

ENVIRONMENTAL CHEMISTRY

CONTENT CARD SET



Environmental Monitoring

Chemicals In The Environment

All living things are made of chemicals and depend on chemicals to survive. Without CO₂ 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, 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**. Willow bark contains salicylic acid. As early as 400B.C Hippocrates - the 'Father of Medicine' - recommended willow bark be used to treat pain and fever. First Nations people used willow bark tea as a medicinal drink. A synthetic version of salicylic acid - acetylsalicylic acid - was developed by the Bayer company in 1898 and Aspirin was born. Another medicine derived from plants found in the environment is Echinacea Purposa - extract from the purple cornflower to help stimulate the immune system.

The Nitrogen Cycle

Nitrogen (N₂) 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. The concentration of nitrogen is not the same everywhere, and if nitrogen is needed in the soil, nitrogen-fixing plants (like alfalfa) and fertilizer can help to replenish the supply.

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/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

Processes Affecting Chemicals

Chemicals in the air and food, 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) too much of a harmless substance 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. Many chemicals are released into the air, water and soil every day by agriculture, sanitation, water and waste treatment, industrial processes, manufacturing, transportation can change the concentration of different chemicals causing an imbalance.

Agricultural Activities - to produce crops that will give a good yield farmers must have an understanding of chemistry (fertilizers pesticides, herbicides).

Fuel Combustion - burning hydrocarbons (fossil fuels - including coal, oil and natural gas) produces large amounts of carbon dioxide and water vapor, sulfur dioxides and nitrogen oxides, traces of mercury and lead.

Industrial Processes - Electrical generation, mineral processing and fertilizer production releases harmful chemicals (sulfur dioxides and nitrogen oxides) into the air. Natural gas contains compounds such as methane, ethane, propane, and butane. If natural gas contains hydrogen sulfide it is called '**sour gas**'. If it doesn't it is called '**sweet**'. When hydrogen sulfide is removed, sulfur dioxide is produced. Laws try to reduce these emissions, and the recovery of the sulfur has enabled the natural gas processing plants to manufacture sulfuric acid, which is used in making fertilizers, steel, synthetic fibers and paint.

Solid Wastes

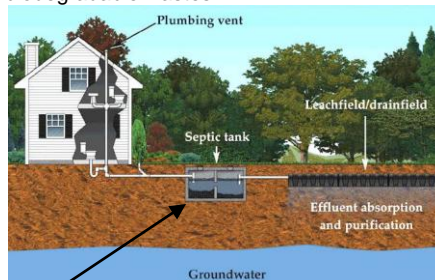
Solid waste includes garbage from households, industries, commercial retailers, institutions and construction or demolition sites. Some of this waste can be recycled or reused, but most of it is placed in landfills.

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)

Septic Sewage System (rural areas)

A **septic tank** is a large underground container that traps grease and large solids. The liquid waste is distributed through pipes with holes; the pipes 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 energy. This system mimics the way in which decomposers normally recycle biodegradable wastes.



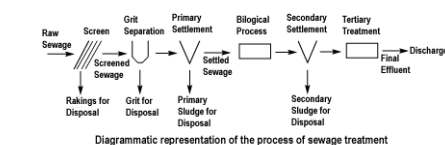
Sewage Treatment Plant (urban areas)

A sewage treatment plant is 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



Diagrammatic representation of the process of sewage treatment