Chapter 2

WATER

You know that about three-fourth of earth's surface is covered with water, yet during summers you would have read in the newspaper about the water crisis. Have you ever thought about the reasons for water crisis despite the abundance of water on the earth? Let us try to understand the reasons.

2.1 Water - A natural resource

Of the total water available on earth, 97% is found in oceans, 2% as ice on the peaks and the poles and the remaining 1% is in rivers, lakes, ponds and beneath the earth's surface. We use this underground water by digging wells. Water is also present in the atmosphere in the form of water vapour, mist and clouds. (Fig. -2.1)



Fig. 2.1 Availability of water on earth

Many substances like common salt and other minerals are present in ocean water in large quantities. Due to these the water becomes salty or saline. It cannot be used for drinking, bathing, washing clothes or irrigation. Water present as icebergs is pure though it cannot be used easily. Of the total water available on earth, the quantity of water which can be used by human beings is very small. This is equivalent to 1 mL of usable water out of every 10 litre available i.e. 0.01%. You can now perhaps see that the quantity of water available for our use is really small and why water is so important? So, we should use water carefully, and prevent its wastage.

2.2 Importance of water for living

Water is an essential component of all living beings. Almost 70% of human body weight is water. Table 2.1 shows the approximate percentage of the water present in certain animals, plants and their products.

A healthy person needs about 2 to 3 litre of water for drinking daily. This is necessary for various process of body for which water acts as a medium. In the stomach water is necessary for the digestion, absorption of food and for the circulation of the digested food in the body. Along with water unwanted waste materials are thrown out of the body in the form of urine and sweat. The temperature of our body is also controlled by sweating. Thus, we should drink plenty of water so that all the processes of our body run smoothly. Water is as important for plants as it is for animals. Let us try to understand this through an activity-

Table - 2.1

Name of Items	Approximate percentage of water by weight
Elephant	80%
Plant	60%
Bread	30%
Milk	95%
Tomato	90%
Orange	85%
Potato	80%

🔁 Actívíty - 1

Materials required : Green gram seeds, bowl, water, cloth, soil

Take some Green gram seeds in a bowl and soak them in water for a few hours. Now take these 'wet seeds' and tie them in a cloth. In the same way take some similiar dry moong seeds and tie them in a cloth. Keep the cloth which has 'wet seeds' moist by sprinkling water on it at regular intervals. Compare the two sets of seeds after 3-4 days. Did you notice any difference? What could be the cause of this difference? Write.

Now divide the germinated seeds into two parts and sow them at separate places "A" and "B" in dry soil. Keep watering the place "A" daily and do not put water over place "B". After 2-3 days you will see that seeds in the place "A" have grown. Though the seeds in place "B" had germinated yet they did not grow further, after being put in the soil. What could be the reason?

Can you now conclude that water is necessary for germination and growth in plants? You also know that roots of the plants absorb minerals dissolved in water and transport them to various parts of the plant. Green plants use sunlight to make food from water and carbon dioxide. In this way we have seen how important water is for plants.

Water is also a habitat for plants and animals living in rivers, ponds and seas. Most of the times animals use oxygen dissolved in water for respiration and water plants use carbon dioxide dissolved in water for photosynthesis. Write in table 2.2 the names of a few plants and animals whose habitat is water.

Table - 2.2

S. No.	Aquatic organisms	Examples
1	Aquatic plants	Lotus,
2	Aquatic animals	Fish,
3	Aquatic microorganisms	Amoeba, paramoecium, euglena

Answer these

- (1) Why can't human beings use water available in the oceans for their daily activities?
- (2) Why is water essential for human body?
- (3) What will happen if the plant in a pot is not watered? Explain giving reasons.
- (4) How is water important for aquatic organisms?

2.3 Drinking water

Water fit for drinking is called drinking water. Is water from all sources fit for drinking? Water from different sources can have dissolved salts, suspended particles and microorganisms. Some salts dissolved in water are necessary for our body but if the amount of these is more than required then they need to be removed from water before it is used.

