EQ #9-Why is the Clean Air Act Needed?
What does it do?

Thursday 2/13

- **Unit Test Tomorrow**- Climate & Energy; Unit Study Guide and INB (EQ #6-8) Due

- Today-
  *What is air pollution? How does it affect the natural world and human life?
  *Why was the CAA needed? When was it passed?
  *How does the CAA work to protect air quality?

Read the Articles

- Discuss What you read and then answer Q's on a new LEFT side in INB.
  *Title- Eugene's Air Q

- 1. In the past, which TWO activities caused most of Eugene's air quality issues?
  2. What changed to improve that?
  3. What pollutant occurs due to forest fires and wood smoke?
  4. Are there other air pollution problems in Eugene? Explain.

Air Pollution and Human Health

- Breathing polluted air can irritate eyes, nose and throat and make breathing difficult and can shorten lives with illness.

- In the U.S., 30 million now have asthma and are sensitive to air pollution.

- Some toxic chemicals released into the air (benzene or vinyl chloride) can cause cancer, birth defects, lung, brain and nerve damage!

Air Pollution & Human Health

- In 2016, 4.2 million people died prematurely due to air pollution according to the World Health Organization;
  - The number is expected to rise to 6 million by 2050
  - **Show Graphic**-https://ourworldindata.org/grapher/annual-deaths-from-outdoor-air-pollution-by-region

Air Pollution and the Environment

- Toxic chemicals, acid rain and smog damage trees, crops, wildlife, lakes, rivers and oceans.

- Fish and aquatic life suffer from air pollution,

Air Pollution and the Economy

- Air pollution causes thousands of illnesses each day.
- This leads to lost days of work and school.
- Air pollution reduces agricultural crop and commercial forest yields by billions of dollars each year.

What led to the Clean Air Act?

- In 1952, over 3000 people died in a "killer fog" in London. Smog from pollution was so thick **buses could not run without guides** walking ahead of them.

- Similar events had also occurred (but with fewer deaths) in U.S.

The Clean Air Act (CAA), 1970

- The first CAA was passed in 1963 but was NOT very strong or effective.

- CAA of 1970 was the first comprehensive federal response to air pollution passed.

- The **Environmental Protection Agency** (EPA) was created in 1970 and carries out and enforces the law.

- In 1990, the CAA received significant revisions and expansion.

Tuesday 2/18

- Unit Test Last Friday- Make up by Wednesday
- Which human activities are harming air quality most? How and why?

CAA 1990 Additions

- The 1990 Amendments added requirements to reduce ACID RAIN, OZONE DEPLETION and TOXIC AIR POLLUTION.

- These were significant additions to the original CAA.

How is the CAA Enforced?

- The **Environmental Protection Agency's** (EPA) mission is to protect human health and the environment.

- The EPA measures and sets limits on air pollutants, including limits on how much can be in the air anywhere in the U.S.

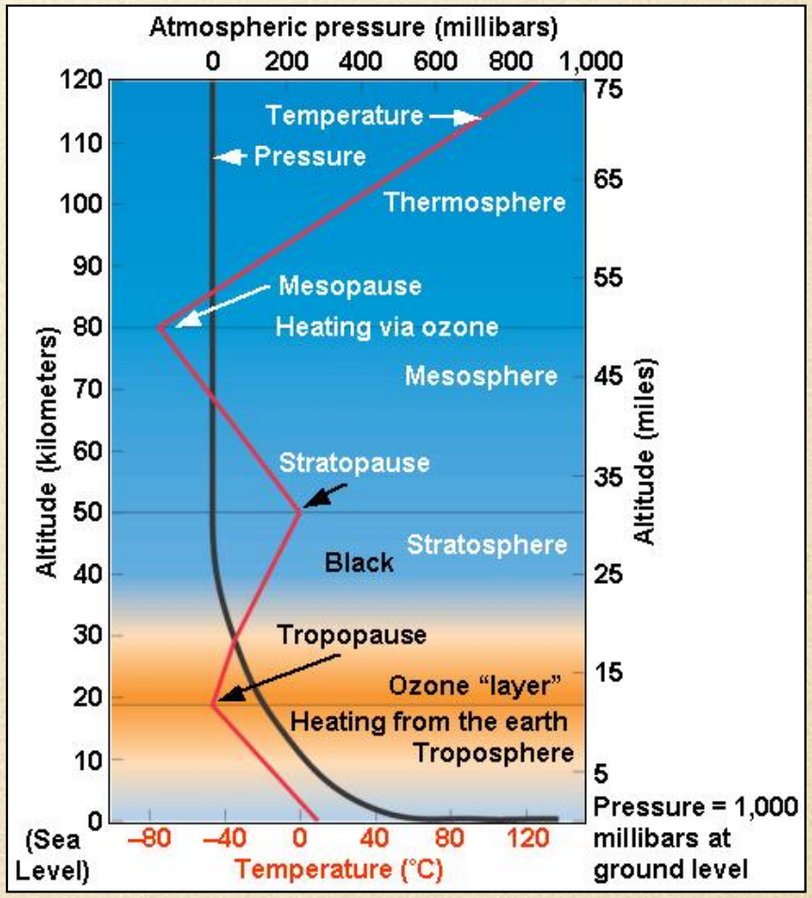
- EPA can limit emissions from chemical plants and industrial plants; can require cars to run cleaner.

Purposes of the CAA

- The Clean Air Act has three purposes-
- 1. To reduce outdoor concentrations of air pollutants.
- 2. To reduce emissions of toxic air pollutants that cause serious health risks (like cancer).
- 3. To phase out production and use of chemicals that destroy stratospheric ozone (Ozone Layer / GOOD Ozone)

What is the Composition of Earth's Atmosphere

Fig. 20-2 p. 434



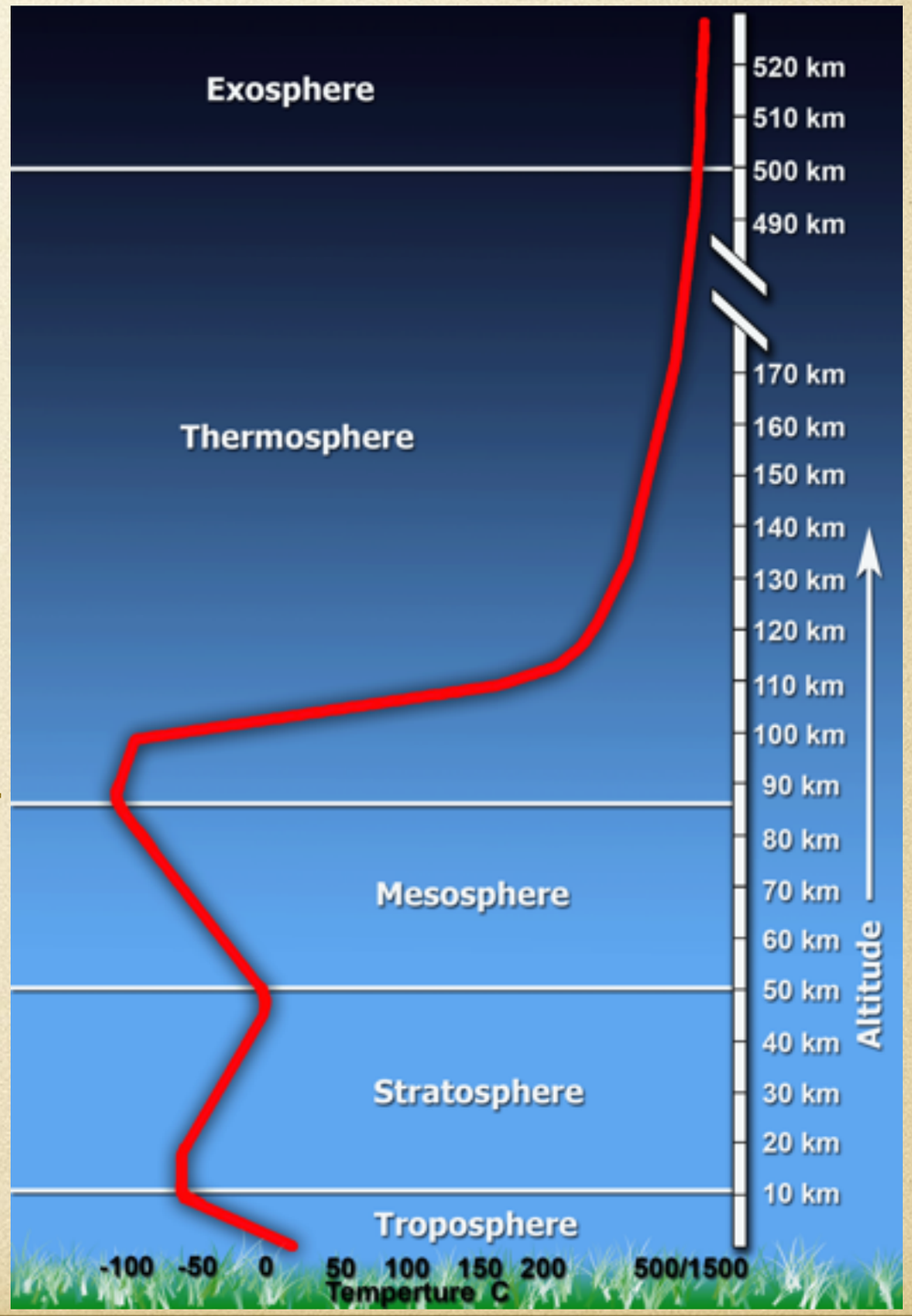
- **Troposphere-** We live here! It is 0-10 miles above Earth's surface.
  - 78% Nitrogen
  - 21% Oxygen
  - 1% Other
- **This is where weather and climate are shaped.**

