

Earth and Space
Contamination of the Atmosphere, Soil and Waterways

(2) Global Warming

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

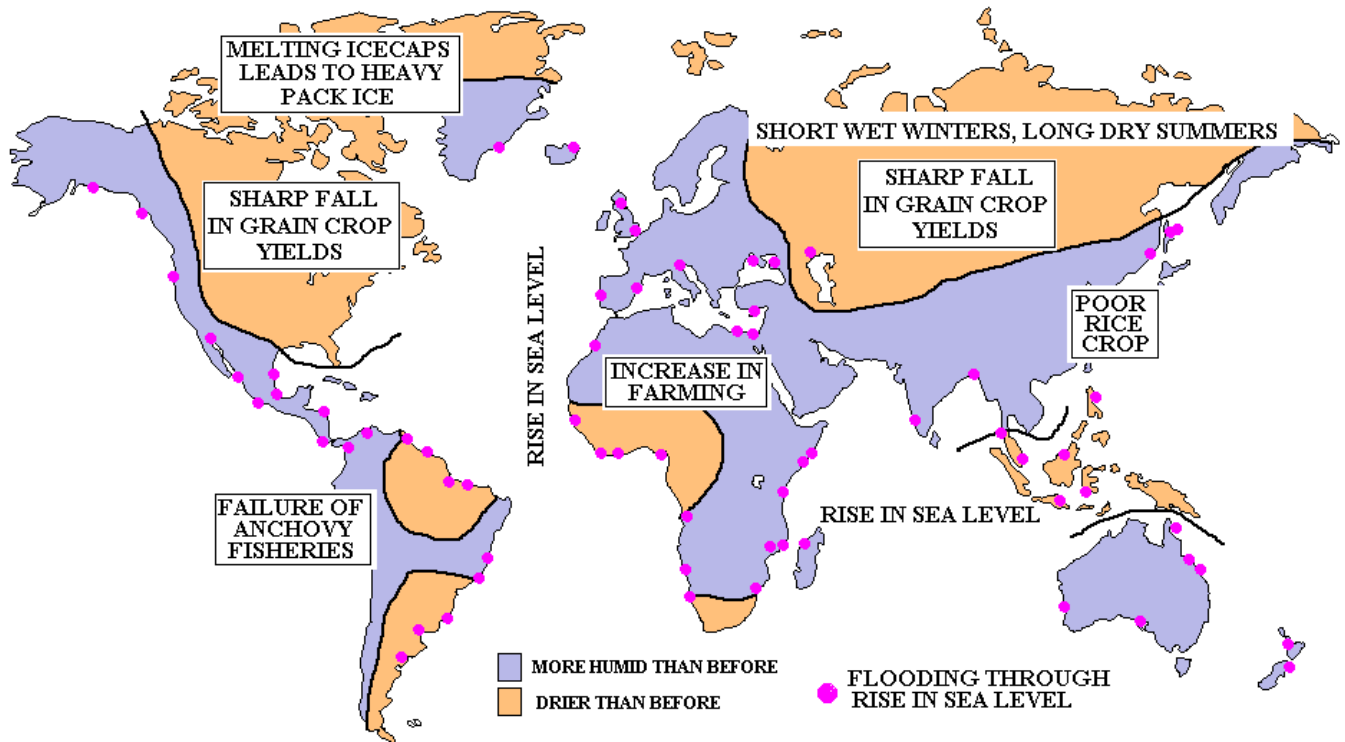
The process, which is vital for life on earth (without it it would be too cold) is somewhat similar to what happens in a greenhouse. The glass in a greenhouse and the gases in the atmosphere both allow visible light to warm up the ground or earth, respectively, and they trap the heat that tries to escape.

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?

Earth and Space

Contamination of the Atmosphere, Soil and Waterways

WHAT MIGHT HAPPEN IF THE EARTH'S SURFACE TEMPERATURE INCREASED, ON AVERAGE BY 1°C



5. What evidence do we have for global warming?

In this century we have been measuring both CO₂ levels and temperatures and both have been increasing, as shown below.