In the cities water is purified at the water treatment plants before its distribution. In these plants all the suspended impurities and bacteria are removed. To get rid of harmful bacteria present in water, bleaching powder is added to it. In the same way water from wells is made germfree for use at home by adding bleaching powder or potassium permanganate in small quantities or chlorine tablet. Water can also be boiled to make it germfree. Nowadays ultraviolet rays are also used to make water germfree.

To remove suspended impurities of water at home we can use a filter fitted with ceramic candle.

The cause of many diseases in our country is the non-availability of safe drinking water. Many government and non-government institutions have been making efforts continuously to remove this problem from Chhattisgarh and provide sufficient safe drinking water available to all.

Distilled water

This is the purest from of water. It is required for conducting experiments in laboratories. Distilled water is obtained by evaporating water to produce water vapour and then condensing these water vapours to get water.

You can also obtain distilled water at home. Take a big utensil and keep a small heavy bowl at the centre of the utensil. Now fill water in the utensil and make sure the bowl does not float in water. Tie a transparent plastic sheet over the utensil. Keep a small stone on the plastic right sheet over the bowl. Keep this apparatus in the sun. After some time water droplets accumulate in the bowl under the plastic sheet. This is distilled water (fig. 2.2).





Answer these

- (1) Why is water from all sources, not fit for drinking?
- (2) What are the various methods by which water can be made fit for drinking?
- (3) What do you understand by distilled water?

2.4 Physical properties of water

Material required :- test tube, water

Fill three fourth of a test tube with water. Look at the test tube carefully. Make the table given below in your copy and fill in the properties of water.

	Ta	ble	- 2.3
--	----	-----	-------

S. No.	Property	Observation
1.	Colour	
2.	Odour	
3.	Taste	
4.	Transparency	
5.	State	
	(at Room temperature)	

It is only due to the transparency of water that light reaches the water plants and they are able to manufacture their food.

Freezing point of water is 0°C which means that at this temperature water gets converted into ice. At the same temperature 0°C ice changes into water. This is called the melting point of ice.

Boiling point of water is 100°C. At this temperature water boils and changes into vapour. At the same temperature 100°C water vapour condense into water.

In hot regions coolers are normally used during summer. In this water is poured over mats fixed on the three sides of the cooler. The air is sucked into the chamber through these wet mats and evaporation of water causes the air to cool. The fan in the cooler continuously sucks in air from outside and throws the cooled air into the room and makes it cool.

Activity - 3

Materials required :- beaker, distilled water, thick cardboard, carbon rods, bulb, wires, cell, salt. Take some distilled water in a beaker. Now fix two carbon rods on the thick cardboard and place these over the beaker as shown in figure 2.3. Connect the two rods to the bulb and the cell with the help



Figure 2.3 Flow or conduction of electricity

of copper wires. Does the bulb light up? Now dissolve a spoonful of salt in water and repeat the experiment. Does the bulb light up now?

Distilled water is a bad conductor of electricity but when salt is added, it becomes a good conductor and the bulb ligths up.

Sometimes in the rainy season if an open electric wire touches a wet wall then we get an electric shock on touching the wall. The reason for this is the conduction of electricity by the water with salts from the wall.

2.5 Water a unique solvent

Many substances dissolve in water. This is why

it is called the universal solvent. Materials dissolved in a solvent are called solutes. When a solute dissolves in a solvent the mixture is called a solution.

Activity - 4

Material required :- glass slide, tap water, source of heat

Put some drops of tap water on a slide and heat till the water evaporates completely. This evaporation can also be done by keeping the slide in sunlight. Do you find any residual material on the slide? These substances are the salts dissolved in water.

Activity - 5

Material required :- Beaker, salt, sugar, water, tripod stand, spoon, wire gauze, source of heat, glass rod.

Fill half of the beaker with water and add a spoon of salt to it. Stir it with a glass rod. Did the salt dissolve completely? Keep adding half spoons of salt and stirring till the salt stops dissolving. The solution thus obtained is the saturated solution of the substance at that temperature. Now place the beaker on a tripod stand and heat it. Add more salt and stir. You will see that with the increase in temperature more salt is dissolved. In this way we see that solubility changes with change in temperature.

