As we begin our discussion of global warming and climate change, let's mention a few key concepts.

1. Global warming. This refers to a heating of both Earth's surface and its atmosphere. We can talk about a particular region or about the planet as a whole. So definitions are important here.

   Suppose we are talking about the temperature in St. Joseph, Missouri. Now we have to specify exactly where in St. Joe and how we are measuring. So I'll say, halfway between Popplewell and the clock tower on the Missouri Western State University campus and five feet horizonally from the sidewalk on the Potter Hall side. We will be measuring six feet off the ground using a mercury thermometer nailed to a post and shielded by wood so that it is never in direct sun.

   Now, unless we have had this set up for some time it will be difficult to compare the temperatures we record with temperatures ten years ago in St. Joe because these were measured with a different thermometer and in a different location. One hundred years ago, the campus wasn't here and we have no idea if the thermometer used (in a different location in St. Joe) calibrates exactly with the one we

use today. So already we have encountered some problems with comparing temperatures over time.

Things get even more complicated when we decide to calculate an average temperature for the planet. There are at least a hundred "reasonable" and possible ways to do this. And, guess what, they don't all give you the same answer—not by a long shot! See the web page link.

Now, if we use the same thermometer and the same locations, and the same algorithm to calculate the average temperature we are in clover. Otherwise, assumptions will have to be made.

But say that using any available method we determine consistently that the planet is warming. That's pretty much the case for the past decade or so. More on all this later!

2. Greenhouse effect and greenhouse gasses. Light energy from the Sun hits Earth, travels easily through the atmosphere and is converted to heat as it is absorbed. Roughly speaking the wave lengths of light from the Sun are short and energetic and are not readily absorbed by the atmosphere. The Earth radiates back into the atmosphere longer

wavelengths, which are felt as an increased temperature.

Normally these radiated wavelengths would leave the Earth and go out into space. But these long wavelengths of energy (heat) are absorbed by water vapor, by CO_2, by methane, and a host of other gasses. The more of these gases that are present the more heat is retained in the atmosphere.

So, as we put more CO_2 and methane into the atmosphere by burning fossil fuels, the more heat is retained resulting in global warming.

In a greenhouse, something similar occurs: Sunlight readily passes through glass or plastic, depending on the type of greenhouse, and is converted to heat by everything in the greenhouse. The glass and plastic prevent heat radiation from leaving, so the greenhouse heats up. I have a large greenhouse. Even on a cloudy day in winter the greenhouse quickly heats up to 100 F. or so even if its' -20 F outside. That's the "greenhouse effect."

The gasses in the atmosphere prevent heat from leaving earth the same way the glass or plastic of the greenhouse prevents its leaving. So we have a

similar greenhouse effect, and the gasses that absorb heat are known as “greenhouse gasses.”

Some greenhouse gasses are more efficient at trapping heat than others. For example the global warming potential of methane is thought to be 72 times that of carbon dioxide over twenty years.