



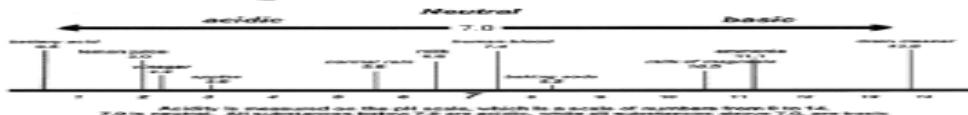
# ENVIRONMENTAL CHEMISTRY



# ENVIRONMENTAL CHEMISTRY

\* Medicines from the Environment \*

**Nutrients**  
- Optimum Amount -  
- Macronutrients  
- Micronutrients (trace)  
**Organic (contain carbon)**  
Carbs, fats, proteins, nucleic acids  
**Inorganic**



**Neutralization**  
Acid + Base → Salt + Water

**Harmful Human Activities**  
Agricultural Waste  
Fuel Combustion  
Industry  
Manufacturing

**Water**  
Chemical Testing (ppm)  
Bioindicator Species

**Air**  
Sulfur Dioxide  
Nitrogen Oxides  
Carbon Monoxide  
Ground-Level Ozone  
Chlorofluorocarbons (CFC's)

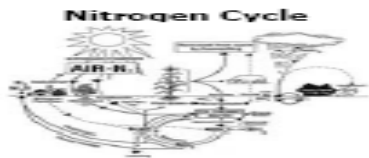
**Soil**  
Pesticides  
Heavy Metals  
Toxins

**Atmosphere**  
Greenhouse Effect  
Enhanced Greenhouse Effect  
Global Warming  
Toxicity

**LD50**

**Chemicals Support or Harm Living Things**

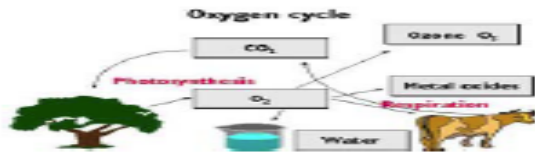
**Monitoring for Quality**



Mo Mn Mg Na Se Fe Sn Ca

Si V B I K Zn Cl Ni Cr Cu S

**Environmental Chemicals**



**Chemical Transportation**

**Chemical Hazards**

**Plants**  
Diffusion  
Osmosis  
Active Transport

**Animals**  
Ingestion  
Digestion  
Absorption

**Environment**  
Release  
Dispersion  
Deposition  
Dissolving  
Dilution  
Leaching

Biomagnification  
Bioaccumulation

W.H.M.I.S.  
MSDS

Labeling  
Disposal Sites

**Substrate**

**Changing Chemical Concentrations**  
Biodegradation  
Phytoremediation  
Photolysis

Storage and Transportation of Dangerous / Hazardous Goods  
Government Regulations



## ***Environmental Chemistry – Preamble & Misconceptions***

**Preamble:** The purpose of this slideshow is to introduce, review, reinforce and provide a study resource, that will help students and teachers become more familiar with the concepts and ideas that are required curriculum components.

**Misconceptions:** The chart on the next slide identifies the **Concepts/Ideas** that are covered in this slideshow – what the **Common Misconception** is and what the **Scientific Response** is, to clarify the student's and the teacher's understanding before the unit begins.



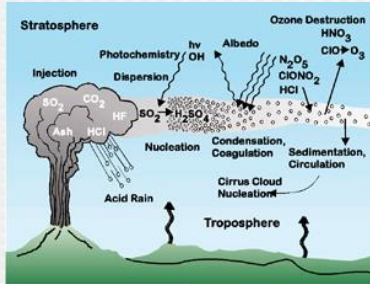
# ***Environmental Chemistry - Misconceptions***

