Department of Mathematics and Natural Science

CHE 101: Introduction to Chemistry

Presented by-Muhammad Mahfuz Hasan

Content: **Environmental Pollution Part-01**

Environments and its chemistry, environmental Pollution and Its sources, types of environmental pollution and their effects,

ENVIRONMENT

The surroundings or conditions in which living organism is present is called environment.

ENVIRONMENTAL SEGMENTS

Four segments-

1) Atmosphere- above 500 – 1200 Km from surface
2) Hydrosphere- water content above and below surface
3) Lithosphere- minerals and soil
4) Biosphere- covers all living organism

Pollutant:

A substance present in nature and is greater than natural abundance due to anthropogenic activity and sometimes also natural, which ultimately has a harmful effect on the environment, living organisms and mankind.
For example lead (Pb), SO_2, CO_2.

Pollutants may come from two source.

1. Anthropogenic activity (Human made activity)

2. Natural activity

Environmental Pollution:

Environmental pollution is defined as any undesirable change in physical, chemical of biological characteristics of our land, air or water that may harmfully affect human life or that of other desirable species, industrial process, living conditions and cultural asset or that may waste or deteriorate our natural resources.

Contaminants:

A material does not exist in nature but introduced by human activity into environment.

For example, Cl_2 gas escaped from a derailed railway tank in Florida 1978 and killed 8 people. This gas does not exist in the atmosphere.

Receptor:

The medium which is affected by a pollutant. For example man is the receptor of photochemical smog causing irritation of the eyes and respiratory tract.

Sink:

The medium which retains and interacts with a long-lived pollutant.

For example- A marble wall act as a sink for atmospheric H_2SO_4 and ultimately get damaged.

$$H_2SO_4 + CaCO_3 \longrightarrow CaSO_4 + H_2O + CO_2$$

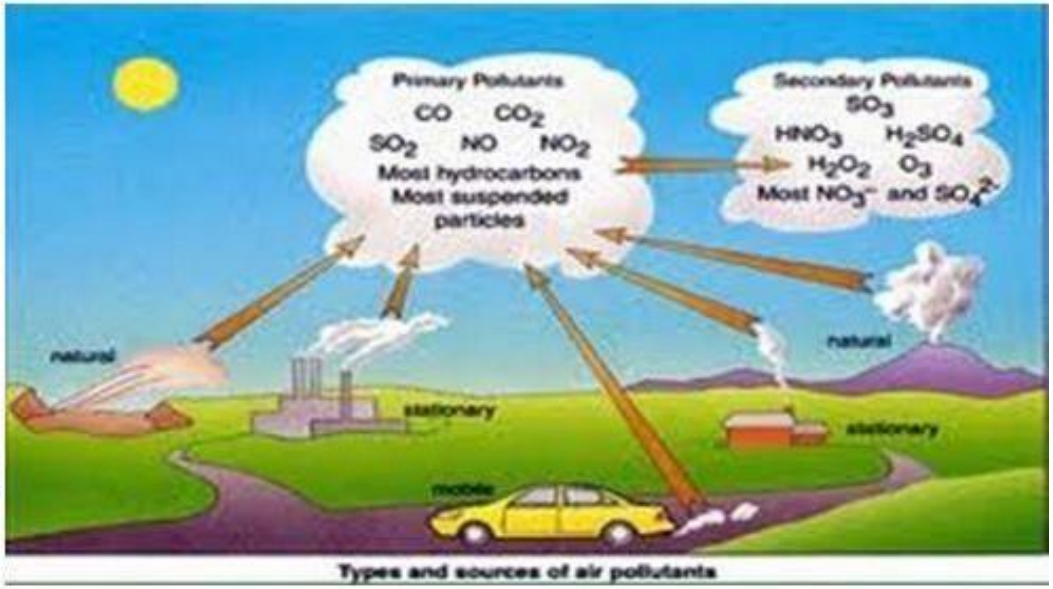
The oceans are the sink for atmospheric CO_2

Types of environmental pollution:

1. Water pollution
2. Air pollution
3. Thermal pollution
4. Light pollution
5. Noise pollution
6. Land pollution

What is the difference between a primary and secondary pollutant?

- Primary pollutant
  - Put directly into air by human activities
    - Ex: Sulfur dioxide released from burning fossil fuel.
- Secondary pollutant
  - Primary pollutants react with other primary pollutants or water vapor to make a new substance
    - Ex: Sulfur dioxide mixes with water in atmosphere and causes acid rain.



