

### 3. Properties of Natural Resources



#### Let's recall.

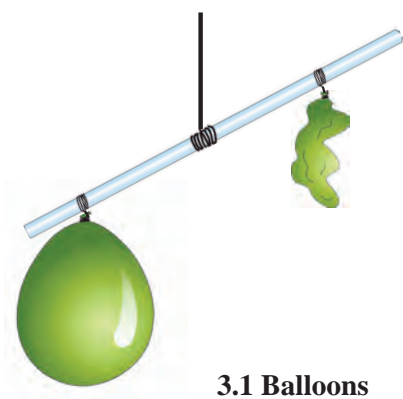
1. Which are the gases present in air? Why is air called a homogeneous mixture?
2. What are the uses of the various gases in air?

#### Properties of air

Air is all around us. We cannot see it, yet we feel the presence of air. When we inhale, air is taken in through the nose. If we blow on our hand through our lips, we can feel the air.



#### Try this.



3.1 Balloons

1. Take a stick from a broom or a paper or plastic straw. Tie a thread at its centre and hang it so that it remains horizontal.

Tie two rubber balloons of the same size at the two ends of the stick. See to it that the stick remains horizontal. Now remove one balloon, inflate it and tie it again at its original position. Does the stick remain horizontal? The stick goes down on the side of the inflated balloon. This means that air has weight. Air is a mixture of gases. Therefore, like all other matter, it has **mass** and **weight**.

2. Take an injection syringe without the needle. Pull its piston and observe it as you do so.

The piston can be pulled out easily. The piston then remains in that position even if you let it go. Now, close the inlet hole of the syringe tightly with your thumb, pull the piston and let it go. Is the force required to pull out the piston more or less than before? Does the piston remain as it is after you let it go.

The molecules of the gases in the air are in constant motion. When these molecules strike a body, they create pressure on that body. This is the pressure of air that we call '**atmospheric pressure**'.

On pulling the piston with the inlet hole of the syringe closed, more space becomes available to the air in the syringe, and it becomes rarified. As a result, the pressure of the air in the syringe is lowered. Comparatively the pressure of the outside air is very high. That is why, when the pulled out piston is released, it is immediately pushed in. If this experiment is repeated, holding the syringe in different positions like vertical, horizontal or inclined, the piston is found to go in to the same extent in all the cases. From this, we can infer that **atmospheric pressure is the same in all the directions**.



3.2 Air pressure



### Find out.

Is there any atmospheric pressure on the moon?



### Do you know?

Under ordinary conditions, atmospheric pressure at sea level is about 1,01,400 Newtons per square metre. It can be measured with the help of a barometer. As we go higher above sea level atmospheric pressure decreases.

### A Little Fun!

Place a piece of cardboard on the mouth of a glass filled completely with water. Holding the cardboard firmly in place with one hand, invert the glass quickly. Take your hand away from the card board. What do you see?

### Great Scientists

In 1726, the Swedish scientist Daniel Bernoulli put forth the important principle that the pressure of air decreases when its velocity increases while the pressure of air increases when its velocity decreases. If a body is moving through air, the air pressure decreases perpendicular to the direction of the motion and then the air in its surroundings flows rapidly from higher pressure to the lower pressure.

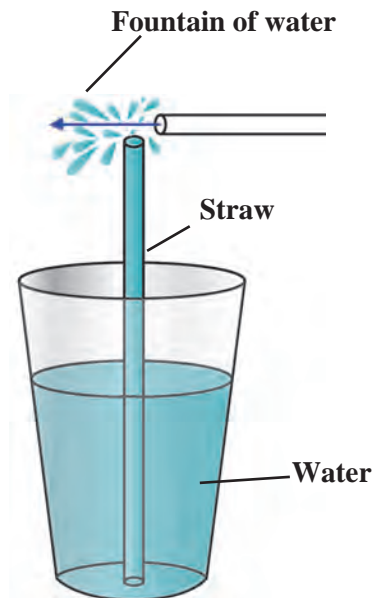
Download a photograph of Daniel Bernoulli from the internet, print and paste it here. What commands did you give the computer to do this?



