

Spring 2020

THE GREENHOUSE EFFECT

1. GREENHOUSE EFFECT VS. GLOBAL WARMING

- A. Global warming can be referred to as the enhanced greenhouse effect, why is this an important distinction?

2. MECHANISM OF THE GREENHOUSE EFFECT

- A. Earth's energy balance. Discuss:

- i. Blackbody radiation
- ii. Incoming vs. outgoing radiation
- iii. Fraction of light reaching earth's surface
- iv. Earth's average temperature
- v. Albedo effect

- B. Discuss the Earth's historical temperature trends.

- C. How do GHG's absorb outgoing radiation?

- i. Explain the mechanism (the process by which molecules absorb IR radiation).
- ii. What portion of the electromagnetic spectrum does outgoing radiation fall into?
- iii. Why do gases like nitrogen and oxygen not absorb outgoing radiation?

- D. Why is carbon dioxide such an important GHG?

- i. Discuss trends in CO₂ concentration through history.
- ii. Discuss seasonal fluctuations.
- iii. Sources of natural CO₂
- iv. Sources of anthropogenic CO₂.
- v. What is meant by fixed carbon?
- vi. What is meant by carbon sequestration?
- vii. Carbon dioxide inputs and outputs.
 1. Sources vs. sinks
 2. What is the primary long-term sink?
- viii. Why are CO₂ concentrations increasing in terms of sources vs. sinks?

- E. Methane

- i. Discuss similar concepts relative to CO₂.

F. Nitrous Oxide

- i. Same again

G. Tropospheric Ozone

- i. Same again

H. CFC's

- i. Same again

I. Water Vapor

- i. Water is unique in its role as a GHG, Explain.
- ii. Discuss the feedback loop.

J. What is meant by the atmospheric window and why is it important to keep this region of the electromagnetic spectrum free from absorbing species?

K. What is the role of aerosols in terms of temperature regulation on the Earth's surface? (see figure 5-15)

- i. How does light interact with aerosols?
- ii. Types and characteristics of aerosols.

3. CLIMATE CHANGE

A. Global warming/cooling

- i. What are the three main driving forces?

B. What is the difference in global temperature change vs. climate change?

- i. Signs of climate change?

C. Why is this such a political issue? (Chapter 6 – pages 277-288)