12. Environmental Problems

1. Acidic Precipitation

A. Why is "clean rain" still a bit acidic?

B. So what is acidic precipitation?

C. What atmospheric contaminants lead to the formation of acid rain?

D. What human activities release these contaminants into the atmosphere?

E. Acidic Precipitation's Impact on Health and the Environment

- Forests: These get damaged by acidic precipitation, especially if they are at higher altitudes.
- Where there is no carbonate in nearby soil to neutralize acid rain, acid kills sensitive fish species and changes the distribution of plankton(floating microscopic life forms)
- What man-made structures are destroyed by acid? Acid attacks marble, limestone, cement and metal.
- People with respiratory diseases (asthma, pneumonia, emphysema) are more likely to get serious attacks or die when there is a high level of acid in the air.

F. What Can Be Done to Solve the Problem

- Transportation: More people should rely on public transport and foot power. There should be more govt. encouragement of alternate fuel sources such as fuel cells.
- Filters(scrubbers): The latest available technology should filter sulfur from industrial sources.
- Legislation(as a result of laws curbing the release of SO_2, form 1991 to 2011, 40% of acidified lakes in North America have recovered)

2. Global Warming

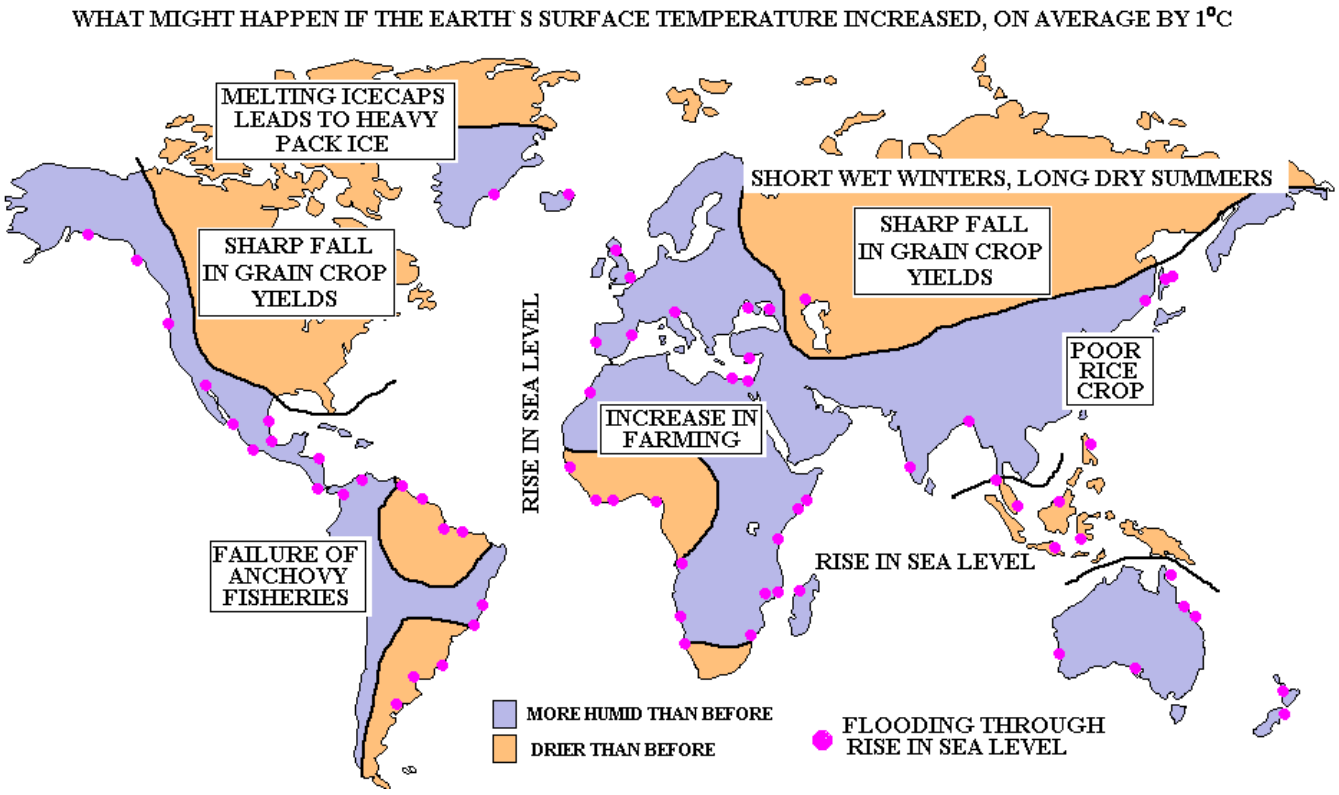
1. What is the *greenhouse effect? Include a drawing in your explanation*

The process,which is vital for life on earth (without it it would be too cold) is somewhat similar to what happens in a greenhouse. The glass in a greenhouse and the gases in the atmosphere both allow visible light to warm up the ground or earth, respectively, and they trap the heat that tries to escape.

