HEAT FACTS REVIEW*

*** Know underlined vocabulary**

Temperature: Average kinetic energy of the atoms or molecules of a substance.
Measured in degrees Celsius, Fahrenheit, or Kelvin.
0E Kelvin = absolute zero = temp. at which all molecular motion stops.
Size of a degree: Fahrenheit = smallest. Celsius & Kelvin larger.

Heat energy: Measured in Joules:
Specific heat: Amount of heat needed to raise the temp of 1g of a substance 1EC
Specific heat of water = 4.18 Joules.

High specific heat (ie. water) = heats up and cools down slowly.
Small specific heat (ie. lead) = heats up and cools down quickly.

If you add equal energy (in Joules) to equal masses of different materials, the one with the smallest specific heat will get hotter, faster.

Water has the highest specific heat of any common substance therefore it heats up and cools down more slowly than almost anything else.
Oceans remain cooler in summer and warmer in winter than the surrounding land.
Land areas near water have cooler summers and warmer winters.

Latent heat: Heat gained or lost during a phase change:
Energy must be added to melt ice or vaporize water: This energy is used to change phase, not increase the temperature.
Energy must be removed to freeze water or make water vapor condense.

Energy added is POTENTIAl (stored) energy. It is stored in the water.

Heat transfer: Conduction = collision of adjacent particles = SOLIDS
Convection = Due to density differences = FLUIDS (liquids & gases)
Radiation* = EM radiation (light or IR) NO MEDIUM REQUIRED
*only method that transfers heat through space.

90% of solar radiation is short wavelength visible light.
Terrestrial radiation (from the earth) is long wavelength infra red.

HOT = EXPAND = LESS DENSE = RISE
COOL = CONTRACT = MORE DENSE = SINK

Radiative balance: when an object is re-radiating as much energy as it absorbs.
Over the long term, the earth is in radiative balance.

Heat flow is always from SOURCE (hot) to SINK (cool).
The rate of heat flow from source to sink depends on the temperature difference:
Small difference - slow flow. Big difference - fast flow.

"Closed system": A system in which no energy can enter or leave. In a closed system the energy lost by the source = energy gained by the sink

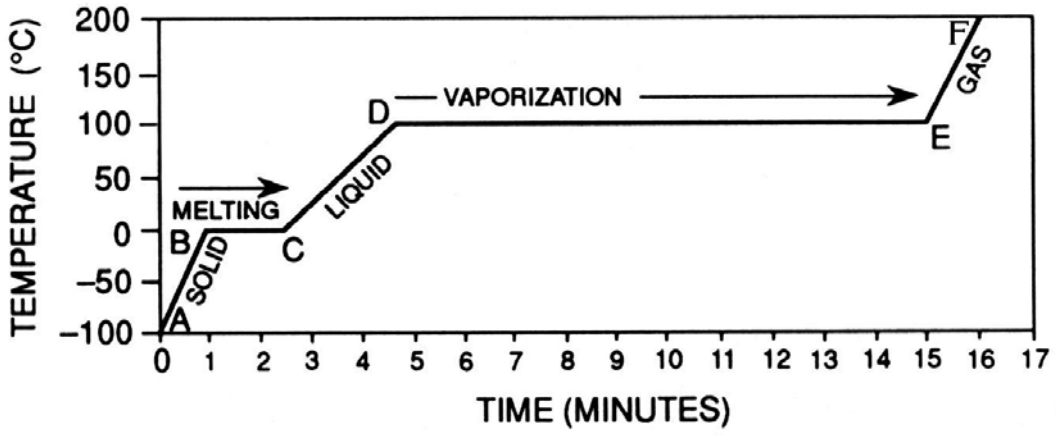
When EM radiation strikes an object it may be reflected or absorbed.
Energy absorbed warms the object.
All warm objects re-radiate infra red.

Best absorber = best radiator = dark/rough - ex. a forest
Best reflector = light/smooth - ex. clouds or snow

Greenhouse effect: 1) SHORT WAVELENGTH, VISIBLE light reaches us from the sun.
2) The light passes through atmosphere and strikes earth.
3) Some is reflected. Some is absorbed.
4) The absorbed energy warms the earth.
5) The warm earth re-radiates LONG WAVELENGTH, INFRA RED waves (terrestrial radiation).
6) I.R. is trapped by CO_2 and water vapor, warming the atmosphere and the earth.

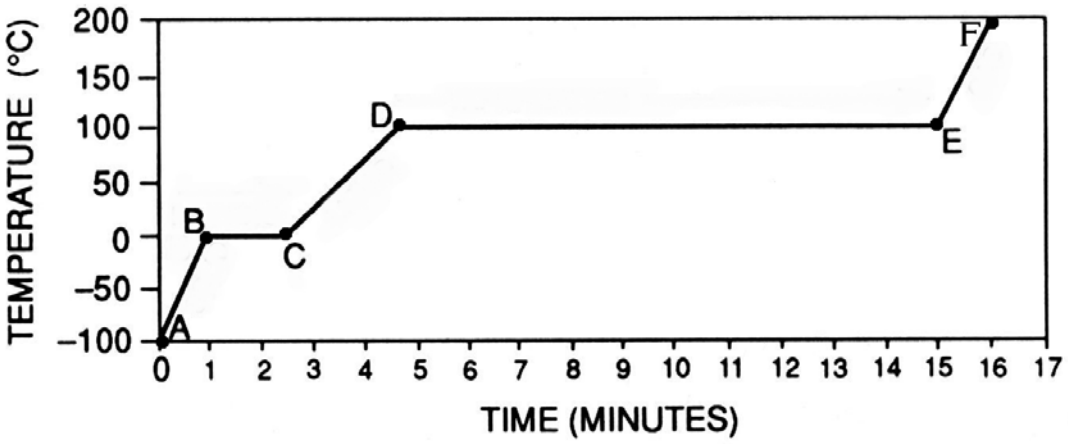
CO_2 is being added to the atmosphere when we burn fossil fuels: coal/oil/natural gas
H_2O (vapor), methane, and CFCs are also greenhouse gases.

SUMMARY: We get SHORT, VISIBLE (solar radiation).
We re-radiate LONG, INFRA RED (terrestrial radiation).
CO_2 is transparent to visible light but NOT to I.R.



Do you understand this graph completely? Do you know the phase of the H_2O at any letter position? Do you know the process that is occurring between any 2 letter positions? Do you understand the energy exchange which occurs between any 2 letter positions?

H_2O Phase Change Review



A) Ice (solid) at -100°C
B) Ice (solid) at 0°C
C) Water (liquid) at 0°C
D) Water (liquid) at 100°C
E) Water Vapor (gas) at 100°C
F) Water Vapor (gas) at 200°C

From A to B: Ice is warming but it remains solid.
NOTE: The line has a steep slope. The ice is warming fast!

From B to C: Ice is melting [PHASE CHANGE from solid to liquid]
BUT the temperature does not change!

From C to D: Water is warming but it remains liquid.
NOTE: The line has a gentle slope. The water warms slowly!

From D to E: Water is evaporating (vaporizing) [PHASE CHANGE from liquid to vapor].
BUT the temperature does not change!

From E to F: Water vapor is warming but it remains a gas (vapor).
NOTE: The line has a steep slope. The vapor is warming fast!

Most energy is added from point D to point E.