BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

SUBJECT:-PHYSICS CLASS- 8

CHAPTER:-Force and Pressure

TOPIC :Atmospheric Pressure

GUIDELINES

Dear Students

- The lesson is based on only one topic- Atmospheric Pressure.
- Solve the assignment in Physics notebook
- Suitable video links have been provided to help you understand the concepts.
- Do read the NCERT textbook for better understanding of these concepts.
- Link to the chapter in the NCERT textbook is: ncert.nic.in/textbook/textbook.htm?hesc1=11-18S
  (Page no 140,141 and 142)

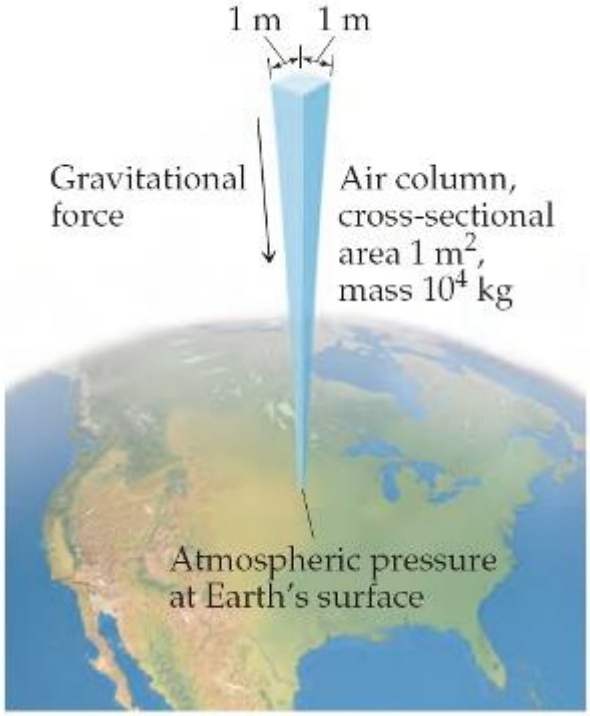
Important YouTube video links are:

https://www.youtube.com/watch?v=KndNN28OcEI&feature=youtu.be
https://www.youtube.com/watch?v=xJHJsA7bYGc&feature=youtu.be
https://www.youtube.com/watch?v=L2WDF1lu5Oc&feature=youtu.be

SUBTOPICS: ATMOSPHERIC PRESSURE

LET US TRY TO UNDERSTAND ATMOSPHERIC PRESSURE AND ITS APPLICATIONS.

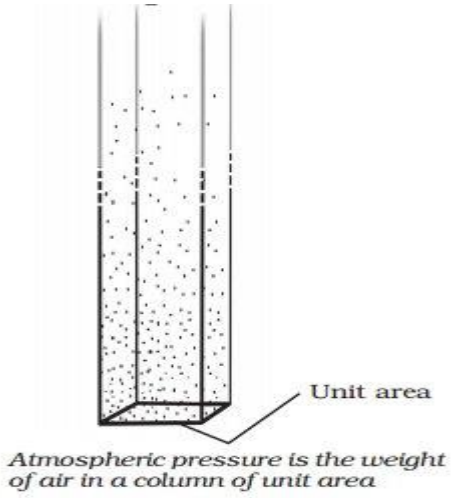
Pressure is also exerted by atmosphere around us. The atmospheric air extends up to many kilometers above the surface of the earth. The pressure exerted by this air is known as atmospheric pressure. Our earth is surrounded by a layer of air called the atmosphere. We live at the bottom of this layer. The air above presses down on us with a force equal to that exerted by a mass of 1kg on every square centimeter. For example, the area of the palm of your hand is about 100 square centimeters, thus a force equal to that exerted by a mass of about 100kg acts on your palm due to the atmospheric pressure. Hence you cannot feel it as equal force is acting from within your hand, which balances the force due to the atmospheric pressure and cancels its effects.

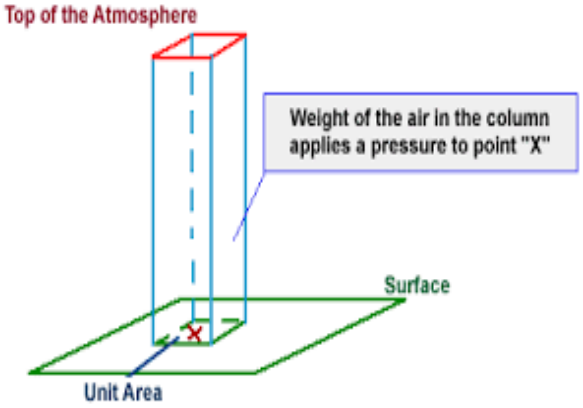


Also, pressure is force per unit area.