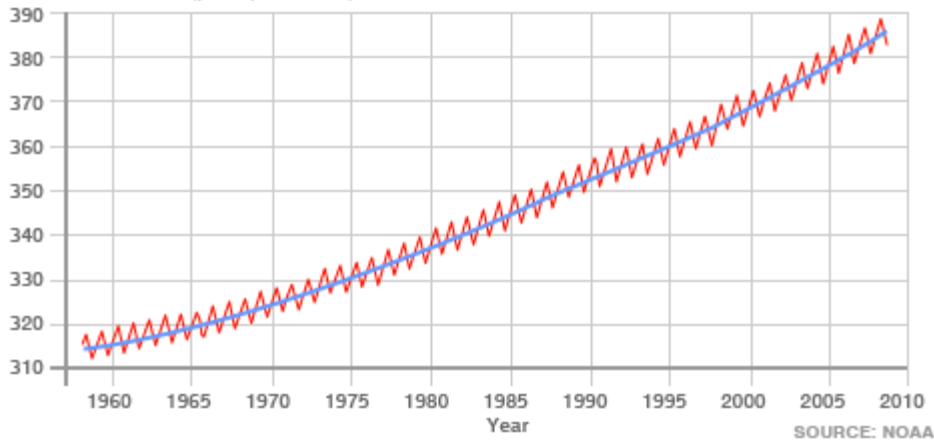
See below for temperature graph.

Earth and Space

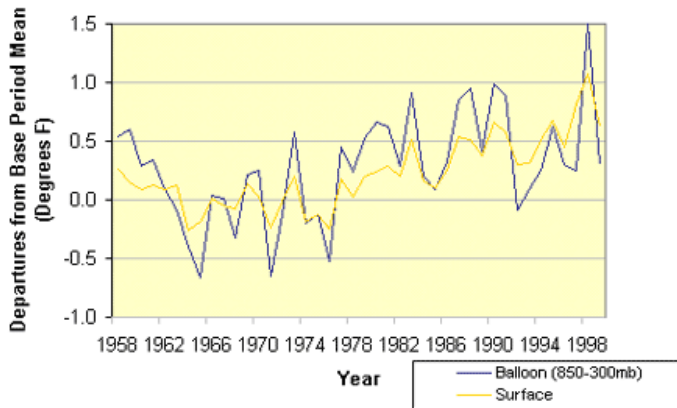
Contamination of the Atmosphere, Soil and Waterways

ATMOSPHERIC CO₂ AT MAUNA LOA OBSERVATORY

CO₂ concentration (parts per million)

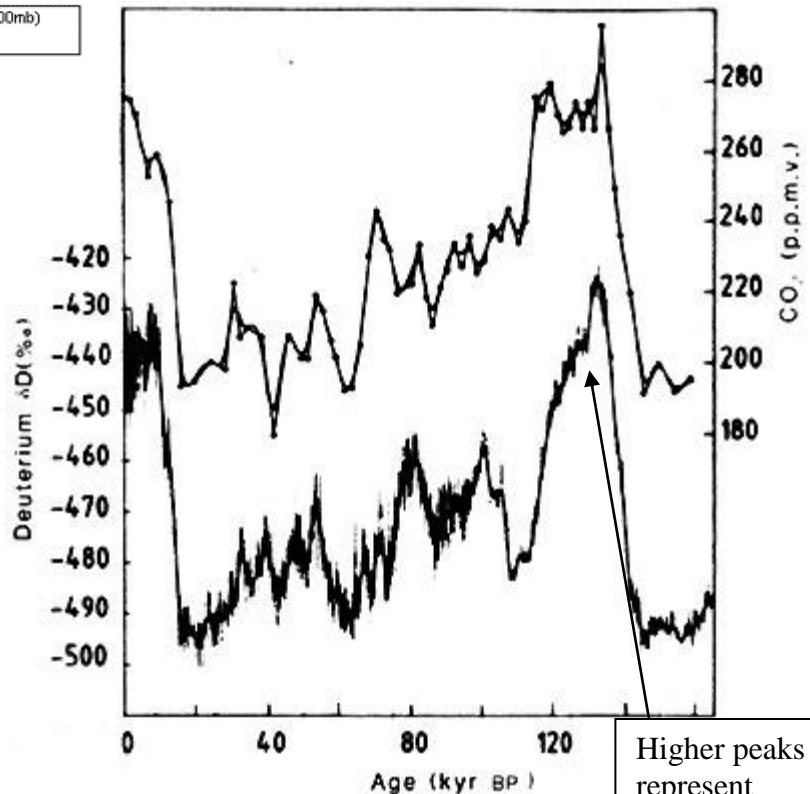


Balloon and Surface Temperature Anomalies (1958-1999*)



