Chemistry Grade 8
Unit 4 Summary

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Environmental Chemistry

- Air is a homogenous mixture of N_2(78%),O_2(21%) , CO_2(0.03%) and other noble gases(1%) (Ar(0.9%), Ne ,He).
- Air pollution is the contamination of atmospheric air due to harmful gaseous substances and tiny solid particles entering into the air that are not normally present in it. It can also be caused by the emission of gaseous substances like CO_2 which results in an increase in its concentration.
- Air pollution is caused by human activities and some natural processes. Those substances that contaminate air are known as air pollutants.
- Examples of Air pollutants are : sulphur dioxide, carbon monoxide ,nitrogen oxides, particulates and pollen , methane , and CFCs.

Environmental Chemistry

- Air pollutants do not originate from the same sources. Examples :

No.	Air pollutants	Sources of these Pollutants
1	Particulates	During road construction.
2	sulphurdioxide	Burning of fossil fuels,
3	Nitrogen dioxide	Combustion of fossil fuels
4	carbon monoxide	Motor vehicles ,wood stoves

Environmental Chemistry

the lives of animals and plants directly or indirectly. What are the effects of Air pollution?

- Air pollution produces different effects on the environment such as:
  - It can harm the lives of animals and plants directly or indirectly.
  - some air pollutants are responsible for acid rain, while others affect breathing, cause coughing, and irritation to the lungs , bring about ozone depletion.
  - It causes disease and allergies and even death to humans.
  - It is a significant risk factor for a number of pollution related disease such as respiratory infections, heart disease ,stroke and lung cancer.
  - It causes global warming

What is Global warming ?

- It is a long term rise in the average temperature of the earth climate system. It is the major aspect of climate change and has been demonstrated direct temperature measurements .
- it is a phenomenon of climate change characterized by the general increase in the average temperature of the earth which modifies the weather balances and ecosystems for a long time. It is directly linked to the increase of green house gases in our atmosphere.
- it results in rise in sea levels, flood and land slides ,drought and wildfires increase, melting of glaciers…

Water : Hardness of water

- Hardness and softness of water is related to the ability of water to form lather with soap . Hence , water that forms a lather ,readily with soap is called soft water ,where as water that does not readily form lather with soap is called hard water.
- This hardness of water is caused by the presence of certain calcium and magnesium salts dissolved in it.
- The process of removing this hardness of water is called softening of water.

Water : Hardness of water

- Hardness of water can be classified into two:
  - **Temporary hardness of water**
  - **Permanent hardness of water**

	Temporary hardness of water	**Permanent hardness of water**
Causes of hardness	Caused by the presence of dissolved **$Ca(HCO_3)_2$** and **$Mg(HCO_3)_2$**	Caused by the presence of dissolved **$CaCl_2$, $MgCl_2$, $CaSO_4$, $MgSO_4$**
How to remove its hardness	It is removed by boiling	It is removed by precipitation using washing soda,
Its chemical reaction	**$Ca(HCO_3)_2 \xrightarrow{heat} CaCO_3 + CO_2 + H_2O$** **$Mg(HCO_3)_2 \xrightarrow{heat} MgCO_3 + CO_2 + H_2O$**	$Ca^{2+}(aq.) + 2C_{17}H_{35}COO^- \rightarrow Ca(C_{17}H_{35}COO)_2(s)$ $Ca^{2+}(aq.) + CO^{2-} \rightarrow CaCO_3$

What is water pollution?

- **water pollution is the decrease in the quality of water caused by the discharge of solid or liquid into it.**
- **polluted water contains substances that can affect the lives of animals and plants or it can damage property.**
- **These harmful substances that can affect the lives of animals and plants are called water pollutants.**
- **Examples of major water pollutants are :**
  - **Domestic wastes –solid or liquid substances we discharge into waters.**
  - **Agricultural chemicals –fields carrying fertilizers ,pesticides, and herbicides.**
  - **Industrial wastes –liquid wastes from factories which contain acid, residues , heavy metal ions , other harmful chemicals.**

What is water purification ?

- It is the process of removing contaminants from untreated water that is pure enough for an intended use.
- water treatment describes those processes used to make water fit for the desired use.
- Substances that are removed during drinking water treatment include: suspended solids, Bacteria, Algae, Viruses , fungi ,minerals and chemicals such as fertilizers .
- The treatments used in water purification are the followings:

What is water purification ?

- These are :

A. Physical treatment – it involves the screening and filtration processes.
   - Screening –is used to remove large pieces of solid wastes.
   - Filtration- is used to remove fine suspended particles.

B. Chemical treatment – it involves the addition of chemicals into water to improve its quality. The most common chemical treatment methods are:
   - Chlorination – is addition of chlorine into water to kill bacteria and other harmful microorganisms.
   - Addition of Aluminum sulphate – is used for removing dissolved harmful substances to improve the quality of water.

C. Biological treatment – it uses micro-organisms ,mostly bacteria, to decompose waste substances in water ,which converted to carbon dioxide, water and other products. This method is mostly used in waste water treatment ,whereas physical and chemical treatments can be used in treating drinking water and waste

Soil : Components of the Soil

- Soil is a mixture of organic matter ,minerals, gases, liquids, and organisms that together support life.
- Soil is the loose surface material consisting of inorganic particles and organic matter that covers most of the land surface.
- Soil provides the Structural Support and the source of water and nutrients for plants used in agriculture.
- Soil is the top layer of the earth in which plants grow.
- Soil consists of components existing in the three physical states. These are : Solid, liquid and gas component of the soil.