Types and sources of air pollutants

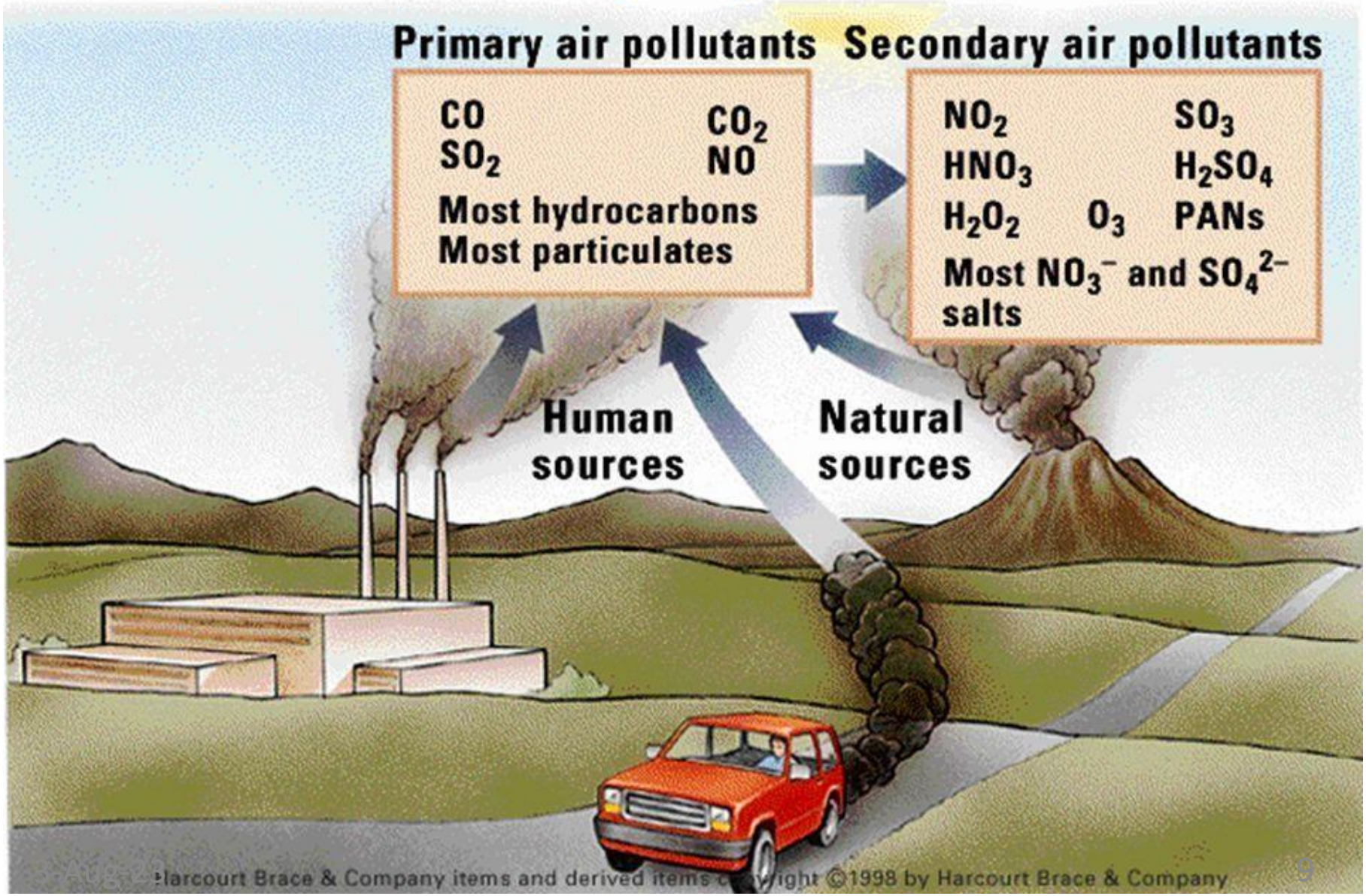
Categories	Primary pollutants	Secondary pollutants
Emission from source	Direct	Indirect
Effect on living things	Direct and Indirect	Mostly direct
Stability	Unstable	Stable
Direct target	Living organisms	Ecological system
How to reduce	Low anthropogenic emissions	Difficult to reduce
Examples	PM, CO, SO2, NOx, VOCs, and heavy metals, etc	O3, PAN, acid rain, enrichment compounds, SPM, etc

Particulate Matter (also called particle **pollution**)

Volatile organic compounds (VOCs) are **carbon-containing gases and vapors such as gasoline fumes and solvents**

Peroxyl acyl nitrates or PAN are **formed by the mixture of Oxygen, nitrogen oxides, and ketone bodies**. it is a major constituent of photochemical smog.

