

- iii. It causes It cause rapid growth of algae. Death and decomposition of algae cause deficiency of oxygen in water that affects other organism living in water.
- iv. It is damaging aquatic life, thus breaking a link in food chain.
- v. It reduces the aesthetic quality of lakes and rivers.
- vi. It is unfit for cleaning or washing purposes.

**Q.14 How waterborne diseases can be prevented?**

**Ans.** Waterborne diseases can be prevented by taking the following measures:

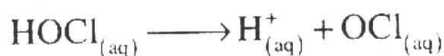
- i. Provision of safe water: Drinking water must be properly treated and purified.
- ii. Disposal of sewage: There must be adequate sanitary disposal of sewage. Any type of waste must not be thrown or discharged directly in water supplies or reservoirs.
- iii. Control of toxic chemicals: Chemical contamination can cause acute illness, but often toxic contaminants are slow poisons and carcinogens. There must be a strict control over the use of pesticides and other chemicals.

**Q.15 Explain the chemistry of swimming pool cleanliness?**

**Ans.** Swimming pools are cleaned by chlorination process. It is the addition of chlorine solution in swimming pools. Chlorine kills bacteria and other micro-organisms.  $\text{Cl}_2$  itself does not kill rather it dissociate in water to form hypochlorous acid (HOCl) and hydrochloric acid.



HOCl further ionizes to produce hypochlorite and proton



Both the products HOCl and OCl kill bacteria and micro-organisms.

## Short Answer Questions

**Q.1 Why water is considered to be universal solvent?**

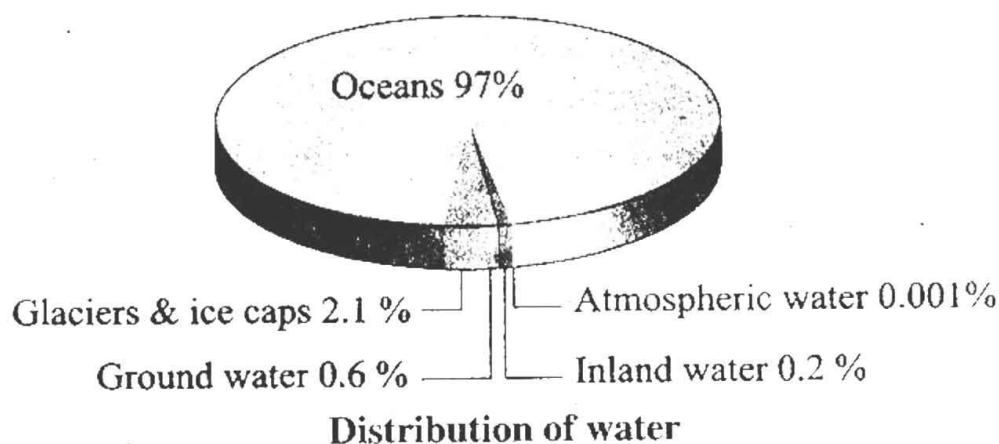
**Ans.** Water is the universal solvent because it can dissolve almost all the minerals. Its ability to dissolve substances is because of two unique properties of water.

- (i) Polarity of water molecule.
- (ii) Exceptional hydrogen bonding ability.

**Q.2 Write occurrence of water?**

**Ans.** The oceans contain about 97% of world water. The rest of the water is in the form of glaciers, ice caps, ground water and inland water (river, lakes, and steams), It is also present

in atmosphere in the form of water vapours.



**Q.3 Why sea water is unfit for drinking purpose?**

**Ans.** Sea water is unfit for drinking and agricultural purposes due to high percentage of dissolved salts. Only 20.2% of the total water on the Earth is potable, i.e. fit for drinking purposes.

**Q.4 What happen if you add lump of cesium to water?**

**Ans.** If you add a lump of cesium to water in a glass trough, the reaction is so vigorous that the trough will shatter into small pieces.

**Q.5 How fluorine is beneficial for life?**

**Ans.** In some parts of the world, the water supply contains small amounts of fluorine compounds. It was found that, in these areas, people did not suffer much from tooth decay. This is because compounds of fluorine protect teeth from decay. This is way many tooth pastes contain fluorine compounds.

