Name _____ Period _____ Date _____

Topic 4.4: Climate Change

4.4.U1 Carbon dioxide and water vapor are the most significant greenhouse gases.

1. Define the terms global warming and climate change.
2. Contrast the two terms: global warming and climate change.
3. What analogy is used to describe how gases in the atmosphere have an effect on the Earth?
4. Which gases in the atmosphere have the greatest effect on the Earth? Review the processes that release and remove those gases from the atmosphere.
5. Without the greenhouse gases, what would the mean temperature of the surface of the Earth be?

4.4.U2 Other gases including methane and nitrogen oxides have less impact.

6. List the other greenhouse gases and their source(s).
7. What percentage do greenhouse gases make up of the atmosphere? Why do scientists and ecologist recommend reducing the amount of greenhouse gases?
8. [Research outside the text] Why is ozone not considered a greenhouse gas? What role does ozone play in our atmosphere?

4.4.U3 The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere. [Carbon dioxide, methane and water vapor should be included in discussions.]

9. Describe the two most important factors in determining the impact a gas has on the greenhouse effect.
10. List several sources that increase the release of each greenhouse gas into the atmosphere.

4.4.U4 The warmed Earth emits longer wavelength radiation (heat).

11. In general, compare the amount of energy in ultraviolet, visible, and infrared radiation.
12. Of the three types of radiation listed above, which is responsible for us feeling warm on a sunny day, our sight, and our skin developing melanin?

4.4.U5 Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere.

13. Using the diagram calculate the percentage of radiation that is:
    a. absorbed by the atmosphere from incoming solar radiation.
    b. absorbed by the surface from incoming solar radiation.
    c. back radiated from surface radiation.
14. According to Figure 4 page 232, which gas absorbs the most wavelengths of light? The least?

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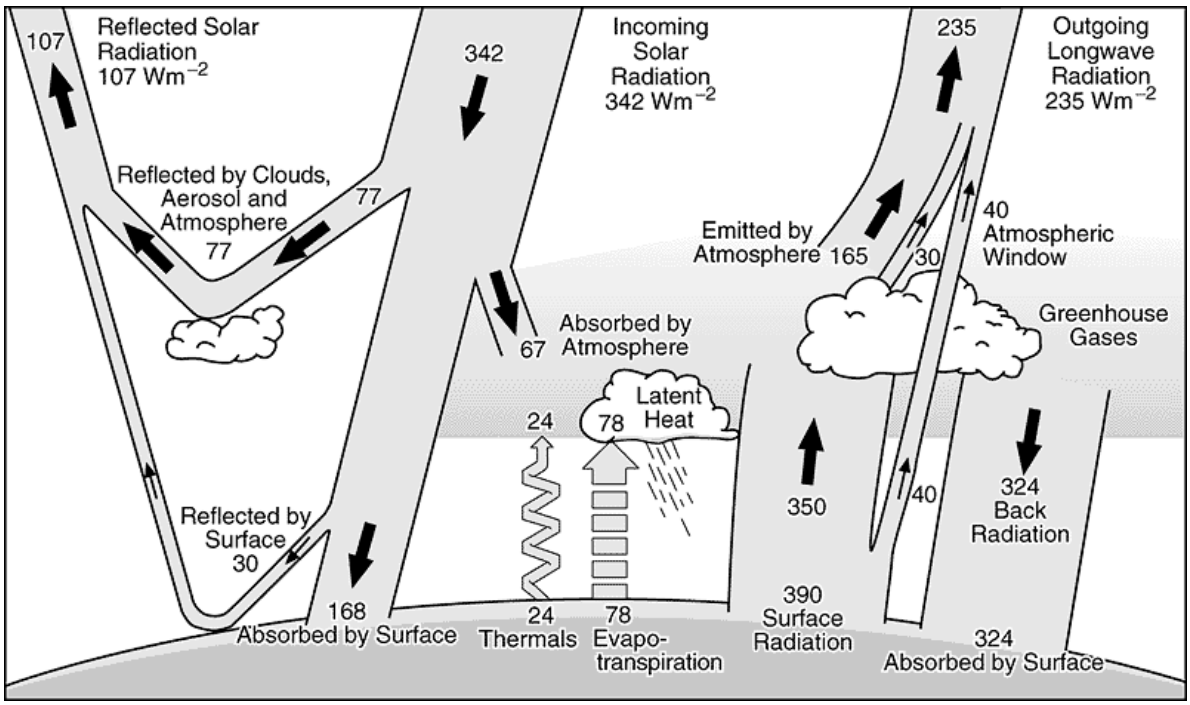


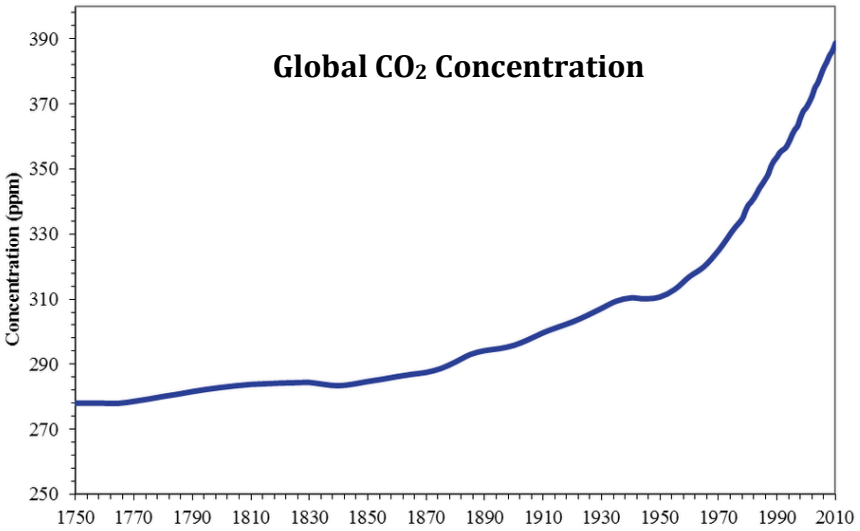
4.4.U6 Global temperatures and climate patterns are influenced by concentrations of greenhouse gases.

15. What evidence has been used to track the levels of carbon dioxide over the last 800,000 years?
16. Analyze Figure 5 on page 233. What conclusions can you draw between atmospheric carbon dioxide concentration and global temperature?
17. Complete the supercool-inquiring-for-knowledge (SIKs): CO_2 concentrations and global temperatures on page 233.
18. Suggest why increasing amounts of greenhouse gases do not necessarily correlate with rising global temperatures.

4.4.U7 There is a correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures.

4.4.U8 Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter.

19. Carbon dioxide forms only 0.04% of Earth's atmosphere, but has been rising over the last 200 years from an average of 280 ppm during non-ice age periods to a current level of 401 ppm (October 5th, 2016) See the graph of Global CO_2 Concentration. What significant human event has lead to this increase in global carbon dioxide concentration? [4.4.A2, 4.4.A3]



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20. Read the Nature of Science: Assessing claims and counter claims and Applications: Opposition to the climate change science pages 236 and 237 respectively.
21. Read the Applications: Coral reefs and carbon dioxide on page 238. Complete the Activity at the bottom of page 238 using graph paper and attach to your reading guide. Outline how decreasing pH can affect atmospheric carbon dioxide concentration [4.4.A1].