase in pressure is 1 atm by 10 m increase of depth of water. If this pressure falls on the diver directly, he will not tolerate it. Therefore, if a diver wants to go to large depth, he should wear the metallic cover. The pressure of water column falls on the metallic cover and the pressure inside the cover remains nearly equal to atmospheric pressure. Thus, by wearing metallic cover, the diver remains quite safe.

Value Based Questions

1. Shyam takes an open pan to cook vegetables at a hill station while Ravi cook the saner vegetables in a pressure cooker at the same place.

Answer the following questions based on the above information:

- (i) Explain with reason who will cook vegetable faster.**
- (ii) Mention the reason for delay in cooking.**
- (iii) Which value is learnt by the student in the process of cooking food in the pressure cooker?**

Ans. (i) Ravi will cook the vegetables faster. Pressure cookers heat food quickly because the internal steam pressure from boiling liquid causes the wet steam to permeate food.

This transfers more heat rapidly.

(ii) At high altitudes the atmospheric pressure is low. This reduces the boiling point of water and thus, cooking is delayed.

(iii) Presence of mind and scientific thinking.

2. while passing nearby a pond, some student 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.

- (i) Why did the passerby use inflated rubber tube to save the drowning man?**
- (ii) Write the principle involved here.**
- (iii) Which qualities shown by the students and the passerby do you identify that helped in saving the drowning man?**

Ans. (i) Inflated rubber tube remain float on water as the magnitude of buoyant force acting on an body immersed in a liquid is equal to weight of liquid displaced by the immersed body.

(ii) Archimedes principle or law of buoyancy or law of floatation.

(iii) Helping and caring nature, awareness towards proper application.

3. You received an e-mail from a friend living in a coastal town. He shared an experience with you that recently, while swimming on the coastline of the sea in common swimming attire, he thought of going deeper inside the sea. He was asked to abstain from delving deeper into the sea by the rescue personnel. Respond to the following questions using the information provided above.

- (i) Why the rescue personnel asked your friend not to swim deeper inside the sea?**
- (ii) What values were exhibited by the rescue personnel?**

Ans. (i) As the density and depth of the sea water is high, there is a possibility that he might drown.

(ii) Prevention is better than cure.