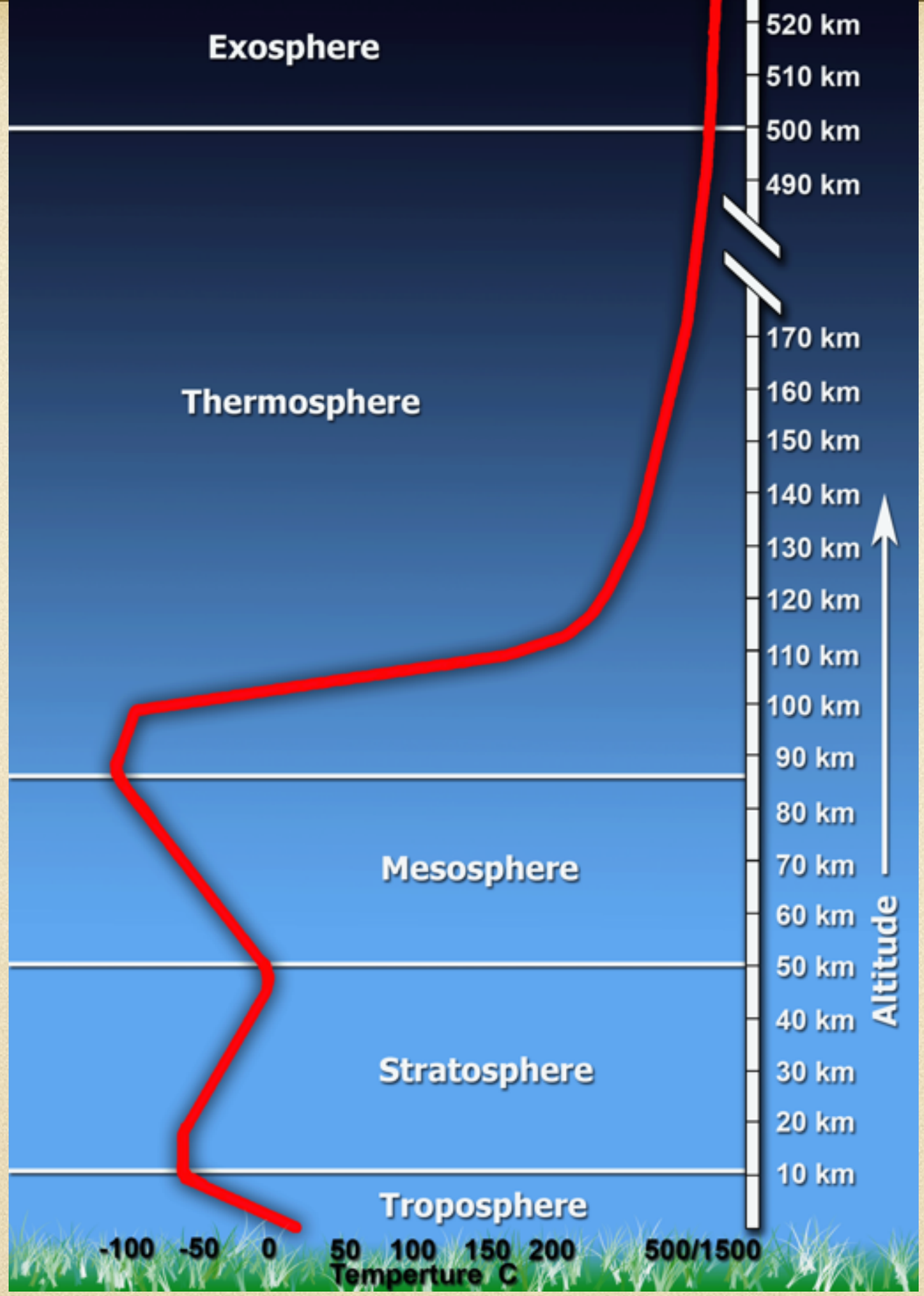
Other Atmosphere Layers

- **Stratosphere-**
  *Is 11- 30 miles above earth's surface;
  *Contains protective ozone layer.

- Meso & Thermospheres form the outer layers

- Draw the layers in your INB; (add details from the next slide)




Exosphere
Thermosphere
Mesosphere
Stratosphere
Troposphere
520 km
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490 km
170 km
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90 km
80 km
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30 km
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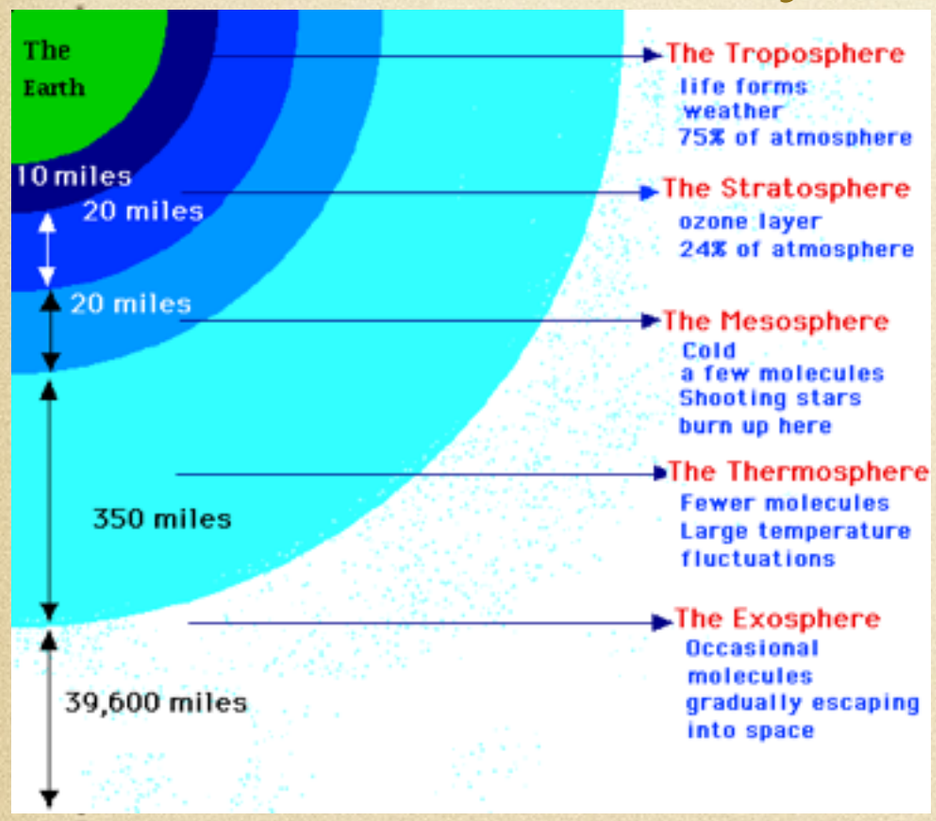
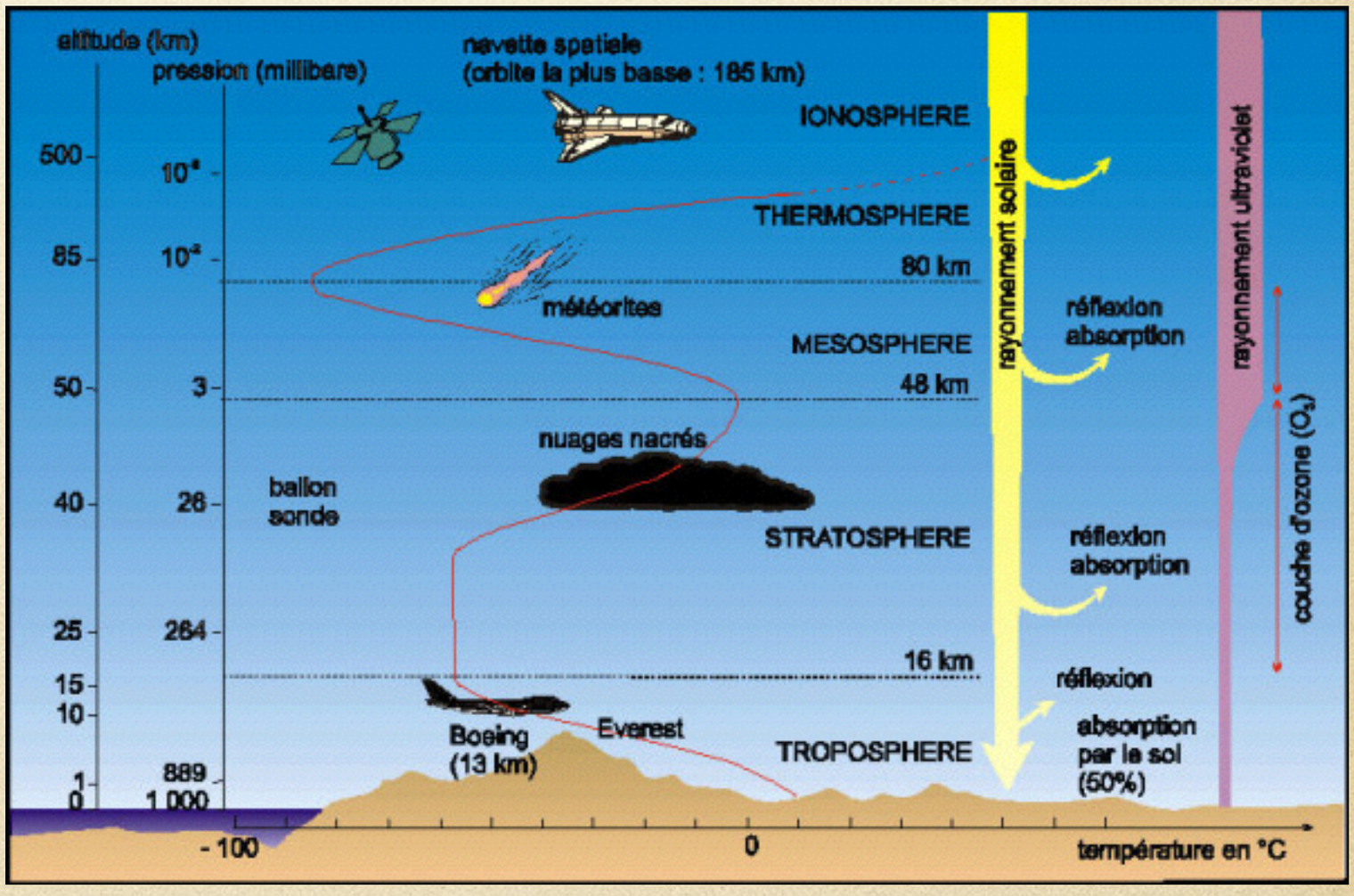
Altitude
-100 -50 0 50 100 150 200 500/1500
Temperture C

