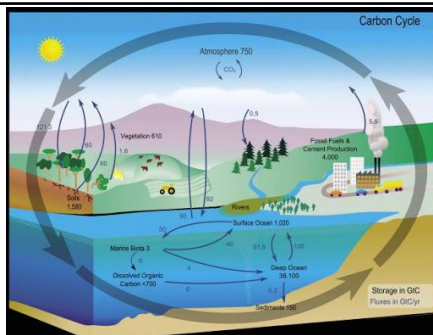
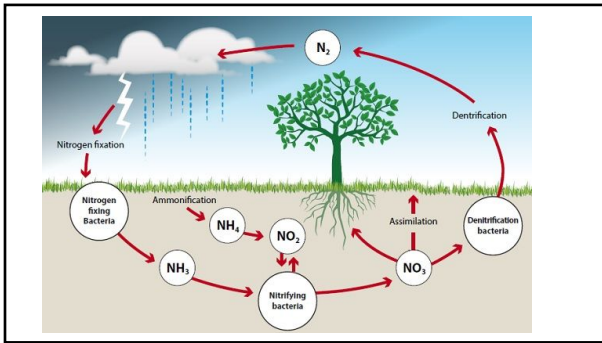


Atmospheric Pollution

APES- Unit 7

Review, Earth's Cycles





Introduction To Air Pollution

What are Air Pollutants?

Definition-is the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.

3 types- Gases, Biological Molecules, Particulate Matter (PM)

Examples

| | |
|-----------------|----------------------|
| Carbon Dioxide | } Coal Combustion |
| Sulfur Dioxide | |
| Toxic Metals | |
| Particulates | |
| Nitrogen Oxides | } Other Fossil Fuels |
| Carbon Monoxide | |
| Hydrocarbons | |



What does Air Pollution Cause?

- Can Lead to the production of Ozone
- Can lead to depletion of Ozone
- Formation of Photochemical smog
- Acid Rain
- Air Quality Issues
- Human Health Problems
- Animal Health Problems
- Soil Health Problems
- Global Warming



Primary Vs. Secondary Pollutants

Primary Pollutants

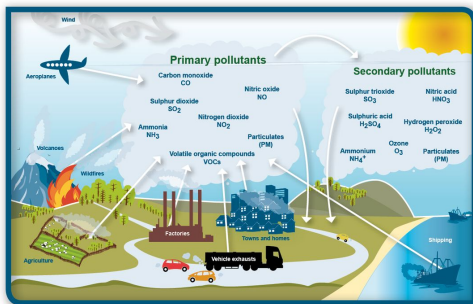
Released directly into the lower atmosphere and are toxic

Ex-Carbon Monoxide

Secondary Pollutants

Those that are formed by the combination of primary pollutants in the atmosphere

Ex- Acid rain



Other Air Pollution Vocabulary

Stationary Sources

Ex- factories

Moving Sources

Ex- cars

Point Source Pollution

Specific Location where pollution is released.

Non-Point Pollution

A combination of many sources



Who is protecting the Air?

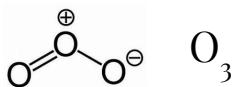
Environmental Protection
Agency (EPA)

- *Clean Air Act*
- *Montreal Protocol (1986)*
- *Energy Policy & Conversion Act (1975)*

National Ambient Air
Quality Standards
(NAAQS)

Ozone

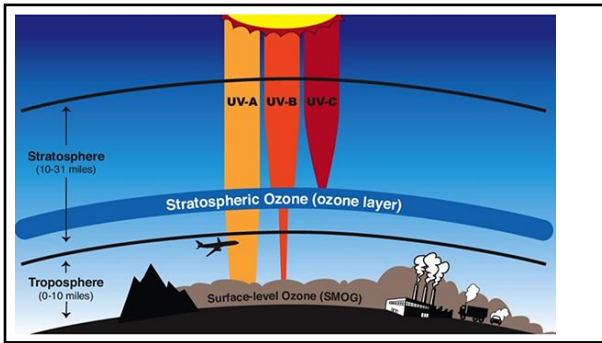
What is it? Is it a good, or bad?



Stratospheric Ozone -Absorbs UV light from the sun. Protects life on Earth

Tropospheric Ozone- A powerful respiratory irritant & precursor to secondary air pollutants

*Up High Ozone helps us; down low, it hurts us

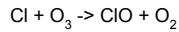


Chlorofluorocarbons (CFCs)

*Invented in the 1930s, CFCs and other related compounds are responsible for Ozone Depletion in the Stratosphere.

*CFCs were used in propellants, fire extinguishers, and cans of Hairspray.

