For thousands of years boats have been equipped with sails to catch the wind to drive them along. When we pump up a tyre, we force a large amount of air into a small container to make compressed air. Trapped air acts as an insulator so we wear thick woolen or cotton cloths in the winter to keep out cold.

Birds fly in the air by flapping their wings, but how does this keep them up in the air? They don’t come crashing down because they push on the air with each wing-beat, and the air pushes back. The force of the wing-beat makes more pressure in the air underneath the wing, and this extra pressure pushes the bird up.

If you’ve ever been to the top of a high mountain, you may have experienced that you need to breathe more often than at sea level or ground level. As the number of air molecules around you decreases, the air pressure decreases. Since you are breathing fewer molecules of oxygen, you need to breathe faster to bring the few molecules there are into your lungs to make up for the deficit. That is why people who climb the peaks of the highest mountains carry a supply of extra oxygen.

The earth is the only planet believed to support terrestrial life. The earth has a layer of gases called the atmosphere, which supports life processes like breathing and photosynthesis. Air in the atmosphere is made up of millions of atoms and molecules of these gases bouncing around pushing each other and exerting a force that we call atmospheric pressure or air pressure. The earth’s atmosphere is pressing against each square inch of us with a force of 14.7 pounds per square inch. The force on 1,000 square centimeters is about a ton!

You have probably measured this atmospheric pressure by doing a simple experiment with a glass filled with water and covered with a piece of paper. When you turn the glass upside down, the water does not fall from the glass but retains the cardboard and the water in the same position as before. This happens because the air pressure outside is heavier than the combined weight of water and air inside the glass.

Here are some more activities that you can try at home using household materials. You will learn how atmospheric pressure affects everyday science.

Air takes up space

Here is a way to show that air occupies space. Hold your palm against your ribs and take a deep breath. Feel what happens to your chest. Your chest expands because you are increasing the number of air molecules inside your lungs. This causes your lungs to expand in order to provide space for the increased number of air molecules.

Air can take up an increasing or decreasing amount of space

Blow up a balloon just enough to fit very loosely in a bottle. Tie a thread around the neck of the balloon so the air will not escape. Drop the balloon into the bottle. Punch a hole in the lid and insert a straw. Seal the straw with modeling clay and close the lid on the bottle. Suck some of the air out of the bottle through the straw and clamp your finger over the top of the straw to prevent air from rushing back into the bottle. The balloon will increase in size because the air inside the balloon expands as the air pressure decreases in the bottle.

More the air particles, greater the air pressure

Air pressure is directly related to the number of air particles there are in a given area. For example, the more air particles there are in a container the greater the air pressure inside the container (and vice versa). Try this activity and find out how hard it is to blow a paper ball inside the bottle!

Hold an empty bottle horizontal and place a small paper ball just inside its neck. Try to blow the ball into the bottle. You cannot! Instead of going into the bottle, the ball flies towards your face.

When you blow, the air pressure in the bottle is increased. At the same time there is a partial vacuum just inside the neck. The pressure inside the bottle drives the ball outside.

We breathe air but cannot see, smell or taste it. That is why we often forget that it is much more than nothing! The best way to find out about air is to demonstrate what it can do when it is in action.
Moving air and drop in pressure

If you stand behind a tree trunk or a round pillar on a windy day, you will feel that it is not safe. A small experiment at home will confirm this.

Blow hard against a bottle which has a burning candle standing behind it, and the flame goes out at once. The air current divides on hitting the bottle, clings to the sides, and joins up again behind the bottle. As you blow with great speed a low pressure zone is created just close to the candle. This low pressure zone allows air to rush inside from all the sides. This inward force of a large volume of air is strong enough to hit the flame.

Particle size and air pressure

The tiny particles that make up air are constantly moving. These particles have weight and therefore exert a force on objects they strike. You can discover this property of the air with a simple experiment.

Place a thin stick on a flat table, with a little less than half of it hanging off the edge of the table. Place a sheet of newspaper over the stick flat against the table. Quickly strike the end of the stick hanging off the edge of the table. If you strike it quick enough, the stick will break near the table edge.

Air rushes from high pressure region to a low pressure region

Nature tries to equalize pressure everywhere. The egg in a bottle experiment is an easy demonstration you can do to prove this property of the air.

Place an egg on top of a bottle. Change the temperature of the air inside the container by dropping a piece of burning paper into the bottle. The egg is pushed into the bottle. The air inside the bottle gets used up by the flame, lowering the air pressure inside the bottle. The higher pressure, now outside the bottle, pushes on the egg and pops it in.

Blowing a balloon inside an empty bottle

Suppose someone asked you to blow a balloon inside the water bottle. It sounds impossible, but with a simple arrangement you could do it.

Insert the balloon into the empty water bottle and pull the neck of the balloon over the outside of the empty water bottle. Place your mouth over the opening of the empty water bottle and attempt to blow the balloon. The balloon will not inflate much because the bottle is already filled with air and there is no room for the balloon to expand inside the bottle.

Now punch a small hole on the side of the bottle and try to inflate the balloon inside again. This time you will be able to inflate the balloon. The hole allows the air inside the bottle to escape when the expanding balloon presses on it.

Isn’t it a good trick to entertain your friends at your birthday party?

Pushing a straw through a potato

Hold an ordinary drinking straw between your thumb and index finger as if holding a pencil. Try to push through the potato. It will not go through the potato. Then place the index finger over one end of the straw as shown in the picture. Rapidly force the straw through the potato.

By sealing the top end of the straw with a finger, the air in the straw is trapped when the other end strikes the potato. Air exerts considerable pressure under normal conditions. But when it is compressed, the pressure is increased. The compressed air in the straw gives the straw strength enough to prevent its bending. The fragile straw will easily go through the potato.

Drinking water through two straws

When you drink something with a straw, the air pressure inside the straw is reduced, so that the air outside the straw forces the liquid up the straw.

To prove this, fill the glass at least half-full with water. Place one straw in the water and drink a mouthful. Add a second straw, but place this straw just outside the glass so that one straw is in the liquid and one is not. Now try to drink through the two straws.

When you drink with one straw, after creating a vacuum inside the straw, the air from the outside pushes down on the liquid and forces the liquid up the straw and into your mouth. With two straws, however, the pressure inside the straw doesn’t decrease because the air is flowing from the other straw. Since the pressures are equal in both straws, it is now much harder to drink.

Controlling water flow with your finger

Make three to five holes at the bottom of a can using a hammer and nail. Then make another hole at the top of the lid of the container. Hold the can over a sink and pour water into it. You will see that the water comes out of the holes. Let’s see if we can stop the water coming out by using air pressure.

Put the lid back on and you will see the water still comes out. Put your finger over the hole on the top and now watch what happens. The water stops, take your finger off and the water comes out again. This is because when you take your finger off the hole, air rushes through the can and pushes the water out of the bottom, but when you cover the hole no air gets in and the water stays in the can. Now you can use your magic can to water the garden!

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