Primary and secondary air pollutants



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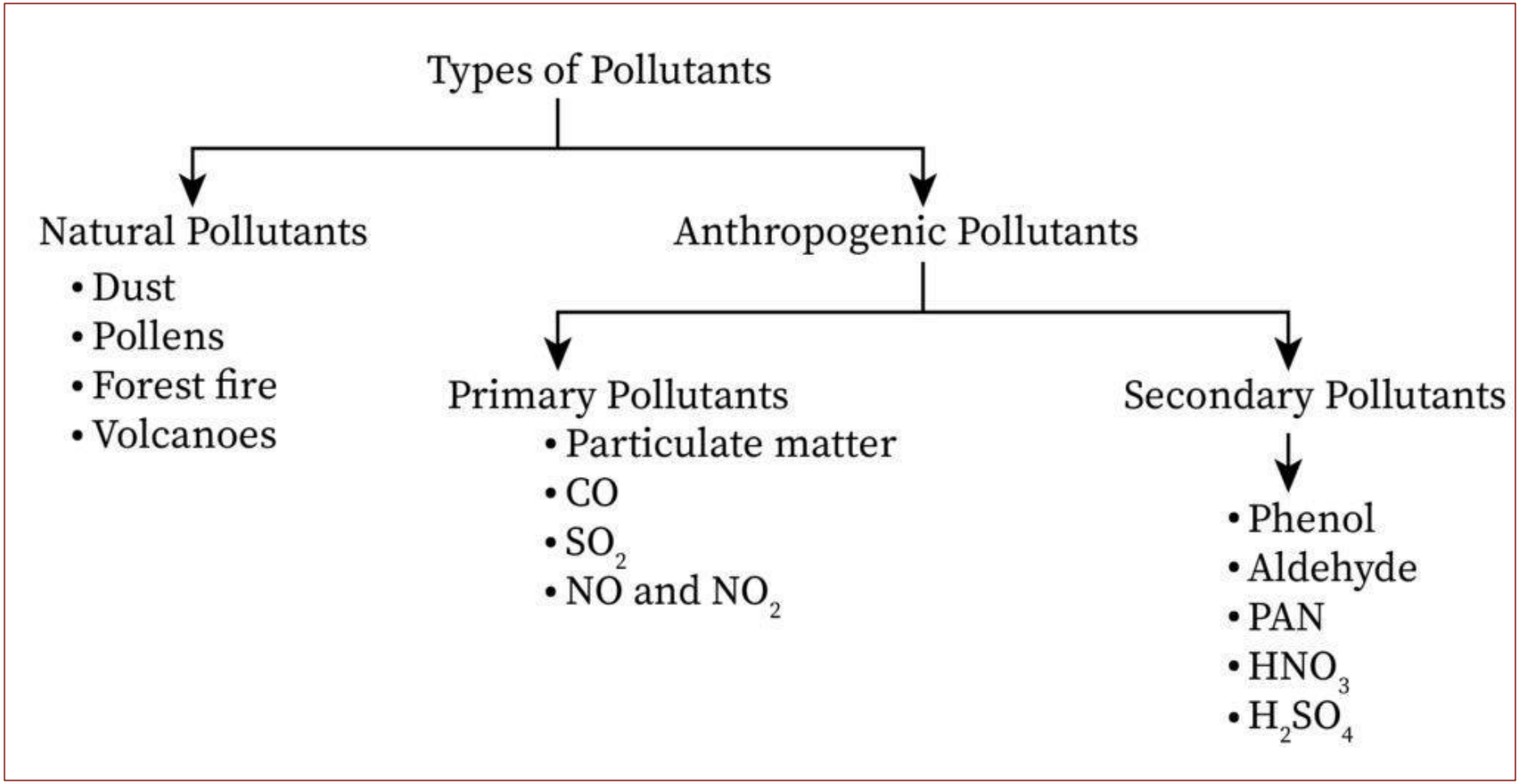