If we imagine a unit area and a very long cylinder standing on it filled with air, then the weight of the air in this cylinder is the atmospheric pressure.

The weight of air on a column of unit area is atmospheric pressure.





It is important to note the following:

- **Atmospheric pressure is measured by a barometer.**
- **Atmospheric pressure at the sea level is 1.013×10^{5}.**
- **$1 \text{ atm} = 1.01 \times 10^{5}$ Pascal.**
- **Atmospheric pressure varies with the variation in height, season, temperature etc.**
- **The standard atmosphere is a unit of pressure defined as 1.01325Pa which is equivalent to 760mm of Mercury.**
- **1atm= 760torr.**
- **Atmospheric pressure is expressed in several different systems of units: millimeters (or inches) of Mercury, pounds per square inch (psi), Dynes per square centimeter, millibars (mb) ,standard atmospheres ,or kilopascals.**

The pressure of the air outside your body is balanced by the pressure of the fluids inside. Therefore, we do not feel the pressure exerted on us by atmosphere as it is compensated by the pressure exerted by our body. Also the weight of air in a column of the height of atmosphere and area 15cm x 15cm is nearly equal to the weight of an object of mass 225kg (2250N).Thus we are not crushed under this weight, as the pressure inside our bodies is also equal to the atmospheric pressure and cancels the pressure from outside.

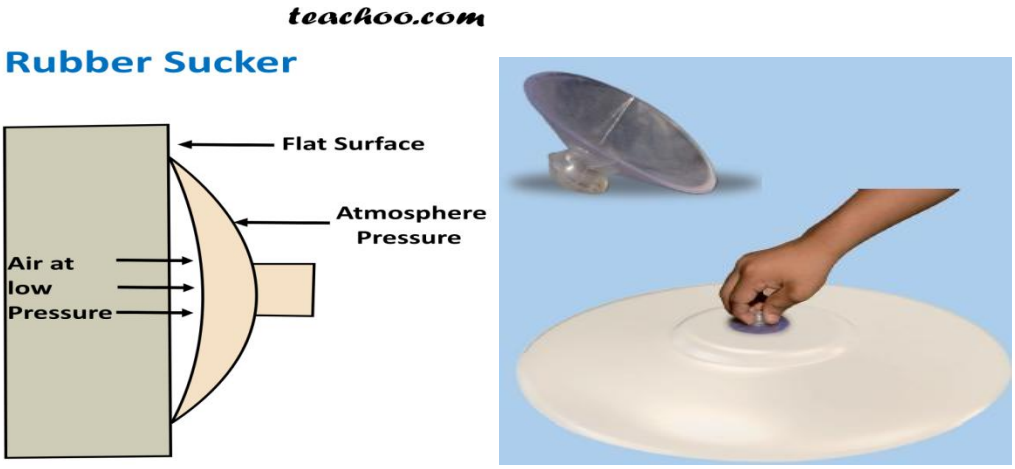
Our body has an internal blood pressure which is more or less equal to the atmospheric pressure in our surroundings. Thus the two pressures cancel each other and that is how our body balances with atmospheric pressure.

Let us perform an activity to get an idea about the magnitude of atmospheric pressure.

ACTIVITY

Step1. Take a rubber sucker. It looks like a small rubber cup.
Step2. Press it hard on a smooth plane surface.
Step3 When we press the sucker we find that most of the air between its cup and the surface escapes out.
The rubber sucker sticks to the surface because the pressure of atmosphere acts on it. Also to pull the sucker off the surface, the applied force should be large enough to overcome the atmospheric pressure.

This activity gives us an idea about the magnitude of atmospheric pressure. If there were no air at all between the sucker and the surface then it would not be possible for any human being to pull the sucker off the surface.

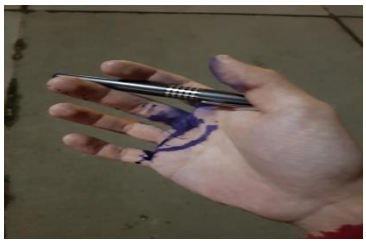


DO YOU KNOW?

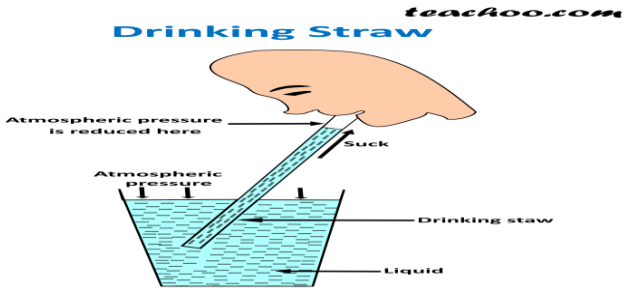
The sudden fall in atmospheric pressure produces the possibility of storm.