### Observe and discuss.

Take some water in a plastic cup and hold a straw upright in it. Hold a small piece of another straw near the upper end of the first straw and perpendicular to that straw. Blow hard through the small piece of straw. You will see a fountain of water. Why did this happen?

On blowing through the straw, the air at its open end is pushed away and hence the pressure of the air at the opening goes down. As the pressure of the air near the upper end of the erect straw becomes less than atmospheric pressure, the water in the cup is pushed from where the pressure is higher to where it is lower, that is, in the upward direction, and the water comes out in the form of a fountain. The more forcefully you blow the higher will be the fountain. This straw fountain works on Bernoulli's principle.



3.3 Effect of air pressure



### Use your brain power!

What is the effect of increased temperature on the pressure of air?

When there exists a difference in the air pressure at two different places, the air starts flowing from the place of higher pressure to the place of lower pressure. At such times, we feel a breeze or a wind blowing. Thus, winds are an effect of the difference in air pressure. You will learn more about this in the lesson called 'Winds', in Geography.



**Try this.**



Take ice-cubes in a glass upto three-fourths of its height. Now observe what happens. How did the water droplets appear on the outside of the glass?

Due to the ice cubes in the glass, the air surrounding the glass cools down. As the water vapour in this air cools down, it condenses and gets transformed into water. It is this water that collects on the outer surface of the glass.

The level of humidity is different in different places. Similarly, the humidity levels also change from time to time during the period of a single day.

The level of humidity of the air is determined by its capacity to hold water vapour. During the night or at dawn, when the temperature of air is low, its capacity to hold the vapour is less. At such times, the excess vapour is transformed

### 3.4 Water droplets collected outside the glass

into water droplets. This is what we call dew.

In the afternoon, when the temperature of the air is high, the capacity of the air to hold the moisture also increases. Then, compared to its full capacity to hold water, the proportion of moisture in the air is less and we feel that the air is dry.

The proportion of water vapour in the air is high during the monsoons and in coastal areas. As a result, we feel the dampness or humidity.

In summer, wet clothes dry quickly, but in the rains, they do not. Why is this so?



**Use your brain power!**

1. Dip an uncorked inverted empty bottle in a slanting position into the water in a wide container. What do you observe?



**Try this.**

2. What change takes place in a balloon on filling air in it?



We come to know from the activities above, that air has properties like occupying space, having a certain volume, having mass and weight.

Air is a mixture of very fine particles of some gases, dust, smoke and moisture. When rays of light fall on these minute particles, the particles spread the light in all the directions. This natural phenomenon is called **scattering of light**.

### 3.5 Properties of air

## Temperature regulation

The earth receives energy from the sun. This energy is reflected by the earth in the form of heat. The constituents of air surrounding the earth, such as water vapour, carbon dioxide, absorb a part of this heat and give it to the other constituents of air. As a result, the earth's surface remains warm and thereby becomes suitable for the living world on the earth. If there were no air on the earth, the average temperature of the earth's surface would have been very low.



### Use your brain power!

1. What would happen if all the air surrounding us is removed?
2. Will sound be heard in space?

## Transmission of sound

All the sounds that we hear reach us through the surrounding air. The density of air also changes due to change in its temperature. In winter, the density of the air increases. We can hear the whistle of a distant train clearly early in the morning in winter. Air is useful as a medium for the transmission of sound.

