

Your Turn 4.53 You Decide The “Big Question” Revisited

Answer these questions based on your current knowledge.

- a. Do you feel the greenhouse effect and warming of the atmosphere is good or bad? Why or why not?
- b. Where does the carbon dioxide in the air come from?
- c. What is climate change?
- d. Is climate change occurring? Why or why not?

Compare your answers to those from the start of the chapter. How have your answers changed?

Conclusions



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This group of chimpanzees contributed minimally, or not at all, to global climate change and likely are not discussing the issue. However, they must adapt to the changes that will occur. Unlike humans, chimpanzees, along with plants and other animals, don't argue with each other about whether climate is changing. They just attempt to adapt to the ever-changing world, which can affect their way of life including their access to food, water, and habitat. For example, as the climate changes, food availability shifts, thus forcing animals such as the chimpanzee to adapt in order to obtain enough calories to survive. The changes also affect their habitat, with variations due to differing weather patterns.

Like much of the planet, the salt water in the oceans has no voice, but it still responds to climate change and has a story to tell. In colder climates, it quietly freezes to form sea ice when temperatures drop. And perhaps more noisily, this ice breaks up with the return of warmer temperatures in the spring. This freeze–thaw cycle has been occurring for thousands of years, gradually shifting to form more or less ice as the temperatures on Earth have shifted. In recent years, however, the freeze–thaw cycle has been more pronounced and the waters in the Arctic have been free of ice for longer periods of time. Might carbon dioxide be the culprit of changes witnessed in the Arctic? As a greenhouse gas, carbon dioxide plays a role in keeping our planet comfortably warm and able to support life, but there can be too much of a good thing. John Holdren has said several times, “Global warming is a misnomer, because it implies something that is gradual, something that is uniform, something that is quite possibly benign. What we are experiencing with climate change is none of those things.”

The first assertion is that global warming isn't gradual. By this he means that in comparison with the past, the climate changes we are seeing today are occurring much more rapidly. Natural climate changes are part of our planet's history. Glaciers, for example, have advanced and retreated numerous times, and global temperatures have been both much higher and much lower than the temperatures we currently experience. But the geologic evidence indicates these past changes occurred over millennia, not decades as they occur today. So Holdren is correct. Global warming is not gradual, at least not in comparison with the geologic time frames of the past.

Second, he asserts that global warming does not occur uniformly across the globe. Holdren is right again. To date, the most dramatic effects have been observed at the poles. These include quickly receding glaciers, shrinking sea ice, and melting permafrost. So far, the more densely populated lower latitudes have experienced far smaller effects from climate change.

His third assertion, that global warming might not be benign, is the most difficult to assess. The issue is complicated in part because we cannot predict with certainty which aspects of our planet global warming will affect and to what degree. It is further complicated because we cannot easily understand why only a few degrees of warming might be catastrophic.

As evidenced by Holdren's points, global climate change is an extremely complicated phenomenon. Like it or not, we are in the midst of conducting a planetwide experiment, one that will test our ability to sustain both our economic development and our environment.

In the next chapter, you will learn about various types of fossil fuels and the details of their combustion. Although these are the culprit reactions responsible for the increased concentration of CO_2 in the atmosphere, we rely on the burning of these fuels for electricity, transportation, and warmth. However, as you will learn, more sustainable fuel options are beginning to be used, including a sustainable use for CO_2 in oil recovery projects.

Learning Outcomes

The numbers in parentheses indicate the sections within the chapter where these outcomes were discussed.

Having studied this chapter, you should now be able to:

- name and identify carbon-containing compounds (4.1)
- illustrate, interpret, and predict sources of carbon using carbon cycle diagrams (4.1)
- identify where carbon is located on Earth (4.1)
- write formulas and names of ionic compounds and transition metal compounds (4.1)
- name and identify the charges for polyatomic ions (4.1)
- summarize photosynthesis, combustion, and respiration using chemical reactions (4.2)
- describe mole–mass relationships, and relate this relationship to real-world reactions (4.3)
- convert among grams, moles, and number of molecules, ions, or atoms using mole–mass relationships (4.3)
- calculate the average atomic mass based on the relative percentages of isotopes (4.3)
- use molar masses to calculate the amount of carbon in gas molecules and ionic compounds (4.4)
- estimate the amounts of carbon in various carbon reservoirs (4.4)
- outline the path(s) of incoming and outgoing radiation in Earth's atmosphere (4.5)
- diagram the greenhouse effect and explain how it influences the temperature on Earth (4.6)
- describe the characteristics of a greenhouse gas (4.6)
- construct and use Lewis structures to predict molecular shape (4.7)
- describe how IR radiation interacts with molecules and can lead to asymmetrical stretching and bending (4.8)
- model and explain how radiation is released from molecules and further warms Earth (4.8)
- interpret graphs to make claims about climate conditions in the past (4.9)
- explain the processes for collecting historical and current climate data and assess the reliability of data (4.9)
- distinguish between weather and climate (4.9)
- differentiate between causation and correlation (4.9)
- recognize that elements can exist as different isotopes and identify that the presence of isotopes allow scientists to determine age (4.3, 4.9)
- make predictions based on trends and models (4.10)
- differentiate between observation and inference in relation to future climate predictions (4.10)
- relate scientific processes to the prediction of Earth's future climates (4.10)
- evaluate conclusions from a scientific report on climate change and interpret how data supported those conclusions (4.9, 4.10, 4.11)
- estimate the possible global consequences of climate change and describe factors that can mitigate the severity of these potential consequences (4.11)
- identify factors that influence individual carbon footprints (4.12)
- devise actions that can lower individual carbon footprints (4.12)
- predict how changes in individual carbon footprints, cities, and nations can mitigate climate change consequences (4.12)