Greenhouse Effect Exploration
Honors Physical Science 2019

Name Key Per _____

Click the links and answer the questions below.

https://www.windows2universe.org/earth/Atmosphere/earth_atmosph_radiation_budget.html

1. Which EM wavelengths reach the ground? ROYGBIV (LONG λ, SHORT λ)
   visible light, shorter IR, longer UV
2. Explain how Earth's atmosphere is much like the glass in a greenhouse.
   Sunlight readily passes through the glass, warming the inside of the greenhouse. The IR does not pass back thru the glass - it is trapped. The glass is like our atmosphere.
3. How does the temperature of our "airless Earth" differ from our actual Earth?
   Airless Earth → -19°C (-3°F)
   Actual Earth → +15°C (+60°F)

https://climate.nasa.gov/causes/

4. Describe the following Greenhouse Gases:
   a. Water vapor most abundant GHG, important in climate bec water vapor increases as atm warms → more poss. of clouds & precip.
   b. Carbon dioxide released via natural means (respiration/volcanism) & through human activities (deforest., burn ff, land changes) - most impt. long-lived "forcing" of climate change
   c. Methane
      CH_4 - more active GHG than CO_2 but much less abundant - released by natural & human activities (decomp of waste, agriculture/livestock)
   d. Nitrous oxide
      powerful GHG prod by use of fertilizers, ff combustion, etc

https://www.windows2universe.org/earth/climate/cli_greengas.html

* 5. Describe what happens to the atoms when they absorb heat.
   the atoms are held loosely enough together that they vibrate when they absorb heat. Eventually the vibrating molecule will release the radiation

https://serc.carleton.edu/eslabs/weather/2c.html

NON GHG are held tighter tog so they don't vibrate or absorb heat

6. Scroll down until you see the animation (picture shown). Click on the Earth and answer the questions:
   a. How does the temperature change with CO_2 (ppm) levels? CH_4 (ppb) levels? N_2O (ppb) levels?
      temp ↑ w/all 3 GHG
   b. Which gas causes the biggest change in temperature?
      CO_2 bec there is more of it (ppm vs ppb)
   c. Describe how the GHG levels have changed from 1850 to today. What affect has that had on global temperatures?
      all have ↑ causing global temps to go from 14°C → 15°C or 57°F → 59°F
   d. According to the simulation, what is predicted for 2100?
      all conc are predicted to sig. ↑

Today → 2100
59°F → 68°F
16°C → 20°C

7. **Both instrumental and satellite data show that the years between 2000 to 2010 were the warmest decade of the past 150 years, and 2014 was warmest year on record since 1880. In fact, 9 of the 10 warmest years on record have occurred during the 21st century. (Source: NOAA State of the Climate 2014)**
View the video "Piecing Together the Temperature Puzzle" (5 min, 48 sec) near the bottom of this webpage, and explain what could be causing the heating of the planet.

SUMMARIZE

8. **Using your own words (not the internet's words), explain the Greenhouse Effect. Include a sketch to help.**

Greenhouse Effect is the NATURAL heating of Earth's surface caused by GHG in the atm. Shortwave radiation comes in, passing right through the atm. The radiation is absorbed by Earth & reradiated by Earth as longwave radiation, which is absorbed by GHG. This traps the heat.

9. **What is global warming (climate change) and how does it relate to the Greenhouse Effect?** causing Earth to warm.

Global warming is the rise in global temps due to the GHE.

10. **What are some possible consequences of global warming/climate change?**

polar ice caps melting, flooding, (rising sea level) ocean acidification due to more dissolved CO_2, more frequent & severe weather, loss of habitats

11. **What role do humans play in GHG concentrations in the atmosphere?**

burning of f.f.:
- automobile exhaust
- industrial emissions

deforestation → rate of photosynth is reduced so more CO_2 remains in air

SO... conserve E, clean E (alt E resources)
↳ turn off lights, bike to work, carpool