1. What do you understand by atmospheric pressure ?
2. Write the numerical value of the atmospheric pressure on the surface of the earth in pascal.

Ans. $1{\cdot}013 \times 10^5$ pascal

3. What physical quantity is measured in torr ? How is it related to the S.I. unit of the quantity ?

Ans. Atmospheric pressure, 1 torr = 133·28 Pa

4. Name the physical quantity which is expressed in the unit 'atm'. State its value in pascal.
5. We do not feel uneasy even under the enormous pressure of atmosphere above as well as around us. Give a reason.
6. Describe an experiment to demonstrate that air exerts pressure.
7. Explain the following :
   (i) A balloon collapses when air is removed from it.
   (ii) Water does not run out of a dropper unless its rubber bulb is pressed.
   (iii) Two holes are made in a completely filled sealed tin can to take out oil from it.
8. Why does the liquid rise in a syringe when its piston is pulled up ?
9. How is water drawn up from a well by a water pump?
10. A partially inflated balloon is placed inside a bell jar connected to a vacuum pump. On creating vacuum

inside the bell jar, balloon gets more inflated. How does the pressure change : increase, decrease or remains same, inside the (a) bell jar and (b) balloon ?

Ans. (a) decrease, (b) decrease

11. What is the purpose of a barometer ?

Ans. To measure the atmospheric pressure

12. What is a barometer ? How is a simple barometer constructed ?

13. Explain how is the height of mercury column in the tube of a simple barometer, a measure of the atmospheric pressure.

14. Illustrate with the help of a labelled diagram of a simple barometer that the atmospheric pressure at a place is 76 cm of Hg.

15. Why is the barometric height used as a unit to express the atmosphric pressure ?

Solution 1S.

The thrust exerted per unit area of the earth surface due to column of air, is called the atmospheric pressure on the earth surface.

Solution 2S.

1.013×10^5 pascal

Solution 3S.

Atmospheric pressure is measured in 'torr'.
1 torr = 1 mm of Hg.

Solution 4S.

At normal temperature and pressure, the barometric height is 0.76 m of Hg at sea level which is taken as one atmosphere.
1 atmosphere = 0.76 m of Hg = 1.013×10^5 pascal

Solution 5S.

We do not feel uneasy under enormous pressure of the atmosphere above as well as around us because of the pressure of our blood, known as blood pressure, is slightly more than the atmospheric pressure. Thus, our blood pressure balances the atmospheric pressure.

Solution 6S.

Experiment to demonstrate that air exerts pressure:

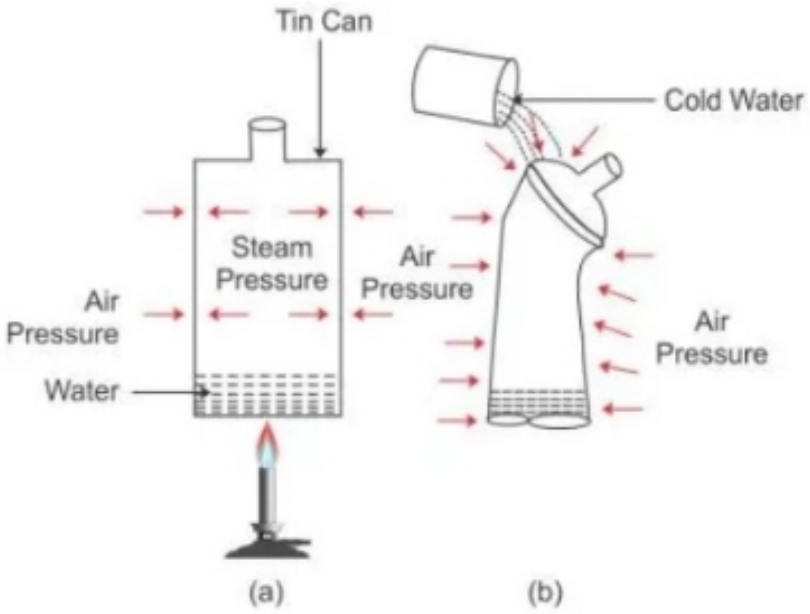
Take a thin can fitted with an airtight stopper. The stopper is removed and a small quantity of water is boiled in the can. Gradually the steam occupies the entire space of can by expelling the air from it [Fig (a)]. Then stopper is then tightly replaced and

simultaneously the flame beneath the can is removed. Cold water is then poured over the can.

