

Atmospheres, Greenhouse Effect, and Planetary Temperatures

- 10-31-2005

Opening Discussion

- Mars life votes: 2-never, 15-past, but not now, 21-then and now.
- Have you seen anything interesting in the news?
- For Halloween I'm the "grave reaper".
- Sample return from Mars and customs.
- Astronomy cards?
- How can water boil and freeze at the same time?
- What is the timescale of the "sudden" water flows on Mars when magma heated subsurface ice?

More Minute Essays

- Can we detect the lithosphere of the Earth getting thicker?
- I do drive a Saturn.
- It can be difficult to teach to people who are falling asleep.
- Venus is terms other than the planet.
- Could the Earth be like Mars someday?
- There was one vote that any life would be tiny and wouldn't matter to the voter.
- Terraforming Mars.

Surface of Venus

- This image from Venera 9 shows a closeup of the surface in color. The yellow hue comes from the haze layer.



Terrestrial Atmospheres

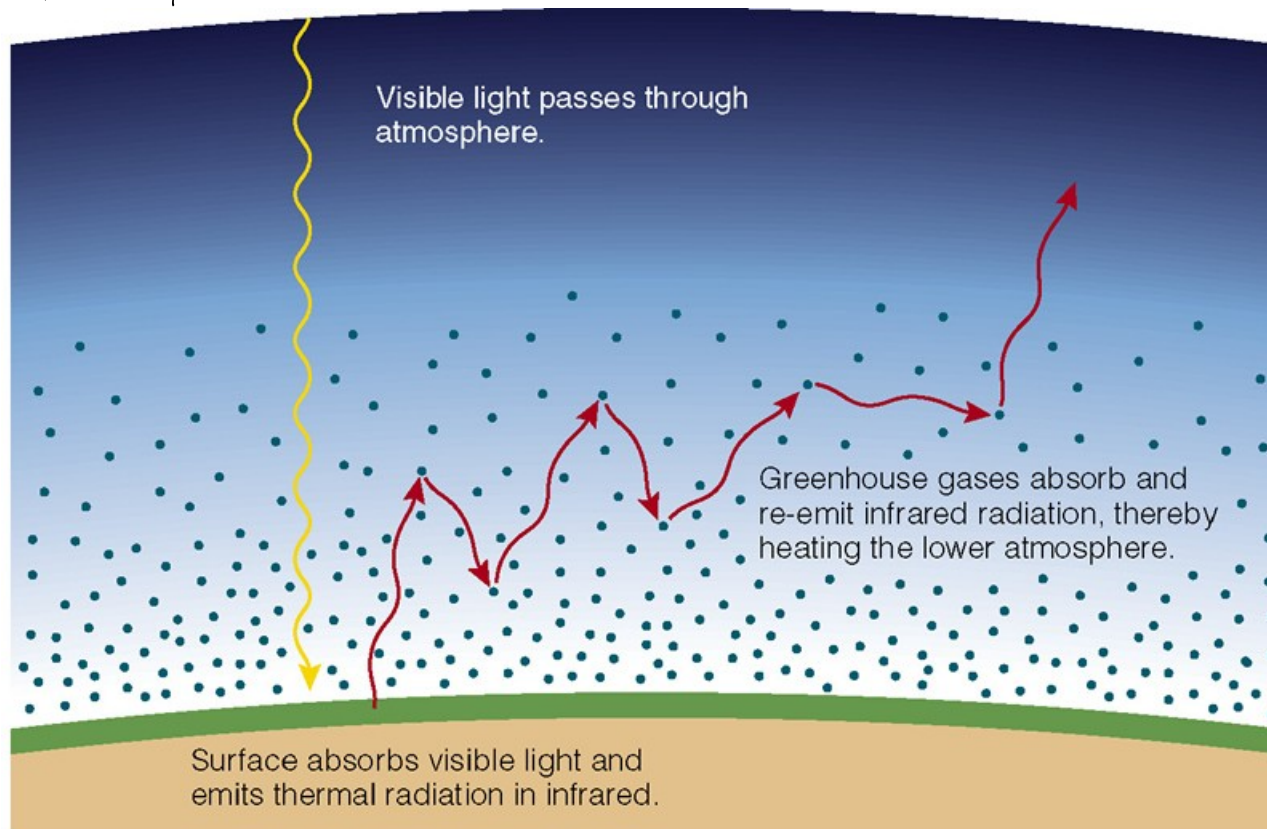
- An atmosphere is nothing more than the outer layer of gas around a planet. Given this definition, all the terrestrial planets have atmospheres. For the Moon and Mercury they just happen to be extremely thin. Even with the Earth, the majority of the atmosphere is within 10 km of the surface.
- The top layers of the atmosphere are supported by the pressure from the layers above them. At any point, the pressure is equal to the sum of the weight of all the air above that point. On the Earth this pressure is about 14.7 psi.
- It is hard to define where the top of the atmosphere is.

Functions of Atmospheres

- Atmospheres can warm planets (the greenhouse effect) and evenly distribute heat.
- They can absorb and scatter light. This protects us from high energy radiation and causes our sky to be blue.
- The atmosphere provides pressure. This is critical for keeping water in a liquid state.
- Atmospheres allow for wind and weather.
- Atmospheres interact with the solar wind and magnetic fields of the planets.

The Greenhouse Effect

- Some gases, mainly molecules with more than 2 atoms that can spin and vibrate, transmit visible light and absorb infrared light. This traps heat and warms up the surface of the planet.



Temperatures Without Atmospheres

- We can figure out how hot planets should be if they had no greenhouse effect. They radiate energy in all directions from the full surface and absorb energy across a cross section on one side. If we know how much they reflect and how intense the Sun is we can figure out at what temperature they radiate as much as they absorb. This assumes a decent spin rate.
- Your book gives this helpful formula where d is in AU.

$$T = 280 [K] * \sqrt[4]{\frac{(1 - \text{reflectivity})}{d^2}}$$

- This predicts the following: Mercury 164C, Venus -43C, Earth -17C, Moon 0C, Mars -55C. That prediction is only close for Mars which is actually -50C. For the Moon and Mercury the spin rate is too slow.

Greenhouse Effect: Good or Bad?

- The greenhouse effect is a major political hot spot these days. You have to understand some things about it to really have an informed opinion. The most significant greenhouse gas in our atmosphere right now is water.
- Should we be worried about the buildup of carbon dioxide and methane in our atmospheres? Is it possible to increase the amount of carbon dioxide in our atmosphere and not have it trap more heat and warm the planet?

Minute Essay

- How important do you think it is that we reduce our emissions of greenhouse gases?
- Meagan's birthday was yesterday. Make sure the event is celebrated in proper Trinity style.