<b>Concept / Idea</b>	<b>Common Misconception</b>	<b>Scientific Response</b>
<b>Decomposition</b>	<b>It disappears</b>	<b>Large molecules of different substances are broken down into much smaller molecules and can involve chemical change.</b>
<b>Diffusion Osmosis</b>	<b>Anything can be diffused Any nutrients can move through cell membranes</b>	<b>Only small molecules (water, carbon dioxide and oxygen can move freely in and out of cells, energy is required for other substances and the process is active transport</b>
<b>Landfill</b>	<b>Waste in landfills is safe</b>	<b>Landfills can produce leachates and toxic vapours that can be harmful.</b>
<b>Nutrients</b>	<b>Plants get their food from the soil</b>	<b>Plants actually use inorganic molecules (Carbon dioxide and water) to make organic molecules (6-carbon sugars) as food</b>
<b>Oceans</b>	<b>They are an infinite supply of water and resources</b>	<b>The continued vast resources of the oceans are affected by the elements in the environment and how they can change the composition of the oceans and interfere with those organisms that live or rely on the ocean for survival</b>
<b>Pollution</b>	<b>Anything natural is not a pollutant</b>	<b>Anything can be a pollutant that does harm to a living organism. This includes natural events, such as volcanoes and forest fires.</b>
<b>Producers</b>	<b>Only land plants are producers</b>	<b>Plants in all environments (aquatic or terrestrial) can be producers and some animals can be producers as well</b>
<b>Respiration</b>	<b>Only animals need oxygen Only animal cells use the process of cellular respiration</b>	<b>Plants need oxygen as well and use the process of cellular respiration to gain energy</b>



# Environmental Chemicals - Types

All living things are made of chemicals and depend on chemicals to survive. Without carbon dioxide and water, green plants could not produce sugar for food. Without oxygen, plants and animals could not carry out cellular respiration.



Forest fires and volcanoes release large quantities of carbon dioxide (volcanoes alone release 130 million tonnes of carbon dioxide each year), sulfur dioxide and ash, which can be harmful to living things. Some chemicals that we use can cause harm.

Some chemicals are also used as medicine, such as Willow bark, which contains *salicylic acid*. A synthetic version of salicylic acid - *acetylsalicylic acid* - was developed by the Bayer company in 1898 and Aspirin was born.



Hippocrates - now known as the 'Father of Medicine' - as early as 400B.C. - recommended willow bark be used to treat pain and fever. First Nations people used willow bark tea as a medicinal drink. Another medicine derived from plants found in the environment is *Echinacea Purposa* - extract from the purple cornflower to help stimulate the immune system.

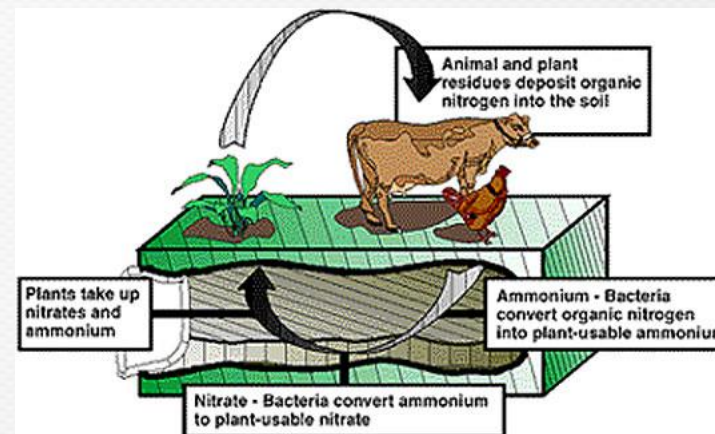


# Environmental Chemicals - Cycles

## The Nitrogen Cycle

Nitrogen (  $N_2$  ) occurs naturally in the atmosphere as a gas. In order for living organisms to be able to use this nitrogen, the two atoms must be separated (**fixed**), so they can easily combine with other elements to form usable compounds.

**Nitrogen Fixation** is the process by which nitrogen gas is fixed in the atmosphere by lightning and fixed in the soil by certain types of bacteria (found in root nodules of beans, clover and alfalfa).



After nitrogen fixation has occurred, plants can use the nitrogen-containing compounds, animals then eat the plants and make larger compounds called proteins, which decomposers can then break down into simpler compounds, to be used over again.

Eventually nitrogen is released back into the atmosphere to begin the cycle all over.



