Hence proved.

EXERCISE–5(A)

1. What do you understand by the term upthrust of a fluid ? Describe an experiment to show its existence.
2. In what direction and at what point does the buoyant force on a body due to a liquid, act ?

   Ans. Upwards, at the centre of buoyancy.
3. What is meant by the term buoyancy ?
4. Define upthrust and state its S.I. unit.
5. What is the cause of upthrust ? At which point it can be considered to act ?
6. Why is a force needed to keep a block of wood inside water ?

   Ans. Upthrust due to water on block when fully submerged is more than its weight.
7. A piece of wood if left under water, comes to the surface. Explain the reason.
8. Describe an experiment to show that a body immersed in a liquid appears lighter than it really is.
9. Will a body weigh more in air or in vacuum when weighed with a spring balance ? Give a reason for your answer.

10. A metal solid cylinder tied to a thread is hanging from the hook of a spring balance. The cylinder is gradually immersed into water contained in a jar. What changes do you expect in the readings of spring balance ? Explain your answer.

11. A body dipped into a liquid experiences an upthrust. State *two* factors on which upthrust on the body depends.

12. How is the upthrust related to the volume of the body submerged in a liquid ?

Exercise 5(A)

Solution 1S.

When a body is partially or wholly immersed in a liquid, an upward force acts on it. This upward force is known as an **upthrust**.

Upthrust can be demonstrated by the following experiment:

Take an empty can and close its mouth with an airtight stopper. Put it in a tub filled with water. It floats with a large part of it above the surface of water and only a small part of it below the surface of water. Push the can into the water. You can feel an upward force and you find it difficult to push the can further into water. It is noticed that as the can is pushed more and more into the water, more and more force is needed to push the can further into water, until it is completely immersed. When the can is fully inside the water, a definite force is still needed to keep it at rest in that position. Again, if the can is released in this position, it is noticed that the can bounces back to the surface and starts floating again.

Solution 2S.

Buoyant force on a body due to a liquid acts upwards at the centre of buoyancy.

Solution 3S.

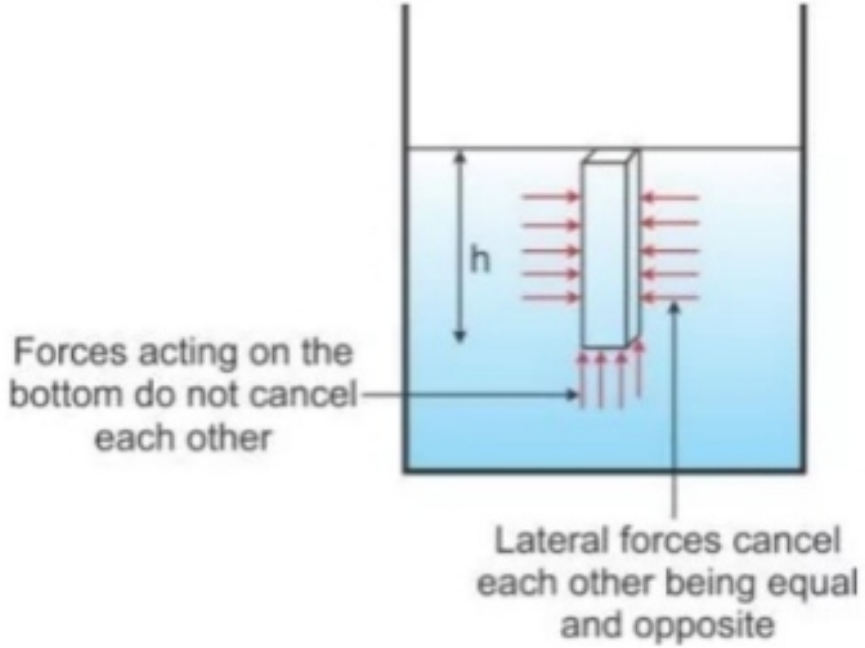
The property of a liquid to exert an upward force on a body immersed in it is called buoyancy.

Solution 4S.

The upward force exerted on a body by the fluid in which it is submerged is called the upthrust. Its S.I. unit is 'newton'.

Solution 5S.

A liquid contained in a vessel exerts pressure at all points and in all directions. The pressure at a point in a liquid is the same in all directions – upwards, downwards and sideways. It increases with the depth inside the liquid.