**Q.6 How hard water hampers the cleanings action of soap?**

**Ans.** Soap is the sodium salt of a long chain carboxylic acid (fatty acid). Hard water contains salts of magnesium and calcium. These ions react with the soap molecule to form an insoluble precipitate of calcium and magnesium salts of fatty acids called scum. As a result, a large amount of soap is wasted in scum formation. Thus, it reduces the efficiency of soap.

**Q.7 What is meant by water pollution?**

**Ans.** Water pollution is a contamination of water bodies (e.g. lakes, rivers, oceans and ground water). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

**Q.8 What is the difference between soft and hard water?**

**Ans. Soft water:** Soft water is that produces good lather with soap.

**Hard water:** Hard water is that which does not produce lather with soap.

**Q.9 What are the types of hardness in water?**

**Ans.**

- i. Temporary hardness** is because of presence of bicarbonates of calcium and magnesium.
- ii. Permanent hardness** is because of presence of sulphates and chlorides of calcium and magnesium.

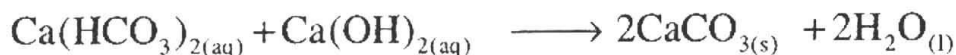
**Q.10 How temporary hardness is removed by boiling method?**

**Ans.** Temporary hardness of water is easily removed by boiling water. On boiling calcium bicarbonate  $\text{Ca}(\text{HCO}_3)_2$  decomposes to produce insoluble calcium carbonate, which precipitates out of the solution.



**Q.11 How temporary hardness is removed by Clark's method?**

A chemical method to remove temporary hardness is by the addition of slaked lime  $\text{Ca}(\text{OH})_2$ . A calculated amount of lime water is added to temporary hard water.



Thus once the magnesium and calcium ions precipitate out water becomes soft.

**Q.12 What is hepatitis?**

**Ans.** It is liver inflammation commonly caused by one of five viruses called hepatitis A, B, C, D and E. Hepatitis A and E can be transmitted by contaminated water.

**Q.13 What is the importance of water in our daily life?**

**Ans.** Its importance is because of two reasons. Firstly, it is an essential and major component of each and every living cell. For example, human body consists of about 70% water. Secondly, it provides an environment for animals, and plants that live in water. So, all living organisms owe their life because of water.

**Q.14 Write characteristics of pure water?**

**Ans.** Good quality water is colourless, odourless and tasteless. Hardness of water can be checked by washing. Soft water produces lather with water. Pure water has least conductivity.

**Q.15 What are the industrial effluents of water pollution?**

**Ans.** Industrial effluents are one of the main causes of water pollution. It includes high toxic organic chemicals, inorganic salts, heavy metals, mineral acids, oil and greases, etc.

**Q.16 What is meant by water borne diseases? How they are controlled?**

**Ans.** Waterborne diseases are those diseases that spread because of drinking polluted water. These diseases spread because of lack of proper sanitation arrangements. These diseases can be prevented by using safe water, properly disposing sewage and controlled use of toxic chemicals.

**Q.17 What is the effect of detergents on scarcity of oxygen?**

**Ans.** Household water in the sewage from toilets, baths, kitchens, etc. consists of detergents used for cleaning purposes. Detergent being non-biodegradable causes rapid growth of aquatic plants. When these plants die and decay, they consume  $O_2$  present in the water. Thus, aquatic life is badly affected because of scarcity of  $O_2$ .

**Q.18 Write a short note on agricultural effluents?**

**Ans.** Agricultural effluents consist of fertilizers and pesticides. These substances provide nitrate and phosphate ions for rapid growth of aquatic plants. When these plants die and decay, their decomposition process consumes  $O_2$  of water. Thus, depletion of  $O_2$  causes damage to the aquatic life.

**Q.19 What is meant by fluorosis?**

**Ans.** Fluorosis is a disease caused by the consumption of excess fluoride. Fluorosis can cause bones and teeth damage.

**Q.20 Give composition of water molecule.**

**Ans.** Water is composed of two elements: oxygen and hydrogen. One atom of oxygen combines with two atoms of hydrogen to form one molecule of water.