# ***Environmental Chemicals - Activities***

## **Processes/Activities Affecting Environmental Chemicals**

The chemicals in the air and food, that are used by living organisms, are changed by the processes of **cellular respiration** and **metabolism**.

Human activities can cause **pollution** (any change in the environment that produces a condition that is harmful to living organisms) it can include too much of a harmless substance, or toxic materials not occurring naturally.

**Phosphates:** nutrients that enhance growth of plants (excess phosphates stimulate the growth of algae and weeds).

**Dioxins:** chemicals found in certain pesticides and industrial wastes can cause severe illness and possibly birth defects.

**Noise Pollution:** can cause hearing loss and other damage to living organisms.

**Thermal Pollution:** can eliminate species unable to tolerate the increase in temperature



# *Environmental Chemicals - Human Activities*

Many chemicals are released into the air, water and soil every day.

Activities may include:

- Sanitation
- Agriculture
- Manufacturing
- Transportation
- Industrial Processes
- Water and Waste Treatment



These activities can change the concentration of different chemicals and cause an imbalance.

If this becomes a problem, an **issue** is born, which can have various **points of view**.





# ***Environmental Chemicals - Issues/Viewpoints***

## **Issues**

An issue is a matter about which people have different opinions or viewpoints.

- cause of the problem
- seriousness of the problem
- how to solve it

An issue is stated (in a statement that can be supported, or opposed) and is science-related, when science can provide relevant information on the issue.