It is observed that the can collapses inwards as shown in fig (b).

The reason is that the pressure due to steam inside the can is same as the air pressure outside the can [Fig (a)]. However, on pouring cold water over the can, fitted with a stopper [fig (b)], the steam inside the can condenses producing water and water vapour at very low pressure. Thus, the air pressure outside the can becomes more than the vapour pressure inside the closed can.

Consequently, the excess atmospheric pressure outside the can causes it to collapse inwards.



Solution 7S.

(i) When air is removed from the balloon, the pressure inside the balloon (which was due to air in it) is much less than the atmospheric pressure outside and hence the balloon collapses.

(ii) Water is held inside the dropper against the atmospheric pressure because the pressure due to height column of liquid inside the dropper is less than the atmospheric pressure. By pressing the dropper we increase the pressure inside the dropper and when it becomes greater than the atmospheric pressure the liquid comes out of the dropper.

(iii) There is no air inside a completely filled and sealed can. When a single hole is made to drain out the oil from the can, some of the oil will come out and due to that the volume of air above the oil will increase and hence the pressure of air will decrease. But if two holes are made on the top cover of the can, air outside the can will enter it through one hole and exert atmospheric pressure on the oil from inside along with the pressure due to oil column, and it will come out of the can from the other hole.

Solution 8S

When syringe is kept with its opening just inside a liquid and its plunger is pulled up in the barrel, the pressure of air inside the barrel below the plunger becomes much less than the atmospheric pressure acting on the liquid. As a result, the atmospheric pressure forces the liquid to rise up in the syringe.

Solution 9S.

In a water pump, on pulling the piston up, the pressure of air inside the siphon decreases and the atmospheric pressure on the water outside increases. As a result, the atmospheric pressure pushes the water up in pump.

Solution 10S.

(a) Pressure increases inside the bell jar.
(b) Pressure decreases inside the balloon.

Solution 11S.

A barometer is used to measure atmospheric pressure.

Solution 12S.

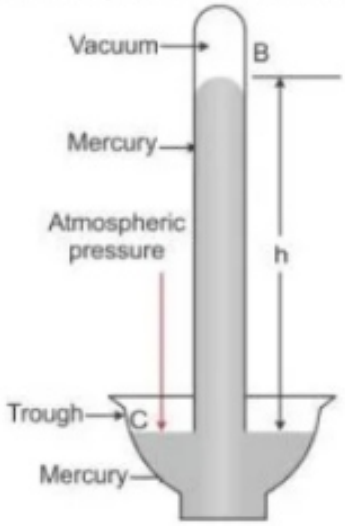
A barometer is an instrument which is used to measure the atmospheric pressure.

Construction of a simple barometer:

A simple mercury barometer can be made with a clear, dry, thick-walled glass tube about 1 metre ling. The glass tube is sealed at one end and is filled with mercury completely. While filling the tube with mercury care has to be taken so that there are no air bubbles present in the mercury column. Close the open end with thumb and turn the tube upside down carefully over a trough containing mercury. Dip the open end under the mercury level in the trough and remove the thumb.

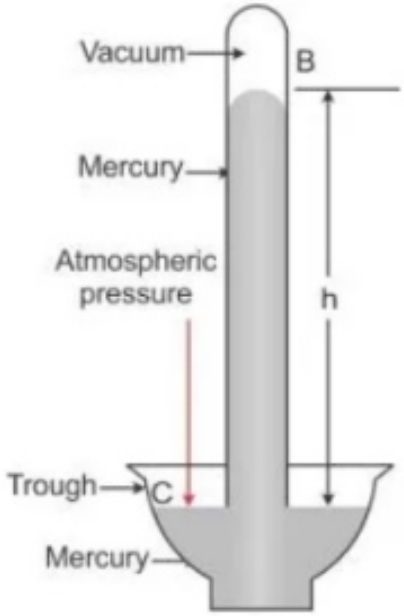
The mercury level in the tube falls until it is about 76 cm (h =760 mm) vertically above the mercury level. It is the atmospheric pressure acting on the surface of the mercury in the trough that supports the vertical mercury column. The empty space above the

mercury column is called the 'Torricellian vacuum'.