2. What 5 gases cause the greenhouse effect or global warming?

3. Where do those gases come from?

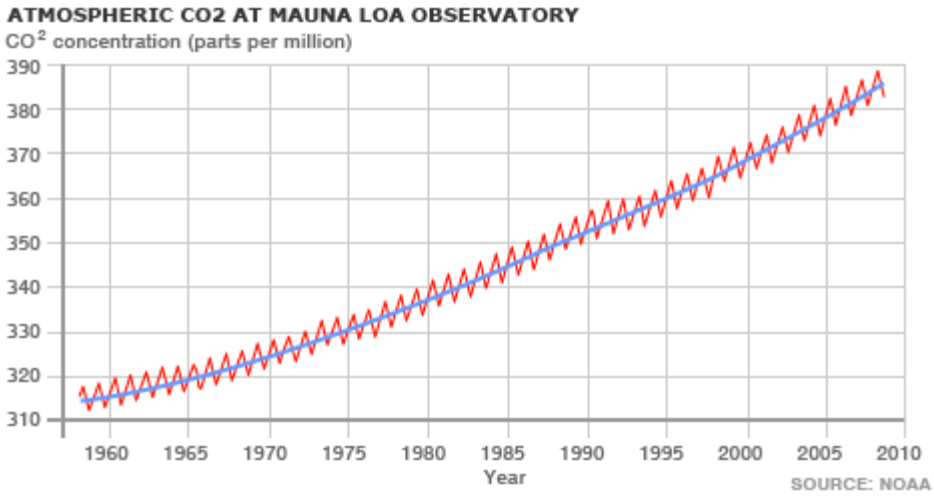
4. What are the consequences of global warming?

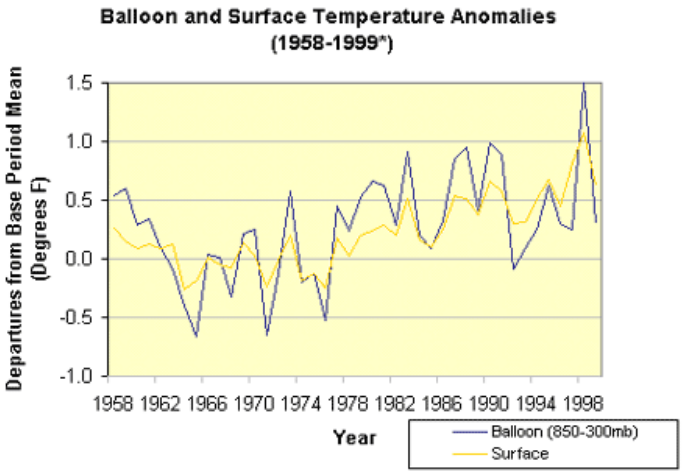


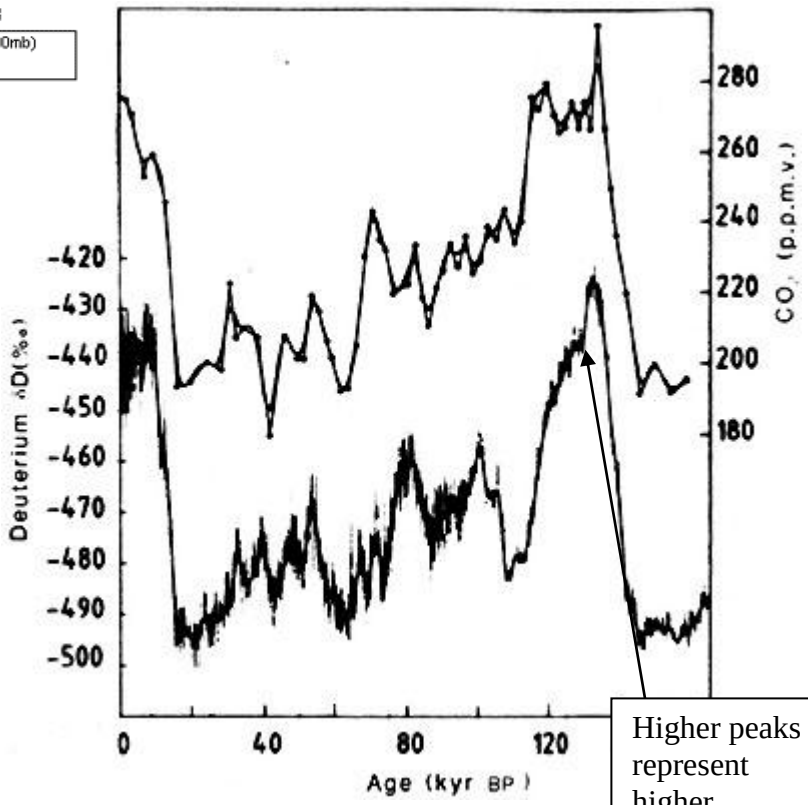
5. What evidence do we have for global warming?