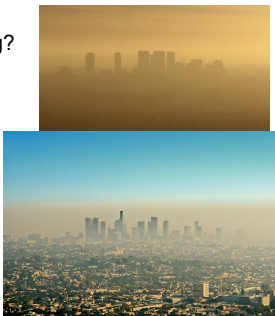
*Once they reach the stratosphere, UV light breaks the molecules apart to form chlorine atoms. Creating Chlorine Monoxide



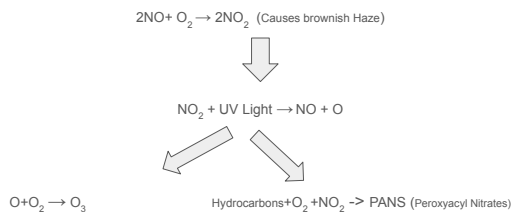
Photochemical Smog

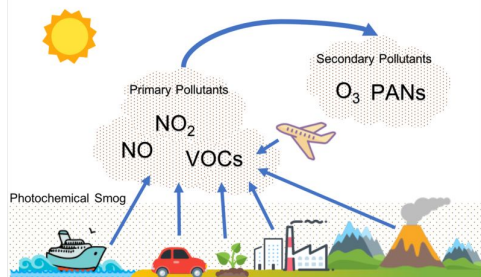
What is Photochemical Smog?

- "Brown Smog"
- Hot, sunny days- the intensity of the sun matters
- Urban Areas
- NO_x Compounds, VOCs, & Ozone all combine
- Las Angeles, California and Athen, Greece are the most susceptible cities



What contributes to Photochemical Smog?





What is the long term health concerns of Photochemical Smog?

Ozone- is hazardous to plants, animals, and materials in the troposphere

Peroxyacyl Nitrates-causes burning eyes & damage to vegetation



Examples of Photochemical Smog Events

The great Smog 1952- London England, December 5th-9th, nearly 12,000 Deaths

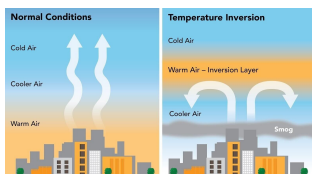
2013 Southeast Asian Haze- Singapore reached a hazardous range of 401

Thermal Inversion

What is Thermal Inversion?

In this phenomenon, air pollutants become trapped over cities

This happen over any city where a large mass of warm air can become stalled



Calm winds and the inversion result in poor air quality.



Atmospheric CO₂ & Particulates

The Natural sources of CO₂ & Air Particulates

CO₂ sources

- Respiration
- Decomposition
- Volcanic Eruptions
- Mother Nature caused Forest Fires



Air Particulate Sources

- Sea Salt
- Dust (Airborn Soil)
- Pollen
- Volcanic Eruptions
- Natural Gaseous Precursors



What is the
opposite of a
natural source?

Anthropogenic

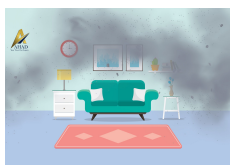
What is the scientific name for
Man-Made?

*Anthropo-, a prefix meaning human, humanoid,
human-like.

Indoor Air Pollutants

What are indoor air pollutants?

Indoor Air Quality (IAQ) refers to the air quality
within and around buildings and structures,
especially as it relates to the health and comfort of
building occupants.

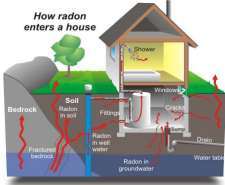


- Asbestos
- Dust
- Smoke
- Radon
- Mold
- Carbon Monoxide
- Nitrogen Oxides
- Sulfur dioxide
- Tobacco Smoke
- Volatile Organic Compounds (VOCs)

Wait..what's radon and asbestos?

Radon-222

Naturally occurring radioactive gas, produced by the decay of uranium found in some rocks and soils



Asbestos

Naturally occurring mineral composed of soft and flexible fibers that are resistant to heat, electricity and corrosion.

Where do indoor Air Pollutants come from?

EVERYTHING

Natural Source

Human Made Sources

Combustion

- Insulation
- Furniture
- Paneling
- Carpets
- Paints
- Upholstery
- Cigarettes
- Vape
- Heaters
- Stoves
- Foundation
- Soil
- Rocks
- Wells

What's the effect of indoor air pollutants?

Shorter Term Effects

- Asthma & other respiratory problems
- Headaches, Dizziness, memory loss, lethargy
- Frequent Colds & Sore throats
- Skin Rashes
- Eye Irritation

Long Term Effects

- Exposure to Radon gas can lead to radon induced lung cancer
- Exposure to Asbestos can cause cancers and lung diseases
- Lung Cancer from Smoke Inhalation
- Chronic Bronchitis

Sick Building Syndrome

What is SBS (sick building syndrome)?

SBS is the term used when the majority of a building's occupants experience certain symptoms.