Layers of the Atmosphere

- Temperatures and pressure change within each layer





CAA and Climate Change

- The CAA was passed in 1970 when climate change was NOT an issue of concern

- CO2 (Carbon Dioxide) occurs naturally and is NOT directly regulated under the CAA as it is not technically pollution.

- Should it be? US Supreme Court has said it can be...

Common Air Pollutants

- The CAA works to reduce the Six Most Common Air Pollutants found all over the U.S.

- These Six Pollutants-**Suspended Particle Matter** (SPM), **Ground level Ozone**, **Carbon Monoxide**, **Sulfur oxides**, **Nitrogen Oxides** and **Lead**

- Particle Matter (or SPM or Particulates) and Ground-Level Ozone are most widespread.

Activity: Research Pollutants

- Find a partner. Each of you will research ONE of the two most common air pollutants:

- Suspended Particulate Matter OR Ground level Ozone

- For each, find out its 1)Major sources, 2)Health Effects, 3)Environmental Effects, 4) Make TWO recommendations for how it can be reduced, 5) Causes and seasons it is worst in the Willamette Valley? 6) Where it is worse in the U.S. overall?

Set up a Grid

- Pollutants in the Willamette Valley
- Now set up a grid in your INB on a LEFT side.
- Complete it with the information you learned.
	SPM	GL Ozone
1. Sources		
2. Health Effects		
3. Env Effects		
4. Recommendations		

Wednesday 2/19

- What is a Criteria Air Pollutant? Which are the most common in the US? Locally?
- What are the effects and sources of each?
- How is Eugene's Air Quality? Evaluate local challenges.

Activity: Research Pollutants

- Find a partner. Each of you will research ONE of the two most common air pollutants:

- Suspended Particulate Matter OR Ground level Ozone

- Share your information with your partner from yesterday or someone who researched the other common air pollutant

- Record key info on your grid

- Answer the Quiz questions in pairs

Which Air Pollutant?

- **Particulate Matter** (PM) or **Ground Level Ozone** (O3) or **BOTH**

  *Sunlight is a key factor in creating it

  *From Forest fires and industrial burning

  *Automobiles cause it

  *Agriculture contributes

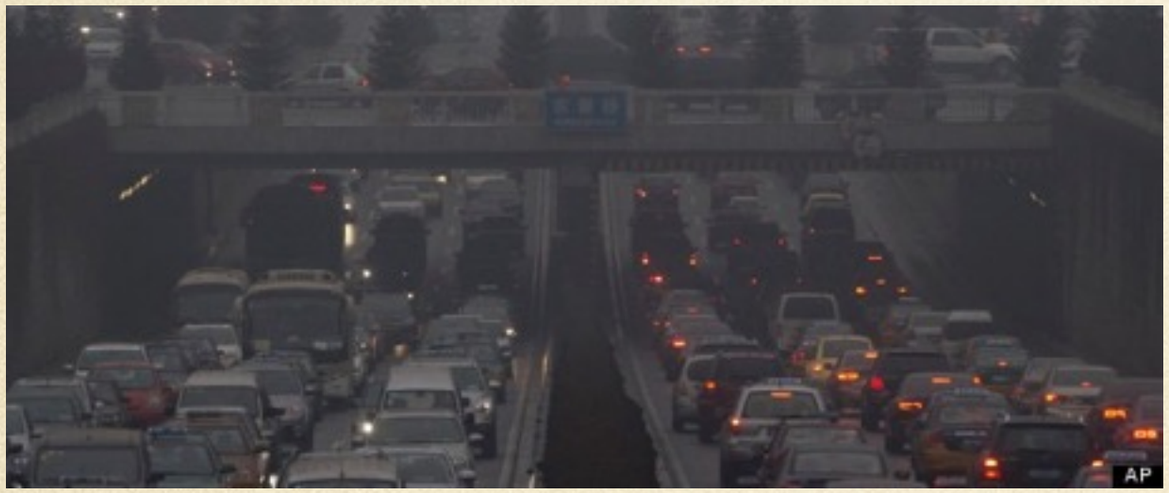
  *Causes human respiratory problems

  *Contributes to acid rain & acid deposits in soil

  *Worse in SUMMER *Worse in WINTER

What Actives Cause the Most Air Pollution?

#1-Transportation



- Vehicles are responsible for about half of the air pollution in the U.S. and up to 75% of all carbon monoxide emissions.

- Trends show that Americans drive more miles and in bigger cars that get fewer miles per gallon. This has been improving.

Cars Under the CAA

- CAA has forced manufacturers to make cleaner cars-- emissions from new cars are over **90% cleaner than in 1970**

- CAA required removal of lead from gasoline in 1974

- CAA requires reformulated gasoline in cities where ground level ozone pollution is bad

Cars Under the CAA

- CAA requires cleaner diesel trucks and buses--these were some of worst polluters.
- CAA requires regular engine inspection and maintenance programs in some areas

Top Causes of Air Pollution-

#1- Transportation

- Beyond cars and trucks, airplane travel, shipping and trains also contribute through burning fossil fuels.

Top Causes of Air Pollution-

#2 Agriculture

- 2. **Agricultural Activities-** Animal agriculture produces huge amounts of ammonia (one of the MOST hazardous gases for breathing).

- The use of insecticides, pesticides and fertilizers add more air toxins.

- Tractors and other farm machinery also pollute the air (particulates and smog).

Top Causes of Air Pollution

- **#3 Industrial Exhaust**

  - Emissions from factories and industry release large amounts of **Carbon Monoxide (CO)**, **toxic chemicals** and **hydrocarbons**

Top Causes of Air Pollution

#4 Mining Operations

- Mining uses large equipment to extract minerals below the earth's surface.

- Mining releases mass amounts of dust and toxic chemicals into the air during extraction.

- Workers and local residents suffer illness and even death from exposure.

Top Causes of Air Pollution

#5 Indoor Pollution

- Sometimes called HAP (Household Air Pol)

- From household chemicals and plastics used in building materials.
  Vinyl windows, paints, stains, flooring, glues

- For Americans, pollution exposure is higher indoors due to the amount of time spent there. Up to 90% of our time is spent indoors.

What is Sick Building Syndrome?

- Sick Building Syndrome is a condition where workers in urban buildings

- Symptoms are dizziness, irritated eyes and respiratory distress

- Causes are exposure to chemicals in buildings and poor air circulation in office buildings

Thursday

- What is a Criteria Air Pollutant? What are the Six Criteria Air Pollutants?
- How is Air Quality Measured?
- Where do you find Eugene's Air Quality?

CAA Warm-Up

- 1. When was the CAA (as we know it today) passed? Why?
- 2. What are the THREE purposes of the CAA?
- 3. What are the greatest contributors to air pollution in the US? List them in order.
- 4. What actions can the EPA take under the CAA? Describe TWO.

LRAPA

- LRAPA
- Air Quality Index
- 1. What is our Air Quality today? Cottage Grove's? Oakridge's?
- 2. What are the various levels of air quality? Describe each by color and number.

Six Criteria Outdoor Air Pollutants

- Under the CAA, the EPA has identified the TOP SIX air pollutants and measures for each of these to assess air quality.