* Meteorological Year (December through November), Base Period = 1958-1977
 Surface Data Source: Surface Data Source: National Climatic Data Center, 2001.
 Radiosonde (850-300mb) Data Source: Jim Angell, NOAA Air Resources Laboratory.

But perhaps this is a coincidence. What makes a stronger connection between CO₂ levels and temperature is the historical record. By analyzing ice that has been around for a half million years we can measure CO₂ 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 CO₂ levels vary hand in hand.



Higher peaks represent higher temperatures.

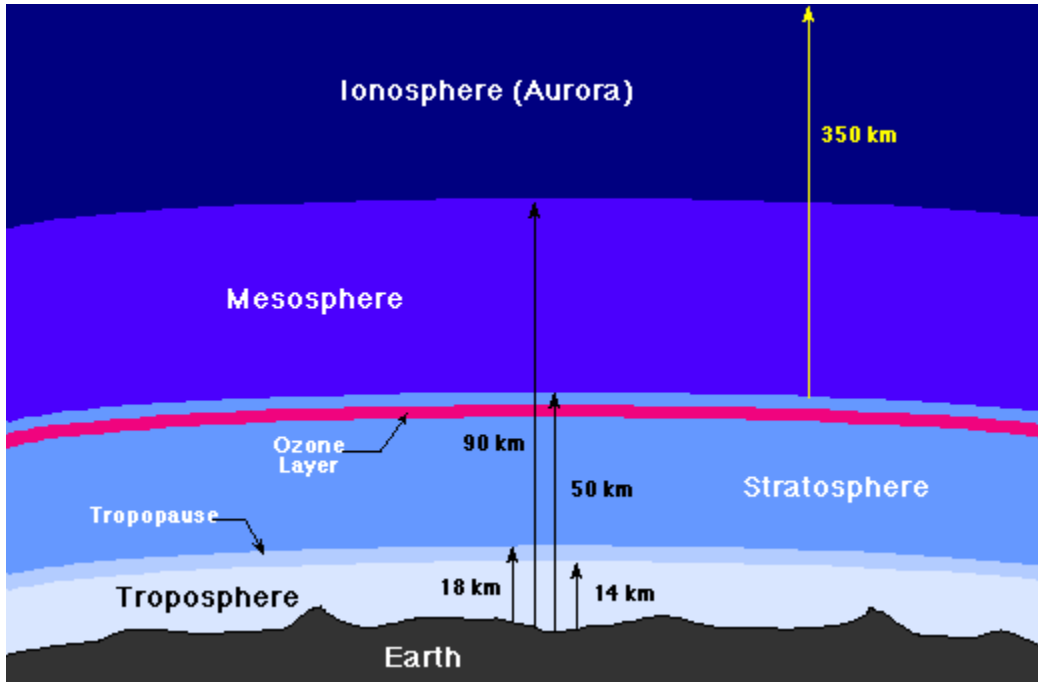
Earth and Space

Contamination of the Atmosphere, Soil and Waterways

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?

Earth and Space

Contamination of the Atmosphere, Soil and Waterways

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)	<ul style="list-style-type: none"> • 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.

Earth and Space

Contamination of the Atmosphere, Soil and Waterways

- 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?