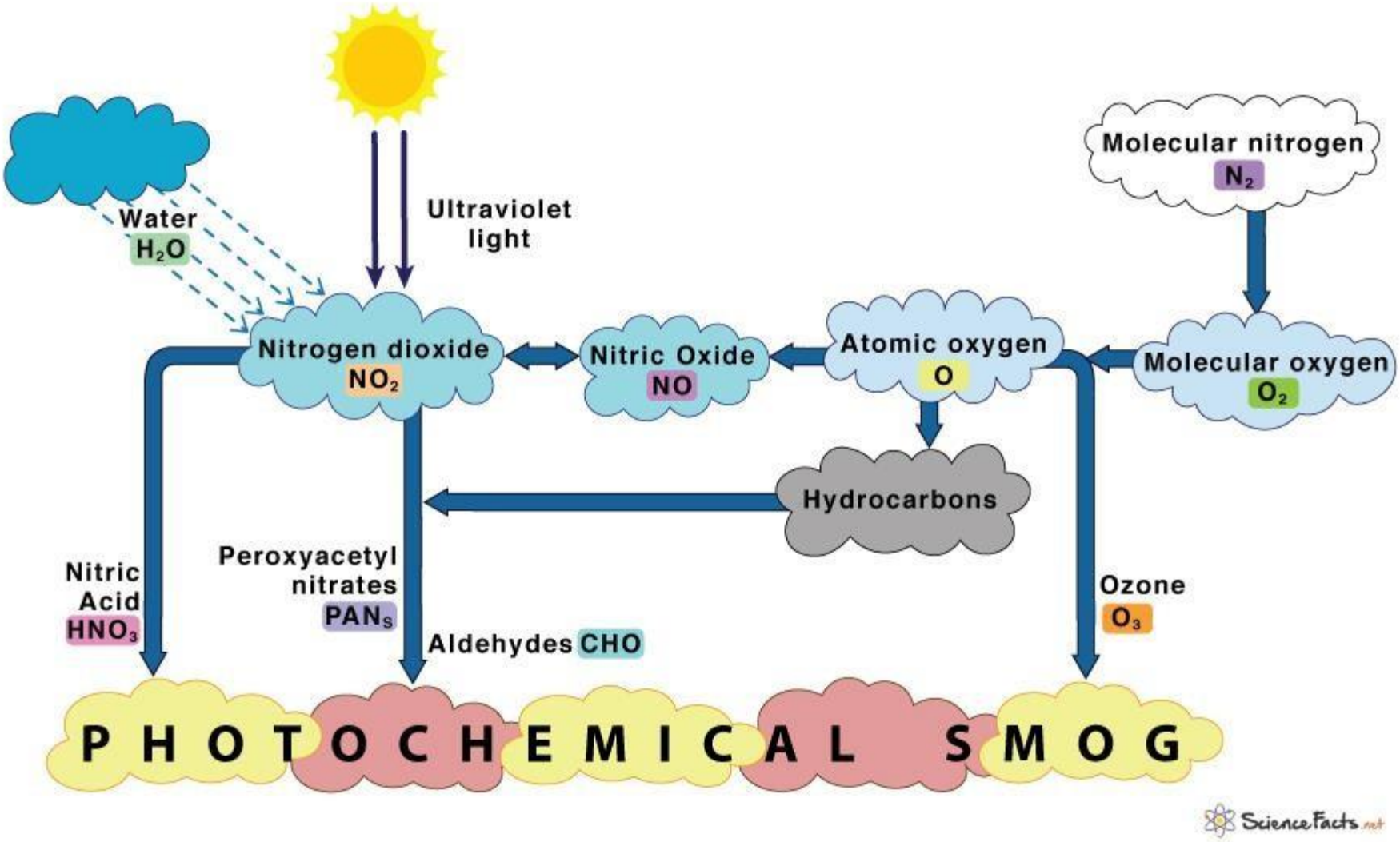
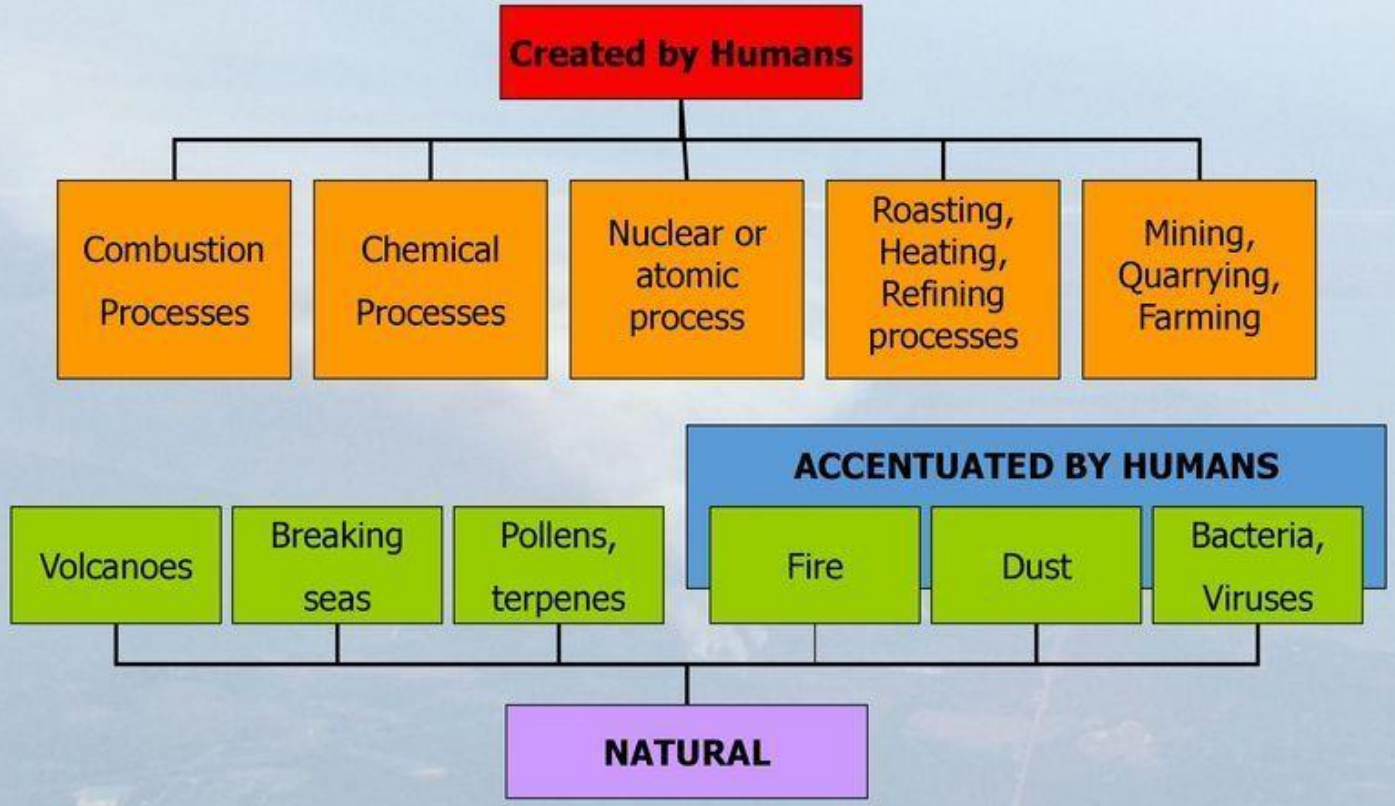

