

# Assignments in Science Class IX (Term II)

10B

## Floatation

### IMPORTANT NOTES

- 1. Pressure :** The thrust (force) acting normally on unit area of a surface is called pressure.
- 2. SI unit of pressure** is newton/(metre)<sup>2</sup> or N/m<sup>2</sup>. It is commonly called pascal (Pa).
- 3. Definition of pascal :** When a force of 1 newton acts normally on an area of cross-section 1 m<sup>2</sup>, then the pressure experienced by the surface is said to be one pascal.
- 4. Buoyancy :** The phenomenon due to which a body on being immersed in a fluid experiences an upward force is called buoyancy.
- 5. Buoyant force or upthrust :** The upward force experienced by a body on being immersed in a fluid is called buoyant force or upthrust.
- 6. Buoyant force or upthrust acting on a body** is always equal to the weight of the fluid displaced by the immersed part of the body in the fluid.
- 7. Archimedes' Principle :** When a body is partially or wholly immersed in a fluid, it experiences an upthrust (or apparently loses its weight) which is equal to the weight of the fluid displaced by the immersed part of the body.
- 8. Density :** Mass per unit volume of a substance is called density. Its unit in CGS system is g/cm<sup>3</sup> and in SI system is kg/m<sup>3</sup>.
- 9. Relative density :** The ratio between the density of a substance and the density of water at 4°C is called relative density.  
The relative density is a pure number and has no units.

### ASSIGNMENTS FOR SUMMATIVE ASSESSMENT

#### I. VERY SHORT ANSWER QUESTIONS

(1 Mark)

#### PREVIOUS YEARS' QUESTIONS

1. Give reason why, a block of plastic when released under water comes up to the surface of water.  
[2011 (T-II)]
2. Define density. What is the SI unit of density?  
[2011 (T-II)]

#### OTHER IMPORTANT QUESTIONS

1. Name and define SI unit of pressure.
2. What do you understand by the term buoyancy?
3. Why does a mug full of water feel lighter inside water?
4. A perpendicular force of 50 N acting on a surface generates a pressure of 250 Pa. Calculate the area of cross-section of the surface on which pressure is acting.
5. What is a lactometer used for?
6. State the unit of density and relative density in SI system.
7. State Archimedes' principle.
8. What is meant by buoyant force?
9. A cork floats while the nail sinks in water. Give reason.
10. What is the principle of floatation?
11. A body of mass 400 g has a volume of 300 cm<sup>3</sup>. Will the body sink in water or not?  
[Density of water = 1000 kgm<sup>-3</sup>]

## II. SHORT ANSWER QUESTIONS - I

(2 Marks)

