RADIANT 2026

Physics

Pressure in Fluid and Atmospheric Pressure

Lecture - 04

By - Akash Shravan Sir

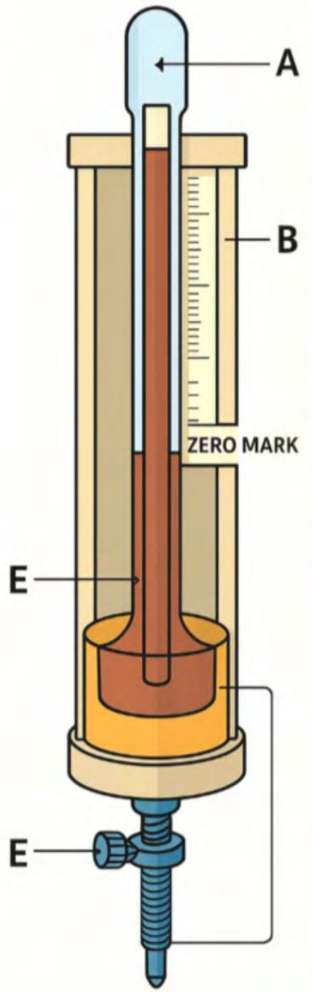
Topics *to be covered*

1. Thrust and Pressure
2. Units of Pressure
3. Pressure in Fluids

4) Practice question


AKASH SIR
JOIN MY OFFICAL
TELEGRAM CHANNEL
@AKASHKETAARE
JOIN NOW
hysics Wallah

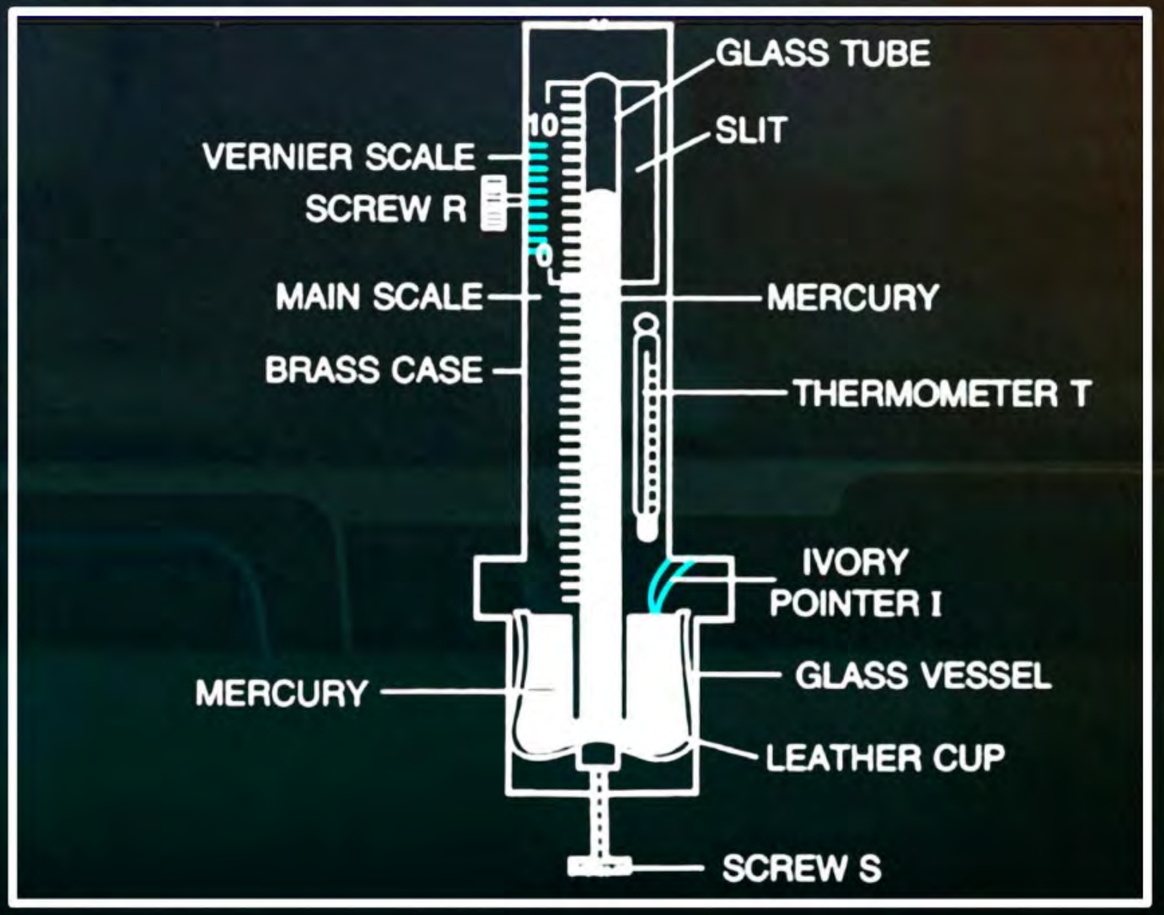
FORTIN BAROMETER



- **A** Closed at upper end
- **B** Mercury column
- **C** Leather bag or reservoir
- **D** Mercury cistern
- **E** Adjusting screw
- **F** Zero mark at mercury level
- **G** Scale for measuring pressure

Fortin barometer

- The Fortin barometer is a modified form of a simple barometer.
- It is used in laboratory to measure the atmospheric pressure.
- It also uses mercury as the barometric liquid.



Construction

- The Fortin barometer shown in Fig.
- consists of a narrow glass tube of length about 85 cm to 90 cm. This tube is closed at one end and has a opening at the other end.
- It is completely filled with pure mercury and is kept inverted in a glass vessel having a leather cup at the bottom.
- The cup contains mercury and behaves like a trough.

- The open end of tube is dipped into mercury of the cup.