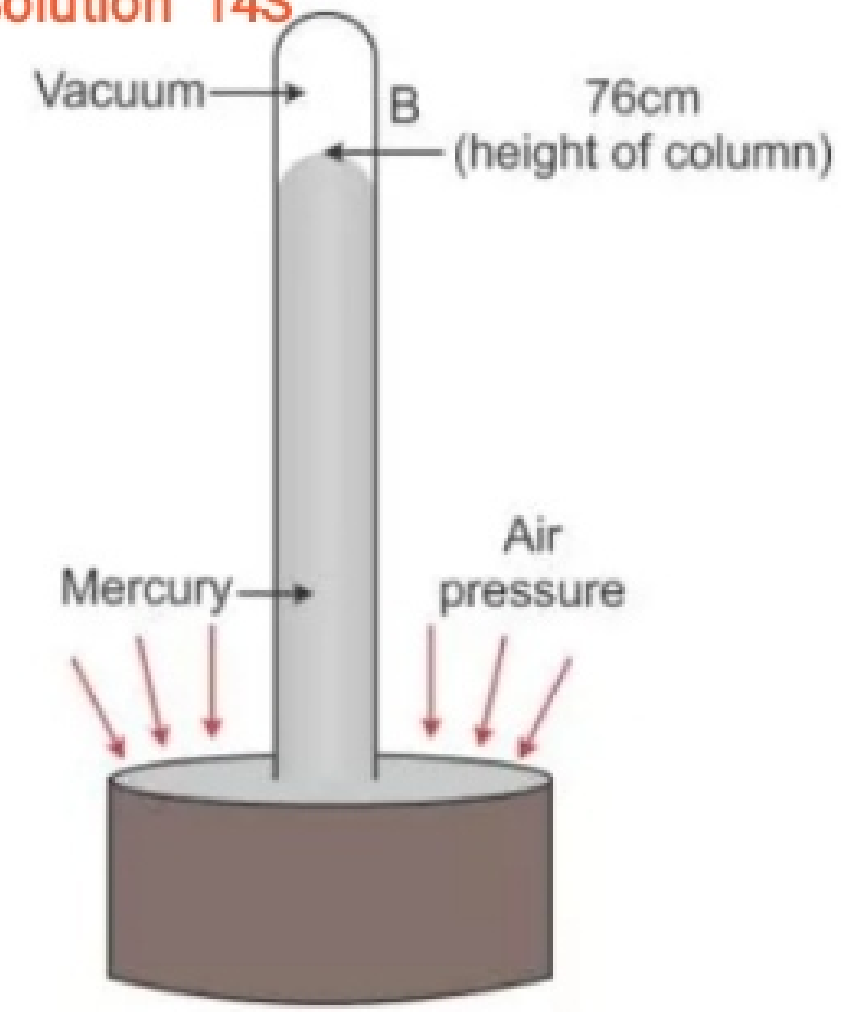


Solution 13S.

In given figure, at all points such as C on the surface of mercury in trough, only the atmospheric pressure acts. When the mercury level in the tube becomes stationary, the pressure inside tube at the point A, which is at the level of point C, must be same as that at the point C. The pressure at point A is due to the weight (or thrust) of the mercury column AB above it. Thus, the vertical height of the mercury column from the mercury surface in trough to the level in tube is a measure of the atmospheric pressure.
The vertical of the mercury column in it (i.e., AB = h) is called the barometric height.
Had the pressure at points A and C be not equal, the level of mercury in the tube would not have been stationary.



Solution 14S



Solution 15S.

It is the atmospheric pressure acting on the surface of the mercury in the trough that supports the vertical mercury column. Hence, barometric height is used as unit to express the atmospheric pressure.