In this century we have been measuring both CO_2 levels and temperatures and both have been increasing, as shown below.

See below for temperature graph.







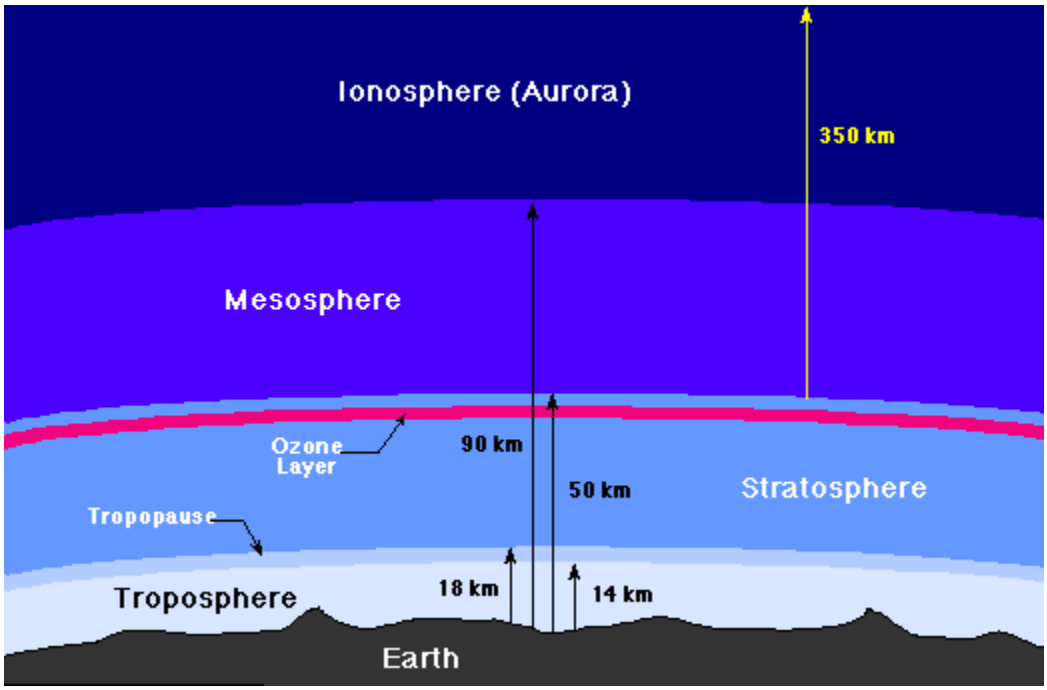
But perhaps this is a coincidence. What makes a stronger connection between CO_2 levels and temperature is the historical record. By analyzing ice that has been around for a half million years we can measure CO_2 levels of the distant past. In addition O-18 to O-16 isotope ratios or H-2 to H-1 ratios give us an idea of temperature. The following data from Antarctica reveals that temperatures and CO_2 levels vary hand in hand.

Higher peaks represent higher temperatures.

6. How do we fix the problem?

3. Ozone Depletion

1. **What is ozone? Where is it found?**



2. Why do we need an ozone layer?

3. What man-made chemicals threaten the ozone layer? Why?

4. What are the effects of a thinner ozone layer?

5. How do we fix the problem?

D. Other Forms of Pollution

Pollution Source	Ecosystem Affected	Specific Pollutant	Disease Caused	How?
nuclear power plants	soil, water and air pollution	radioactive waste	cancer	radiation attacks DNA
industrial waste, batteries, treated wood	soil, water pollution	Pb(lead), Hg(mercury), As(arsenic), Cd(cadmium)	• Pb and Hg attack brain. • Arsenic is carcinogenic (cancer-causing) • Cadmium damages kidneys	unknown

Exercises

I *Acidic Precipitation*

1. Even clean rain is still a bit on the acidic side because of the presence of what gas in the atmosphere?

2. a. What pollutant causes HNO_3 to appear in rain?
   b. What pollutant causes H_2SO_4 to appear in rain?

