

Homework #10
AS101 Summer 2006
Dr. Withers

Assigned: 2006.06.15
Due: 2006.06.16, start of class

1) Read Chapter 10

2) Purpose: Encourage reading of Chapter 10

People on Earth's surface are often hit by raindrops falling from clouds. The atmosphere of Venus is very cloudy, but rain never falls on the surface of Venus. Why not?

Clouds on Venus form high in the atmosphere, where it is cool. 10 points

Raindrops can condense in these clouds and start to fall down, but they evaporate before they hit the surface due to the very hot atmosphere near the surface (page 313 for more details). 15 points

3) Purpose: Understand the greenhouse effect.

Which of the following is the best description of the basic principles that are responsible for the greenhouse effect?

A) The Sun emits thermal radiation at infra-red wavelengths, the Earth emits thermal radiation at visible wavelengths. Earth's atmosphere transmits visible photons, but absorbs infra-red photons.

B) The Sun emits thermal radiation at visible wavelengths, the Earth emits thermal radiation at infra-red wavelengths. Earth's atmosphere transmits visible photons, but absorbs infra-red photons.

C) The Sun emits thermal radiation at visible wavelengths, the Earth emits thermal radiation at infra-red wavelengths. Earth's atmosphere transmits infra-red photons, but scatters visible photons.

D) The Sun emits thermal radiation at visible wavelengths, the Earth emits thermal radiation at infra-red wavelengths. Earth's atmosphere transmits visible and infra-red photons.

B) The Sun emits thermal radiation at visible wavelengths, the Earth emits thermal radiation at infra-red wavelengths. Earth's atmosphere transmits visible photons, but absorbs infra-red photons. 25 points

4) Purpose: Understand seasons

Which planet has the most extreme seasons, Venus, Earth, or Mars? Why?

Mars. 5 points

Its axis is tilted by the same amount as Earth's is, whereas Venus's axis is not tilted at all. 10 points

Also, its orbit is very elliptical, whereas the orbits of Venus and Earth are almost circular. 10 points

5) Purpose: Mathematical exercise

Read the Mathematical Insight about “No Greenhouse” temperatures on page 294 of the textbook. What is the “no greenhouse” temperature of a planet that has a reflectivity of 0.2 and is 1.5 AU away from the Sun?

Stating that:

$T = 280\text{K} \times \text{the fourth root of } ((1-\text{reflectivity}) / d^2)$ 5 points

Stating that:

reflectivity = 0.2 and $d = 1.5$ 5 points

Writing down this equation:

$T = 280\text{ K} \times \text{the fourth root of } ((1-0.2) / 1.5^2)$ 5 points

$T = 280\text{ K} \times \text{the fourth root of } (0.8 / 2.25)$

$T = 280\text{ K} \times \text{the fourth root of } 0.356$

$T = 280\text{ K} \times 0.77$

$T = 216\text{ K}$

Attempting the calculation

5 points

Getting the right answer

5 points