3. Atmospheric Pressure

Exercises

1 A. Question

Answer the following question.

Why do knives and blades have sharp edges?

Answer

As we know that $\text{Pressure} = \frac{\text{force}}{\text{area}}$;

Hence, we can see from above formula that pressure depends on the surface area ($\text{Presssure} \propto \frac{1}{\text{surface area}}$) that means,

The less is the surface area, the greater is the pressure produced. Hence knives and blades have sharp edges because sharp edges have less surface area due to which we can get more pressure and object can be cut easily with less force.

1 B. Question

Answer the following question.

Why are ski-boards that are used to glide over snow long and broad?

Answer

We know that pressure depends on the surface area ($\text{Presssure} \propto \frac{1}{\text{surface area}}$).The large is the surface area less is the pressure produced. Therefore the ski-boards are long and broad to increase the surface area, which reduces the pressure on snow and we will not sink in snow.

1 C. Question

Answer the following question.

Why does ink not spill out of an ink dropper?

Answer

Ink enters the dropper till the pressure of the air inside the dropper becomes equal to the atmospheric pressure outside acting on the ink in the bottle. It is because the two pressures (atmospheric pressure, Pressure of air in the dropper) are equal the ink does not spill out unless the bulb is pressed, because on pressing the bulb the pressure inside the dropper becomes more than atmospheric pressure thus the two pressures are not equal.

2. Question

Fill in the blanks.

(a) The unit of pressure is _____.

(b) Ink rises into the ink dropper because of the _____ pressure acting on the surface of the ink in the bottle.

(c) When the piston of a pump is pulled up, the pressure inside _____.

(d) The air pressure inside our body is equal to the _____ .

Answer

(a) The unit of pressure is N\m^2(Newton Per meter square).

Since Standard (S.I) unit of force is Newton(N) and of area is meter square(m^2) .And As we know that $\text{Pressure} = \frac{\text{force(N)}}{\text{area(m}^2\text{)}}$

Hence Standard (S.I) unit of pressure is N/m^2 (Newton per meter square).

(b) Ink rises into the ink dropper because of the atmospheric pressure acting on the surface of the ink in the bottle.

On pressing the bulb of the dropper the air inside the dropper is pushed out of the hole in the dropper. This makes the pressure of the air in the bulb less than the atmospheric pressure. Hence to make the pressure inside the bulb equal to the atmospheric pressure outside, the ink rises in the dropper.

(c) When the piston of a pump is pulled up, the pressure inside Decreases.

When the piston of the pump is pulled up all the air inside the pump is pushed outside through the narrow tube, this reduces the pressure inside the piston. Due to this reduced pressure only the water comes inside the pump so that pressure inside the pump becomes equal to the atmospheric pressure outside.

(d) The air pressure inside our body is equal to the Atmospheric pressure.

The atmosphere exerts a pressure called as the atmospheric pressure. We do not get crushed by the pressure because the atmospheric pressure inside our body is equal to the atmospheric pressure outside.

3. Question

Match the following.

'A'	'B'
(a) Fluid substances	1. Greater pressure
(b) Sprinkle irrigation	2. Equal pressure in all directions.
(c) Blunt weapon	3. Pressure on water
(d) Sharp weapon	4. Less pressure

Answer

'A'	'B'	Explanation
(a) Fluid substances	2. Equal pressure in all directions.	Exerting equal pressure in all directions is the important property of the fluids. Because of this property only they have uniform shapes
(b) Sprinkle irrigation	3. Pressure on water	In sprinkle irrigation the huge amount of water is pumped through small pores. Since these pores have small area hence water comes with great pressure outside due to which it reaches to a larger area. Below is the image of the sprinkle irrigation
(c) Blunt weapon	4. Less pressure	Blunt weapon has large surface area hence it exerts less pressure because Pressure is inversely dependent on surface area, that means Larger is the surface area lesser is the pressure exerted on that area.
(d) Sharp weapon	1. Greater pressure	Sharp weapon has small surface area hence it exerts more pressure because Pressure is inversely dependent on surface area, that means smaller is the surface area greater is the pressure exerted on that area.