### PREVIOUS YEARS' QUESTIONS

- When we stand on loose sand, our feet go deep into the sand. But when we lie down on the sand our body does not go that deep in the sand. Why? [2011 (T-II)]
- Define relative density of a substance. Relative density of silver is 10.8. The density of water is  $1000 \text{ kg m}^{-3}$ . What is the density of silver in SI units? [2011 (T-II)]
- A cork floats in water, while the iron nail sinks. Give reason. [2011 (T-II)]
- State Archimedes' Principle. Based on this principle, write its two applications. [2011 (T-II)]
- (i) Define pressure.  
(ii) Why is it easy to walk on sand with flat shoes, then with high heel shoes? [2011 (T-II)]
- (i) Define buoyant force.  
(ii) Mention any two factors affecting the buoyant force. [2011 (T-II)]
- 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. [2011 (T-II)]
- If two equal weights of unequal volumes are balanced in air, what will happen when these are completely dipped in water? [2011 (T-II)]
- The volume of 40 g of a solid is  $15 \text{ cm}^3$ . If the density of water is  $1 \text{ g/cm}^3$ , will the solid float or sink? Why? [2011 (T-II)]
- A steel needle sinks in water but a steel ship floats. Explain how. [2011 (T-II)]
- (a) Name the forces acting on a body? When it is fully or partially immersed in a liquid. [2011 (T-II)]  
(b) Briefly explain, why some objects float and some sink?
- A dining hall has dimension  $50 \text{ m} \times 15 \text{ m} \times 3.5 \text{ m}$ . Calculate the mass of air in the hall. (Given, density of air =  $1.30 \text{ kg/m}^3$ ) [2011 (T-II)]
- Relative densities of two substances A and B are 2.5 and 0.9 respectively. Find densities of A and B. Also find whether they will sink or float in water. (Density of water =  $1000 \text{ kg/m}^3$ ) [2011 (T-II)]
- (a) List two factors on which buoyant force depends.  
(b) Find pressure, when a thrust of 20 N is applied on a surface area of  $10 \text{ cm}^2$ . [2011 (T-II)]
- Which will exert more pressure 100 kg mass on  $10 \text{ m}^2$  or 50 kg mass on  $5 \text{ m}^2$ ? Give reason. [2011 (T-II)]
- (a) Explain why a truck or a motor bus has much wider tyres?  
(b) Why do we feel lighter when we swim? [2011 (T-II)]
- You have a bag of cotton and an iron bar, each indicating a mass of a 100 kg when measure on a weighing machine. In reality, one is heavier than the other. Can you say which one is heavier and why? [2011 (T-II)]
- Account for the statement : "camel walks easily on sand but it is difficult for a man to walk on sand though a camel is much heavier than a man". [2011 (T-II)]
- A piece of stone is tied at one end of a rubber string and holding from other end, it is allowed to immersed partially then full into water. What difference if any, you will observe, and why? [2011 (T-II)]
- An object of 40 N weight when immersed in water losses 10 N weight. Will the object float or sink? Why? [2011 (T-II)]
- Why is it easier to swim in sea water than in river water? [2011 (T-II)]
- Differentiate between density and relative density? [2011 (T-II)]
- What is Thrust? Why do buildings have wide foundation? [2011 (T-II)]
- Lead has greater density than iron and both are denser than water. Is the buoyant force on a lead object greater than, or lesser than or equal to

the buoyant force on an iron object of the same volume? Explain your answer giving reason.

[2011 (T-II)]

25. The wheels of a army tank rest on a steel belt, give reason. [2011 (T-II)]
26. While drawing water from a well, a bucket of water appears to be heavier as it comes out of the water. Explain giving reasons. [2011 (T-II)]
27. Why are railway tracks laid on large sized concrete sleepers? Explain. [2011 (T-II)]
28. What happens when :
- (a) Buoyant Force exerted by the fluid is less than the weight of the body? [2011 (T-II)]
- (b) Buoyant Force exerted by the fluid is equal to the weight of the body?
29. What is Relative Density? The relative density of a substance is greater than 1, what does it signify? [2011 (T-II)]
30. If relative density of aluminium is 2.7 and density of water is  $1000 \text{ kg/m}^3$ . What is the density of aluminium in SI unit? [2011 (T-II)]
31. The volume of a solid block is  $300 \text{ cm}^3$ , find the mass of water displaced when it is immersed in water? (Density of water is  $1 \text{ g/cm}^3$ ) [2011 (T-II)]
32. A solid object of mass 50 g and volume  $100 \text{ cm}^3$  is put in water. Will the object float or sink? Give reasons for your answer. [2011 (T-II)]
33. Name the instrument used to determine the density of liquid in which balance and graduated cylinder are not required. Why this instrument is made heavy near the bottom? [2011 (T-II)]
34. A sphere of mass 5 kg and volume  $2.2 \times 10^{-4} \text{ m}^3$  is completely immersed in water. Find the buoyant force exerted by water on the sphere. Density of water =  $1000 \text{ kgm}^{-3}$ . (Given :  $g = 9.8 \text{ ms}^{-2}$ ) [2011 (T-II)]