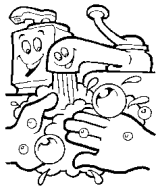
V *Mixed Bag of Questions*

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

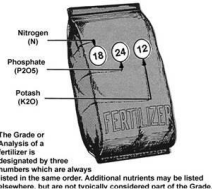
- | | | | |
|----|---|-------|-----------------------------|
| a) | CO ₂ | _____ | 1. Acid rain |
| b) | SO ₂ | _____ | 2. Global warming |
| c) | CFC's | _____ | 3. Ozone depletion |
| d) | CH ₄ | _____ | 4. Soil and water pollution |
| e) | NO ₂ | _____ | |
| f) | Cl | _____ | |
| g) | Hg | _____ | |
| h) | deforestation | _____ | |
| i) |  | _____ | |
| j) | cattle ranches | _____ | |

Earth and Space
Contamination of the Atmosphere, Soil and Waterways

21- Phosphorus Cycle, Runoff and Eutrophication.

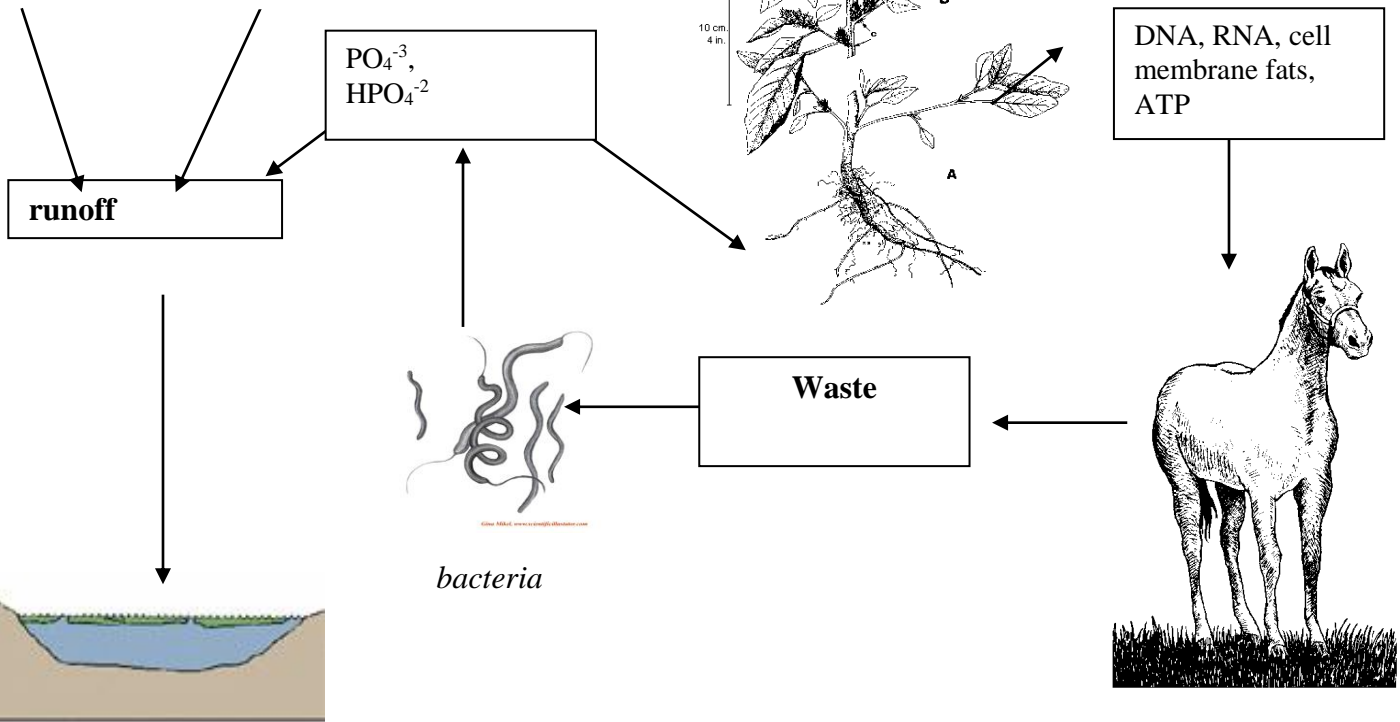


What's in a fertilizer "Grade" or Analysis



Grey water

Fertilizer



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?

Earth and Space

Contamination of the Atmosphere, Soil and Waterways

4. What are runoff and eutrophication?

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?

