

Air, Atmosphere and Climate

Lecture Outline

(Chapters 12-13)

Earth's Atmosphere

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- 75% of our atmospheric gases are in the troposphere because of the pull of _____.
- The layers of the atmosphere were named and divided based on _____ differences.

Air Pollution = _____

Common Diseases Caused by Air Pollution:

- _____
- _____
- _____
- _____

Natural and Man Made: Air pollution can be natural like _____
or _____.

Indoor air Pollution

- Indoor air pollution can be _____ times worse than outdoor air.
- _____
- _____
- _____
- _____
- _____
- _____

Radon

- A _____ occurring colorless, odorless, _____, that is responsible for _____ deaths every year.
- _____ leading cause of lung cancer
- _____ air pollution
- Radon comes from _____.
- Radon is very high in some parts of _____
- Radon is a problem in Florida because the porous _____ in Florida allows the gas to pass through.
- Cheapest and easiest prevention is to _____

Asbestos = _____

- Very _____ and _____
- Used in _____

- Fibers floating in the air will _____ making breathing difficult.
- Causes _____ in the lungs and _____
- Victims develop _____ and some die of _____

Dust Mites

- Are in _____ home
- Feed on _____
- Lay eggs every _____ days
- One ounce of dust contains _____ living dust mites
- Can cause serious _____.
- Most are in your _____.

Outdoor Air Pollution

PM₁₀ = particulate matter that is less than 10 micro meters in size. A micrometer is _____ of a meter. This is small enough to get past your _____

- _____ of all air pollution comes from _____.
- The 10 cities with the most polluted air (*ozone pollution*)
 1. _____
 2. Bakersfield, CA
 3. Visalia, CA
 4. Fresno, CA
 5. Houston, TX
 6. Sacramento, CA
 7. Dallas-Fort Worth, TX
 8. Charlotte, NC
 9. Phoenix, AZ
 10. El Centro, CA

Ground Level Ozone

- Ozone is created when _____ and _____ (*volatile organic compounds*) are altered by _____.
- Ozone levels are higher in the _____ and on _____ days.
- NO_x and VOCs mostly from _____ and _____ burning fossil fuels.
- Health effects – _____ (long term exposure)
- Ozone also destroys _____ in plants.

Thermal Inversion

- Normally _____ air _____ taking pollution up out of our breathing area.
- **Thermal Inversion** is when a ceiling of _____ air traps _____ air below and trapping _____ with it.
- Thermal inversion happens in _____ because the city is in a _____ surrounded by _____.
- _____ air from the mountains is dense (heavy) and sinks from the _____ down into the valley.
- Native Americans called it _____

US Congress makes laws to regulate air pollution:

- Air Pollution Control Act – 1955
- Clean Air Act – 1963
- Air Quality Act – 1967
- Clean Air Act Extension – 1970
- Clean Air Act Amendments – 1977, 90



Example: Ban of _____ in gasoline 1973. _____ causes brain & nerve damage in children.

Alternative Fuels for Cars:

1) **French Fry Car** - burns used vegetable oil

The Good:

- _____
- _____
- _____

The Bad:

- _____
- _____
- _____

2) **Ethanol** - made from _____ crops, mostly _____ in the US.

Other crops that can be used: _____

E85 means _____% ethanol and _____% gasoline.

Most gasoline in the US is _____% ethanol.

The Good:

- _____
- _____
- _____



The Bad:

- _____
- _____
- _____

• Other crops that can be used to make Ethanol.

- _____
- _____
- _____

- _____
- _____

- **Cellulosic Ethanol** = uses genetically modified _____ to digest and ferment the woody tissue _____ parts of the plants.

3) **Biodiesel** – made from _____ crops.

The Good:

- _____
- _____
- _____
- _____

The Bad:

- _____

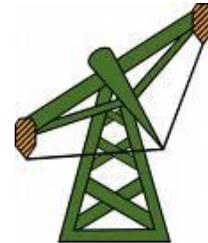
4) **Natural gas (NGV)**- _____ with some ethane, propane, & butane.