## Properties of water



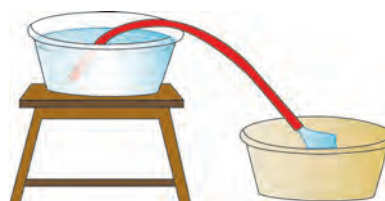
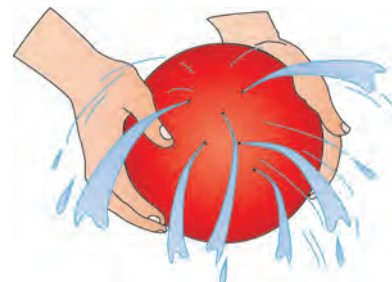
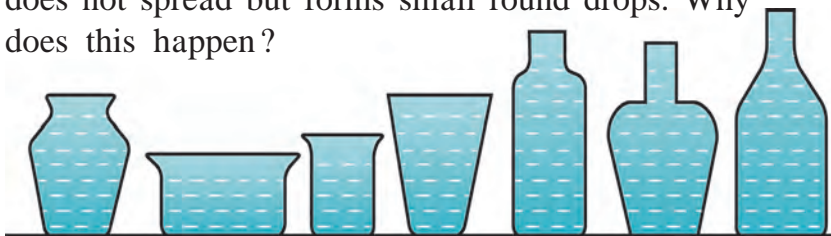
### Let's recall.

1. What are the states in which water is found?

What inference will you draw from the pictures alongside?

Water occurs in liquid state under ordinary conditions. Water is a fluid substance. Water does not have its own shape, but has a volume. It can pass through small holes or seep through very small gaps or cracks.

On pouring water in an oil-cladded dish, water does not spread but forms small round drops. Why does this happen?



### 3.6 Properties of water



### Try this.

1. Take a plastic bottle, more than half full of water. Mark the water level on the bottle. Keep this bottle upright in the freezer for making ice. Open the freezer after a couple of hours and observe. You will see that the water has changed into ice. Note the level of the ice. You will find that the ice-level is higher than the water-level before freezing. What can you infer from this?

As water freezes to form ice, it expands and its volume increases. On freezing, how much was the increase in the volume of the water? In what proportion did it increase?



2. Take a bucket of water. Drop many different kinds of articles in it. Make separate lists of the articles which sink in the water and those that float on it.

3. Take some water in a pot and add a few pieces of ice to it. Observe what happens.

Why do we see the ice float on water?

Ice is lighter than water. When water freezes to form ice, it becomes lighter than the original liquid. When water freezes, that is, when it transforms into the solid state, its volume increases. Therefore, the density of ice is less than that of water. That is why the ice floats on water.



3.7 Density of water

### Density of water

The inter-relation between the volume and mass of a substance : the space occupied by a substance is its volume. The store of matter in a substance is its mass.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Mass is measured in grams and volume in cubic centimetres. Hence, density =  $\frac{\text{gm}}{\text{cc}}$

Hence, g/cc is the unit of density. If the mass of 1 litre of water is 1 kilogram, then what is the density of water?

**Think :** Will the mass of water change when its state changes during the transformation of liquid water into ice?

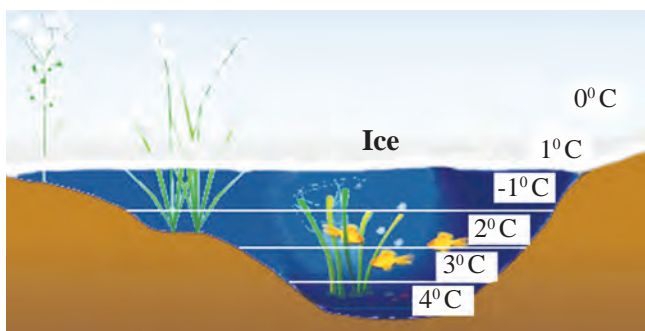
### Anomalous behaviour of water

Usually, when the temperature of a substance is lowered, its density increases as the volume decreases; but water is an exception to this rule.

4. Keep a glass full of water in the freezer for five to ten minutes. Then take it out and observe it carefully.

From which part in the glass does the water first start freezing?

The density of water is peculiar. When water at normal temperature starts cooling, its density increases like that of most liquids. However, if its temperature falls below 4<sup>0</sup> C its density starts decreasing. This means that the density of water is maximum at 4<sup>0</sup> C. If the temperature of water is lowered below 4<sup>0</sup> C, its density decreases and volume increases. It means that water expands when the temperature falls below 4<sup>0</sup> C. This is called the **anomalous behaviour** of water.



