



WORKSHEET 21

School: Ba Sangam College

Year: 11

Subject: Chemistry

Name: _____

Strand	5 – Environmental Chemistry
Sub strand	5.2 -Water and Water Pollution
Content Learning Outcome	-Describe and show some properties of water. -Collect information and present on types of water pollution in Fiji, their sources, effects and ways to minimize these effects. -Describe the stages of water treatment processes and its importance to human health.

Importance of water

- Water is essential for life and for maintaining our lifestyle, which depends extensively on industries.
- Water makes up a very large proportion of all living things. It is essential for many of the chemical reactions in living organisms.

Density of Water and Ice

- Water expands when frozen; therefore, the density of ice is less than that of water, therefore ice floats on top of water.
- Water molecules in ice arrange themselves in a regular hexagonal pattern.

Surface Tension of Water

- Water molecules are attracted to one another.
- Surface tension is **an effect where the surface of a liquid is strong.**

Solubility and Water

- The solubility of a substance is measured by the amount of that substance that dissolves at a particular temperature.
- The solubility of a gas in water depends on the pressure of the gas.
- Gases also become less soluble with increasing temperature.
- Oxygen is also present in all natural waters and is very important for the plants and animals which live in them.
- Green water plants perform photosynthesis and keep oxygen and carbon dioxide balance just as they do on land.
- When water is polluted e.g. with raw sewage, bacteria in the water may feed on the pollutant and multiply very rapidly. These bacteria need oxygen and use it up faster than it can be replaced. The balance is thus upset and animal life can no longer survive in the water.

Water Pollution

- Water can be polluted by toxic chemicals which mainly comes from pesticides and poisonous chemical or by heavy metals, such as mercury and lead.
- Organic materials from household garbage and human waste can also pollute water. Pollutants such as heavy metals accumulate inside fish and people can be affected by eating fish which are contaminated.
- Toxic chemicals from land fill sites can also be washed into the waters which can contaminate surrounding soil and water and harm fish and other aquatic creature.
- Organic pollutants which have high biochemical oxygen demand (BOD) use up oxygen in the water and kill aquatic life.

Hard and Soft Water

- Water which will not form lather with soap is called hard water. The opposite is true for soft water. Hard water contains dissolved salts which react with soap and detergent and prevent it from forming lather.
- Usually the soap causes an insoluble scum to form in hard water.
- Dissolved minerals that cause hardness in water are mainly calcium ions (Ca^{2+}), magnesium ions (Mg^{2+}) and very occasionally iron ions (Fe^{3+}).

Types of Hardness

- There are two types of hardness of water; temporary hardness and permanent hardness.
- Temporary hardness is caused by calcium hydrogen carbonate and can be removed by boiling.
 $\text{Ca}(\text{HCO}_3)_2(\text{aq}) \xrightarrow{\text{heat}} \text{CaCO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 - Permanent hardness is caused by calcium sulphate and cannot be removed by boiling.
 - Washing soda and ion exchange is used to remove permanent hardness as well as temporary hardness.

–Water softening is removal of calcium ions from hard water.

Differences between Soap and Synthetic

Detergent

-Soap is made from natural products like vegetable oil while synthetic detergent is made from synthetic material mainly petroleum products. Soap forms scum when used in hard water whereas synthetic detergents do not form scum in hard water. Soap is biodegradable while some detergents are not biodegradable.

Solvent cleaners and bleaches

-Cleaning solvent is used to remove oil, grease and other contaminants.

-They are usually liquids and their purpose includes removing offensive odour and prevention of contamination.

-Bleaches are used as household chemicals to whiten clothes and remove stains and as disinfectants primarily in the bathroom and kitchen.

Components of soap

-Soap is made up of vegetable oil and caustic soda.

-A soap molecule has two ends: one end that is soluble in grease and the other end that is soluble in water.

-Soap removes oil and grease by helping it to dissolve in water.

Stain removal

-Solvent cleaners remove stains by dissolving the stains in the solvent such as water or alcohol.

-Detergents decrease the surface tension of water, essentially making it ‘wetter’ so that it is less likely to stick to itself and more likely to interact with oil and grease.

Sodium hypochlorite

-Sodium hypochlorite is the most common bleaching agent. It is used in many households to whiten laundry, disinfect hard surfaces in kitchens and bathrooms and keep swimming pools free of infectious agents.

-Excessive exposure to lead causes seizures, mental retardation, and behavioural disorder and memory

Lead Poisoning

-Lead is a heavy metal found naturally in the environment as well as in manufactured products.

-The major sources of lead emissions are motor vehicles, lead smelters, waste incinerators and lead-acid battery manufactures.

problems.

Exercise

1. Briefly explain why the density of ice is less than that of water. **(1 mark)**

2. Briefly explain what you understand by the term ‘surface tension’ of water. **(1 mark)**

3. There are two types of hardness of water, temporary and permanent hardness.

i. Which type of hardness can be removed by boiling? Given a suitable reaction equation to support your answer. **(2 marks)**

ii. List way(s) to remove permanent hardness in water. **(1 mark)**

4. What is the difference between hard water and soft water? **(1 mark)**

5. Briefly explain why soap does not lather in hard water? **(1 mark)**

6. List some effects of lead poisoning. **(2 marks)**

7. List some practices which lead to water pollution.

-People, animals and fish are mainly exposed to lead by breathing and ingesting it in food, water, soil, or dust.

-Lead accumulates in the blood, bones, muscles and fats. It causes damage to the kidneys, liver, brain and nerves and other organs.

-Excessive exposure to lead causes seizures, mental retardation, and behavioural disorder and memory problems.