- The top six air pollutants are known as **Criteria Air Pollutants (or the Dirty Six)**

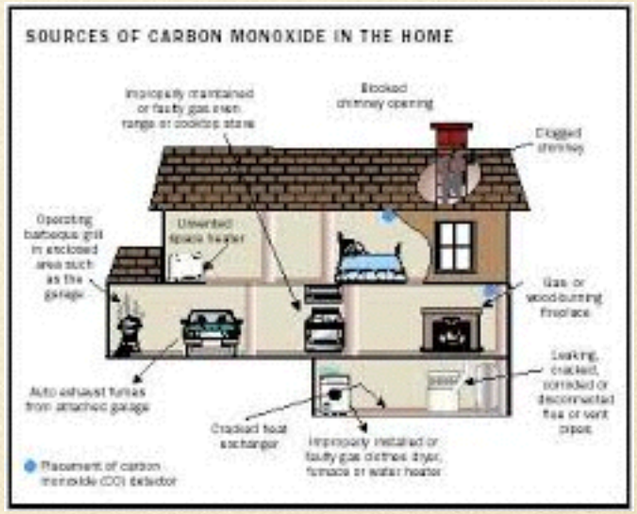
Six Criteria Air Pollutants

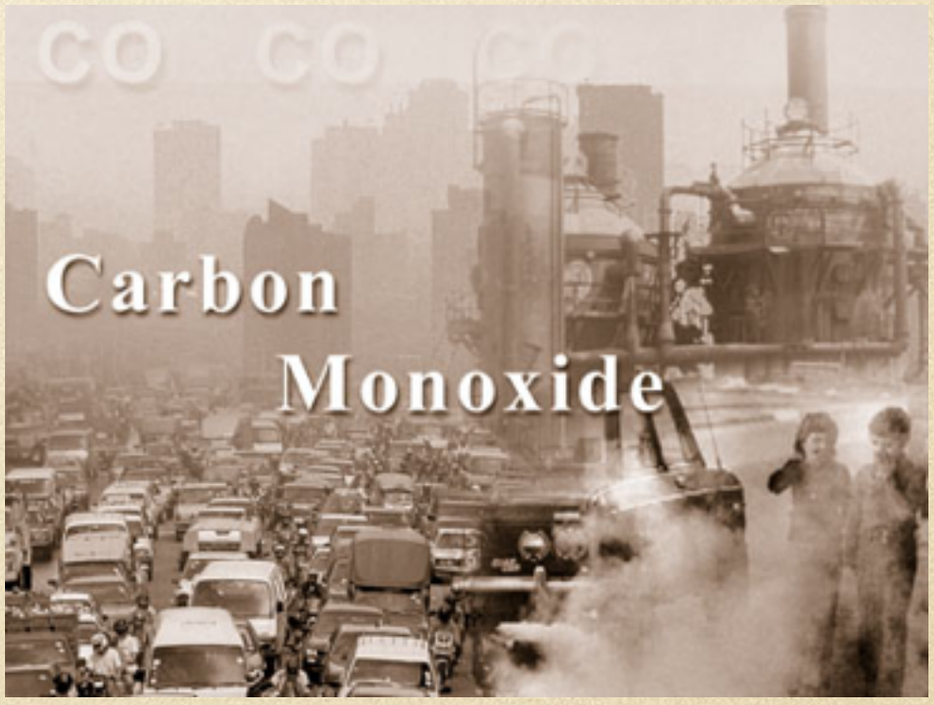
	MAJOR SOURCES	HEALTH EFFECTS	ENVIRONMENTAL EFFECTS
SO_2	Industry	Respiratory and cardiovascular illness	Precursor to acid rain, which damages lakes, rivers, and trees; damage to cultural relics
NO_x	Vehicles; industry	Respiratory and cardiovascular illness	Nitrogen deposition leading to over-fertilization and eutrophication
PM	Vehicles; industry	Particles penetrate deep into lungs and can enter bloodstream	Visibility
CO	Vehicles	Headaches and fatigue, especially in people with weak cardiovascular health	
Lead	Vehicles (burning leaded gasoline)	Accumulates in bloodstream over time; damages nervous system	Fish/animal kills
Ozone	Formed from reaction of NO_x and VOCs	Respiratory illness	Reduced crop production and forest growth; smog precursor
VOCs	Vehicles; industrial processes	Eye and skin irritation; nausea; headaches; carcinogenic	Smog precursor

Six Criteria Outdoor Air Pollutants

- 1. **Carbon Monoxide (CO)**- Results from unburned fossil fuels like coal, oil, wood, gasoline and natural gas.

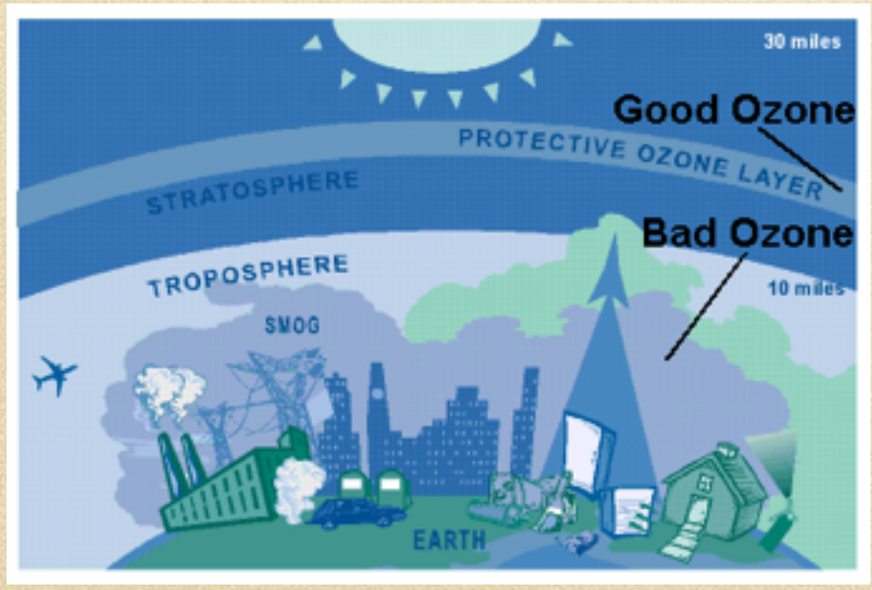
- Vehicles & Industry

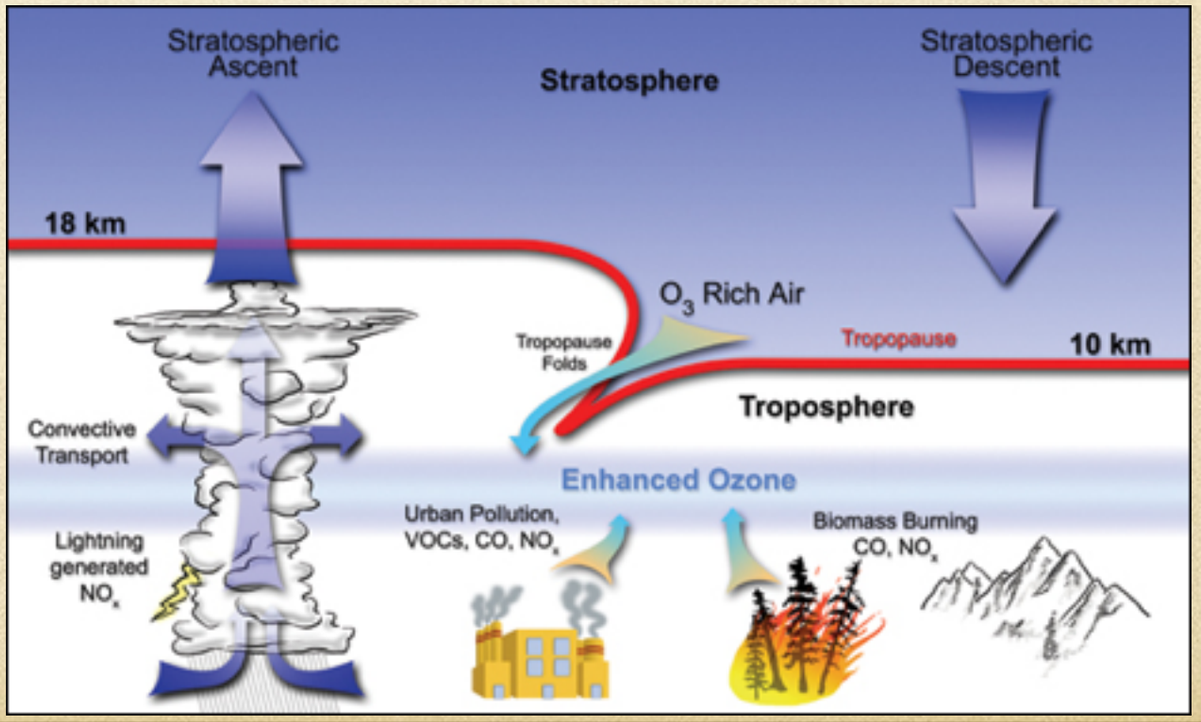




2. Tropospheric GL Ozone (O3)

- 2. **Ozone (O3)**- Is a combination of polluting gases from cars & factories that are cooked by sun on hot days to form a secondary pollutant; occurs in cities with clear, warm weather.