3.8 Anomalous behaviour

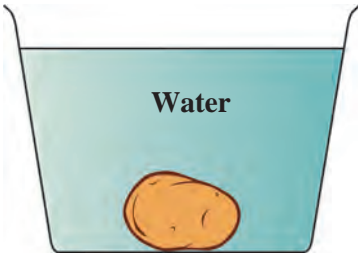


### Use your brain power!

In cold countries, how do aquatic animals remain alive even after the rivers or lakes freeze in winter?



### Try this.



A



B

### 3.9 Effect of density

Take two big glasses of water. Add 4-5 spoonfuls of salt to the water in one glass and dissolve it completely. Now place a potato in the water in the second glass. The potato will sink.

Take out the potato from that glass and put it in the salt water and observe. The density of water in that glass is greater due to the dissolved salt. The potato floats in that water because of the increased density.

Why is it easier to swim in the sea than in a well or a lake?

In the above activity the salt dissolves in the water in the glass, that is, it disappears. What happens when it disappears like this?

When the salt dissolves in water, its particles spread in water. Slowly they become smaller and smaller. Ultimately they become so small that they cannot be seen, that is, they mix completely with water. This is what is called dissolving.

**Solute** : the substance that dissolves - **Salt**

**Solvent** : the substance in which the solute dissolves - **Water**

**Solution** : what we get when the solute dissolves in the solvent.

### Uses of water according to its properties

1. Water is useful for water transport due to its fluidity. Water falling down from a height is used to generate electricity with the help of a generator.
2. Water is a good coolant and is used in motor vehicles to control the temperature of the engine.
3. Many substances are soluble in water. Water is a universal solvent. Water is used as a solvent in factories, laboratories, foodstuffs and in various types of biological processes occurring in the body such as digestion, excretion, etc.
4. Water is useful for cleaning purposes such as for bathing, washing clothes.

### Soil



### Let's recall.

1. What is meant by soil? How is soil formed?
2. What are the ingredients of soil?

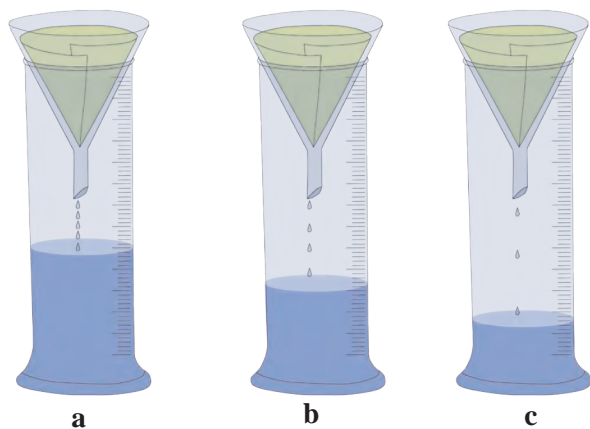
## Properties of soil

Colour is an important property of soil. The soil gets its colour as a result of several processes. The colour of soil near land surface is darker than the colour of the lower layers. Soil may be of different colours, such as black, red, copper, yellow, gray.

The colours of soil are useful for its classification. Besides, they are indirectly useful in indicating several properties of the land. In this way, the properties of the soil such as its fertility, drainage of water, capacity to hold water become clear from its colour. The colour of the soil depends upon its texture and its organic ingredients as well as on chemical ingredients like iron, lime.



**Try this.**



3.11 Collected water

**Apparatus :** Three measuring cylinders, three glass funnels, filter paper, water, fine sand, coarse sand, soil from an earthen pot used for growing plants, etc.

**Procedure :** Fit cones of the filter paper in the three glass funnels. Fill the cones with equal quantities of (a) sand (b), sandy soil and (c) clay respectively. Place the funnels on the measuring cylinders. Pour one test tube of water into each of the funnels and observe how much water is collected in each measuring cylinder. What inference will you draw from this?

## Soil texture

Soil contains particles of different sizes. The texture of the soil is determined by the proportion of particles of the various sizes in it. Following are the types of soil on the basis of its texture.

