**Summary of Lecture 10**

Key points include:

1. Our atmosphere is clear to visible (optical) light and radio waves, but is opaque to much of the electromagnetic spectrum (e.g., X-rays). When the optical light from the Sun is absorbed by the Earth, it is re-radiated as infrared light.
2. Greenhouse gases (e.g., water vapor, carbon dioxide, methane) absorb infrared light. Thus the re-radiated light is partially trapped by the gases, which keeps the Earth and other planets warmer than they would be.
3. Extreme example: Venus! Highest average temperature of any planet (470°C, or 880°F), even though Mercury is closer to the Sun. Why? Venus has a mainly carbon dioxide atmosphere, with 90 times the pressure of Earth's atmosphere.
4. Mars' atmosphere has 1/160 the pressure of Earth's atmosphere, so very little greenhouse effect.
5. Early in Mars' history, it had a thicker atmosphere and very likely had surface water, but not for the last 3 billion years.
6. Earth is the only place we know to have life. Features that seem important include (a) surface liquid water, (b) atmospheric oxygen, (c) plate tectonics, and (d) climate stability. Note, though, that with only one example we can't be certain; maybe there are other combinations that will work, but at least we do know that they worked well on Earth!