When a body is immersed in a liquid, the thrusts acting on the side walls of the body are neutralized as they are equal in magnitude and opposite in direction. However, the magnitudes of pressure on the upper and lower faces are not equal. The difference in pressure on the upper and lower faces cause a net upward force (= pressure x area) or upthrust on the body.
It acts at the centre of buoyancy.

Solution 6S.

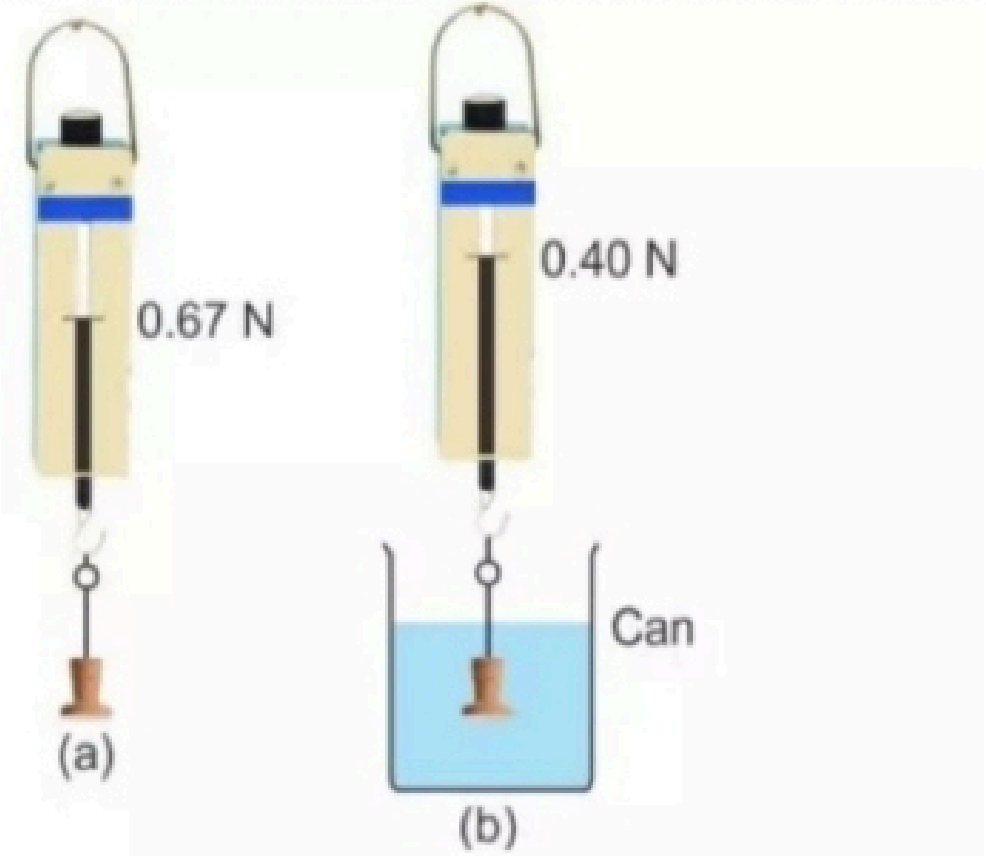
Upthrust due to water on block when fully submerged is more than its weight. Density of water is more than the density of cork; hence, upthrust due to water on the block of cork when fully submerged in water is more than its weight.

Solution 7S.

A piece of wood if left under water comes to the surface of water because the upthrust on body due to its submerged part is equal to its own weight.

Solution 8S

Experiment to show that a body immersed in a liquid appears lighter:



Take a solid body and suspend it by a thin thread from the hook of a spring balance as shown in the above figure (a). Note its weight. Above figure (a) shows the weight as 0.67 N.

Then, take a can filled with water. Immerse the solid gently into the water while hanging from the hook of the spring balance as shown in figure (b). Note its weight. Above figure (b) shows the weight as 0.40 N.

The reading in this case (b) shall be less than the reading in the case (a), which proves that a body immersed in a liquid appears to be lighter.

Solution 9S.

The readings in the spring balance decreases.
As the cylinder is immersed in the jar of water, an upward force acts on it, which is in opposition to the weight component of the cylinder. Hence the cylinder appears to be lighter.

Solution 10S.

A body shall weigh more in vacuum because in vacuum, i.e. in absence of air, no upthrust will act on the body.

Solution 11S.

Upthrust on a body depends on the following factors:

1. Volume of the body submerged in the liquid or fluid.
2. Density of liquid or fluid in which the body is submerged.

Solution 12S.

Larger the volume of body submerged in liquid, greater is the upthrust acting on it.