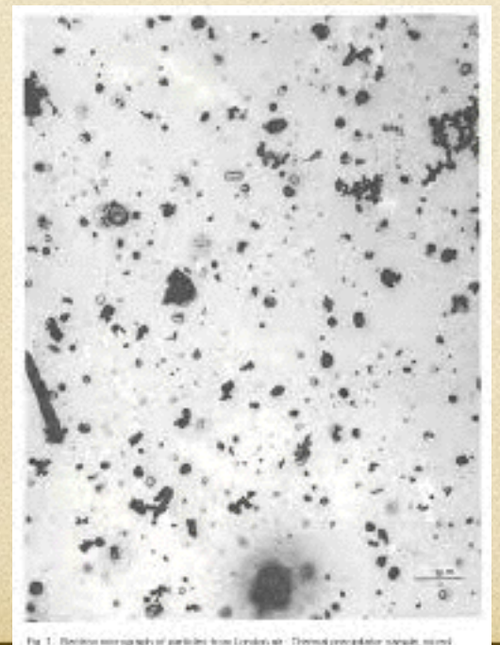


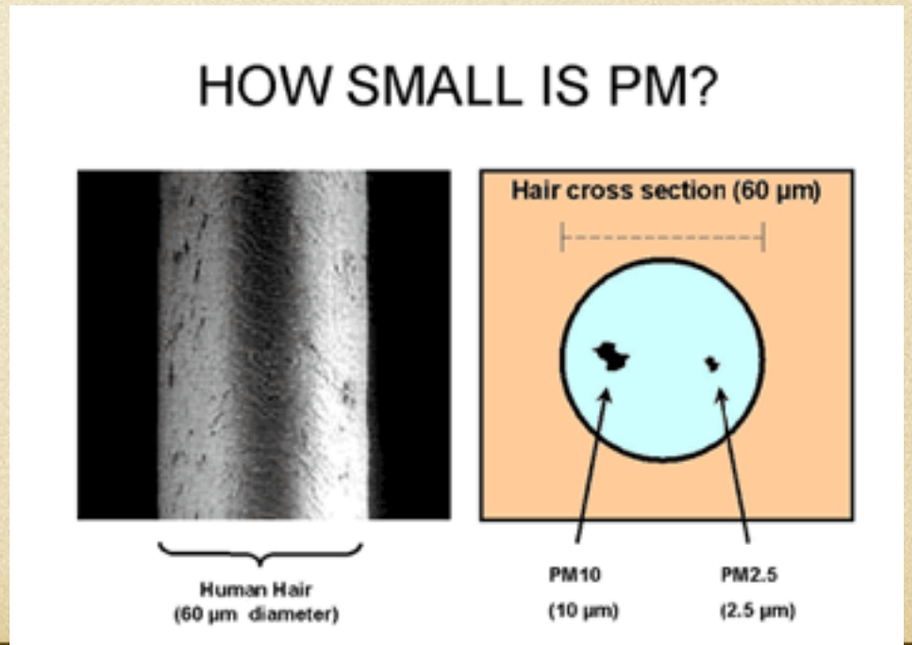


3. SPM

- 3. **Suspended Particulate Matter (SPM)**- Is a collection of fine solids or liquids from smoke and soot that result from burning fossil fuels (cars, wood stoves, fires and industry)

*Also can come from dust.



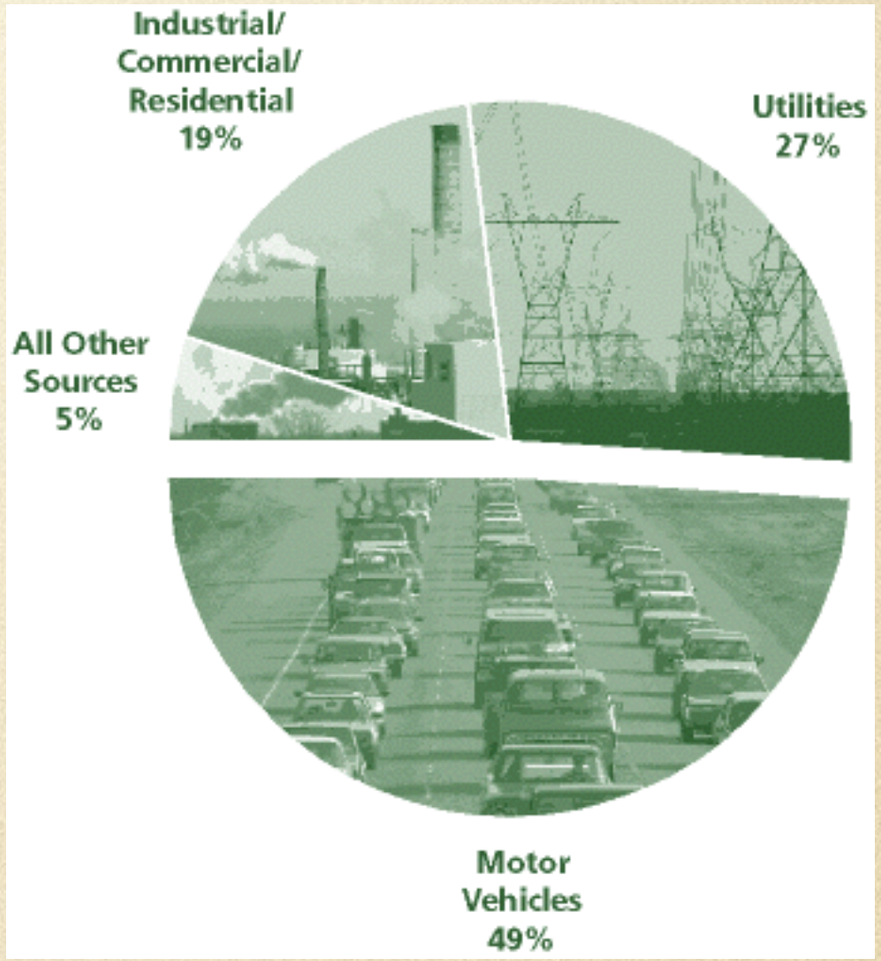


4. Nitrogen Oxide

- 4. **Nitrogen Oxide (NOx)-** Is an orange / light brown gas; it is a major component of smog;

- Produced by burning gasoline, natural gas, coal & oil at high temperatures.

- Greatest source is cars.

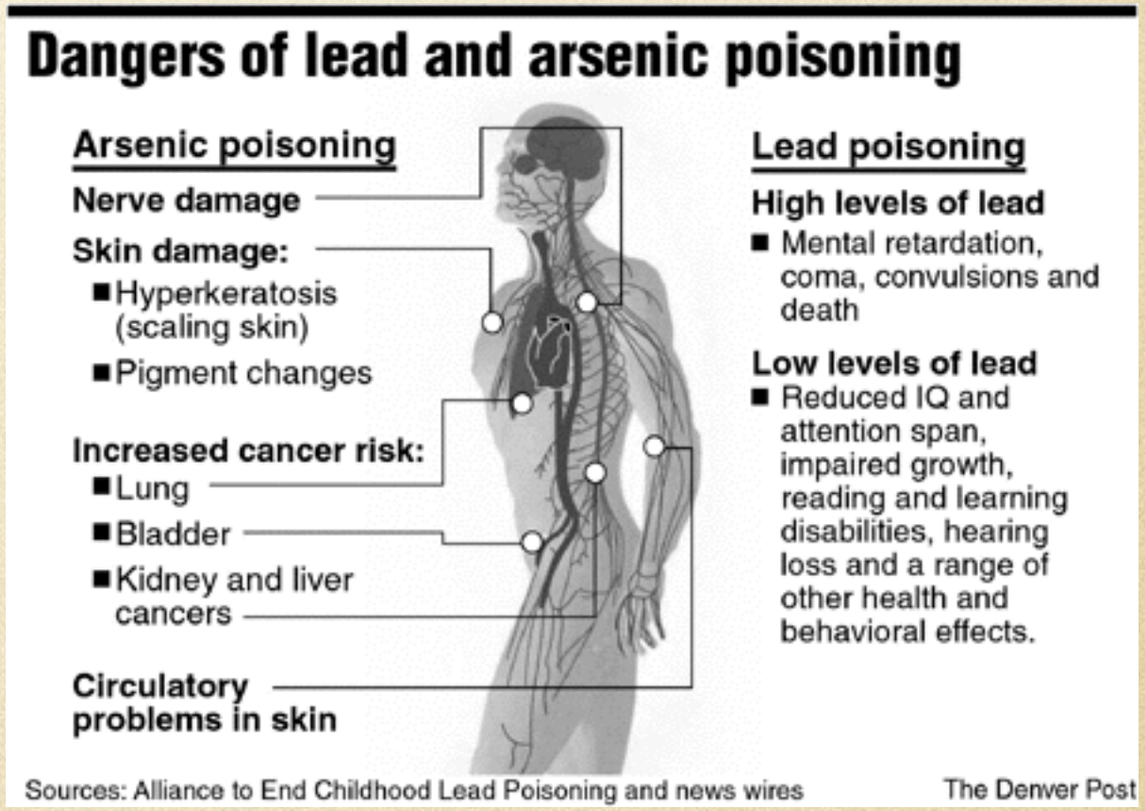


5. LEAD (PB)

- 5. **Lead (Pb)-** Is a metal that can become airborne as a particulate.

- Found in batteries, metals and paint; It can float around as dust.

- Damages brain, nerves, skin. Causes cancer.



6. SULFUR DIOXIDE (SO2)

- 6. **Sulfur Dioxide(SO2)**- Looks like gray smog due to sulfur content.

