**Pre-Lab Activity**

**Climate Change: The Gas Phase**

**Materials Per Pair**

2 Computers *(We recommend one computer displaying the instructions and one displaying websites)*

1 molecular model kit

**As a Class – Greenhouse Gases**

1. Watch the following video together: <http://tinyurl.com/drdenning> (It will automatically download to your computer—find it in your default downloads folder). As you watch the Colorado State University climate scientist’s explanation, use your model kits to build the greenhouse gas molecules that he describes.
2. At the end of the video, capture the points you *didn’t already know* about greenhouse gases. Discuss these points with in a group of 4 and summarize below:
3. With the same group of 4, discuss this image in relation to the video: <http://tinyurl.com/greenhsimg>
4. If needed, watch the video again to ensure the new points you learned are clarified.
5. As a class, build a methane molecule and discuss its role as a greenhouse gas: <http://tinyurl.com/methanegg> and <http://tinyurl.com/arcticch4>
6. Then build a couple of hydrocarbons and discuss their combustion as a source of CO and CO2. <http://tinyurl.com/hyrdocarbcomb> Relate combustion reactions and fossil fuels to hydrocarbons.

**With a Partner – Photon Absorption Simulation**

1. Go to <https://phet.colorado.edu/en/simulation/greenhouse> and click DOWNLOAD. Check your download folder for the file if you don’t see it. Open the simulation.
2. First, go to the Photon Absorption tab at the top. You have 5 gases to test with both the infrared and visible photons.
   1. Create a data table to capture data for both types of photons and all 5 gases. You might want to play with the sim for a few minutes before creating your data table.
   2. Based on your knowledge of the EM spectrum and the previous lab, define *infrared* and *visible light photons*:
   3. Insert your data table below:
3. Use your collected data as evidence to answer these questions:
   1. Which gases are greenhouse gases?
   2. Does this evidence confirm or disprove the information you learned from Dr. Denning in the video?
   3. At the molecular level, describe what is happening when a greenhouse gas encounters an infrared photon.
4. Now click the **Build Atmosphere** radio button in the Photon Absorption tab. With your partner, discuss HOW you want to build your atmosphere and why. Don’t just randomly pick numbers of molecules, THINK about what you want to SIMULATE.

Copy your final atmospheric composition here, and explain why you composed your atmosphere this way:

1. Run your atmospheric simulation, noting what happens.
2. As a class, come together to discuss the results of the atmospheric simulation.

**With a Partner – Greenhouse Effect Simulation**

1. Now click the Greenhouse Effect tab in the same simulation. Take a look at the right side menu items to orient you to the simulation. NOTE: You cannot see the greenhouse gases, only the photons.
2. Create a second data table to capture your observations. Then complete the table
   1. Note the greenhouse gas composition at each time period (Today, 1750 and Ice Age).
   2. Describe infrared photon activity at each time period.
   3. Describe sunlight photon activity at each time period.
   4. Note temperature range (°C) at each time period.
3. Click the radio button **Adjustable concentration** and move the slider between None and Lots. What slider position most closely resembles “Today?”

**As a Class – Human-accelerated Greenhouse Effect and Climate Change**

1. Discuss your findings from this simulation.
2. Together view and discuss the visualizations from NASA on this web page: <http://tinyurl.com/NASAviz1>

Also download this image and insert it below: <http://tinyurl.com/tempindgw>

1. Humans have accelerated global warming on our planet, but **global warming is not equal to climate change**. According to the US Global Change Research Program, climate change may be described as:

*Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of our climate system.*

Climate science is complex, but you can continue to understand more about the impact of climate change and the urgent need to take action. View these two videos together as a class:

<http://tinyurl.com/hcullenvid> and <http://tinyurl.com/jrommvid>

Capture two facts that you will share with someone else (not in this class)

**Follow @climateprogress on Twitter to get news feed from Joe Romm’s journal until the end of this lab**.