Chemistry Short Notes

Day 1/2

Chapter 1: Atmosphere and environment

- **Composition of Air**

Earth is surrounded by a layer of air called the atmosphere. Air is a mixture of gases; elements (nitrogen, oxygen and the noble gases) and compounds (carbon dioxide and water vapour).

Gases	Percentage by volume (%)
Nitrogen	78
Oxygen	21
Carbon dioxide	0.04
Noble gases (mainly argon)	0.96
Water vapour	Variable

The percentage composition of oxygen and carbon dioxide in air is regulated by the following three processes:

1. **Combustion** is the burning of fuels to release energy. Carbon dioxide is liberated while oxygen is used up.
2. **Respiration** is the breaking down of food to release energy in our body. Carbon dioxide is liberated while oxygen is used up.
3. **Photosynthesis** is the process by which green plants use carbon dioxide and water to make glucose and oxygen.

- **Greenhouse effect and Global Warming**

Many gases such as carbon dioxide and methane traps heat on earth and this is called the **greenhouse effect**. However, as the level of carbon dioxide and methane in the atmosphere is increasing, more heat from the Sun is being trapped on Earth. This leads to a rise in the temperature of the Earth and is called **global warming**. Global warming leads to changes in weather patterns resulting in **climate change**.

- **Causes of Global warming**
    1. Burning of fossil fuels
    2. Cattle breeding
    3. Decay of vegetation and animals
    4. Deforestation
    5. Landfills

- **Effects of Global warming**
    1. Decrease in crop productivity
    2. Melting of icecaps in the North and South poles
    3. Increase in sea level.
    4. More severe droughts or floods in some countries.
    5. Coral bleaching
    6. Heat waves

- **Combating climate change**
    1. Reduce the use of fossil fuels
    2. Use alternative sources of energy such as solar energy and wind energy.
    3. Plant more tress to absorb carbon dioxide from the air.
    4. Save electrical energy by using economic bulbs

- **Air Pollutants**

A number of compounds resulting from human activities and natural activities are known to cause air pollution. Pollutants are substances which are **harmful** to the environment. That is they cause harm to people, animal, plants and materials.

Carbon monoxide:

Most carbon monoxide comes from **incomplete combustion** of fuels in motor vehicles engines and in heating systems. It is also formed from combustion in low ventilated area. Carbon monoxide is **highly poisonous** as it binds irreversibly to hemoglobin in red blood cells which normally carries oxygen to tissue. Carbon monoxide poisoning leads to headaches, loss of consciousness, vomiting and eventually death.

Sulfur dioxide:

Coal and petroleum are major fuels. They are burnt in large amounts in power stations. Both of them contain sulfur which on burning forms sulfur dioxide. This escapes into the air and they form **acid rain**. It also causes eye and skin problems. It irritates the respiratory tract. Sulfur dioxide is released naturally into the atmosphere during volcanic eruptions.

Nitrogen oxides:

At high temperature, nitrogen reacts with oxygen to form oxides of nitrogen. They are produced naturally during lightning and forest fires. But they are also results of some man-made activities. Nitrogen oxides are formed in motorcar engines and by power stations. These oxides damage the human lungs, cause **acid rains** and photochemical smog.

- **Acid rain**

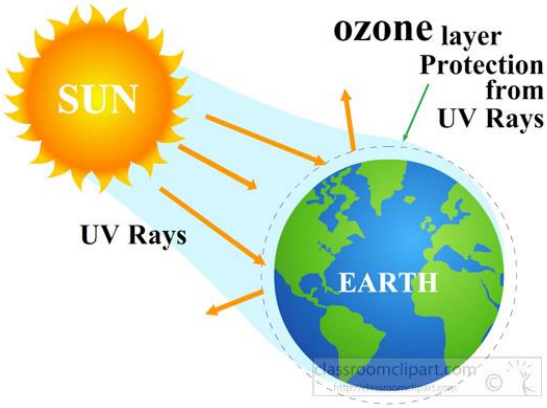
Acid rain is caused when sulfur dioxide and oxides of nitrogen dissolve in rain to form acid. Acid rain consists of mostly sulfuric acid and nitric acid.

Acid rain causes

· Lakes to become acidic, this may cause fish and plants in the water to die.
· Corrosion of limestone buildings.
· Corrosion of metal structures such as bridges, statues and metallic gates.
· Soil acidification and hence improper plant growth.

- **The ozone depletion**

Ozone exists naturally in the upper atmosphere. It absorbs ultraviolet (UV) radiation which can cause damages such as improper plant growth and death of aquatic animals. UV can cause skin and eye problems to human beings. Hence the ozone layer acts as a screen to protect the Earth from UV radiations.



This layer is unfortunately being depleted by chemicals used in human activities. One such group of chemicals is called the **ChloroFluoroCarbons**. These are very stable and inert substances.

CFCs are used as refrigerants, aerosol propellants and industrial solvents.
Ozone depletion leads to:

- Skin cancers and acute eyes problems.
- Destruction of plant and forests.
- Destruction of aquatic life.
- Destruction of materials such as rubber and plastics.