Repeat this experiment with sugar and other materials. You will note that the quantity of material required to make a saturated solution is different for different materials. This means that different materials have different solubility in water.

The maximum quantity of a given substance that is soluble in 100 ml of water at a specific temperature is the solubility of the substance at that temperature.

Not only solids but gases like oxygen, carbon dioxide etc. are also soluble in water. Carbon dioxide is more soluble in water than oxygen is. While manufacturing cold drinks, carbon dioxide gas is dissolved in water at a high pressure.

Solubility of gases decreases with increase in temperature. This is the reason why in summers when the water of shallow ponds and lakes becomes hotter, the quantity of oxygen disolved in it reduces.

2.6 Salinity of sea water

Rain water is distilled water. It does not contain mineral salts. However, due to atmospheric pollution various gases dissolve in it. When this water flows over soil and rocks many types of mineral salts dissolve in it. This water reaches the sea through the rivers. In this way the amount of minerals present in sea water increases and it becomes saline. In one litre of sea water there are about 35 gram of salts. Common salt (sodium chloride) is the main salt present but small quantities of sodium bromide, magnesium chloride and potassium iodide are also present.

Presence of a small quantity of iodine in our body is important for it. Salt obtained from sea water has small quantities of potassium iodide. But this is separated at the time of purification. Required quantities of this compound are however added to pure salt to iodize it. This helps prevent goitre – a disease caused by deficiency of iodine.

Answer these

- 1. Why is water called a universal solvent?
- 2. Write the names of some of those salts that are present in sea water?
- 3. Write short notes
 - a. Saturated solution b. Solubility
- 4. Due to which property of water does sunlight reach the water plants?

2.7 Anamolous behaviour of water

Normally the solid form of a substance is heavier than its liquid form. But this is not correct for water. You would have seen that in summer ice cubes put in a glass of sharbat (soft drink) float on its surface. Thus we can say that the density of ice is less than that of water.

Density of a substance is its mass per unit volume. Density $= \frac{Mass}{Volume}$	
---	--

Density of water is the maximum at 4°C. This is one kilogram per litre whereas the density of ice is 0.9 kilogram per litre. This is why when ice is added to water about 1/9 th part of the ice is above the water surface and 8/9 th part is below the water surface. This is the reason why in cold regions one cannot make out the exact size of the rock of ice floating on water immediately. Due to this the captains of the ships have to be cautious when passing by the sides of the ice rocks.

Thousands died when a ship named Titanic sank in water after colliding with a floating rock of ice which is called an iceberg.

Density of ice being less than of water is a boon for water organisms. In extreme cold climates when the atmospheric temperature is less than 0°C the water on the surface of sea and on the ponds starts freezing. Being less dense than water ice floats on the water surface. As ice is a bad conductor of heat, the heat trapped inside cannot get out and the temperature of the water is maintained comparatively higher. This is how plants and animals living in water survive in winters.

We have seen that on freezing the density of water decreases and its volume increases. If a fully filled bottle of water is kept in the freezer of a refrigerator fridge the bottle would break when the water freezes due to an increase in volume.

2.8 Hard and soft water

Soap is used for washing and bathing usually. When soap gives a lot of lather with water then that water is called soft water. Water from some sources that does not give good lather is called hard water. Calcium and magnesium salts dissolved in hard water react with soap to form insoluble substances and hence soap can not form adequate lather.

Hardness of water is of two types -

- 1. Temporary hardness
- 2. Permanent hardness

Temporary hardness is due to presence of bicarbonates of magnesium and calcium. This can be removed by boiling the water.

Permanent hardness is due to chlorides and sulphates of calcium and magnesium salts dissolved in water. This hardness cannot be removed by boiling.

2.9 Electrolysis of water- (demonstration by the teacher)

To find the constituents of water we electrolyse it..

Materials required :- a wide mouthed plastic bottle, knife, a rubber cork with two holes, a stand, sulphuric acid, water, two carbon rods, two test tubes with corks, battery (6 volt), matchbox.