- The glass tube is protected by enclosing it in a brass case. At the bottom of the brass case, there is a screw S, the end of which supports the leather cup of the glass vessel. The leather cup can be raised up or lowered down with the help of the screw S to adjust the mercury level in the glass vessel.
- mercury level in the glass vessel is adjusted to coincide with the zero mark of the main scale graduated in mm attached with the brass tube. The zero mark of the fixed scale is at the tip of an ivory pointer I which is distinctly visible from outside.
- The upper part of the brass tube has a slit in it so as to note the mercury level in the glass tube. For accurate measurement, a vernier scale is provided which slides over the main scale by using the screw R. A thermometer T is also mounted on the case which records the room temperature.

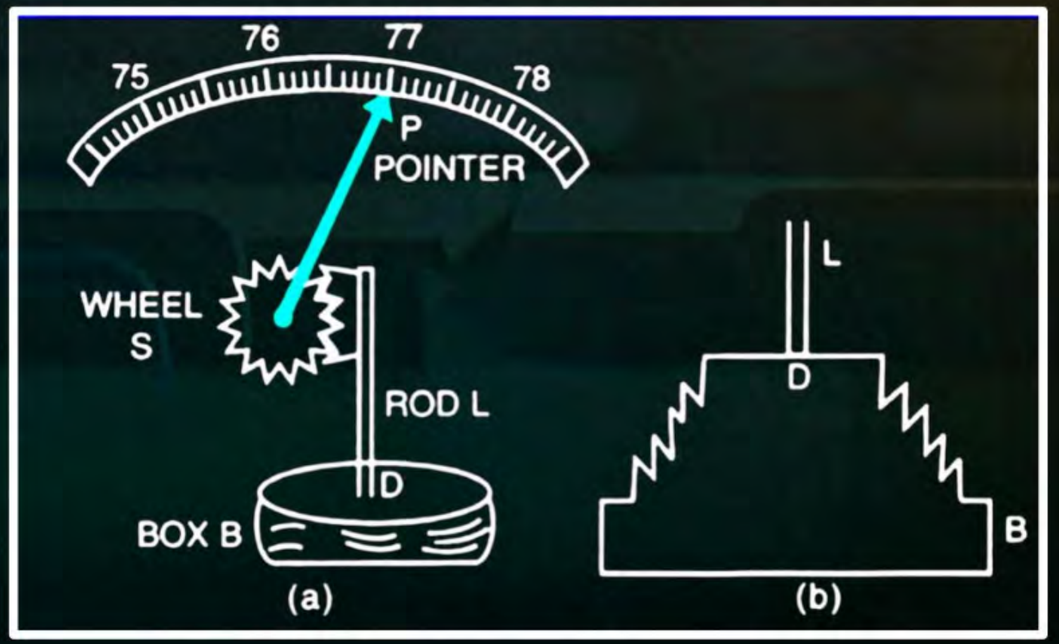
Aneroid barometer

- This barometer has no liquid. It is light and portable and therefore, it can easily be carried from one place to another.
- It is calibrated to read directly the atmospheric pressure. It needs no prior adjustment like Fortin barometer


760
770
750
780
740
790
730
800
720
1010
1020
1030
1040
1050
1060
1070
1000
990
980
970
960
hPa
Barometer
mmHg

Construction

Fig. (a) shows the main parts of an aneroid barometer. It consists of a metallic box B which is partially evacuated. The top D of box is springy and is corrugated in form of a diaphragm as shown in Fig.