35. A ship is loaded in sea water to maximum capacity. What will happen if this ship is moved to river water? Why? [2011 (T-II)]

36. (a) Differentiate between upthrust and weight.  
(b) When does an object float or sink? [2011 (T-II)]
37. A sealed can of mass 600 g has a volume of  $500 \text{ cm}^3$ . Will this can sink or float in water? [Density of water is  $1 \text{ gcm}^{-3}$ ] Why? [2011 (T-II)]
38. Explain the factors which determine whether an object floats or sinks when placed on the surface of water. [2011 (T-II)]
39. Two blocks, one of iron and other of wood are immersed in water at same depth. Which one will come upward? Why? [2011 (T-II)]
40. (a) Define relative density.  
(b) If the relative density of a substance is less than 1, will it float or sink in water support your answer? (Density of water =  $1000 \text{ kg m}^3$ ) [2011 (T-II)]
41. (a) Define relative density. [2011 (T-II)]  
(b) Relative density of gold is 19.3. The density of water is  $10.3 \text{ kg/m}^3$ . What is the density of gold in S.I. units?
42. The mass of an empty 40 litre petrol tank of a vehicle is 8.0 kg. What will be its mass when filled completely with a fuel of density  $700 \text{ kg/m}^3$ . [2011 (T-II)]
43. (a) A floating boat displaces water weighing 6000 N. [2011 (T-II)]  
(i) What is the buoyant force on the boat?  
(ii) What is the weight of boat?  
(b) What happens to the buoyant force as more and more volume of a solid object is immersed in a liquid?

### OTHER IMPORTANT QUESTIONS

1. Why does a skier not sink in fresh snow?
2. Why do sledges used by Eskimos have no wheels?
3. Why are cutting instruments often sharpened?
4. Why is the butt of a rifle very broad, but tip of a bullet pointed?
5. Name the force experienced by a body when immersed in a fluid. What is the direction of force?
6. Explain why sheet of paper falls slower than a coin under through air.
7. A solid body of mass 150 g and volume  $250 \text{ cm}^3$  is placed in a jar contains water. Will it float or

### III. SHORT ANSWER QUESTIONS - II

(3 Marks)

#### PREVIOUS YEARS' QUESTIONS

- sink in water? Density of water is  $1 \text{ g/cm}^3$ .
- An object is made to fall from different heights 20 cm, 40 cm and 60 cm on a wet sand. [2011 (T-II)]
    - What do you observe on the sand?
    - Explain the reasons of the observations.
  - Define Buoyancy.
    - A solid body of mass 150 g occupies  $60 \text{ cm}^3$  volume. Will the solid sink or float? Given density of water is  $1 \text{ gcm}^{-3}$ . [2011 (T-II)]

#### OTHER IMPORTANT QUESTIONS

- State the SI units of thrust and pressure.
  - In which situation we exert more pressure we stand on the foot or on the both feet? Justify your answer.
- State Archimedes' principle.
  - Define relative density of substance, why it has no units?
- State Archimedes' principle.
  - The relative density of silver is 10.8. The density of water is  $10^3 \text{ kgm}^{-3}$ . What is the density of silver in SI units?
- Give reasons :
  - Cutting tools have sharp edges.
  - A sheet of paper falls slower than one is crumpled into a ball.

### ASSIGNMENTS FOR FORMATIVE ASSESSMENT

#### A. Field Trip

Visit the nearest port or jetty where cargo is moved by boats or ships. Observe how the level of water around the boat changes when it is loaded or unloaded.

#### B. Group Discussions

(a) Discuss the following with your teacher.

- Boats filled with people or cargo capsize in midstream.
- White or yellow lines are marked around the hull of ocean going vessels.
- Archimedes principle be used to find out the purity of gold.

(b) Discuss the following situations in groups.