- Sources are coal, oil, industrial furnaces, oil refineries and power plants that burn coal.

- Is a major component of **acid rain** causing environmental and health problems.

Winter Weather Increases SPM

- SPM pollution is worse in winter in the Willamette Valley during Temperature Inversions.

- This is where warm air sits on top of a cold air mass and traps pollution
- During Temperature Inversions, it gets warmer as you go up.

Ozone Pollution in Eugene

- Ozone pollution occurs most often on hot, dry, sunny days in summer.

- Ozone requires a combination of SUNLIGHT and AUTO EMISSIONS pollution

Eugene's Air Quality

- TWO main pollutants impact Eugene's air quality- 1. Particulates (SPM) and 2. Ground Level (tropospheric) Ozone.

- Particulates are the worst overall in Eugene. They come from wood smoke, fires, dust, and agricultural processes.

Activity- Eugene's Air Quality

- Go to the Lane Regional Air Pollution Agency website (www.lrapa.org). Scroll down page...

- Complete the Questions from the handout in your INB as you explore the site for information.

Friday 2/21

- Six Criteria Air Pollutants - Play Kahoot!
- What is Acid Rain and its effects?
- Is the CAA effective? How yes? How no?

Warm-Up - Air Pollution

- 1. What is a Criteria Air Pollutant?
  2. Which TWO air pollutants (from the CAA Criteria Pollutants list) affect Eugene's air quality most?
  3. Describe ONE source of each.

- 4. Which is worse in summer? Which is worse in winter? Which is worse overall?

- 4. Describe TWO ways that Eugene's weather affects our air quality.

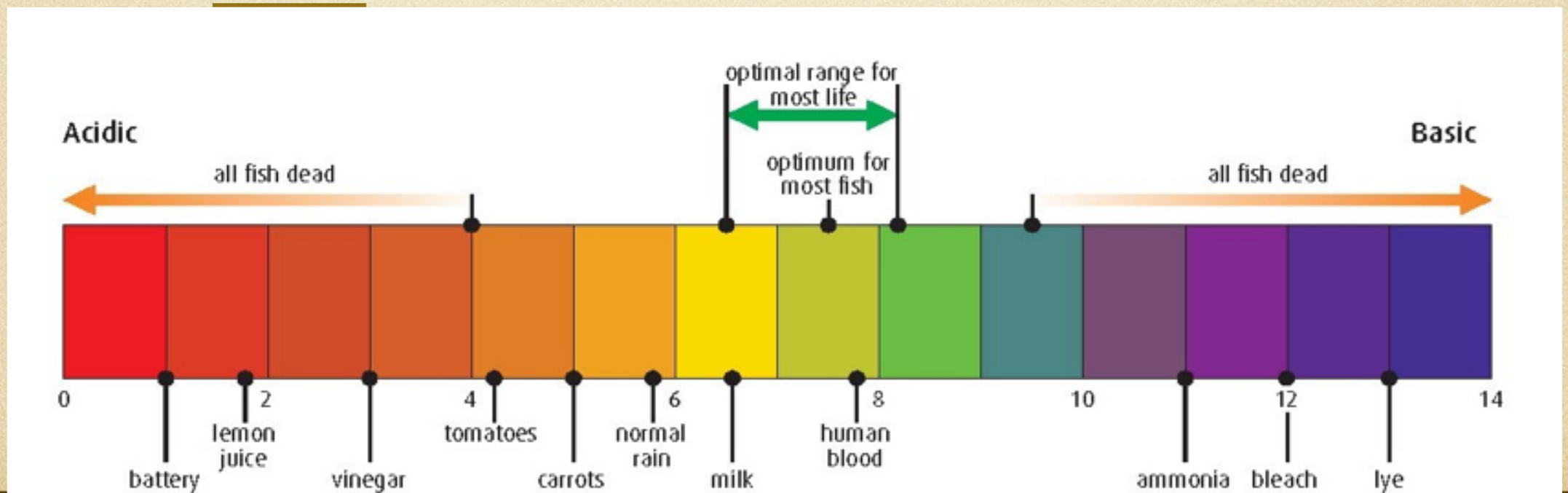
Geography & Air Pollution

- Weather & geography affect pollution levels
- GEOGRAPHY- Urban cities in valleys surrounded by mountains trap pollution at low points between mountain ranges.
- WEATHER- **Inversions**- winter weather pattern where cold surface air and pollution is trapped by higher warm air sitting on top; Eugene gets these in winter. Foggy and cold at ground. Traps pollution at ground level.

What is Acid Rain?
What is the pH Scale?

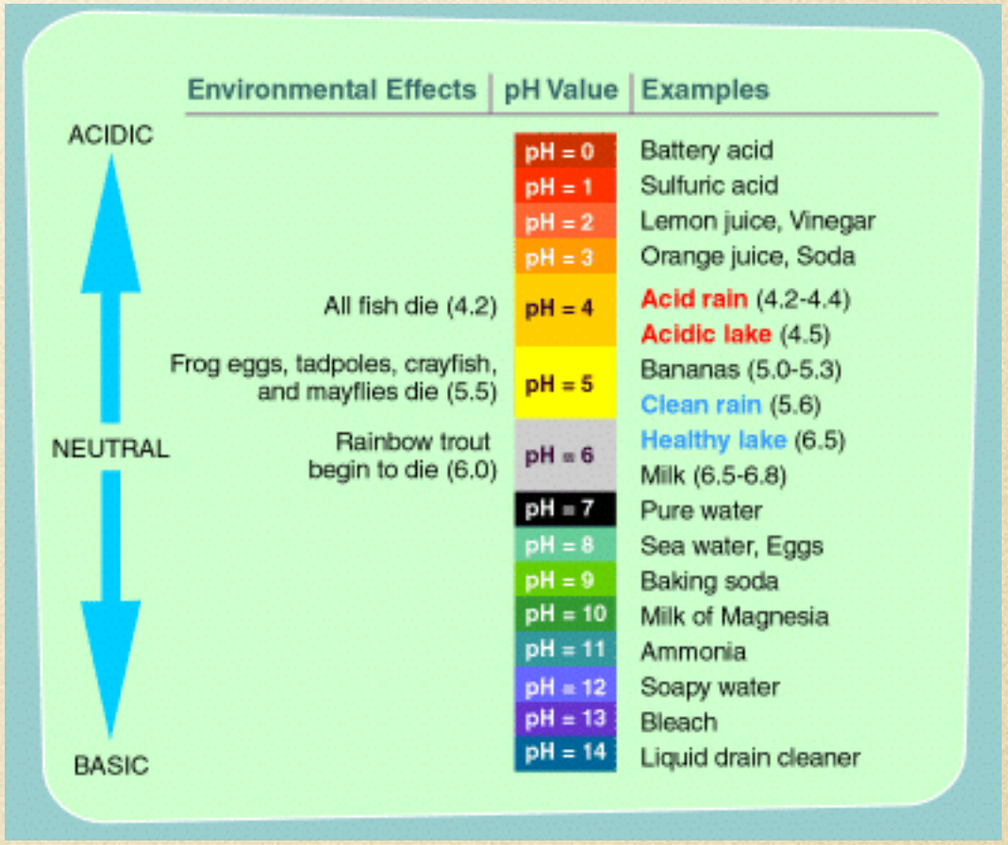
- All substances have a pH range that tells how basic / alkaline (7-14) or acidic (0-7) it is.

- The optimal pH range for most aquatic life is 6.5-8.



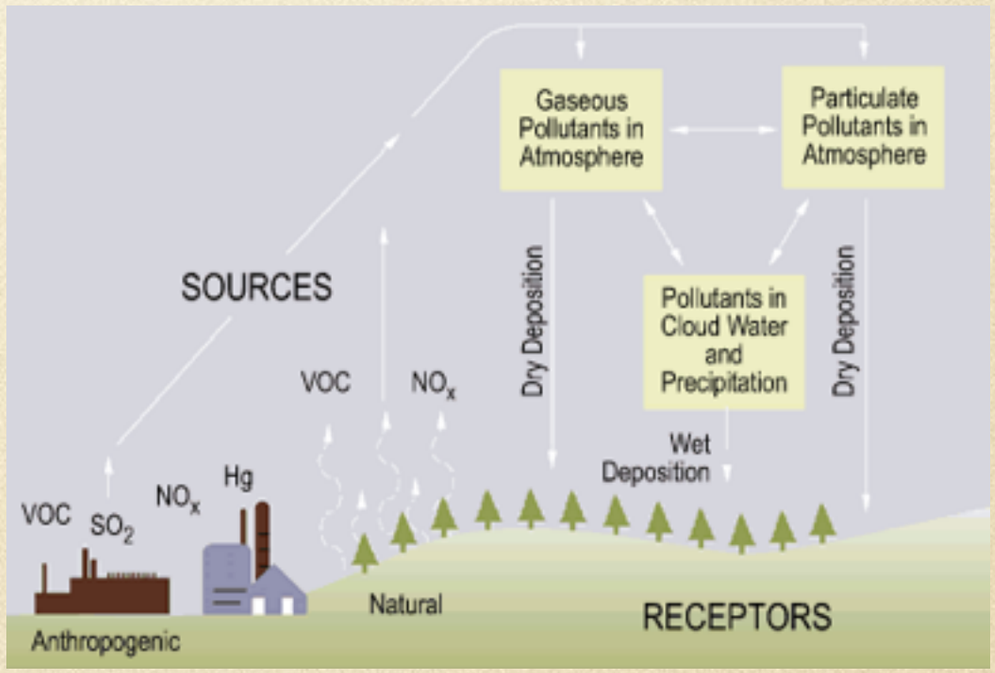
What is Acid Rain?