At the middle of diaphragm, there is a thin rod toothed at its upper end. The teeth of rod fit well into the teeth of a wheel S attached with a pointer P which can slide over a circular scale. The circular scale is graduated and is initially calibrated with a standard barometer so as to read the atmospheric pressure directly in terms of the barometric height.

Working

When atmospheric pressure increases, it presses the diaphragm D and the rod L gets depressed. The wheel S rotates clockwise and pointer P moves to the right on the circular scale. On the other hand, when atmospheric pressure decreases, the diaphragm D bulges out due to which the rod L moves up and the wheel S rotates anti-clockwise. Consequently, the pointer moves to the left.

USES OF A BARMETER

A barometer is used for the following three purposes:

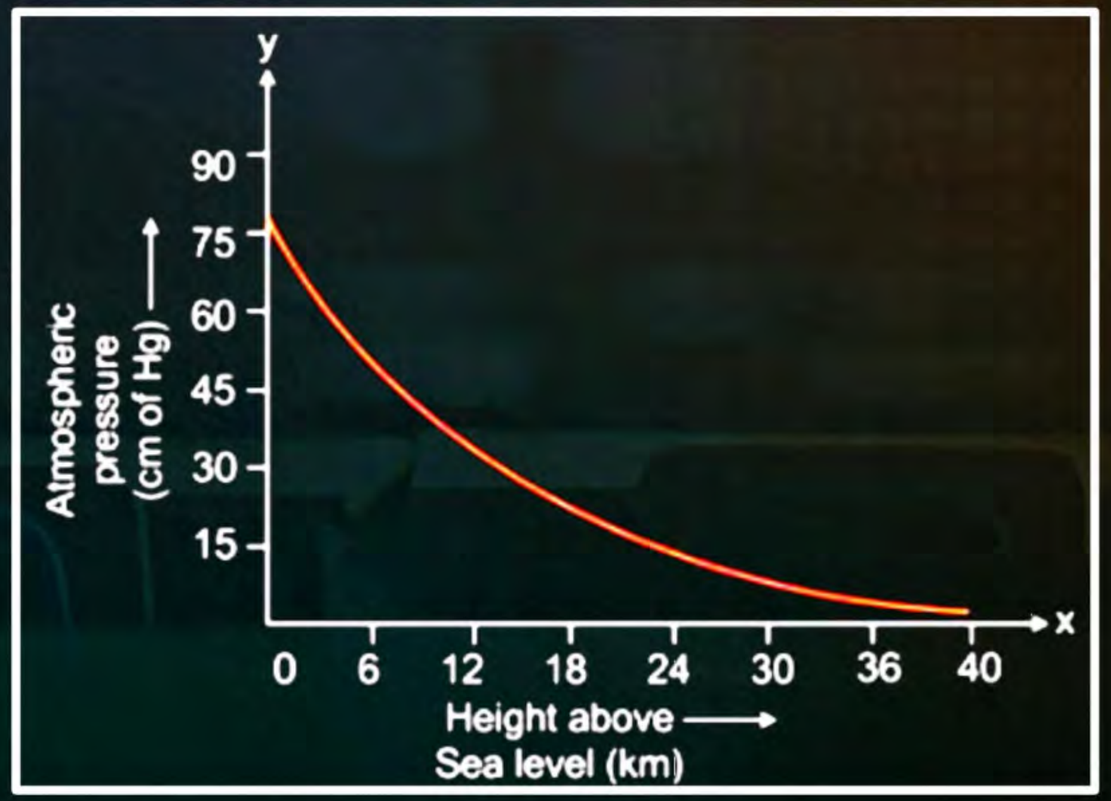
1. To measure the atmospheric pressure at a place.
2. For weather forecasting.
3. As an altimeter to measure the height.

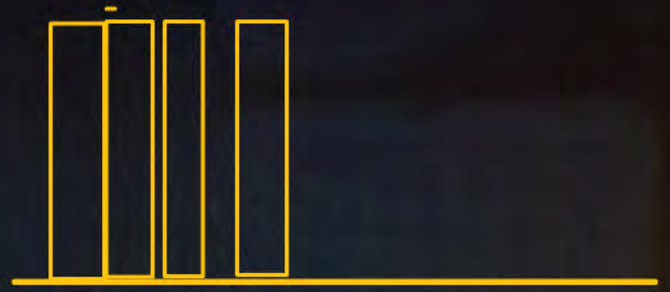
VARIATION OF ATMOSPHERIC PRESSURE WITH ALTITUDE

The atmospheric pressure decreases with altitude mainly due to the following two factors:

i. decrease in height of air column which causes a linear decrease in the atmospheric pressure,

ii. decrease in density of air which causes a non-linear* decrease in atmospheric pressure.