3. a. How does burning coal and roasting metal ores lead to the formation of acidic precipitation?
   b. How do cars, trucks and airplanes contribute to acidic precipitation?

4. How does acidic precipitation have an impact on…(don't be too brief!)

a. people's health?
b. our cities?
c. our lakes?
d. our forests?

II *Global Warming*

5. a. List the two main gases that cause global warming.
   b. What human activities release these gases in large quantities?

6. Use 2 diagrams to explain what is meant by the greenhouse effect.

- The first diagram should include a sketch of the earth and the gases that cause global warming.

- The second diagram should include a diagram showing how an actual glass greenhouse traps heat.
- Then include a written explanation of what you've drawn.

7. What evidence do we have for global warming? Mention data from both the recent and distant past.

8. How is global warming a threat to society?

III The Ozone Problem

9. Fill in the blanks.

a. Ozone is actually formed from the common gas _____
b. The stratosphere is where harmful _____is/are converted into heat.
c. Older refrigerators, air conditioners, and freezers are a source of _____.
d. The atom from CFC's that actually destroys ozone is _____.
e. A disease that results from overexposure to UV is _____.

10. Why is there an ozone hole over Antarctica but much less thinning of the ozone over warmer areas?
What can be done to save the ozone?

IV *Miscellaneous Forms of Pollution(see chart on p118)*

11. What two metals can attack the brain and the nervous system?

12. What waste product from nuclear power plants is carcinogenic (cancer-causing)?

13. *From class notes*: What is the connection between acid rain and arsenic in treated wood?

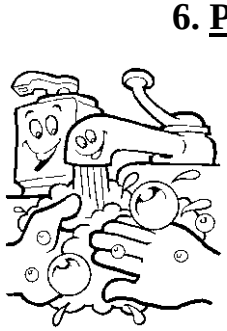
V *Mixed Bag of Questions*

14. Match the chemical or technology with the associated environmental problem. For some letters, more than one number is necessary.

a. CO_2 _____
b. SO_2 _____
c. CFC's _____
d. CH_4 _____
e. NO_2 _____
f. Cl _____
g. Hg _____
h. deforestation_____
i.  _____
j. cattle ranches_____

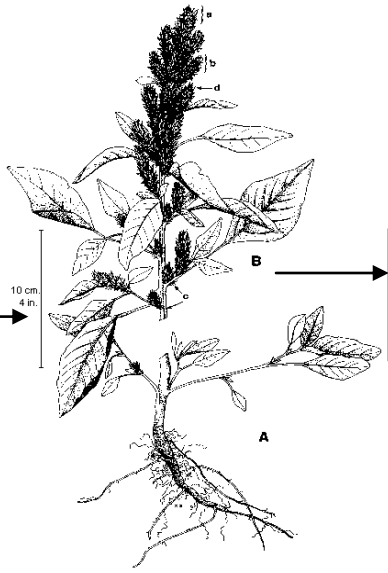
1. Acid rain
2. Global warming
3. Ozone depletion
4. Soil and water pollution

6. Phosphorus Cycle



Grey water

PO_4^{-3}, HPO_4^{-2}

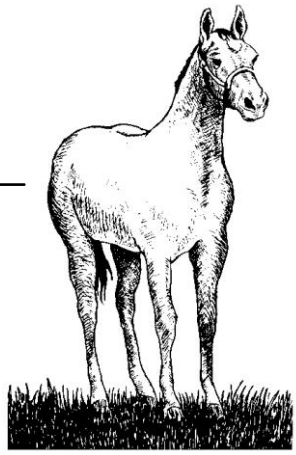


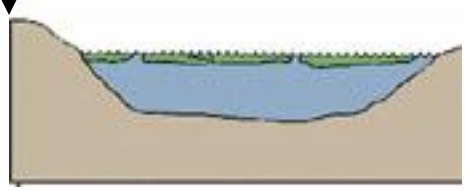
DNA,RNA, cell membrane fats

runoff

bacteria

Waste





1. What role do bacteria play in the phosphorus cycle?

2. Compared to the nitrogen and carbon cycles, what makes the phosphorus cycle simpler?

3. What do the nitrogen and phosphorus cycles have in common?

Exercises

1. Which polyatomic ions play a role in the phosphorus cycle?

2. What do plants do with inorganic phosphate?

3. How does organic phosphate waste turn into PO_4^{-3}?

4. How do excess phosphates found in commercial fertilizer end up in lakes?

5. What is the consequence of raising phosphate concentration in water systems?