4. Question

Are the following statements true or false?

(a) The pressure of air inside an inflated balloon is equal to atmospheric pressure.

(b) Fluids always flow from higher pressure to lower pressure.

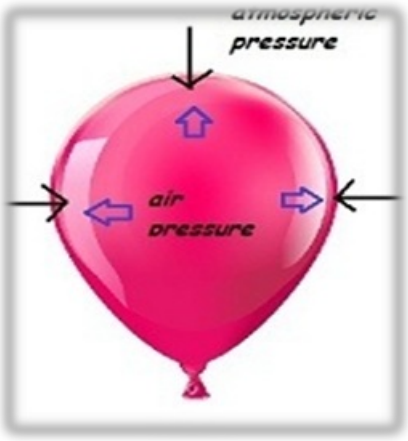
(c) If area is reduced, pressure is reduced.

(d) Standing on a cane chair increases the possibility of the cane breaking due to increased pressure.

Answer

(a) True

When the air is filled inside the balloon the pressure inside the balloon increases and the balloon becomes spherical and exerts equal pressure in all directions in order to balance the atmospheric pressure. Figure below illustrates the following.



(b) True

In order to make the pressure equal both sides the fluids always flows from the higher pressure to lower pressure(this makes pressure difference equal to zero), once the pressure becomes equal both sides the flow of the fluid stops. Therefore the above statement is True.

(c) False

As we know that $\text{Pressure} = \frac{\text{force}}{\text{area}}$;

Hence we can see from above formula that pressure depends on the surface area ($\text{Presssure} \propto \frac{1}{\text{surface area}}$) that means,

Hence less is the surface area, the greater is the pressure produced.

Therefore the above statement is False.

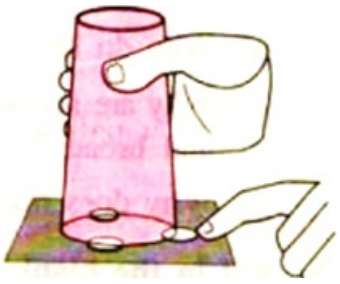
(d) True

When we stand on a cane chair the area of contact (surface area)with the chair is less , hence the pressure exerted on the chair due to the weight is more . And this increased pressure increases the possibility of breaking the cane chair due to more force.

Activities

1. Question

Carry out this simple experiment to test the strength of atmospheric pressure.



Fill a glass with water. Place a dish on it upside down. Holding the dish in place with your hand, turn the glass over. Place the dish on a table.

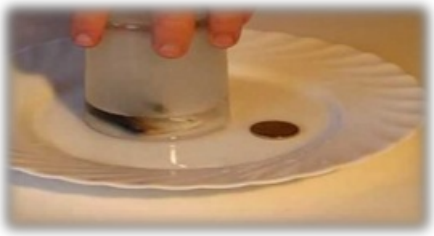
Take a few 50 paisa coins. Slide one coin under the edge of the glass without disturbing the water even slightly. Now, slide a second and third coin under the glass in the same way. You will see something remarkable. The glass is standing on three coins but the water inside does not spill out ! This is the magic of atmospheric pressure. With practice, you will learn to do this experiment quite easily. Then you will even be able to make the glass stand on piles of coins without spilling all the water ! Try it, have fun !

Answer

The glass stands on the three coins and the water does not come out of the glass because of the Atmospheric pressure.

Here is the Experiment along with the images.

1) Place a dish upside down on the glass filled with the water as shown in the figure.



2) Now gently slide the coin under the glass without disturbing water.

3) Push three coins under the glass in a way similar to first coin as shown in the figure below.

OBSERVATION: You will see that the glass is standing on the three coins. And the water does not spill out of the glass.

WHY THIS HAPPENS: There is no such magic which has happened; it is due to the atmospheric pressure. When we have gently pushed the coins under the glass the air inside the glass comes out which reduce the pressure inside the glass and pressure becomes less than the atmospheric pressure outside the glass. Therefore the atmospheric pressure exerts the force on the glass thus due to the force exerted by the atmospheric pressure the water does not come out of the glass.