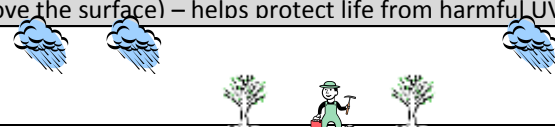


AIM: What are the sources and effects of air pollutants?

Layers of the Atmosphere:

4. thermosphere (thickest layer – extends upward to approximately 480km (300mi) above Earth’s surface)
3 mesosphere
2. stratosphere stratospheric ozone - (O ₃ gas approx. 20-30km above the surface) – helps protect life from harmful UV rays
1. troposphere (lowest / thinnest layer – approximately 11km)



Primary Air Pollutant: substances directly emitted from a process

Primary Pollutant	Source	Health / Environmental Effects	
1 Carbon Oxides (CO and CO ₂)	COMBUSTION OF FOSSIL FUELS ↓ any chemical that readily vaporizes	both are asphyxiants – prevents O ₂ delivery to blood, tissue, and organs CO ₂ – greenhouse gas	
2 Nitrogen Oxides (NO _x) NO – colorless/odorless NO ₂ – reddish brown/pungent		respiratory irritation / illnesses component of acid rain contributes to smog contributes to ground level ozone	
3 Sulfur Dioxide (SO ₂) ("fireworks smell")		smelting	toxic to plants respiratory irritation / illnesses component of acid rain contributes to smog
4 Particulate Matter (PM) (dust, soot, ash, salts)		natural and anthropogenic	respiratory problems (asthma, bronchitis) cardiovascular / lung diseases may lead to cancer volcanic ash → climate alteration
5 Volatile Organic Compounds (VOCs) hydrocarbons: methane, propane, benzene chlorofluorocarbons (CFCs) formaldehyde paints, glues, and solvents		gas fumes, glues, solvents, paints	toxic (affects many body systems) may be carcinogenic contributes to smog contributes to ground level ozone
6 Heavy Metals (mercury, lead) chromium, arsenic, cadmium		smelting coal burning old paint (banned 1978) gasoline (phasedown in 1980s)	brain damage and sensory impairment kidney damage harmful to developing fetuses and young children

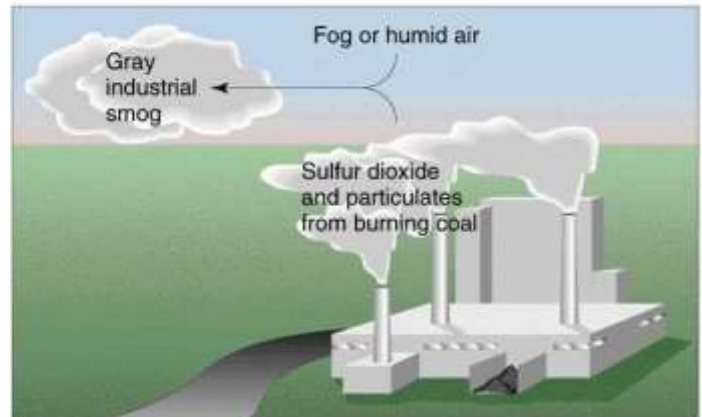
blocks sunlight – causes a temp. drop at Earth's surface

neurotoxins
endocrine disruptors and teratogens

Secondary Air Pollutants: form in the air when primary pollutants react or interact

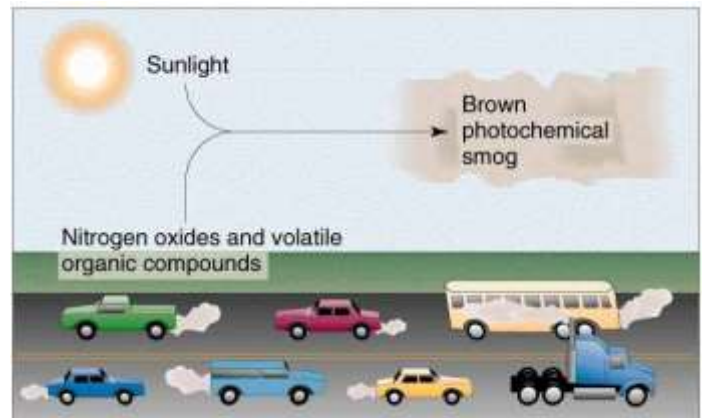
Industrial Smog ("gray-air smog")

- smoke (mainly SO_2 from coal & oil) + fog
- prevalent in urban areas of countries with poor pollution control (China, Ukraine, India)
- London's "Killer Fog" -1952 – killed 16,000 people
- exhibited the synergistic effects of multiple pollutants
- winter months
(heating = burning more fossil fuels)



Photochemical Smog ("brown-air smog")

- sunlight activates reactions with pollutants (esp NO_x + VOCs)
- forms HNO_3 , and ...
- **GROUND-LEVEL OZONE**
- summer months (sunlight is more intense)
(ozone advisories issued in summer months because of negative effects of inhaling ground-level ozone)
- decreased lung function, throats irritation / cough)



Temperature Inversion a.k.a. Thermal Inversion

Normally, air temperature decrease upward through the troposphere.

Sometimes, cold dense air gets trapped under a warm layer of air

prevents smog and other pollutants from rising up and dispersing (explains how L.A.'s surrounding topography causes it to have so much smog)

Donora, PA – 1948

deadly industrial smog lasted 5 days because of thermal inversion