**Sandy soil :** The proportion of sand, i.e., large particles is high in sandy soil. Water drains rapidly through sandy soil. **It is easy to plough this soil.** But it is less fertile. This is because the particles of sandy soil are made of the mineral called silicon dioxide (quartz). These particles do not dissolve in water and, therefore, the soil has very little capacity to supply nutrients.

**Silt soil :** The particles of silt soil are of medium size. Silt soil is not as ploughable as sandy soil. However, it is much more ploughable than clay soil. This soil contains a large proportion of organic materials. Its capacity to supply nutrients is much greater. Silt soil is also called sedimentary soil.

**Clay soil :** In this soil, the proportion of small particles is maximum. The particles of clay soil feel smooth to touch. Clay soil has a high water holding capacity.



3.12 Types of soil



### Use your brain power!

1. Why is it difficult to plough clay soil?
2. Why is it easy to plough sandy soil?
3. What is the water holding capacity of silt soil?
4. Which soil is suitable for cultivation? Why?

### Soil structure

The structure of soil depends upon the different shapes of the particles in it. Soil occurs in the form of columnar, laminar, granular as well as block-shaped structures.

#### Importance of soil structure

The fertility of soil depends upon soil structure. The advantages of good soil structure are as follows :

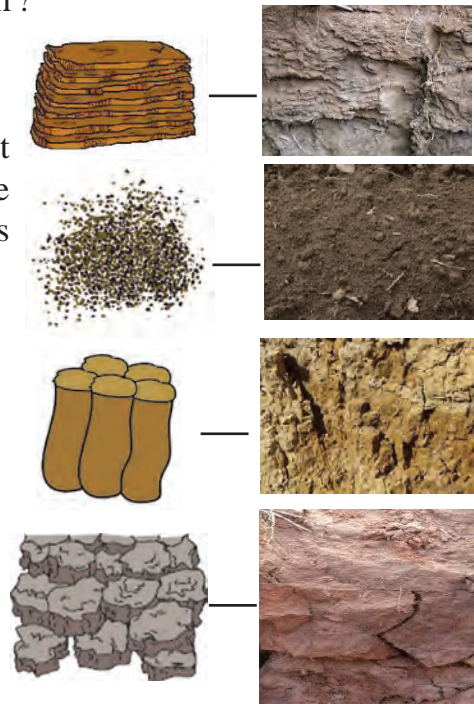
1. Roots get a sufficient supply of oxygen.
2. Water drainage is good. Therefore, the roots of plants grow well.

### Uses of soil

1. **Plant conservation** : To help plants grow.
2. **Water conservation** : Soil holds water. As a result, by means of bunds and lakes, we can get water for use throughout the year.
3. **Plasticity** : Soil can be given any required shape. This property of soil is called plasticity. Because of its plasticity, we can use it to make articles of a variety of shapes. These articles can be baked to make them hard. Water storage earthen pots, earthen lamps, idols, bricks, etc. are articles made from soil.

#### Some useful types of soil

1. **China clay : (Kaolin)** It is white in colour. It is used to make crockery, bathroom tiles, tanks, laboratory apparatus, masks, jars, etc.
2. **Shadu soil** : It is whitish in colour. It is used for making statues and idols.
3. **Terracotta soil** : This soil is red in colour. Decorative articles and pots used for growing plants are made from this soil.
4. **Multani soil** : This soil is used in cosmetics.



3.13 Soil structure



3.14 Uses of soil



### Do you know?

China clay is an industrial mineral of the type 'Kaolinite'. It is found in China and hence called China clay. Upon heating, this soil acquires a glaze and hardness and, therefore, is used for making crockery.

### Soil testing

The proportions of the various ingredients of soil can be determined by 'soil testing'. During soil testing, the soil is examined for colour, texture and the proportion of organic matter in it. Soil is tested to find out if there is a deficiency of any ingredients and to decide what measures should be taken to remove the deficiency.

The soil sample collected for testing is dried in an open space in the shade for eight to ten days. It is then sifted through a sieve.