Applications of atmospheric pressure

1. **Fountain pens leak on higher altitudes** as the atmospheric pressure is less. Due to this, the air within the tube of the fountain pen exerts pressure and forces the ink out.

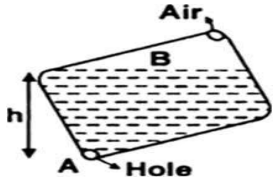


2. **Sucking up a drink with the help of a straw** is also based on atmospheric pressure. When we suck the air, the pressure inside the straw falls. The atmospheric pressure acting on the drink forces it to rise in the straw.

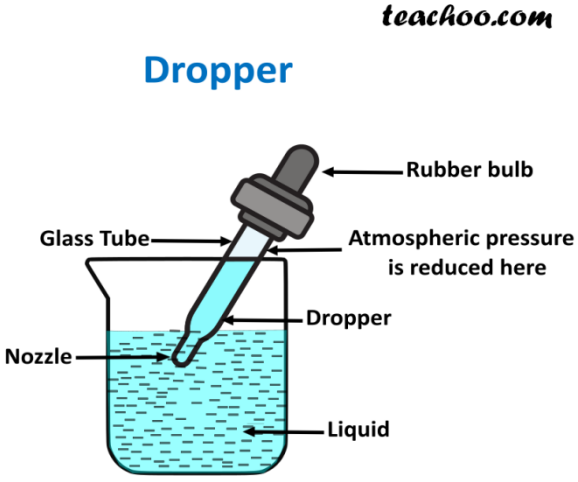


3. **Astronauts wear special suit in space.** This is because there is no atmospheric pressure in space. But the internal pressure of blood is very high. Due to this pressure difference the blood vessels will burst. So, they wear special space suits.

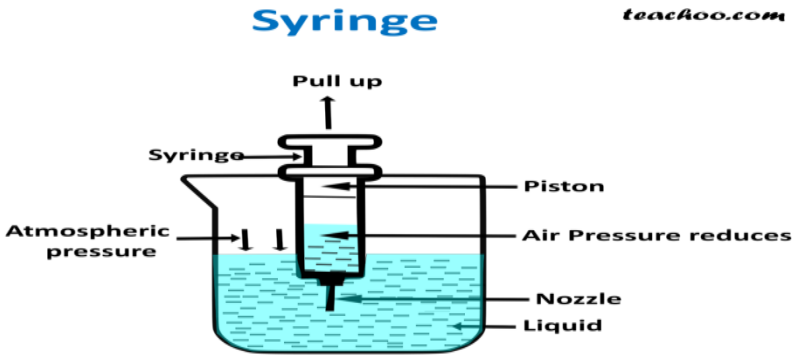
4.Two holes are made in a sealed oil can. Through one hole the atmospheric pressure acts and forces the oil to come out from the other hole.



5. When you squeeze the rubber bulb on the **dropper,** you squeeze the **air** out. Then when you put the tip into the liquid and stop squeezing the top, the low **pressure** inside sucks up the liquid. In fact, it is the higher **pressure** outside the **dropper**, in the liquid, that pushes the liquid up into the **dropper**



6. The **syringe** works on the existence of **atmospheric pressure**. When the nozzle of a **syringe** is dipped into a liquid, and its piston is withdrawn, the **pressure** inside the **syringe** becomes low. The greater **atmospheric pressure** acting on the surface of the liquid pushes the liquid up into the **syringe**.



The following activity will help you understand how strong atmospheric pressure is.

Step 1 Take a tin can or a plastic bottle.
Step2 Put some boiling water into it. The steam coming out of the water will expel most of the air in the bottle.
Step3 After a few minutes, screw the cap tightly onto the bottle and put the bottle into a tub and pour some cold water mixed with ice on it.
Step4 As the bottle cools down, and the steam condenses, you will observe that the bottle gets crushed.

Conclusion: As the steam had expelled most of the air in the bottle, and steam inside the bottle is condensed, there is very little air inside it. The atmospheric pressure acting on the bottle from outside is, therefore, much larger than the pressure exerted by the air inside it. Since the bottle gets crushed from all sides it shows that the atmospheric pressure, like the pressure exerted by liquids, acts equally in all directions.

Similarly, when soda can is placed upside down in a bowl of cold water, the cold water causes the gas to cool and condense into liquid. Thus, decreasing the pressure inside the can. The air pressure outside the can is much greater than the pressure inside the can hence it pushes the can inwards.

