LESSON TOPIC TWO: WATER

Learning objectives

In this topic, you will learn about:

- Sources and types(soft and hard) of water
- Water pollution
- Uses of water
- Procedure for labouratory preparation of water (distilled water)

WATER

Water is an oxide of hydrogen. It is very important to living things, for without water; there can be no life here on earth. It is the most abundant substance in plants and animals tissue as well the world around us. It accounts for about 70% in human body and is higher in many growing plants. Over 80% of the earth surface is covered with water.

Water is a covalent compound that exhibits hydrogen bonds between its molecules. Water is formed when hydrogen, H_2 is burnt in oxygen, O_2

$$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$$

PHYSICAL PROPERTIES OF WATER

- Pure water is tasteless, odourless and colourless
- Pure water is neutral to litmus paper
- Pure water melt or freeze at 0^oC and boils at 100^oC. Any deviation from this indicates that the water sample is impure.
- Pure water is universal in that it exist in the three state of matter and can dissolve a number of organic and inorganic compound.

SOURCES OF WATER

Water can either be found as a natural source or as treated water. There are natural sources of water found on the earth surface, they include rainfall, spring, wells, river, lake, sea, oceans, lagoons.

Rainfall water: it is the purest form of natural water because it is form as a result of condensation of vapour in the atmosphere.

Spring water: a spring is formed when the water table rises to the surface of the earth. They contains a considerable amount of mineral salts, but very little suspended impurities like dust and bacteria so it can be consumed directly.

Well-water: when a deep hole is dug in the ground to reach the water table, water then flows into the hole forming a well. It contains a lot of clay and other mineral salts.

Rivers: they are channels of water which flows to the sea or ocean. They are formed in the earth surface. They get their water from rain and from sprigs.

Lake water: lacks are deep hollows or basin which are filled with water and are surrounded by land. They are formed on the earth surface and most lakes got their water from rain and springs

Oceans: this is a great body of water that surrounds the masses of the earth, eg Atlantic and Pacific oceans. The water is salty.

Lagoons: this is salty water lakes separated from the open sea by sand banks.

TYPES OF WARER

Hard water: hard water is a sample of water which does not readily form lather with soap. They has a high concentration of dissolved mineral salts, particularly calcium and magnesium salts, eg calcium tetraoxosulphate (VI), magnesium tetraoxosulphate (VI) and calcium hydrogen trioxocarbonate (IV). When soap is added to hard water, the dissolve salt in the water will immediately react with soap to form insoluble salt of calcium or magnesium. The insoluble calcium or magnesium salts form an unpleasant scum which stick to cloth and is difficult to rinse away.

Types of hard water
There are two types of hard water: temporary and permanent hard water
Temporary hard water: this is the hardness of water cause by the presence of hydrogen trioxocarbonate (IV) salt of calcium or magnesium. Temporary hardness can be remove readily by boiling.
Permanent hard water: this is the hardness of water caused by the presence of tetraoxosulphate (VI) salt of calcium or magnesium. This cannot be remove by boiling.
Generally, sample of natural water from rivers and wells except rainwater have varying degree of temporary and permanent hardness.

Advantages of hard water
- Hard water taste better than soft water because of the dissolved minerals in it.
- The calcium salt present in hard water when taken in by animals helps to build strong teeth and bones.
- Hard water helps animals such as snails and crabs to make their shells.

Disadvantages of hard water
- it causes wastage of soap because it requires a lot of soap before it can form lather
- it causes furring of kettles and boilers
- the insoluble salt (scum) form causes dulling of white fabric.

Soft water: soft water is a sample of water that produces lather readily with soap and they contain little or no dissolved mineral salts. Example, distilled water which is almost pure is soft water. Many of its dissolved minerals or impurities are removed through distillation.

Advantages of soft water
- soft water does not waste soap
- it does not deposit scales in boiler and fur in kettles
- it is suitable to use in laundry, textiles, tanning and paper manufacturing industries.

Disadvantages of soft water
- Soft water attacks water pipes made of lead slowly. Hence, water flowing through lead pipes is made a little bit hard, so as not to attack the pipes
- It has no taste, hence it is not suitable for brewing
- It does not contain calcium salts required for the development of strong bones and teeth.