**Q.21 What is hepatitis?**

**Ans.** It is liver inflammation commonly caused by one of five viruses called hepatitis A, B,

C, D, and E, Hepatitis A and E can be transmitted by contaminated water.

**Q.22 Write the role of hookworm in causing waterborne disease.**

**Ans.** Hookworm is a parasitic worm that infects the small intestine. Severe cases can result in anemia and stunted growth in children. Hookworm larvae enter the body through the skin, often via the feet. Spread by poor sanitary conditions, hookworms infect about one billion people worldwide per annum.

**Q.23 How Jaundice is caused?**

**Ans.** Jaundice is caused by an excess of bile pigments in the blood. Liver ceases to function and eyes turn yellow. Patient feels weakness and fatigue.

**Q.24 How typhoid is caused?**

**Ans.** A dangerous bacterial disease often spread by contaminated water or by food prepared with contaminated water.

**Q.25 What is meant by water softening?**

**Ans.** The removal of  $Mg^{2+}$  and  $Ca^{2+}$  ions which are responsible for the hardness is called water softening.

**Q.26 What is Capillary action?**

**Ans.** Capillary action is the process by which water rises up from the roots of plants to leaves.

This process is vital for survival of land plants.

**Q.27 Point out two properties of water that makes it an excellent solvent.**

**Ans.** The ability of water to dissolve substances is because of two unique properties which are given below.

- (1) Polarity of water molecule.
- (2) Exceptional hydrogen bonding ability.

**Q.28 Why the water molecule is polar?**

**Ans.** Polar nature of Water: Water molecule has a polar structure i.e., one end of the molecule is partially positive while the other end is partially negative because of electronegativity difference between oxygen and hydrogen atoms.

**Q.29 Explain why non-polar gases are soluble in water?**

**Ans.** Water can even dissolve non-polar (un-ionizable) gases like oxygen, hydrogen and nitrogen etc. through dipole-induced dipole forces.

**Q.30 Which salts are responsible for hardness of water?**

**Ans.** Rain water dissolves many salts of divalent cations like  $\text{Mg}^{+2}$ ,  $\text{Ca}^{+2}$ , and anions like  $\text{Cl}^{-1}$ ,  $\text{SO}_4^{-2}$ ,  $\text{HCO}_3^{-}$  and  $\text{CO}_3^{-2}$ . For example, gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) and lime stone ( $\text{CaCO}_3$ ). These salts make the water hard.

**Q.31 What is the principle of removing permanent hardness of water?**

**Ans.** The permanent hardness can only be removed by using chemicals calcium ( $\text{Ca}^{+2}$ ) and magnesium ( $\text{Mg}^{+2}$ ) are removed as "Insoluble salts" by adding washing soda ( $\text{Na}_2\text{CO}_3$ ) or sodium zeolite.

**Q.32 How addition of  $\text{Na}_2\text{CO}_3$  removes permanent hardness of water?**

**Ans.** The addition of washing soda removes the calcium and magnesium ions as the insoluble calcium and magnesium carbonate respectively.



**Q.33 How sodium zeolite softens water?**

**Ans.** Sodium zeolite is a naturally occurring resin of sodium aluminium silicate  $\text{NaAl}(\text{SiO}_3)_2$ , which can also be prepared artificially. When water is passed through resin sodium ions of the resin are exchanged with the unwanted calcium and magnesium ions of the hard water.



**Q.34 What do you mean by boiler scales? How are they removed?**

**Ans.** Hard water is unfit for use in steam engines, boilers and turbines because insoluble calcium and magnesium salts are deposited inside. This hard deposited layer of calcium and magnesium salts is called as boiler scale, they can be removed by washing the boilers with washing soda, slaked lime and sodium zeolite.

**Q.35 What is an industrial waste?**

**Ans.** All the industrial units discharge their wastes (chemical and solid materials) either to open ground or to water channels this is called industrial effluent.

**Q.36 How water used as a cleaning agent in industries cause pollution?**

**Ans.** Water used as cleaning agent in industries is directly discharged out. This water contains all kinds of toxic chemicals and detergents.