To do this experiment take a wide mouth bottle and cut out its bottom. Now put the cork with the two holes on the mouth of the bottle and insert the two carbon rods in the holes. Set up the apparatus as



Figure 2.4 Electrolysis of Water

shown in fig.2.4. Fill the inverted bottle upto two-third with water and add a few drops of sulphuric acid. Now fix the two test tubes on the electrodes. Ensure that the test tubes are filled with water. Connect the two electrodes to a source of electricity (battery). After some time bubbles of gas start rising from electrodes and collect in the test tubes. Is the amount of gas collected in both the test tubes equal? The amount of gas collected in one test tube would be almost double of that in the other test tube. When the faster filling test tube is completely filled with gas, remove it from the electrode by putting your thumb over the mouth of the test tube. Close the mouth of the test tube with a cork. To test the gas take a burning matchstick near the mouth of the test tube. The gas burns with a blue flame and a 'pop' sound is produced. This shows the presence of hydrogen gas. When the other test tube gets filled, remove the test tube from the electrode in the same way. Take a smouldering matchstick near the mouth of the test tube. What happens? The matchstick starts burning. This happens because of oxygen gas.

By this we can see that water is formed by the reaction between hydrogen and oxygen and the volume of hydrogen is double than that of oxygen.

2.10 Water cycle

Water from oceans, ponds, lakes and other sources is continuously evaporating. Plants and animals also produce some water vapour through various living processes. This water vapour keeps accumulating in the atmosphere.



Fig. 2.5 Water cycle

As water vapours are lighter they rise upwards. In the upper layers of the atmosphere the temperature is lesser and because of this the water vapour condense to small droplets of water and form clouds. When small droplets of water come together then big droplets of water are formed and they start falling in the form of rain. This way water reaches its various sources again and the water cycle is completed (fig-2.5).

Answer these

- 1. How do plants and animals living inside water in cold regions survive even after the freezing of water?
- 2. State the reason why ice floats on water.
- 3. How would you identify hard and soft water?
- 4. With the help of an experiment show that water is made up of two gases.

2.11 Water pollution

Many chemical substances, excreta and other unwanted substances like waste materials, dirty water from drains etc. get mixed with water from different sources. Due to this the water becomes unfit for

drinking and household use. This water is called polluted water. The substances which pollute water are called pollutants and the process of the water getting polluted due to these pollutants is called 'water pollution'. Due to growing industrialization water pollution has become a serious problem.

2.11.1 Causes of water pollution -

1. Activities of human beings

Many activities of human beings pollute water. You would have seen that people usually throw the waste and rotten materials from their homes in to the drains. Water from these drains pollutes water of ponds, rivers etc. Similarly people pollute water of rivers and ponds by bathing, washing clothes, animals and vehicles. In some places dead bodies are also thrown in water. Water also gets polluted due to the colours used in the making of idols of god – goddesses that are immersed in water. Waste material thrown by hospitals, urine and excreta of animals also pollutes water. Many germs that can cause disease get in to water because of this.

2. Through agriculture

To save the crop from pests and to increase productivity, many insecticides, weedicides and different kinds of manures are used. These substances dissolve in water and reach rivers and ponds, thus pollute the water.

3. Through industries

Along with useful materials manufactured in industries some waste products are also produced. These products are often harmful. When there are no proper systems of disposing these products in the factory they are disposed off in rivers and ponds, resulting in water being polluted. This water is harmful when used by plants and animals. If these disposed materials contain lead, mercury, chromium, cadmium etc. then they can cause fatal diseases.

2.11.2 Controlling water pollution

Government has made some rules to stop environmental pollution. These rules should be compulsorily followed by all citizens, institutions and industries. Many measures can be taken to stop water pollution. For example, industries should put up such equipment which can remove harmful substances, organic compounds, colour and odour from water. This would make water reusable.

Make a list of causes of water pollution in near by water sources and its preventive measures in your note book and discuss it with your class.

2.11.3 Treatment of polluted water

To help you understand, the processes that take place at the waste water treatment plant let us perform the following activity.

Actívíty - 6

Materials required: A large glass jar, 4 test tubes, orange peels or grass twigs, detergent, water, ink, stirrer, filter paper, stand, funnel, sand, fine gravel and medium sized gravel.