- Why are the rear wheels of tractors very wide?
- Why do the army tanks move over broad steel chains?
- Why do we often sharpen kitchen knives?
- Why do the Eskimos not fix wheels to their sledges?
- Why are the dams made very wide and thick at the base?

- Why do skiers use wide and long skies?
- Why are certain trailers provided with 16 wheels or more?
- Why should we spread over the body as flat as possible, if we get struck in quicksand?

#### C. Activity

##### Activity

To find the change in pressure by a solid, by changing

- area of cross-section of solid
- force exerted by solid.

##### Materials Required

- Three bricks of same size and weight
- Soft mud about  $2' \times 2' \times 4''$



##### Part (a)

- Place a brick gently on the mud, such that its maximum area touches the mud.

- Place another brick gently on its side on the mud.
- Place the third brick in upright position gently on the mud, such that its maximum area touches the mud.
- Lift the bricks gently one by one. Look at the depression created in mud. You will notice that the depression created by the first brick is least and it is maximum in case of the third brick. From the above observations, it implies that more is the area of contact, less is the pressure exerted.

**Part (b)**

- Place a brick gently on the mud, such that its maximum area touches the mud. Mark a line with a chalk upto which the brick sinks in mud.
- Now place another brick on the first brick. Again mark a line with the chalk on the brick upto which it sinks.
- Repeat the procedure with the third brick.
- You will observe that with the increase in the number of bricks, the depression produced in the mud increases. From this activity, it implies that pressure increases with the increase in force. In the present case, it is the gravitational force.

**Conclusions :**

- (i) Pressure exerted by a solid increase with the decrease in area of cross-section,

$$i.e., P \propto \frac{1}{A}$$

- (ii) Pressure exerted by a solid increases with the increase in applied force (thrust),

$$i.e., P \propto F$$

**D. Experiment**

**Objective :** To find the buoyancy offered by various liquids.

**Materials required :**

A steel or a stiff plastic glass, 20 marbles of the same size and weight, a mm graph paper, cellotape, a pencil.

**Procedure :**

- Cut 1 cm wide strip from the mm graph paper, equal to the length of glass. Mark on the strip 0, 1, 2, 3 - - - - - 14, 15 in centimetres.

- By placing the zero end of the mm strip at the mouth of the glass, fix the mm strip along the length of glass with the help of cellotape.
- Take water in a bucket and try to float the glass in an upright position. You will notice that the glass does not float upright. Drop one marble in the glass gently. See, if the glass floats upright. If not, go on dropping marbles till it floats upright. At this moment read and record the length of the glass outside the water from the mm strip and the number of marbles added.
- Add one more marble. Read and record the length of glass and the number of marbles.
- Repeat the experiment at least 6 more times. Read and record the lengths in each case and the number of marbles.
- Empty the glass and try to float it in saturated salt solution. Add marbles, till it starts floating upright. Read and record the length of glass outside the salt solution and number of marbles added.
- Repeat the experiment at least 6 more times. Read and record the lengths in each case and total number of marbles.

	Water		Saturated Salt Solution	
	Number of marbles	Length outside water	Number of marbles	Length outside salt solution
1				
2				
3				
4				
5				
6				
7				

**Conclusions :**

- The glass initially does not float upright, because upthrust due to water or brine is more than the weight of glass.
- When the glass just starts floating upright, the weight of the glass acting in the downward

direction is equal to the weight of the fluid (water or salt solution) acting in the upward direction.

3. When more weight is added to the glass, it slips more in water or salt solution. From this it implies that with the immersion of more volume of the vessel in a fluid, the upthrust increases.
4. The upthrust offered by brine is more than that by water. From this it implies that more is the density of a fluid, more is the upthrust it produces.

### Science Quiz

1. Why does the empty glass not float upright in water?
2. How does the addition of marbles make the glass float in an upright position?
3. Why are more marbles required to make the glass float upright in the salt solution?
4. Why does the salt solution offer more upthrust than brine?

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