Soil : Components of the Soil

- The Solid component – consists of minerals and organic matter or humus. It makes up about 50% of the total volume of the soil.
- The liquid component – consists of water and dissolved minerals . It makes up about 25% of the total volume of the soil.
- The gas component – consists of air. The composition Soil air is nearly the same as that of the atmospheric air. But , the percentage of carbon dioxide (CO_2)is slightly higher in the soil than that of atmospheric air.

Acidity and Alkalinity of the soil

- The Nature of the Soil depends on the material from which it is developed , the material it contains and many other factors. Naturally a Soil can be :
  - Acidic soil –the concentration of hydrogen ion (H^+) is greater than hydroxide ion (OH^-) and its pH is less than 7.
  - Alkaline soil – the concentration of hydrogen ion (H^+) is less than hydroxide ion (OH^-) and its pH is greater than 7.
  - Neutral soil- the concentration of hydrogen ion (H^+) is equal to hydroxide ion (OH^-) and its pH is equal to 7.

- Generally Soils of humid regions are acidic , soils of arid regions are alkaline and regions where Deseret conditions predominant are neutral.
- All types of soils are not suitable to grow specific crop plant. Each kind of plant can grow in a soil of specific pH range.

Acidity and Alkalinity of the soil

- This implies , pH of a soil is an important factor in determining the suitability of the soil for growing of different crops.
- Plant nutrients are minerals required by plants for their growth and stay healthy. Plants get these minerals from the soil. They do not need all the nutrients in the same amounts for their growth. These plant nutrients can be classified in as :Macro nutrients –are those plant nutrients used by plants in large amount e.g. Nitrogen, phosphorous, potassium, calcium,sulphur,magnesium,carbon,and oxygen. And micro nutrients are those plants nutrients used by plants in smaller amount e.g. Boron, Chlorine, copper, iron, manganese and Zinc.
- Fertilizers are chemicals that are added to the soil to increase Soil fertility which in turn increases the growth of crops.

Types of Fertilizers

- Fertilizers can be classified as:

1.Organic(Natural)Fertilizers–derived from plants and animals. Animal dung, Urine ,Materials obtained from the Decay of Plants residues such as leaves,roots,grass,and green manures.

2.Chemical(SyntheticorArtificial)Fertilizers are manufactured by chemical industries. They are grouped as nitrogen, phosphorous and potash fertilizers(NPK).

Examples:Urea($(NH_2)_2CO$),Ammonium nitrate (NH_4NO_3), DAP($(NH_4)_2HPO_4$),PotassiumSulphate(K_2SO_4),and Ammonium sulfate$(NH_4)_2SO_4$.

The pH range of Soil suitable for the growth of some crops

No.	Crops	pH ranges
1	Potatoes	5.5 - 6.5
2	Oats	5.5 -7.0
3	Beans	6.0 -7.5
4	Barely	5.5 -6.5
5	Wheat	5.5 -6.5
6	Sorghum	5.5 -8.5
7	Maize	5.5 -6.5
8	Tomatoes	6.0 -6.8

Acidity of the Soil

- The acidity of the soil can be reduced or its pH can be raised by spreading lime stone , quick lime and slaked lime into the soil.
- Fuels are substances that are capable of burning to produce heat energy and light. It can be Solid fuel , liquid fuel or gas fuel. Examples of :
- 1. Solid Fuels –Wood, Charcoal, mineral coal are solid fuels
- 2. Liquid Fuels – Kerosene is an example of liquid fuel
- 3.Gas fuels –bottled gas, biogas and natural gas . Fuels are used for domestic use, like wood, coal kerosene, cow dung. They are also used for transportation ,like diesel and petrol and coal. They are also used in generating electricity, as rocket fuels etc.

Fuels

- Coal is used as a domestic fuel and industrial fuel. It is also used in thermal power generation which further helps to produce electricity.
- Coal can be converted into another type of fuels called coke,ammonical liquor, coal tar and coal gas.
- Coke is used in the manufacture of iron and other metals .It is also used in the production of gaseous fuels.
- Ammonical liquor is used to produce fertilizers.
- Coal tar is used as source of organic compounds.
- Coal gas is used as fuel.

Fuels

- Fossil fuels contain some amount of sulfur or sulfur compounds . But, some amounts of sulfur or sulfur compounds will remain in the fuel and during burning of these fossil fuels ,sulfur and sulfur compounds react with oxygen to form sulfur dioxide. Since this gas is air pollutant and one of the causes of acid rain, it has to be removed using different technology.
- The set of technologies used to remove sulfur dioxide from exhaust flue gases of fossil fuel power plant is called Flue gas desulphurization(FGD)

Fuels

- Natural gas (also called fossil gas) is a naturally occurring hydrocarbon gas mixture consisting primarily of methane (CH_4) and small amounts of ethane ,propane , butane and carbon dioxide.
- Natural gas is used in power generation : electricity.
- Crude oil is separated into different fuels and other useful products by a process called fractional distillation based on their differences in boiling point ranges.

(Refer Students' text Book ,Page 112,Table 4.2)