- Happens when air pollution gets into the water cycle and falls.
- It changes the natural pH of fresh or salt water & harms aquatic life.
- Pollution can fall as solid particles that affect soils, too.



What is Acid Rain?

- Is a broad term used to describe air pollutants (both rain and particles) that come from SO2 & NOx

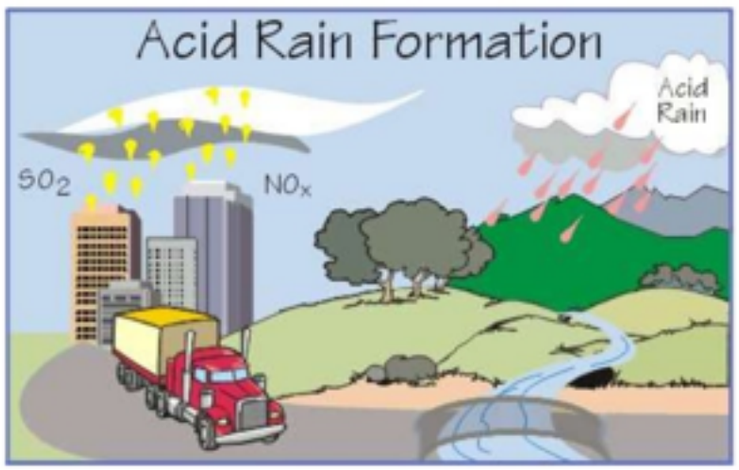


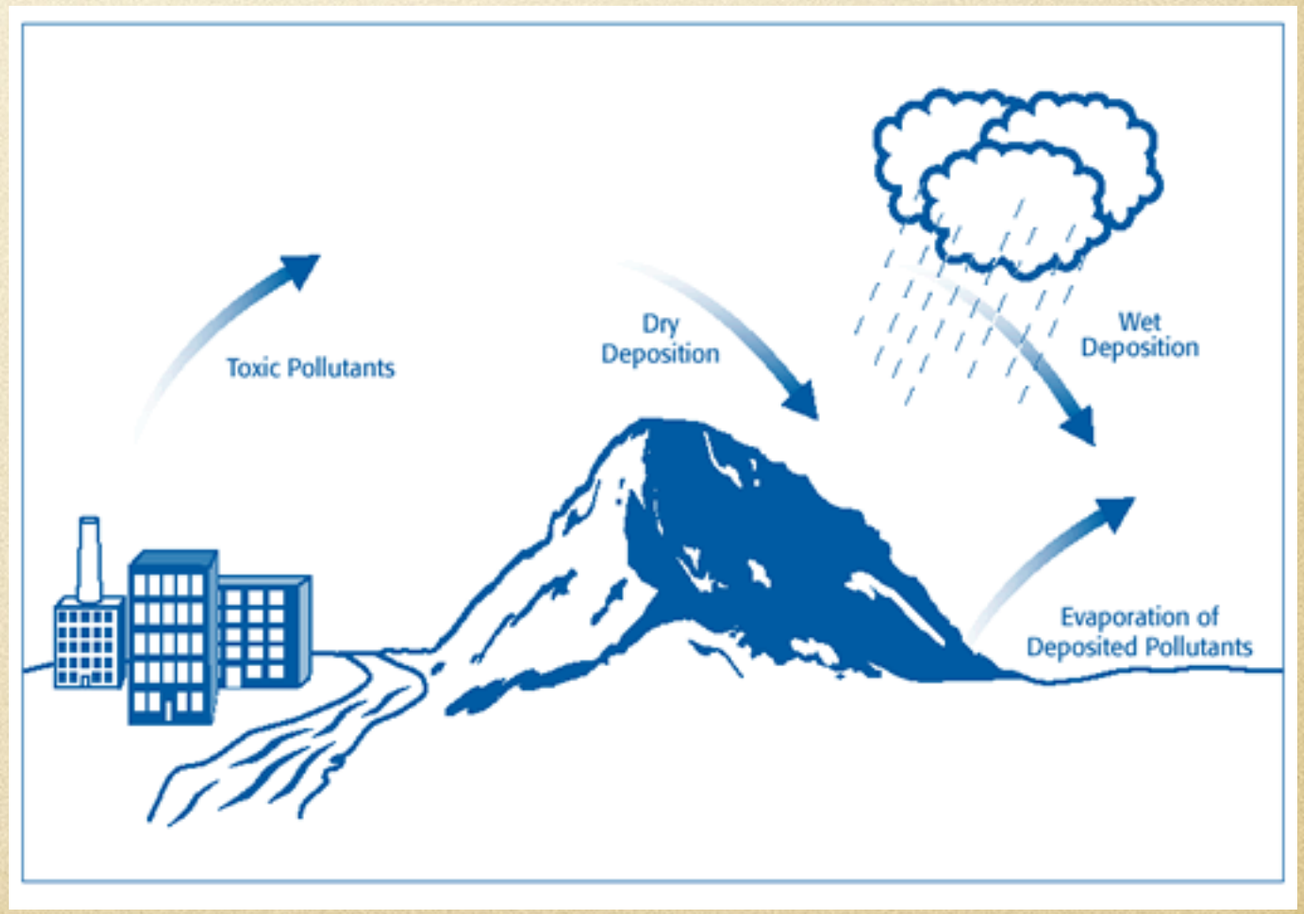
- Can occur naturally from volcanoes & decaying plants

- Humans cause most through the burning of fossil fuels; 2/3 comes from burning coal for electricity.

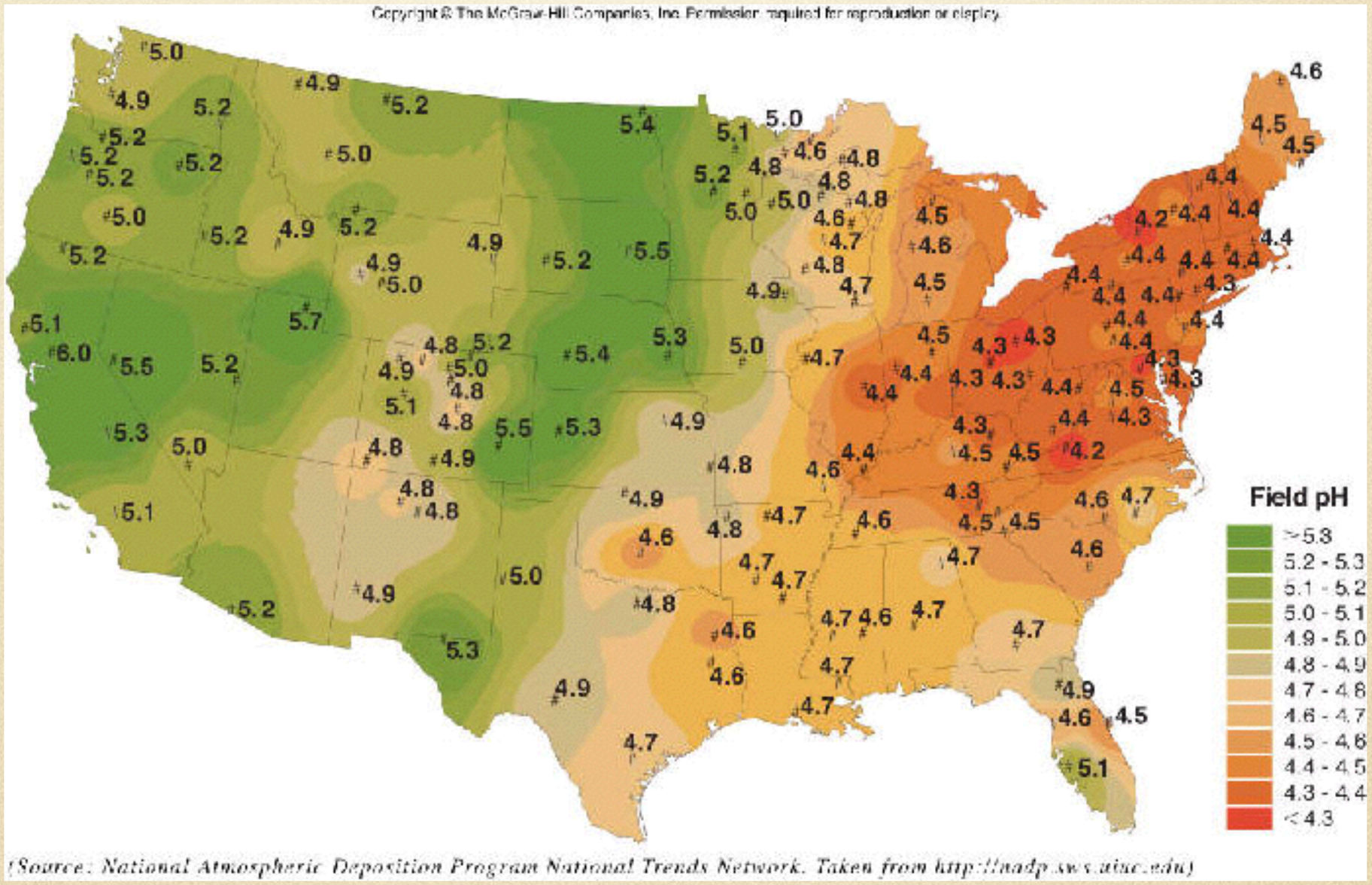
Can be liquid or solid

- **Acid "Rain"**- Primarily comes from burning coal to produce electricity
  - SO_2 and NO_x





Where is Acid Rain Worst in U.S.?