Types of Pollutants
Natural Pollutants
• Dust
• Pollens
• Forest fire
• Volcanoes
Anthropogenic Pollutants
Primary Pollutants
• Particulate matter
• CO
• SO_2
• NO and NO_2
Secondary Pollutants
• Phenol
• Aldehyde
• PAN
• HNO_3
• H_2SO_4

Formation of Photochemical Smog



Sources of Primary Pollutants



Water pollution:

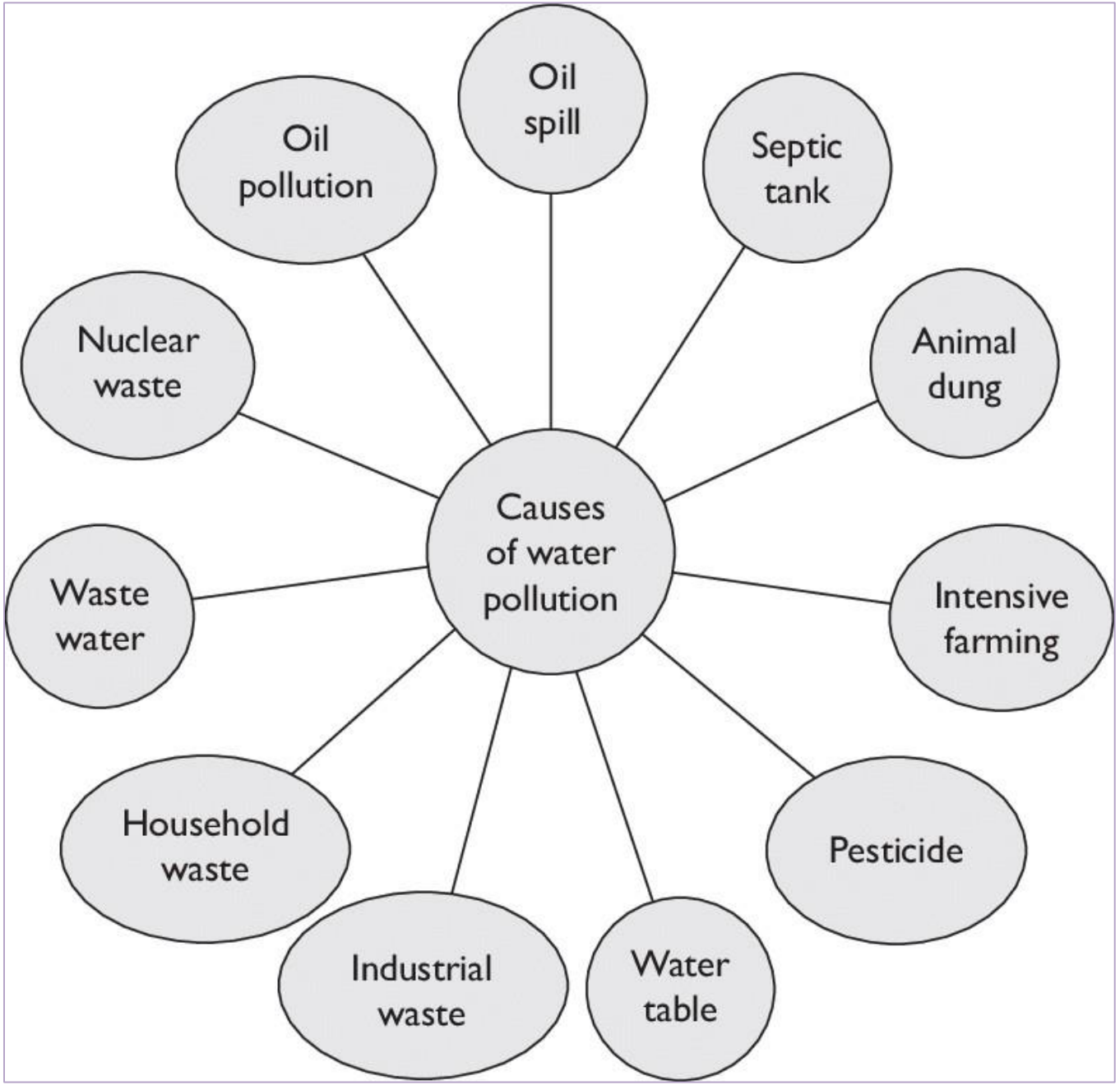
Any human activities that impairs the use of water as resources is called water pollution.

Water Pollutants

- Organic
- Inorganic
- Sediments
- Radioactive materials
- Thermal pollutants

Sources of Water Pollutants

- Industrial wastes
- Sewage and other oxygen-demanding wastes
- Infectious or disease causing agents
- Plant nutrients
- Synthetic organic chemicals
- Inorganic minerals and chemical compounds
- Suspended solids or sediments
- Radioactive substances like I-131, Sr-90, Ra-226
- Thermal discharges
- Oil
- Detergents, etc


Oil spill
Oil pollution
Septic tank
Nuclear waste
Animal dung
Causes of water pollution
Waste water
Intensive farming
Household waste
Pesticide
Industrial waste
Water table

Effects of Water Pollution

- Sewage and domestic wastes effect human health resulting diseases such as cholera, typhoid, dysentery
- Industrial discharges contain Lead, arsenic, Mercury, Cadmium etc., which pose deleterious impacts in life systems

  Lead – damages liver and kidney

  Arsenic – lung cancer, ulcers in gastro intestinal tract

  Cadmium – diarrhea, kidney cysts, bone deformation etc

  Mercury – Neurological disorders
- Agricultural discharges include fertilizers, pesticides which are toxic to both aquatic and human life.

Thank You All