- **Reducing air pollution:**

1. Catalytic converters are fitted in air exhaust pipes to convert any carbon monoxide and oxides of nitrogen to carbon dioxide and nitrogen respectively which are less harmful, before they are released in the atmosphere.
2. Use alternative sources of energy such as solar and wind energy.
3. Sulfur dioxide is produced when coal is burnt. To prevent the escape of sulfur dioxide, factories have chimneys with interior lining coated with wet calcium hydroxide or calcium oxide. This is called **flue gas desulfurisation**. Thus there is a reduction in the formation of acid rain.
4. Avoid burning waste so as to limit the release of carbon dioxide into the atmosphere.
5. Use alternatives to CFCs.

- **Water pollution**

It occurs when harmful substances are released into water bodies such as rivers, lakes and oceans.

1. Sewage released by households and factories contains bacteria and viruses that might cause diseases to humans as well as kill aquatic animals.
2. Fertilisers from agriculture cause algae in water bodies to grow rapidly thus blocking the sun from reaching aquatic plants. When the plants die, bacteria use oxygen from the water leading to a decrease in oxygen level in the water body. Aquatic animals consequently die. This is called **eutrophication**.
3. Waste water from factories may contain heavy metals such mercury, lead and cadmium, as well as detergents, acids and dyes. This substances are harmful to humans and aquatic organisms.
4. Oil spills due to shipwreck affect marine organisms. The oil gets stuck on the feathers of marine birds and the latter cannot fly. Oil spills lead to death of fish.
5. Plastic are the most common garbage dumped into water bodies. They travel over long distances and lead to death of aquatic animals such as dolphins and turtles.

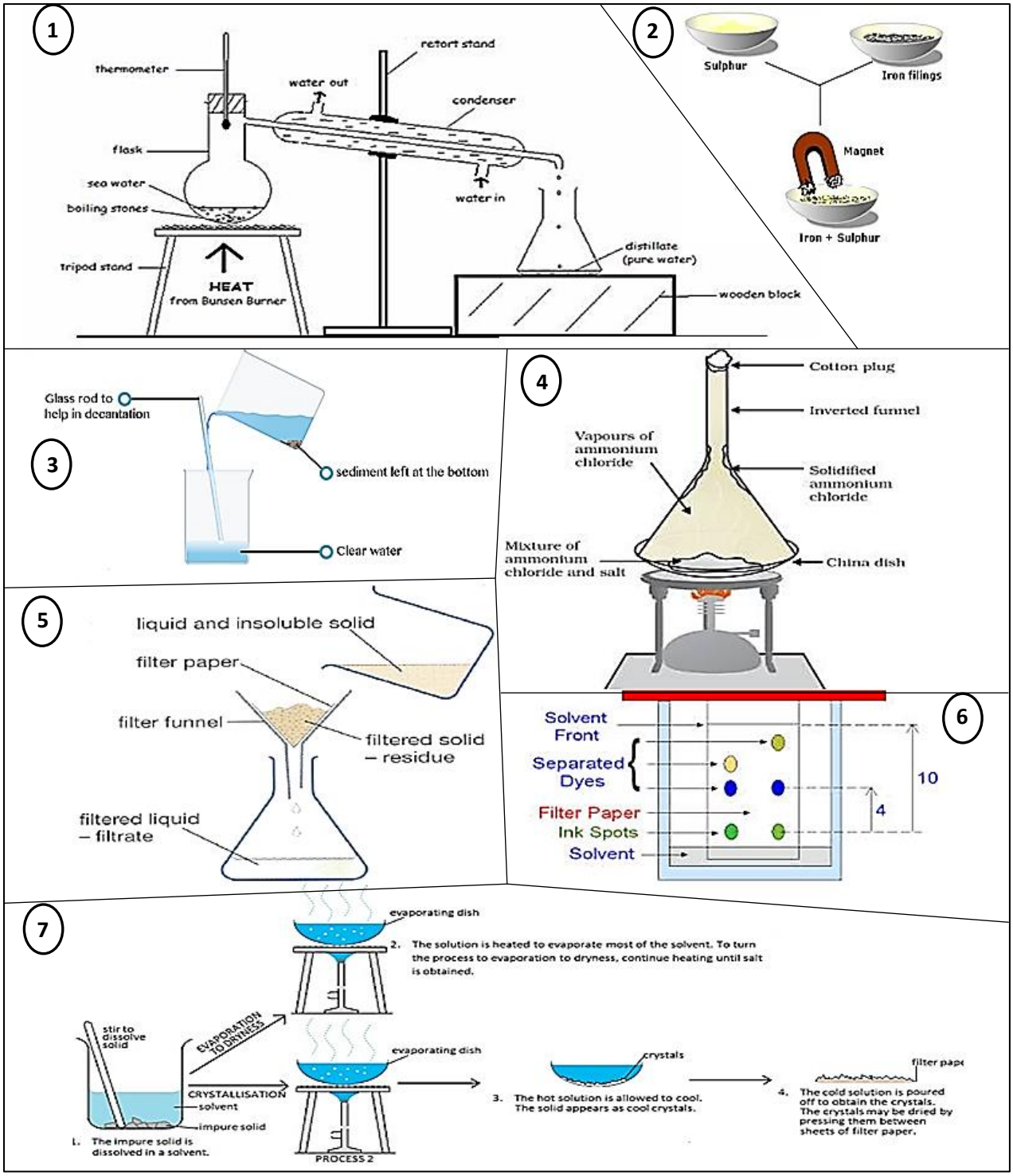
Water pollution can be prevented by:

1. Treating waste water before dumping into water bodies.
2. Use the appropriate amount of fertilisers.
3. Do not throw plastic waste in water bodies.
4. Manage oil spills.