Hard to Diagnose



Preventing SBS

- Making sure buildings are properly ventilated
- Limiting exposure to certain chemicals & Cleaning Fluids
- Don't smoke indoors



Acid Rain

What is Acid Rain?

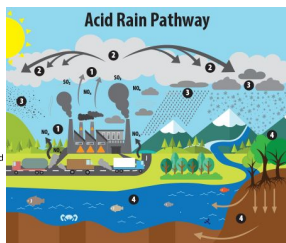
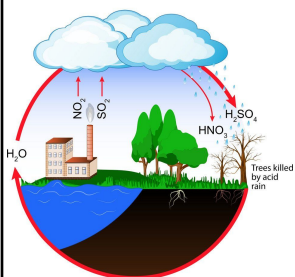
Its real name is Acid Deposition

Due to Nitrogen Oxides and Sulfur Oxides from anthropogenic and Natural sources in the atmosphere.

- Rain usually has a pH of about 5.6
- Acid Rain can have a pH as low as 2.3

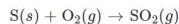


ACID RAIN

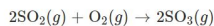


Show me the Chemistry! Sulfur Oxides

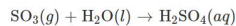
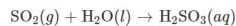
1) Sulfur dioxide (SO_2) is produced industrially from the combustion of sulfur-containing fossil fuels and smelting of sulfide ores



2) Sulfur dioxide (SO_2) is then oxidized by sunlight to form sulfur trioxide (SO_3)

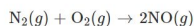


3) The oxides react with water to form acids

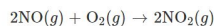


Show me the Chemistry! Nitrogen Oxides

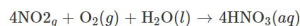
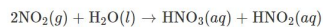
1) Nitrogen monoxide (NO) is produced from internal combustion of engines



2) Nitrogen monoxide (NO) oxidizes to form nitrogen dioxide



3) Nitrogen dioxide reacts with water to form nitric acid (HNO_3) and nitrous acid (HNO_2) or it reacts with oxygen and water and becomes nitric acid



The impact of Acid Deposition

- Mainly affects communities that are down wind from coal-burning power plants
- Can lead to acidification of soils and Bodies of water
- Corrosion of human-made structures
- Regional differences in soil and bedrock affect the impact
 - Limestone bedrock had the ability to neutralize the effect of acid rain on lakes and ponds.
- Creating a buildup of sulfur and nitrogen ions in soil
- Leaching calcium ions from the needles in conifers
- Elevating the aluminium concentration in lakes, that are toxic to fish
- Lowering the pH of streams, rivers, lakes, may lead to fish death
- Causing human respiratory irritation

Examples of Acid Rain



Before and After effects of acid rain on the Taj Mahal



Noise Pollution

What is Noise Pollution?



Noise Pollution is sound at levels high enough to cause physiological stress and hearing loss

Sources of Noise Pollution in Urban Area's

- Transportation
- Construction
- Domestic and Industrial activity

Sources in Marine Ecosystems

- Boats
- Sonar
- Oil & Gas Drilling

The Impact of Noise Pollution on...

Animal Ecosystems

- Stress
- Masking of sounds used to communicate or hunt
- Damaged hearing
- Causing Changes to Migratory Routes

Humans

- Damage to People's Hearing
- Cause anxiety
- Poor concentration
- Loss of productivity
- Lack of sleep
- Stress

Reduction of Air Pollutants

The Three Methods to Reduce Air Pollutants

1. Regulation Practices
2. Conservations Practice
3. Alternative Fuels



Wet & Dry Scrubbers

Industrial Scrubbers are devices that can control pollution by purifying the exhaust streams

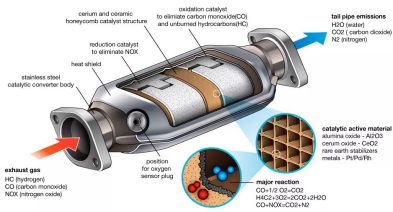
*Both types of industrial scrubbers are able to eliminate acidic gases that are known to directly contribute to harmful acid rain

Wet- remove harmful substances from exhaust gases by using a wet substance to do so. When flue gas is sent through the system, the wet industrial scrubber sprays this gas with a special fluid that reacts mainly with the heavier contaminants that are present in the gas

Dry- sprays numerous dry reagents onto the exhaust stream. This slurry can either neutralize pollutants or change them into a different substance altogether

Catalytic Converter

Converts pollutants (CO, NOx, & Hydrocarbons) into less harmful molecules (CO₂, N₂, O₂ and H₂O)



Vapor Recovery Nozzle



They capture the gasoline vapors that escape from automobile tanks when they are being refueled

The vapors are returned to the underground gasoline storage tank through special hoses and pipes.

Methods to Fix Coal Burning

- Scrubbers
- Electrostatic Precipitators