WATER POLLUTION
Pollution means spoiling or contamination of the environment (air, water and land). Water pollution is the gross contamination of natural body of water by such substance as industrial wastes, agricultural and nuclear waste thus making it unsafe for human consumption or to any living

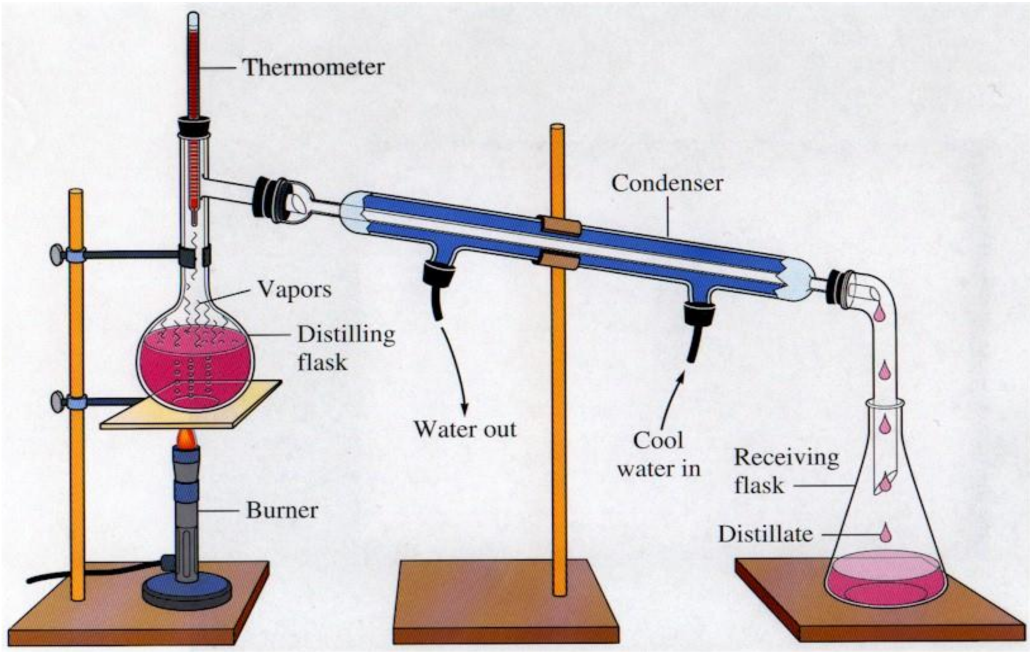
organism that depends on it. Water pollution threatens aquatic life and changes water body into unsightly foul-smelling scene.
The main cause of water pollution is the indiscriminate dumping of solid and liquid waste from home, industries, farm, and land and so on into the water bodies. These wastes are described as water pollutants.

WATER POLLUTANTS
The common water pollutants are:
- Refuse and sewage
- Industrial and agricultural wastes
- Crude oil spills
- Thermal pollution (use of water for cooling process)
- Domestic waste

USES OF WATER
Water is a universal solvent, so many of its uses depend on its ability to dissolve a wide variety of substances. Water can be use for the following purposes:
- For life processes: living organisms need water to dissolve and transport minerals and nutrients necessary for growth and survival.
  Plants need water for photosynthesis and to keep them turgid.
  Each cell in a living organism needs water to function properly.
- Domestic uses: water is use for drinking, washing and cleaning in the homes
- Industrial uses: it is use in the food and chemical industries as a raw material in the production of food, paper, metals and chemicals such as drugs. Other industrial uses of water include cooling and cleaning. The agricultural industry uses water for irrigating crops.
- Recreational: lakeside, beaches and water parks are some places for people to carry out leisure activities such as swimming and boating.

LABORATORY PREPARATION OF DISTILLED WATER (DISTILATION OF WATER)
Distillation is the boiling out of water molecules from contaminants and collecting the boiled out water vapour in a separate container by cooling it below the boiling point of water. The cooling process is called condensation. Hence in the school laboratory distilled water is obtained from aqueous solution by simple distillation. Distillation yield pure water.

To obtain pure water from a salt solution
Procedure:
- Place the salt solution in a distillation flask, add a few small pieces of broken porcelainor boiling chip (anti-bumping granules in order to prevent bumping of the liquid and hence, provide smooth boiling), and set up the apparatus as in the diagram below.
- Heat the solution until it starts to boil. The steam condenses as it passes through the water-cool liebig condenser, to form a distillate, which is distilled water.
- Continue the heating process until only the salt is left in the flask, as the residue.



Simple distillation to obtain pure water

EVALUATION QUESTIOS

1. (a). state the two types of hardness in water (b). Name a salt that causes each type of hardness (c). State one effect of hard water on soap.
2. (a). Mention two sources of water pollution (b). Name three water pollutants and explain why they are pollutants.
3. Explain why temporary hardness of water results in the furring of kettles.
4. Describe briefly the procedure on how a sample of pure water can be obtained from water collected from a pond.

<u>ASSIGNMENT</u>

Water pollution on a large scale has caused serious health problem in the past. Find out how water pollution was in involved in mercury poisoning at Minamata Bay, Japan in the 1950s.