

Pressure and Buoyancy

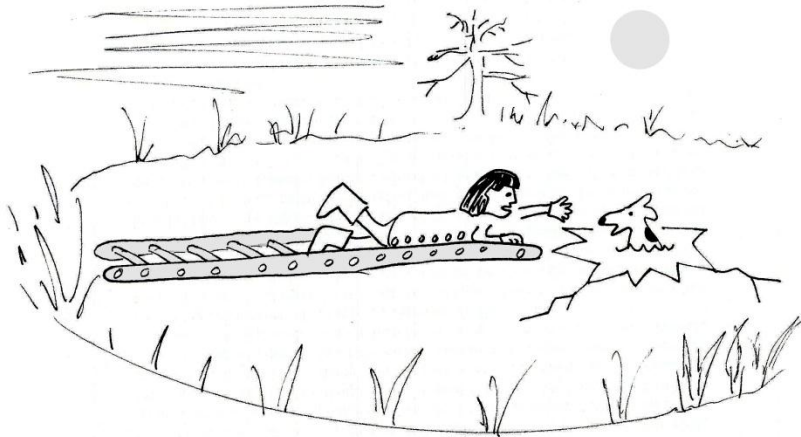
What is pressure?

Force applied per unit area is called pressure.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

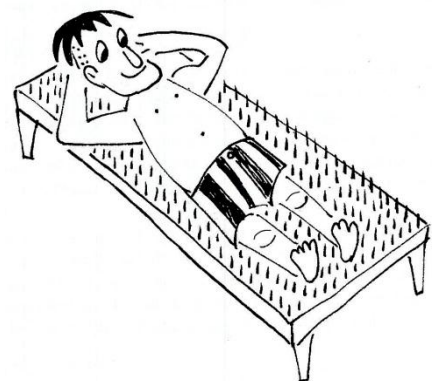
S.I. unit for pressure Pascal (Pa) which equal to 1 is N/m^2 .

Checkpoint



In the wintertime, Shweta's dog falls through the ice into a pond. Instead of just walking over the pond, she lies over a ladder is able to save her dog. Why did she have to use a ladder?

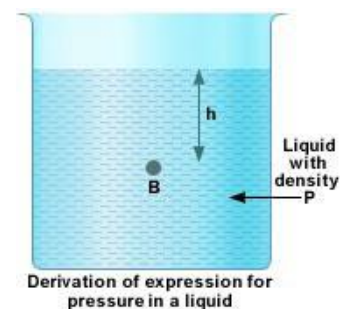
Rajat can lie on a bed of nails. Everyone thinks he's a superman, but Rajat's secret is that science helps him to do the trick. Can you find his secret? (Warning: Don't try this at home)



Pressure in fluids

Fluids like air and water exert equal pressure in all directions.

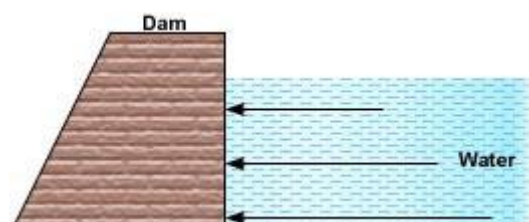
force at level B	= weight of liquid column above B
weight of liquid column above B	= mass (m) * gravity (g)
	= volume (v) * density (ρ) * gravity (g)
	= area (a) * height (h) * density (ρ) * gravity (g)
pressure at level B	= force at level B / area
	= height (h) * density (ρ) * gravity (g)



Thus pressure at a point inside the liquid is given by its depth or height, density and g, the gravitational acceleration. The liquid pressure on the surface is zero as $h = 0$.

Checkpoint

Why is it necessary to make the base of the dam broader than the top?