Divide yourself into groups to perform the activity. Record your observation at each stage -

Fill a large glass jar 3/4 full of water. Add some dirty organic matter such as grass pieces or orange peels, a small amount of detergent and a few drops of an ink of any colour. Cap the jar, shake it well and let the mixture stand in the sun for two days. After two days, shake the mixture and pour a small sample into test tube. Label this test tube as'Sample-1'how does it smell? Use a stirrer or mixer and stir the sample several times and leave overnight. Next day pour another sample into a second test tube. Label it as 'Sample-2.'Fold a piece of filter paper to form a cone. Wet the paper with tap water and then insert the cone in a funnel. Mount the funnel on a support (as you have learnt in class VI)

Place layers of sand, fine gravel and finally medium gravel in the funnel (fig 2.6). An actual filtration plant does not use filter paper, but the sand filter is several meters deep. Pour the remaining stirred liquid through the filter into the beakers. Do not allow the liquid to spill over the filter. If the filtered liquid is not clear, filter it a few times till you get clean water. Pour the sample of the filtered water into a third test tube labeled as "Filtered Sample-3'.

Pour another sample of the filtered water into a fourth test tube. Add a small piece of a chlorine tablet. Mix well until the water is clear. Label the test tube "Chlorinated Sample-4". Observe carefully the samples in all the test tubes. Do not taste. Just smell them.

Now answer the following questions.

- What changes did you observe in the appearance of the liquid after stirring?
- Did aeration change the odour?
- What was removed by the sand filter?
- Did chlorine remove the colour?



Fig 2.6 Filtration process

2.12 Ground water and Ground water table

If we dig a hole in the ground near a water body, we may find that the soil is moist. The moisture in the soil indicates the presence of water underground. If we dig deeper and deeper, we would reach a level where all the space between particles of soil and gaps between rocks are filled with water. The upper limit of this layer is called the water table. The water found below the water table is called ground water. What is the source of this ground water? The rain water and water from other sources such as rivers and ponds seeps through the soil and fills the empty spaces and cracks deep below the ground.

2.12.1 Depletion of water level

You must have noticed that a huge amount of ground water is bore through pumps to fulfill the requirement of drinking, construction work, irrigation and various other purposes. Generally this water gets replenished by seepage of rainwater and other natural processes. However water table may go down if the water is not sufficiently replenished. This may happen due to many reasons like increase in population, industrial and agricultural activities. Scanty rainfall is another factor that may deplete the water table. Yet another factor affecting water table could be deforestation, urbanization and decrease in the effective area for seepage of rain water. All these factors contribute to depletion of water table.



Table - 2.4

S.No	Activity	Yes/No
1.	Keeping the tap open while washing teeth, face & bathing and	
	using a lot of water.	
2.	Not closing a running or leaking tap but move on.	
3.	Take a full glass of water, drink half and throw the rest.	
4.	Water, garden plants in the morning instead of in the evening	
5.	Not reusing the water left over from washing of fruits, vegetables etc.	
	in the kitchen for watering plants in the garden.	
6.	Use a pipe to bring water from a source (pond) instead of a bucket for	
	washing vehicles.	
7.	Filling water in utensils, buckets and tanks till it starts overflowing.	
2.12 Water Managment		

We normally recognize the importance of water only when adequate water is not available to us. Every drop of water is valuable. Human activities are largely responsible for the depletion of water table. We should try to save it. In our country the tradition of water conservation exists since ancient times. Presence of a pond in every village and town is an evidence of this. Due to industrial development and growing urbanization, there is a decrease in their numbers. This could become a cause of water crisis in the future.

You can also help in water conservation. Consider the following and see for yourself whether you help in water conservation or waste water.

If your answer to the above questions is no, then you are helping in water conservation.

Water is a precious resource and we should use it with care. There are many other ways of water conservation. Discuss them in your class. Nowadays, many special ways for water conservation are being used in cities.

A farmer using water in the field can also use water economically by adopting certain techniques like drip irrigation, use of sprinklers and using narrow tubing which deliver water directly at the base of the plant.