When these effluents or used water enter lakes, streams, rivers or oceans, they either get dissolved or float suspended in water. Even they get deposited on the bed. This results in pollution of water.

**Q.37 Why use of detergents is increasing day by day?**

**Ans.** The use of detergents is increasing in houses and industries because detergents have strong cleaning action that of soap even in hard water. They can even work in acidic solution.

**Q.38 How decaying plants consume oxygen?**

**Ans.** Decaying plants consume oxygen for the biodegradable.

**Q.39 What is function of fertilizers?**

**Ans.** Fertilizers are used to make up the deficiency of nitrogen, phosphorous etc. of the soil because of intensive cultivation of crops in the recent years.

**Q.40 How pesticides cause water pollution?**

**Ans.** Run-off from the agricultural land (where fertilizer and pesticides have been used) enters into ponds, streams or rivers. This water contains nitrate ( $\text{NO}_3^{-1}$ ) and phosphate ( $\text{PO}_4^{-3}$ ) salts. These substances results in a rapid sunlight and air to reach the aquatic life.

When algae dies and decompose, bacteria consume oxygen of the water for decomposition. As a result, oxygen depletes in water. Aquatic animals feel suffocation and ultimately die due to insufficient supply of oxygen.

In this way, pesticides play their role in water pollution.

**Q.41 Define water borne diseases.**

**Ans.** Diseases that spread because of drinking polluted water or eating food prepared with polluted water are called water borne diseases.

**Q.42 What is dysentery?**

**Ans.** Dysentery is an intestinal disease which is typically caused by certain bacteria or parasites. It is characterized by severe diarrhea that may be accompanied by blood or mucous.



**Q.43 Which of the bacteria causes the cholera?**

**Ans.** Bacteria vibrio cholera causes cholera.

### Multiple Choice Questions

**1. Which one of the properties of water is responsible for rising of water plants?**

- (a) specific heat capacity
- (b) surface tension
- (c) excellent solvent action
- (d) capillary action

**2. Specific heat capacity of water is**

- (a)  $4.2 \text{ kJg}^{-1}\text{K}^{-1}$
- (b)  $4.2 \text{ Jg}^{-1}\text{K}^{-1}$
- (c)  $2.4 \text{ KJg}^{-1}\text{K}^{-1}$
- (d)  $2.4 \text{ Jg}^{-1}\text{K}^{-1}$

**3. Water dissolves non-ionic compound by**

- (a) ion-ion forces
- (b) ion-dipole forces
- (c) dipole –dipole forces
- (d) hydrogen bonding

**4. Temporary hardness is because of**

- (a)  $\text{Ca}(\text{HCO}_3)_2$
- (b)  $\text{CaCO}_3$
- (c)  $\text{MgCO}_3$
- (d)  $\text{MgSO}_4$

**5. Temporary hardness is removed by adding**

- (a) quick lime
- (b) slaked lime
- (c) lime stone
- (d) lime water

**6. Permanent hardness is removed by adding**

- (a)  $\text{Na}_2\text{zeolite}$
- (b) soda lime
- (c) lime water
- (d) quick lime

**7. Which one of the following salts makes the water permanently hard?**

- (a)  $\text{NaCO}_3$
- (b)  $\text{NaHCO}_3$
- (c)  $\text{Ca}(\text{HCO}_3)_2$
- (d)  $\text{CaSO}_4$

**8. Rapid growth of algae in water bodies is because of detergent having**

- (a) carbonate salts
- (b) sulphonic acid salts
- (c) sulphate salts
- (d) phosphate salts

**9. Which one of the followings is not a reason of depletion of  $\text{O}_2$  from water**

- (a) decaying of aquatic plants
- (b) biodegradation of aquatic plants
- (c) sulphate salts
- (d) phosphate slats

**10. Which one of the following diseases causes liver inflammation?**

- (a) typhoid
- (b) jaundice
- (c) cholera
- (d) hepatitis

**11. Which one of the following diseases causes severe diarrhea and can be fatal?**

- (a) jaundice
- (b) dysentery
- (c) cholera
- (d) typhoid

**12. Which one of the following gases is used to destroy harmful bacteria in water?**