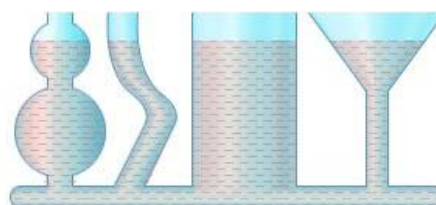
Activity: Liquid seeks its own level

Join two plastic bottles near their base by means of rubber tube. Close the clamp and fill water in both the bottles. Fill one bottle completely with water and the other till the water level is just above the rubber tube. Note the level of water of in both bottles.

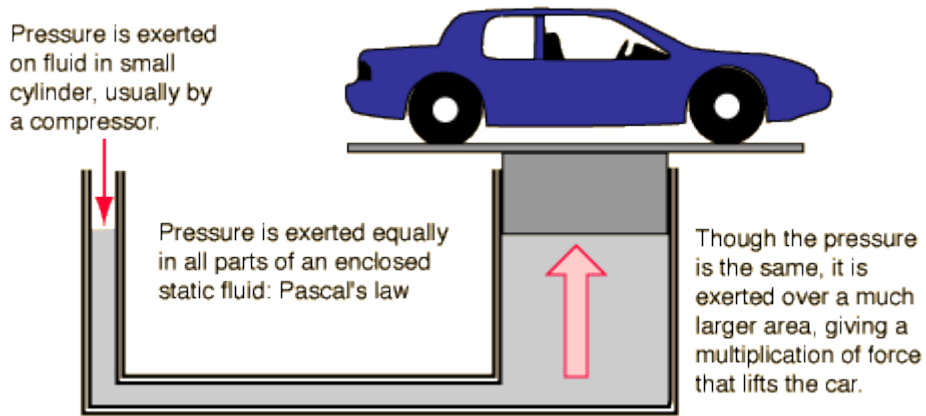
Now open the clamp. What do you observe?

Note the level of water in both the bottles once the water has stopped flowing.

If you fill a container with liquid, you will notice that the liquid will form a uniform level. The same does not happen with solid particles; solid level can remain uneven. Irrespective of the shapes of the container, the water will stand at the same level in all the vessels. Thus liquid seeks its own level. Why does this happen?

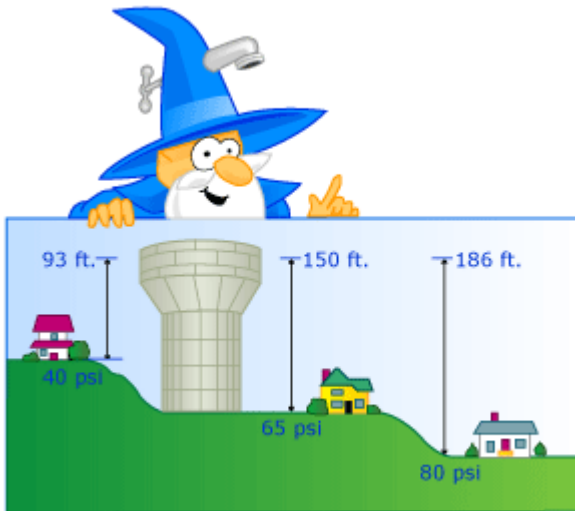


A hydraulic lift is used to lift heavy object using less force. Explain how this is made possible.



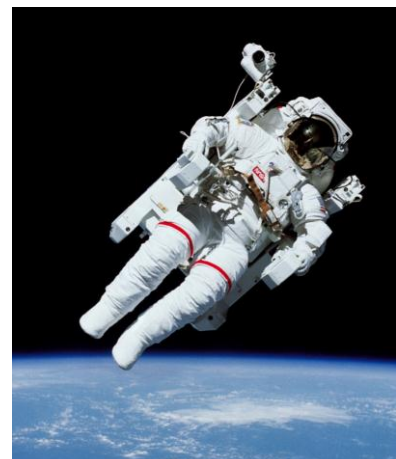
Checkpoint

Why is water tank built at a high altitude?