The Good:

- _____
- _____

The Bad:

- _____
- _____



5) **Hydrogen Fuel Cells**

The Good:

- _____

The Bad:

- _____
- _____

6) **Electric Vehicle (EV) / Battery**

The Good:

- _____
- _____

The Bad:

- _____
- _____



7) **Hybrid Cars** are a combination car containing an _____ motor and a _____ engine.

The Good:

- _____

The Bad:

- _____
- _____

Weather and Climate

Weather = atmospheric events at a _____.

Climate = the interaction of the _____ (earth's air), _____ (earth's water), _____ (earth's crust), and _____ (earth's life) over _____ periods of time.

Greenhouse Effect

- It keeps the temperatures on earth _____ and _____.
- Our atmosphere is clear like glass that allows _____ radiation in and then traps some of that heat around earth so it doesn't escape.
- Heat trapping gasses are : _____

Global Climate Change / Global Warming

- Increasing the heat trapping gases holds in _____ heat.
- Global warming is the increase of the _____ on earth.
- Ancient ice cores from Greenland show that over the last _____ years, as CO₂ goes up and down the _____ goes up and down.
- Since the industrial revolution, carbon dioxide in the atmosphere has increased _____.
- The oceans strongly influence our _____.
- The oceans absorb _____% of the sun that hits the earth and then _____ that energy and water into the atmosphere and creates the climate.
- Since _____ the glaciers are _____.
- Global warming is melting the Siberian permafrost and releasing tons of _____ gas.
- Methane is _____ times more potent greenhouse gas than CO₂.
- His methane release is expected to warm earth _____ than expected.

Ocean Acidification

- The ocean are called _____ because they absorb large amounts of _____ from the atmosphere.
- Carbon Dioxide reacts with water and makes _____.
- The pH in the ocean is _____.
- Lower pH prevents some important species from making their _____.
- The extinction of _____ in the ocean would likely cause a _____ effect of extinction.

Expected changes from global warming include:

- Forecasts of climate change are most based on sophisticated _____
- The climate system is extremely _____.

Predictions....

- Earth's temperature will increase _____.
- Seas will rise _____ by 2100.
- Increased _____ and _____.
- Mass extinction of species.

Acid Rain

- Acid rain has a pH of _____.
- Normal rain has a pH of _____ to _____.
- pH Scale – _____.
- Acid rain kills _____.
- It can _____.
- It also comes in the form of _____, _____, _____, _____, and _____.

What causes acid rain?

- Burning of _____ (like: _____) releases _____ and _____.
- These gases react with _____ in the air to form acids.
- $\text{SO}_2 + \text{water vapor} \rightarrow (\text{_____})\text{H}_2\text{SO}_4$
- $\text{NO}_x + \text{water vapor} \rightarrow (\text{_____})\text{HNO}_3$

EPA Acid Rain Program

- Phase 1 began in 1995 and reduced NO_x and SO_2 by _____ by requiring fossil fuel burning power plants to upgrade equipment.
- **Cap and Trade Regulation** is how the EPA acid rain program is _____.
- Cap and Trade laws use the _____ to control gas emissions.
- **Cap** = the _____ for a particular gas.
- **Trade** = those who get emissions far below the limit can _____ the difference to others who want to go above the legal limit.

Ozone Depletion

- Ozone is a molecule made up of _____
- Ozone close to _____ is a pollution (common in the _____ and _____).
- Ozone in the stratosphere protects us from 99% of _____ radiation from the sun.
- Ozone in the northern hemisphere is declining _____ per decade
- Ozone is thicker in the _____ and thinner in the _____.
- Ozone is thinnest over the _____ (70%).

Why are we losing ozone?

- Ozone can be depleted by _____ catalysts:
Nitric oxide – _____
Hydroxyl – _____
Chlorine – _____
Bromine – _____
- **Chlorofluorocarbons (CFCs)** used in _____ and _____ float up to the _____ (takes 10 -100 years).
- Once there: _____ splits off _____ which has the ability to break apart up to _____ molecules.
- The Antarctic ozone hole was discovered in _____.
- In 1987 the Montreal Protocol required the _____ of ozone destroying substances by _____.
- Destruction of ozone has slowed since the ban and full recovery is expected by _____.