Day 3/4

Chapter 2: Separation Techniques

1. **Distillation:** To obtain pure solvent from a solution. Examples: Desalinate sea water, Make distilled water, purify alcoholic drinks and perfume industries.
2. **Magnetic separation**: for mixtures containing iron. Example: Iron filling and Sulphur powder.
3. **Decantation**: Separate a mixture of solid and liquid with the solid having a higher density. Example: Sand and water.
4. **Sublimation:** To separate a mixture of solids where one of the solids sublime. Examples of substance that sublime are Ammonium chloride, Carbon dioxide, Iodine and Naphthalene.
5. **Filtration**: Separation of a solid and liquid forming a suspension. Example: Sulfur and water.
6. **Chromatography**: To separate different components dissolved in a solvent. Examples: To test purity of drugs, identify colors used in food and doping cases among athletes.
7. **Crystallisation**: To obtain pure crystals from a solution. Examples: crystals of soluble salts, sugar, silicon.


1
thermometer
retort stand
water out
condenser
flask
sea water
boiling stones
water in
tripod stand
HEAT
from Bunsen Burner
distillate
(pure water)
wooden block
2
Sulphur
Iron filings
Magnet
Iron + Sulphur
3
Glass rod to
help in decantation
sediment left at the bottom
Clear water
4
Cotton plug
Inverted funnel
Vapours of
ammonium
chloride
Solidified
ammonium
chloride
Mixture of
ammonium
chloride and salt
China dish
5
liquid and insoluble solid
filter paper
filter funnel
filtered solid
– residue
filtered liquid
– filtrate
6
Solvent
Front
Separated
Dyes
Filter Paper
Ink Spots
Solvent
10
4
7
evaporating dish
2. The solution is heated to evaporate most of the solvent. To turn the process to evaporation to dryness, continue heating until salt is obtained.
stir to dissolve solid
EVAPORATION TO DRYNESS
CRYSTALLISATION
solvent
impure solid
1. The impure solid is dissolved in a solvent.
evaporating dish
PROCESS 2
crystals
3. The hot solution is allowed to cool. The solid appears as cool crystals.
filter pape
4. The cold solution is poured off to obtain the crystals. The crystals may be dried by pressing them between sheets of filter paper.

Chapter 3: The Language of Chemistry

- **Physical changes** are reversible changes (Examples: Melting, freezing, boiling and condensation)
- **Chemical changes** are irreversible processes. (Examples: rusting of iron, cooking)
- **Valencies** are combining power of elements
- A **chemical reaction** occurs when reactants react together to form products.
- A **balanced chemical** equation contains same number of atoms of elements on the left hand side and right hand side.

- **Colour of some compounds**
  - Copper solution: blue
  - Iron (II) solution : green
  - Iron(III) solution: orange
  - Copper (II) carbonate: green powder
  - Copper (II) oxide: black solid
  - Hydrated copper(II)sulfate: blue solid
  - Anhydrous copper (II) sulfate: white solid

Symbols and Valencies

Element	Symbol	Valency
Nitrogen	N	3
Phosphorus	P	3,5
Oxygen	O	2
Sulphur	S	2,4,6
Fluorine	F	1
Chlorine	Cl	1
Bromine	Br	1
Iodine	I	1
Neon	Ne	0
Copper	Cu	1,2
Gold	Au	1
Lead	Pb	2,4
Zinc	Zn	2

Element	Symbol	Valency
Sodium	Na	1
Potassium	K	1
Magnesium	Mg	2
Calcium	Ca	2
Barium	Ba	2
Aluminium	Al	3
Carbon	C	2,4
Silicon	Si	4
Helium	He	0
Argon	Ar	0
Iron	Fe	2,3
Silver	Ag	1
Tin	Sn	2,4

Radical	Symbol	Valency
Hydroxide	OH	1
Nitrate	NO_3	1
Carbonate	CO_3	2
Sulphate	SO_4	2
Ammonium	NH_4	1
Hydrogen carbonate	HCO_3	1
Hydrogen sulphate	HSO_4	1

Diatomic Molecules	State	Formula
Iodine	solid	I_2
Bromine	liquid	Br_2
Fluorine	Gas	F_2
Chlorine	Gas	Cl_2
Hydrogen	Gas	H_2
Oxygen	Gas	O_2
Nitrogen	Gas	N_2