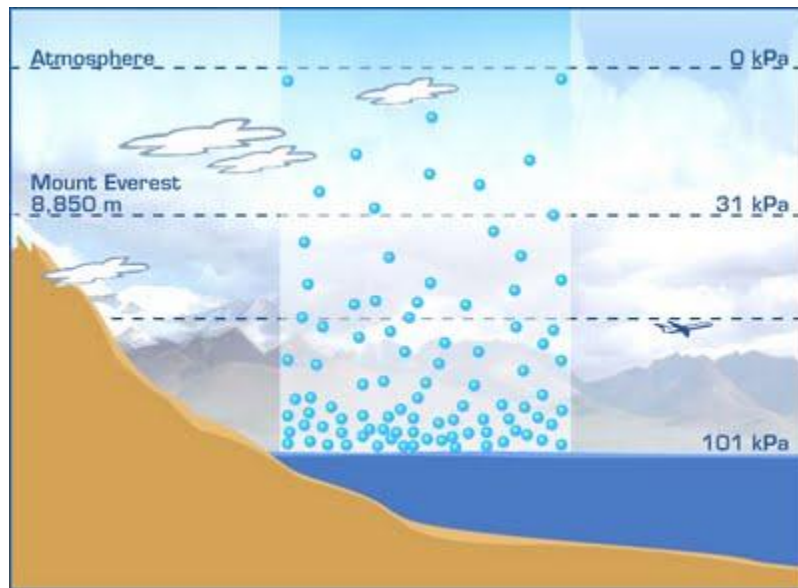


Atmospheric Pressure

Why do astronauts wear spacesuits when in space?



Atmospheric pressure decreases with altitude. Why?

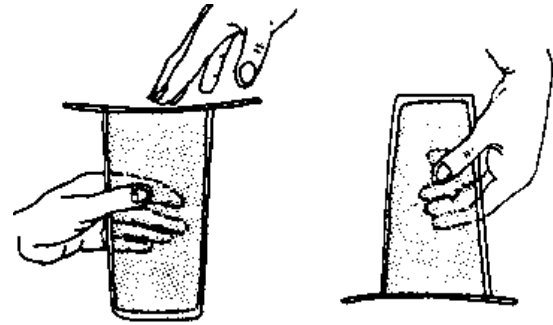


A plastic bottle sealed at 14,000 feet on Mauna Kea observatory on the island of Hawaii. It was then taken down to 9000 feet and then 1000. The photos show bottle at the various altitudes. Why did the bottle get crushed at a lower altitude?



Activity: Experiencing atmospheric pressure

Fill a glass with water. Cover it with a stiff card paper. Holding the paper in place with your hand, turn the glass upside down. Carefully take your hand away from the paper. What happens? Why?

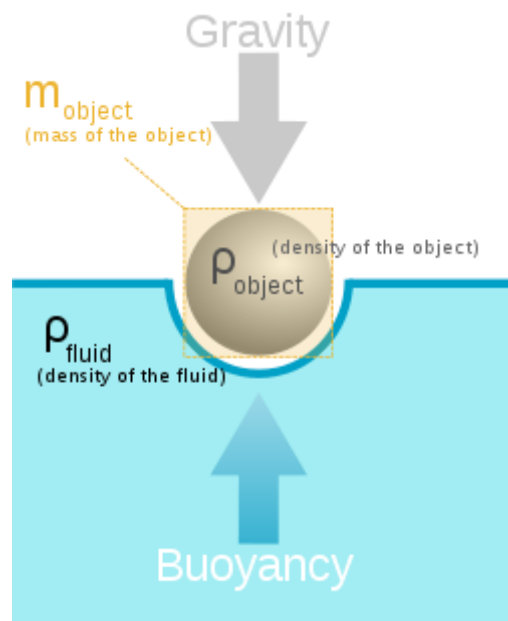


What would happen if you used a handkerchief instead of card paper? Would you get a similar result?

Can atmospheric pressure be used to explain the working of an ink dropper or a Holi pichkari?

Buoyancy

What enables wood to defy the force of gravity and float on water?



Archimedes principle

Any object, wholly or partly immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object.