Watch the following video clips (by clicking on the links given below) to understand atmospheric pressure in oil tanks.

https://youtu.be/j0TQxYemrgg

https://youtu.be/DllULl2LdTg

PLEASE NOTE :

- The atmospheric pressure is maximum at sea level. As we go to higher altitudes, the air becomes thinner and the atmospheric pressure decreases.
- At the height at which a jet plane flies, the air pressure is very low. At such low pressure, we can have problems like nose bleeding because the pressure exerted by the blood in our body will be much higher than the pressure outside. This can cause blood vessels to burst. That is why the pressure inside an aero plane is maintained at the normal ground level atmospheric pressure.

LOOKING AT THESE PICTURES WE CAN ALSO SAY THAT APART FROM ABOVE APPLICATIONS, ATMOSPHERIC PRESSURE FINDS ITS USE IN MANY OTHER WAYS (AS DEPICTED IN THE FLOW CHART).

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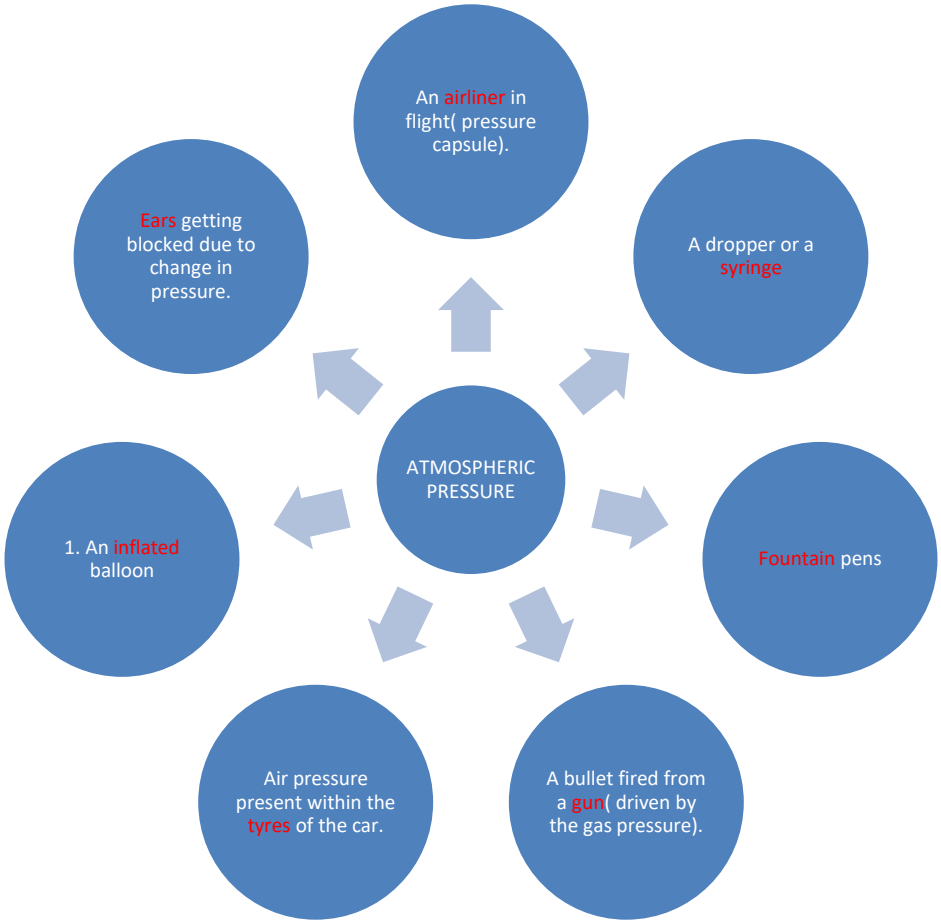

Look how much we could interpret about the atmospheric pressure and its applications in day to day life !

Now solve the following questions based on atmospheric pressure.

ASSIGNMENT 7

Q1.a)What is meant by atmospheric pressure? What is the cause of atmospheric pressure?

b) Why are our bodies not crushed by the large pressure exerted by the atmosphere?

c) Explain why atmospheric pressure decreases as we go higher up above the earth's surface.

Q2. What is a rubber sucker? How does it work? State any one use of a rubber sucker.

Q3. Why do mountaineers usually suffer from nose-bleeding at high altitude?

Q4. Describe one activity to show the existence of atmospheric pressure.

Q5. Why it is necessary for astronauts to wear pressurized suits?

STAY HOME STAY SAFE

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