(i)

The atmosphere can be considered to consist of a number of parallel air layers. Each layer experiences a pressure on it due to the thrust (or weight) of the air column above it. Therefore, as we go up, the height of air column above us decreases and so thrust exerted by the air column also decreases, which results in the decrease of atmospheric pressure with increase in altitude.

(ii)

Since the lower air layers get compressed due to the weight (or thrust) of the upper layers, therefore, the density of air layers is more near the earth surface and it decreases as we go higher and higher. The decrease in density with altitude is not linear. It is rapid at low altitude (near the sea level) and is slow at higher altitude. Due to decrease in density of air with altitude, the atmospheric pressure also decreases with altitude in a non-linear way.

shows the variation of atmospheric pressure with height above the sea level. At Mount Everest, the atmospheric pressure is only 30% of the atmospheric pressure at sea level.

Consequences

(1) At high altitudes, since the atmospheric pressure is less, breathing becomes difficult and nose bleeding may occur due to excess of pressure of blood over the atmospheric pressure. Therefore blood pressure patients are not advised to go to hill stations or higher altitudes.

(2) At high altitude, a fountain pen leaks. The reason is that the fountain pen filled with ink contains some air at a pressure equal to the atmospheric pressure on the earth surface. When pen is taken to an altitude, atmospheric pressure at attitude is low so the excess pressure inside the rubber tube forces the ink to leak out.

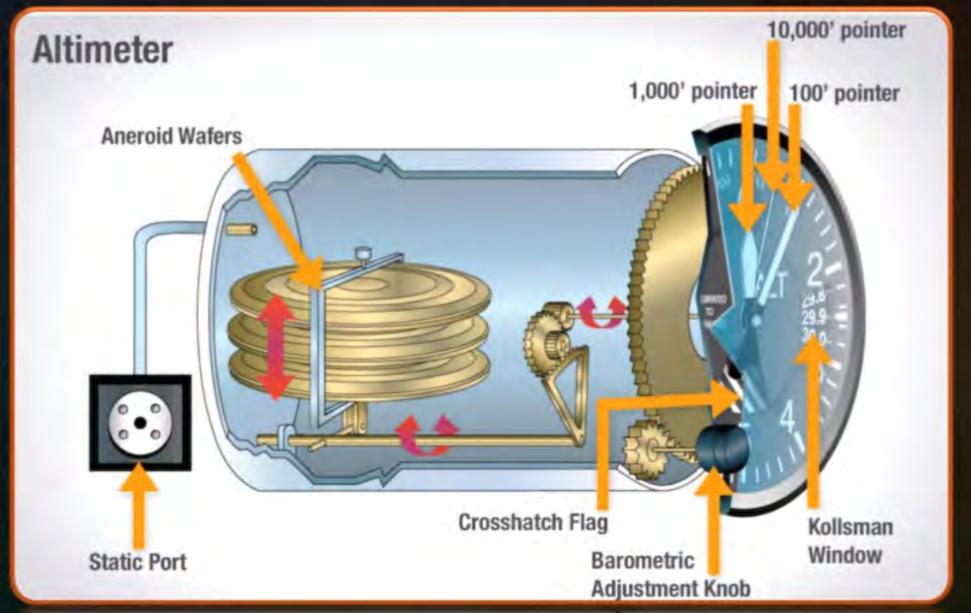
WEATHER FORECAST BY THE USE OF BAROMETER

- The atmospheric pressure at a place is affected by the change in temperature and the amount of water vapours present in air at that place. The reason is that the density of air changes with the change in temperature and with the change of water vapours present in it.
- The density of air decreases with the increase in temperature and also with the increase in the amount of moisture present in it (i.e., the density of moist or humid air is less than the density of dry air).
- Consequently, the atmospheric pressure (or the barometric height) gradually decreases as the temperature or the presence of moisture increases. Thus, the change in the atmospheric pressure helps us to know about the weather in advance. By seeing the barometric height, the weather forecast can be made as follows:

- If the barometric height at a place suddenly falls, it means that the pressure at that place has suddenly decreased which indicates the coming of a storm or cyclone.
- If the barometric height gradually falls, it indicates that the moisture is increasing i.e., there is a possibility of rain.
- A gradual increase in the barometric height means that the moisture in air is decreasing. This indicates the coming of a dry weather.
- A sudden rise in the barometric height means the flow of air from that place to other surrounding low pressure areas. This indicates the coming of an extremely dry weather.
- If there is no abrupt change in barometric height, it indicates that the atmospheric pressure is normal i.e., the weather will remain unchanged.

