

Energy

Understanding climate and climate change depends, more than anything else, on understanding energy and the flow of energy into, out of, and within the earth system.

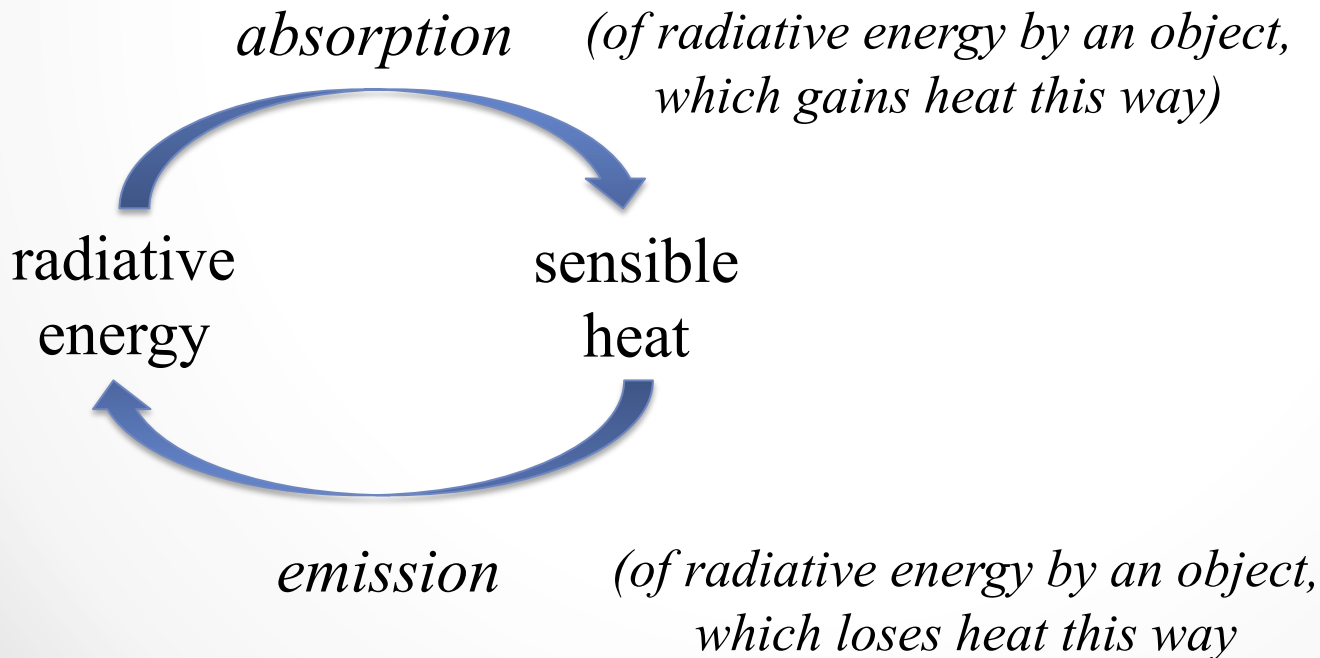
Forms of Energy

- electromagnetic radiation*
- heat*
 - also called sensible heat, thermal energy, or internal energy
 - energy of random molecular motions (rotational, vibrational, and translational)
- latent heat*
 - associated with the phase or state of a substance (solid, liquid, gas)
- kinetic
 - energy of bulk motion of chunks of matter (wind, water, any moving object)
- electrical
- magnetic
- chemical potential
 - energy in bonds between atoms to form molecules
- nuclear
 - energy in bonds between subatomic particles in atoms
- gravitational potential
- etc.

** Most important for understanding climate and climate change*

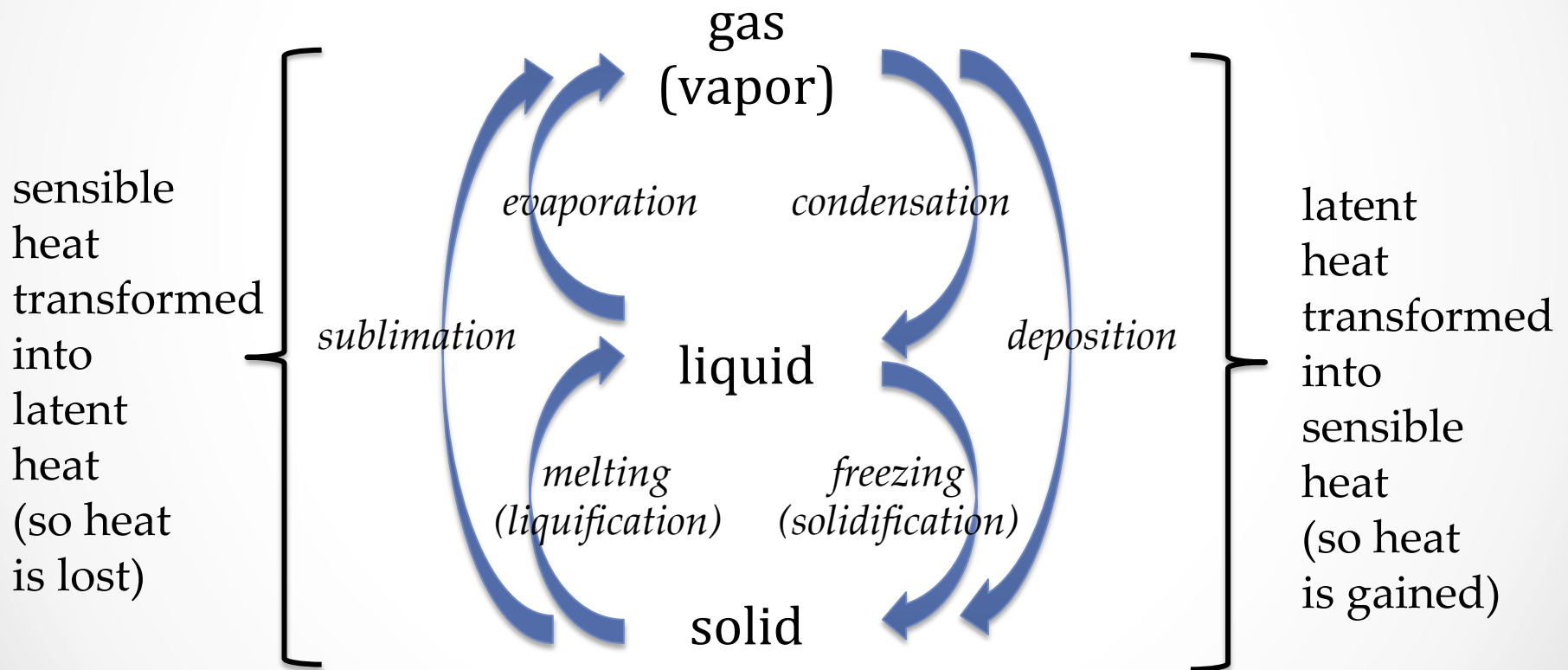
Principle of Conservation of Energy

- Energy cannot be created or destroyed
- However, energy can be *transformed from one form to another*
 - Example:



Principle of Conservation of Energy (cont'd)

- Example: Phase changes of matter (especially of water)



Principle of Conservation of Energy (cont'd)

- Moreover, individual bits of material (discrete, definable chunks of matter) can gain or lose energy
- Moreover, individual bits of material can gain or lose particular *forms* of energy, such as heat
 - The temperature of an individual bit of material will change when the material gains or loses heat
 - **Temperature** is a measure of the *average* kinetic energy of random motions of the molecules of an object/material
 - **Heat** is the *total* kinetic energy of random molecular motions of molecules of an object/material