## **Viewpoints**

Health-related - physical and mental well-being

Recreational - useable for leisure activities

Political - affects a govt. party or politician

Scientific - knowledge gained by observation & experimentation

Technological - problem solving/application

Ecological - concern for protection of ecosystems

Economic - concerned with money & jobs

Educational - acquiring & sharing knowledge

Egocentric - concern for self

Ethical/Moral - right or wrong

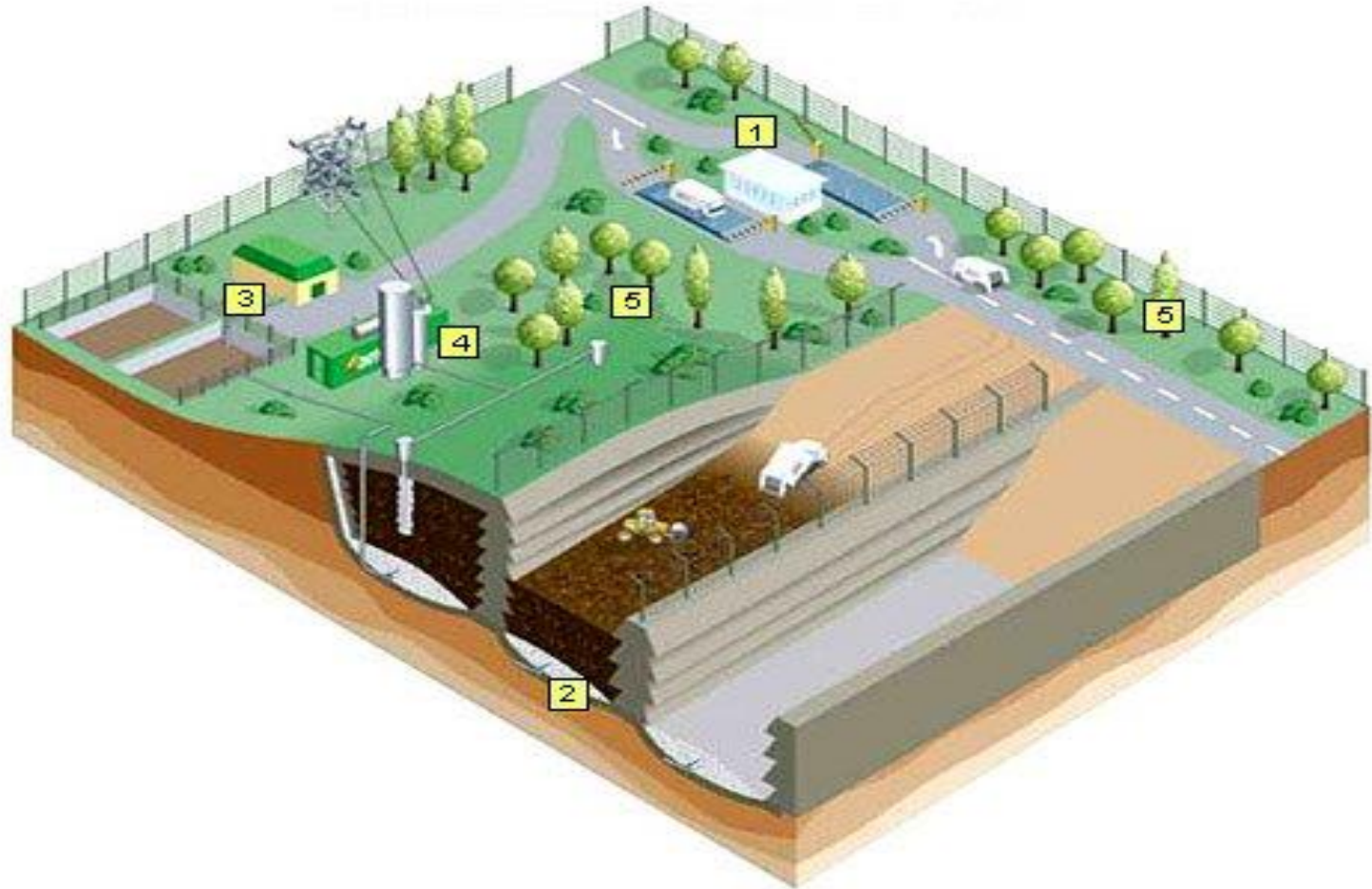


# *Environmental Chemicals - Treatment*

## **Solid Waste Sanitary Landfill**

- 1** – Waste Control
- 2** – Landfill Area
- 3** – Septic System
- 4** – Gas Recovery (Methane)
- 5** – Remediation and Reclamation of land (soil)

Non-hazardous waste landfill



# ***Environmental Chemicals - Treatment***

## **Solid Wastes**

Solid waste includes garbage from households, industries, commercial retailers, institutions and construction or demolition sites. Some of this waste can be recycled or reused, but most of it is placed in landfills. A small amount is incinerated (burned).

**Hazards** that occur when solid waste, are not properly disposed of include:

- air pollution (controlled emissions - scrubbers)
- leaching (prevented by plastic liners and compacted clay foundation at the landfill site)
- contamination (bacteria removes dissolved nitrates, phosphates and undissolved solids from effluent – which also includes: dissolved and undissolved materials from your kitchen, bathroom and laundry)



# Environmental Chemicals - Treatment

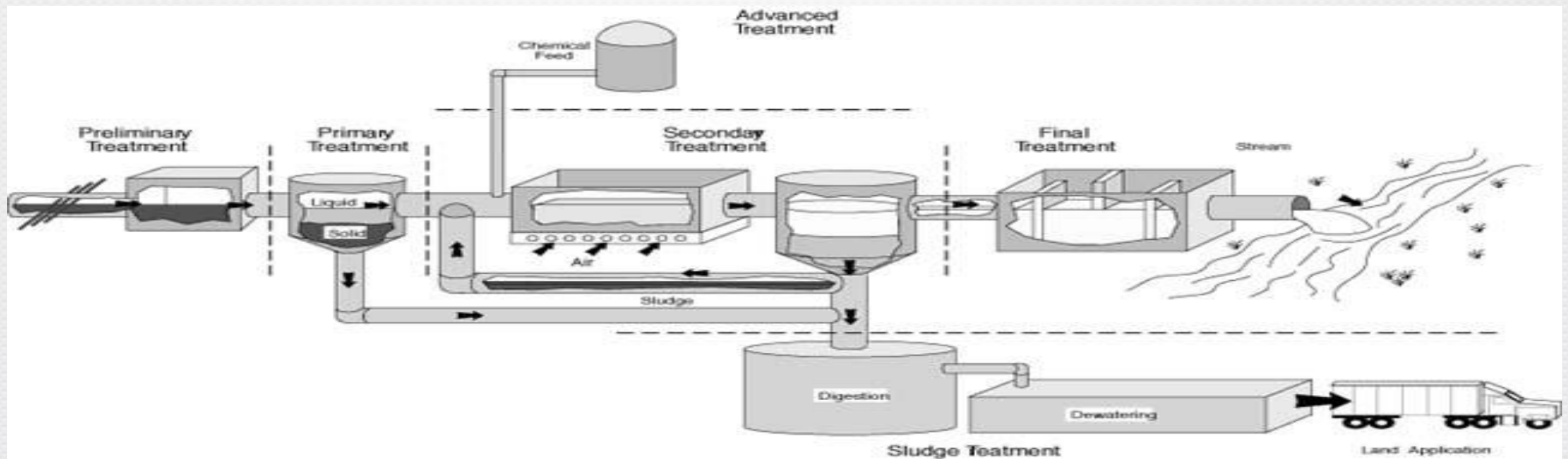
## Waste Treatment Plant (Urban Areas)