2.14 Rain Water Harvesting

Collecting rain water for use as per requirement is called rain water harvesting. The rain falling on house roofs is collected and routed to pits in the ground through pipes. This pit is of an appropriate shape with concrete walls. The bottom of the pit is (not cemented) kuchcha and a layer of small stones (gitti) and sand is spread on it. These layers help in filtering the water. The filtered water then seeps through the soil. In this way the ground level of the water rises. This water is pumped up by tube well and hand pumps and then used.

In the villages, village panchayats can play an important role in this direction. They can dig up the bottom surface of dry ponds before monsoon so that the rainwater does not flow out but seeps in to the soil easily. Small ponds can also be constructed before monsoon to collect rainwater.



- 1. What are the main causes of water pollution? What measures would you take to stop water pollution?
- 2. Why is conservation of water necessary?

we have learnt

- > $\frac{3}{4}$ th of earth's surface is covered by water. However, the amount of usable water is a very small portion of this.
- > Water is necessary for living. It acts as a medium for various living processes.
- Aquatic organisms use oxygen dissolved in water for respiration and carbon dioxide is used by plants in photosynthesis.
- Drinking water should be free of suspended impurities and harmful microorganisms. Water can be made bacteria free by bleaching powder, potassium permanganate and ultraviolet rays.
- ▶ Freezing point of distilled water is 0°C and boiling point is 100°C. Density of water is maximum at 4°C.
- > Sea water is unfit for drinking due to large quantities of salts being present in it.
- > Density of water is more than the density of ice.
- > Water is a universal solvent. Solubility of different substances in water is different.
- Water is made up of hydrogen and oxygen. By electrolysis of water we can see that the volume of hydrogen in water is double than the volume of oxygen.
- > Water gets polluted due to impurities.
- > Shortage of water can be reduced by rain water harvesting.
 - Questions for practice

1. Choose the correct answer –

a)	Ice floats on the surface of water because –			
	(i)	density of ice is more than water.	(ii)	density of ice is equal to water.
	(iii)	density of ice is less than water.	(iv)	air bubbles are found in ice.
b)	Ratio of hydrogen and oxygen in water is 2:1 –			
	(i)	as per weight	(ii)	as per volume
	(iii)	as per density	(iv)	as per weight and volume both
c)	Wat	Water cycle is a —		
	(i)	process of evaporation	(ii)	process of condensation
	(iii) process of evaporation and condensation (iv)		process of melting	
d)	Distilled water is the closest to —			
	(i)	sea water	(ii)	rain water
	(iii)	ground water	(iv)	tap water

2. Fill in the blanks –

- a) Water is a solvent.
- b) gas is more soluble in water than gas.
- c) Hardness in water is due to and salts dissolved in it.
- d) Distilled water is a conductor of electricity.
- e)gas obtained by electrolysis of water produces a 'pop' sound on burning.
- 3. Identify true and false statements and rewrite the false statement after correcting them.
 - a) Bleaching powder is used to make water bacteria free.
 - b) Distilled water is suitable for drinking.
 - c) Solubility of gases in water increases with temperature.
 - d) Density of ice is more than the density of water.
 - e) Heating water kept at 0°C leads to an increase in volume.

4. Answer the following questions –

- 1. Why is there a water crisis even though $\frac{3}{4}$ th of the Earth's surface is covered by water?
- 2. What would happen if all the sources of water in a forest, dry up?
- 3. Explain water cycle on earth.
- 4. How will you make a saturated solution of sugar? What would happen if this solution is heated?
- 5. Water containing salts is a good conductor of electricity. Give an activity to explain it.
- 6. What is water pollution? Write the causes of water pollution.
- 7. What would you do to stop water pollution in your city/village?
- 8. What is meant by rain water harvesting?

Do these also

- 1. Make a list of water sources around you and specify, water from which source is fit / unfit for drinking. What would you do to keep the drining water source clean?
- 2. Every drop of water is valuable. Thus, wastage of water should be stopped. To fulfill the above objective start a community awareness campaign with your friends.
- 3. List the different measures that can be adopted for the treatment of polluted water. You can also discuss about it with your family members, and neighbour and also search in newspapers and internet.