Two tests, namely, the pH and the electrical conductivity tests, are particularly useful in finding out the characteristics of soil. You can determine the fertility of the soil in your fields with the help of different tests.

### Causes of diminished soil fertility:

1. Soil pH less than 6 or higher than 8.
2. Low proportion of organic matter.
3. No proper drainage of water.
4. Repeated cultivation of the same crop.
5. Continuous use of saline water.
6. Excessive use of chemical fertilizers and pesticides.

**World Soil Day : 5<sup>th</sup> December**  
**To make efforts for**  
**conservation of soil**

### Great Scientists

The Danish Scientist Sorensen put forth the concept of pH, based on the concentration of hydrogen ions. To determine the pH of soil, a mixture of water and soil in the proportion 1:2 is taken and tested using several indicators. Accordingly, soil may be found to be one of the following three types.

1. Acidic soil - pH less than 6.5
2. Neutral soil - pH 6.5-7.5
3. Alkaline soil - pH higher than 7.5



### Always remember -

Soil texture is disturbed if chemical fertilizers are used excessively and that land becomes unsuitable for sowing. Crops should be rotated in order to maintain the fertility of the land.

For example, the fertility of land decreases after a harvesting of wheat. Hence, leguminous crops like peanut, *moong*, *moth bean*, *pea*, lentil, Bengal gram, soyabean should be cultivated to restore the fertility of the soil.



**1. Fill in the blanks with the appropriate term.**

(Temperature, volume, mass, density, humidity, acidic, weight, neutral, shape.)

- (a) The capacity of air to hold moisture depends upon the ..... of the air.
- (b) Water does not have a ..... but has definite ..... and .....
- (c) While freezing, the ..... of water is lowered.
- (d) ..... soil has pH 7.

**2. Why is it said that –**

- (a) Air is a homogeneous mixture of various gases.
- (b) Water is a universal solvent.
- (c) There is no alternative to water for cleaning purposes.

**3. What will happen if.....**

- (a) The amount of water vapour in the air increases.
- (b) Only one crop is grown repeatedly in the soil.

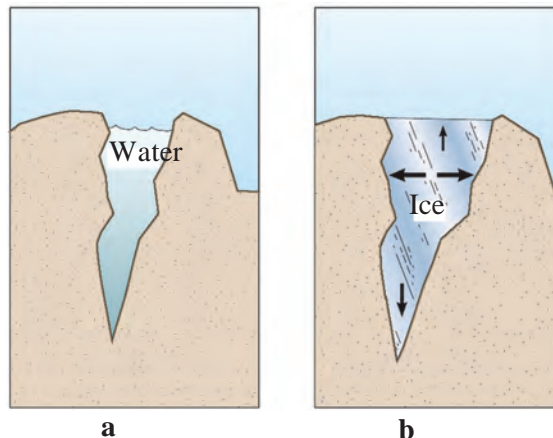
**4. With whom should I pair up?**

- | <b>Group 'A'</b> | <b>Group 'B'</b>         |
|------------------|--------------------------|
| (1) Air          | (a) Excretion            |
| (2) Water        | (b) Scattering of light. |
| (3) Soil         | (c) Plasticity           |

**5. State whether the following statements are true or false.**

- (a) Sandy soil has low capacity for holding water.
- (b) The substance in which a solute dissolves is called a solvent.
- (c) The pressure exerted by air is called atmospheric pressure.

**6. Explain the picture in your own words.**



**7. Write answers to the following questions in your own words.**

- (a) How is light scattered by the air?
- (b) Explain the various properties of water.
- (c) Why is the density of seawater more than that of rain water?
- (d) What is the importance of good soil structure?
- (e) What are the various uses of soil?
- (f) What is the need and importance of soil testing from the point of view of farmers?
- (g) What is the importance of air in transmission of sound?
- (h) Why should a glass bottle completely filled with water never be kept in a freezer?

**Project :**

Visit a soil testing laboratory. Learn the process of soil testing and share it with others.