A facility treating sewage in three levels or steps.

**Primary - Physical** - filtering, sieving and settling - waste water can be further treated with chlorine and returned to the environment as effluent. Waste material, called sludge, can be recycled as fertilizer or landfill.

**Secondary - Biological** - bacteria and micro-organisms decompose most of the remaining biodegradable waste.

**Tertiary - Chemical** - UV radiation to kill all remaining bacteria and harmful organisms before returning the effluent to the water system.

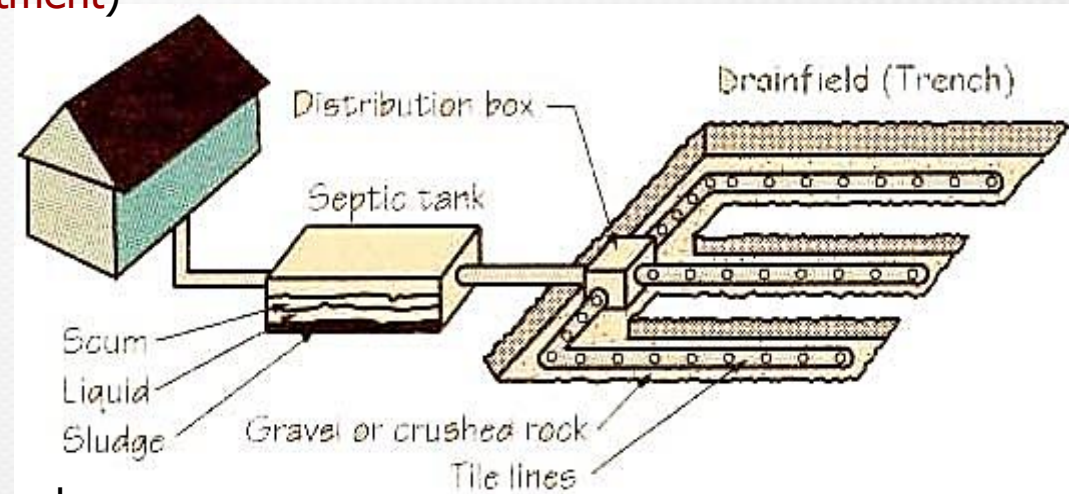


# Environmental Chemicals - Treatment

## Septic System (Rural Areas)

A septic system mimics the way **decomposers** normally recycle biodegradable wastes and consists of:

- A **Septic tank** (that traps grease and large solids which are decomposed by bacteria and later removed, along with the lighter scum, by a professional septic tank pumper). (**primary treatment**)
- A **Distribution box** (for liquid waste)
- A **Drainfield**, all connected by pipes with holes at the bottom of each line, allowing the wastewater to drain into gravel trenches for temporary storage. These pipes (conveyance lines) lead into a drainage area containing gravel. Bacteria and other micro-organisms in the gravel and soil break down the organic waste and use it as a source of food.



The **effluent** then slowly seeps into the subsurface soil where it is further treated and purified (**secondary treatment**). A properly functioning septic system does not pollute the groundwater.

