

The finale



Previous lecture

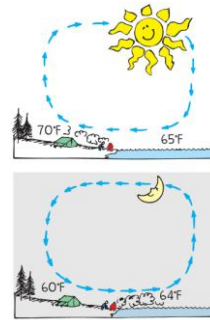
- Three different mechanisms of heat transfer
- Properties of water
- Greenhouse effect: The name applied to the process which causes the surface of the Earth to become warmer than it would have been without an atmosphere
- Global warming: The marked increase in the magnitude of the greenhouse effect in recent times which is "very likely" due to the increase in anthropogenic greenhouse gas concentrations.

Heat transfer I

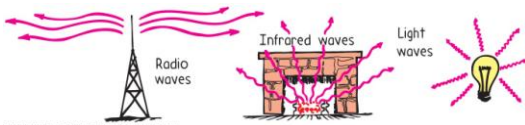


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Heat transfer 2



Heat transfer 3

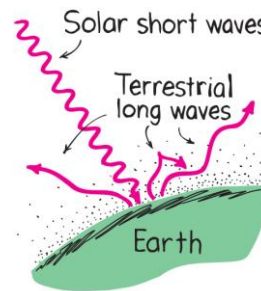


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Any object at a finite temperature radiates energy with a certain frequency/wavelength and that energy can be transferred in vacuum and absorbed by another object!

Greenhouse effect

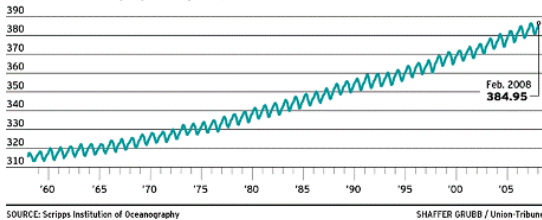
- Effect first proposed by Fourier in 1824



Global warming

Keeling plot:

ATMOSPHERIC CARBON DIOXIDE
Carbon dioxide concentration (parts per million by volume)



SOURCE: Scripps Institution of Oceanography

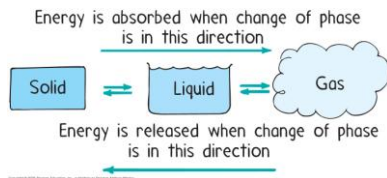
SHAFFER GRUBB / Union-Tribune

Countering global warming?

- Plant more trees!!!!
- Umbrella in the sky---release millions of tons of sulfur dioxide into the sky using balloons or planes
- Turn the ocean green---adding iron stimulates growth of plankton that soak up carbon dioxide
- Increase the reflectivity of the sky with more clouds---ocean mist
- Lenses in space to bend some of the sunlight away from the Earth

Heat transfer and change of phase

- Matter exists in three common phases: Gas, liquid, solid



- Some materials are not so easily characterized in one category or the other, i.e. Silly Putty

PHY101

One page encapsulates all that we have done this semester in PHY101. What is that page?!

Please review past two exams, homework, labs, lecture notes and Chapters 1-6,8-11 in the book.

Review problem 1

Gerald wants to know how fast he can throw a ball, so he hangs a 2.3 kg target on a rope from a tree. He picks up a 0.5 kg ball of putty and throws it horizontally against the target. The putty sticks to the target and the putty and target swing up a vertical distance of 1.5 m from its original position. How fast did Gerald throw the ball?

Review problem 2

- An electron with a velocity of 10 m/s in the positive y direction enters a region where there is a uniform electric field of 200 V/m in the positive x direction. What are the x and y components of the electron's displacement 2.4 microseconds after entering the electric field region if no other forces act on it?

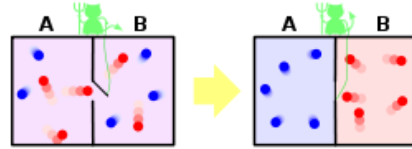
Entropy

- Entropy is a measure of the amount of disorder in a system
- If disorder increases, then entropy increases
- Can decrease entropy if work is put into system



Entropy and Maxwell's Demon

- In 1867 physicist Maxwell came up with a thought experiment meant to raise questions about the possibility of violating the 2nd law of thermodynamics



Otto engine: Car engine

- Intake stroke: The air-fuel mixture is sucked in the cylinder by the piston sliding downward
- Compression stroke: The piston sliding now upward compresses the mixture using work of a crankshaft
- Power stroke: Mixture is ignited and pressure of burning mixture pushes the piston back into cylinder performing work
- Ejection stroke: Burned exhaust is ejected by the rising piston through another valve.

Third law of thermodynamics

- A system can never reach absolute zero, 0 K.
- Postulated by Nernst around 1910
- Entropy of a perfect crystal is zero at 0 K.

Thermal expansion

- Due to a rise in temp. of a substance, molecules jiggle faster and move further apart
- *Most* substances expand when heated and contract when cooled
- Examples: railroad tracks laid on winter days expand and buckle in hot summer, warming metal lids on glass jars under hot water loosens the lid by more expansion of the lid than the jar
- When water becomes ice, it expands!!!! Water is most dense at 4 degrees Celsius!!!! Important for life!