(Source: National Atmospheric Deposition Program National Trends Network. Taken from http://nadp.sws.uiuc.edu)

What are the Effects of Acid Rain?

- **Health**- Few direct risks. Food crop production is reduced due to impact on soil.

- **Environment**- Causes acidification of streams, lakes, rivers and soils (fish kills); plant and tree damage in forests.

- **Cultural**- Can destroy buildings and outdoor sculptures;

- Pollution originates in upper Midwest but affects cities in the NE U.S.

How Effective has the CAA been?

- Divide your INB page in 1/2 long ways.
- Read your assigned article (there are TWO)
  - In what ways has the CAA been successful or not? Record FIVE ways described in your article.
  - Pair up with someone who read the OTHER article. Discuss and record their answers.

The Clean Air Act--successes since 1970

- **Many lives (400,000) saved** due to reduced air pollution

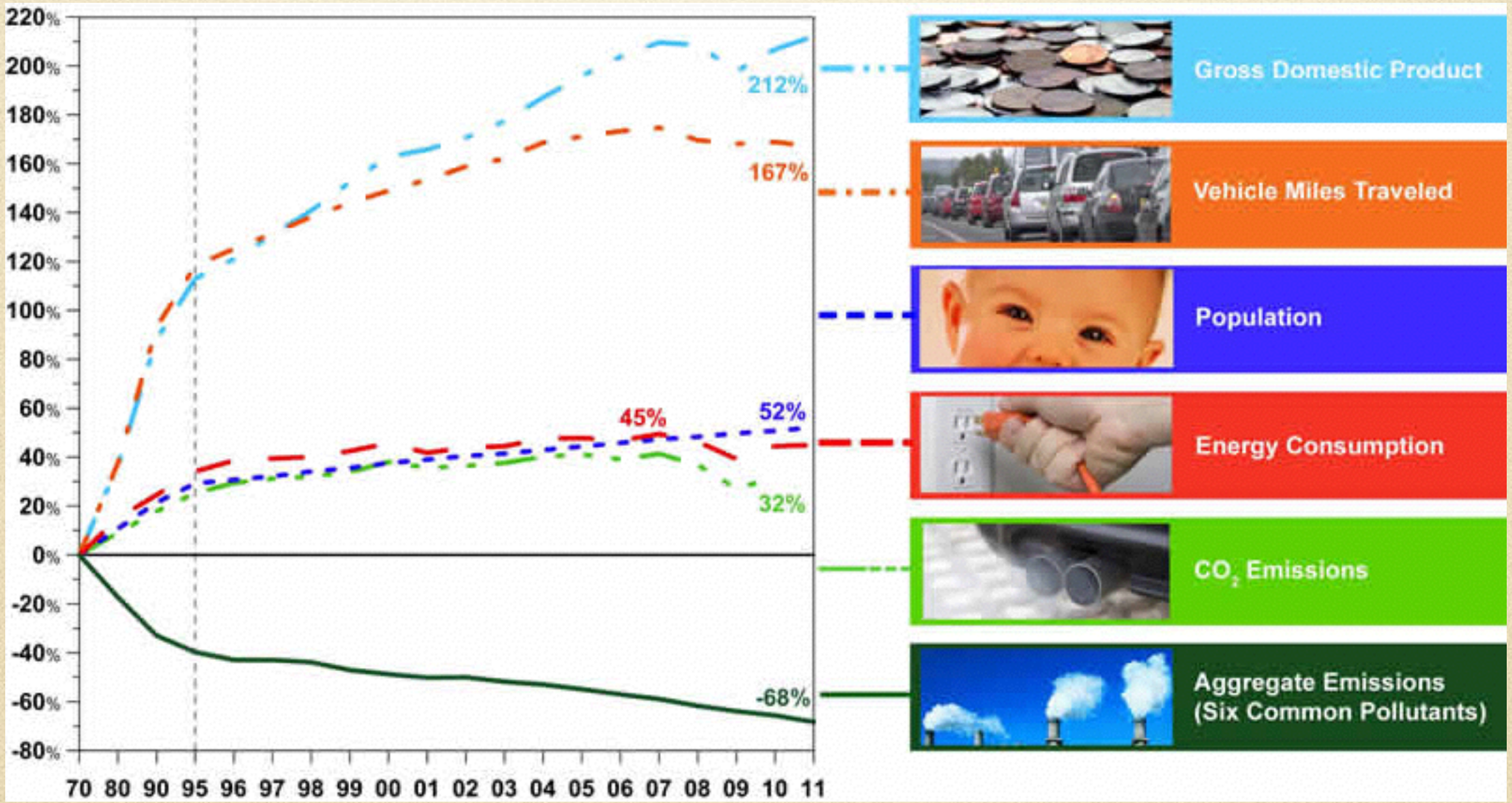
- **The Six Criteria (most common) Air Pollutants have decreased by more than 50%**

- Industrial air pollution **reduced by 70%**

- **New cars are more than 90% cleaner**

- **Fewer ozone-depleting chemicals produced.**

Is the CAA Effective?



WHAT THE CLEAN AIR ACT HAS DONE FOR AMERICA

A RICHER, CLEANER, HEALTHIER NATION

The Clean Air Act is the best argument for sensible environmental regulation. America's public health and its economy have thrived, and pollution has fallen, since the Act's inception.

- GDP 207%
- ECONOMIC PRODUCTIVITY 100%
- ENERGY CONSUMPTION 40%
- 160,000 LIVES SAVED IN 2010 ALONE
- PARTICULATES 22%
- NITROGEN OXIDES 39%
- SULFUR DIOXIDE 63%
- LEAD 98%

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work
www.edf.org/cleartheair

WHAT MIGHT HAVE BEEN America without the Act

In 1970, President Richard Nixon created the EPA and Congress passed the Clean Air Act. Imagine what the United States would be like without those landmark achievements...

LEADED GAS
Cars would still run on leaded gas, leading to dangerous lead levels in nearly nine out of ten American children.

DYING FORESTS
Vast forests would be destroyed by acid rain. Thousands of lakes that have returned to health would remain lifeless.

HAZARDOUS WASTE
We'd still have raw sewage flowing into rivers, and higher doses of airborne mercury contaminating lakes and affecting the food chain.

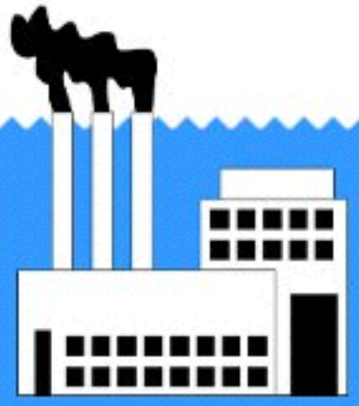
FILTHY AIR
Coal plants would emit 50% more pollution than they do now, and nearby office workers would still be changing their shirts at lunchtime because of soot.

CLEAN AIR ACT

Protecting the air since 1970

The Clean Air Act is a United States federal law designed to control air pollution on a national level. It requires the Environmental Protection Agency (EPA) to develop and enforce regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health.

WE CAN DO MORE



Industrial production is a major source of greenhouse gas (GHG) emissions across the globe. Energy intensive industrial activities such as iron and steel production and oil refining combust large amounts of fossil fuels. In addition, industrial and chemical processes, like those used in cement manufacturing, also emit GHGs.

$2 TRILLION SAVED

ESTIMATED ECONOMIC VALUE OF AIR QUALITY IMPROVEMENTS MADE BY 2020

160,000 DEATHS PREVENTED

EPA estimates that the Clean Air Act Amendments prevented over 160,000 early deaths in 2010.

1.5 BILLION

Approximate number of people breathing dangerously high levels of pollution every day.

Humans breathe an average of over 3000 gallons of air a day.

3000 GALLONS A DAY

SOURCES:
www.lung.org
www.epa.gov
greenliving.lovetoknow.com

Share to support Healthy Lung Month
www.simmonsfirm.com

Is the CAA Effective?

- The CAA **has cost businesses who must comply with new rules**.

- **Cities and counties with higher rates of air pollution spend more to do business**; higher unemployment; less profits.

- 42% of Americans still live in areas of high air pollution
  *Some argue the CAA doesn't go far enough…

How can we reduce air pollution?

- Conserve energy at home- Saving energy reduces carbon emissions.

- Reduce driving- Duh!

- Improve fuel economy- 1% decrease in fuel consumption = 1% decrease in your carbon output.

- Cut down on packaging and garbage- This cuts pollution used to make and deliver products

Reflection Statement

- In INB, Do you think the CAA has been effective? Why or Not.

CAA- Not Enough!

- Film Clip-

- https://www.huffingtonpost.com/entry/clean-air-act_us_57f7ad24e4b0e655eab38e8f