ALTIMETER

An altimeter is an aneroid barometer, but it is used in aircraft to measure its altitude.



Since atmospheric pressure decreases with the increase in height above the sea level, therefore a barometer which measures the atmospheric pressure, can be used to determine the altitude of a place above the sea level. Its scale is calibrated in terms of height of ascent with height increasing towards left because the atmospheric pressure decreases with increase of height above the sea level.

A → 10%.

B → 20%.

C → 30%.

D → 40%.

Question

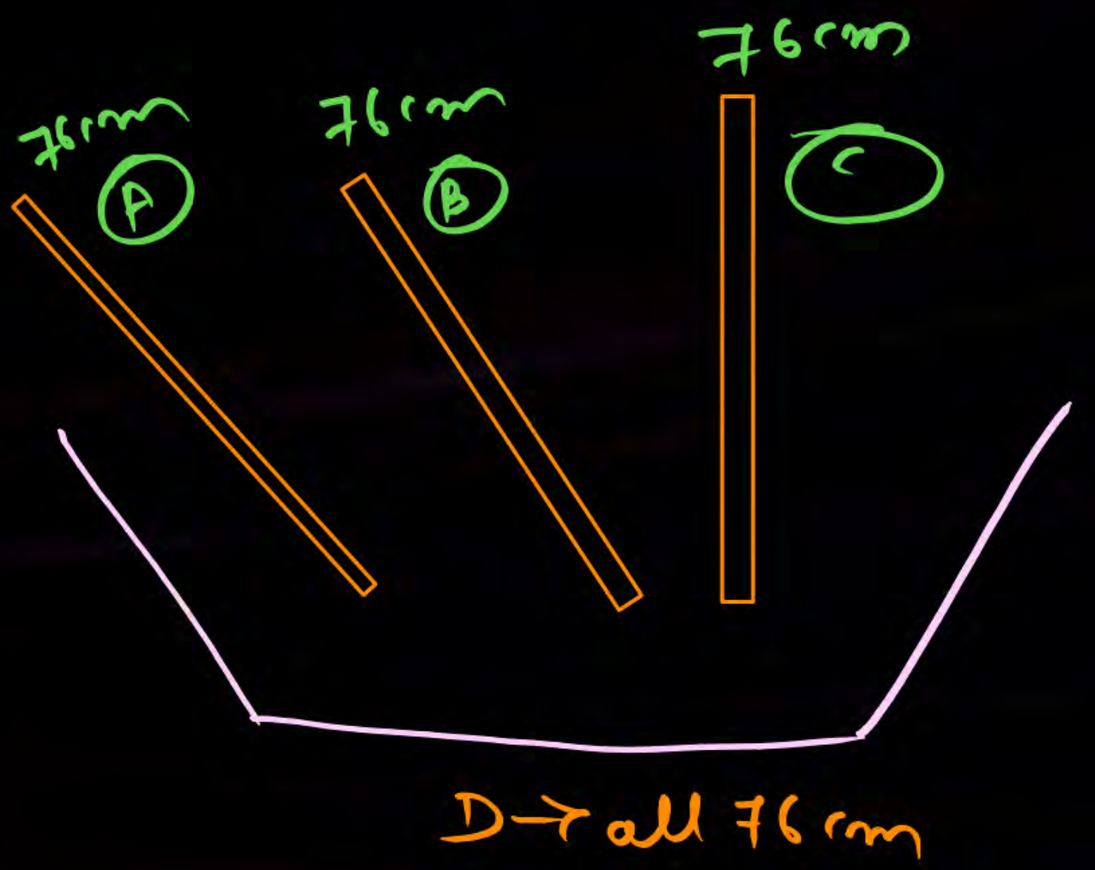
The normal atmospheric pressure is:

A. 76 m of Hg

B. 76 cm of Hg

C. 76 Pa

D. 76 N m^{-2}


76 cm
A
76 cm
B
76 cm
C
D → all 76 cm

93%

A → Ag

B → Og

C → Hg

D → Mg

Question

The atmospheric pressure at earth surface is P_1 and inside mine is P_2. They are related as:

$P_2 > P_1$

$P_1 < P_2$

A $P_1 = P_2$

B $P_1 > P_2$

C $P_1 < P_2$

D $P_2 = 0$


Thank You