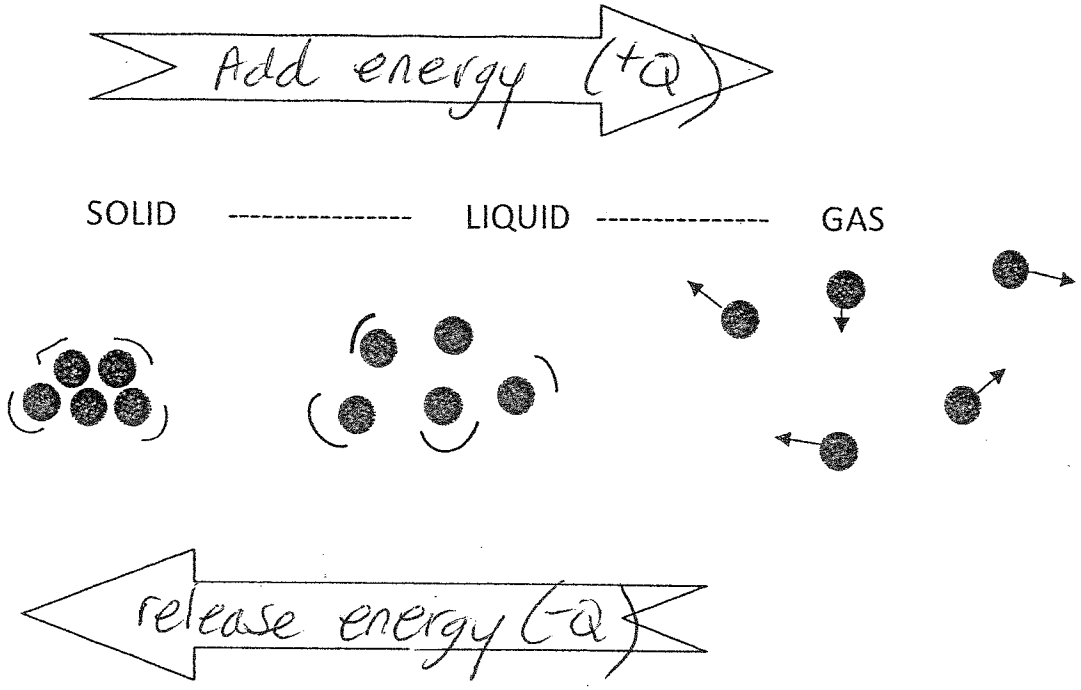
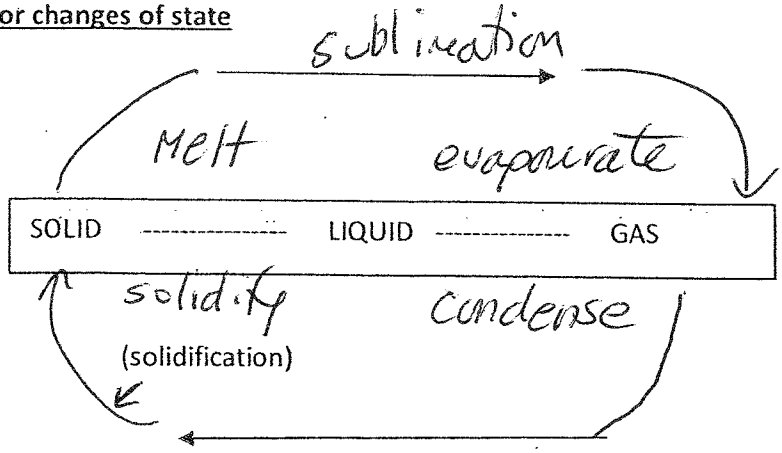
Change of State – Latent Heat

3 states of matter: solid, liquid and gas.



Names for changes of state

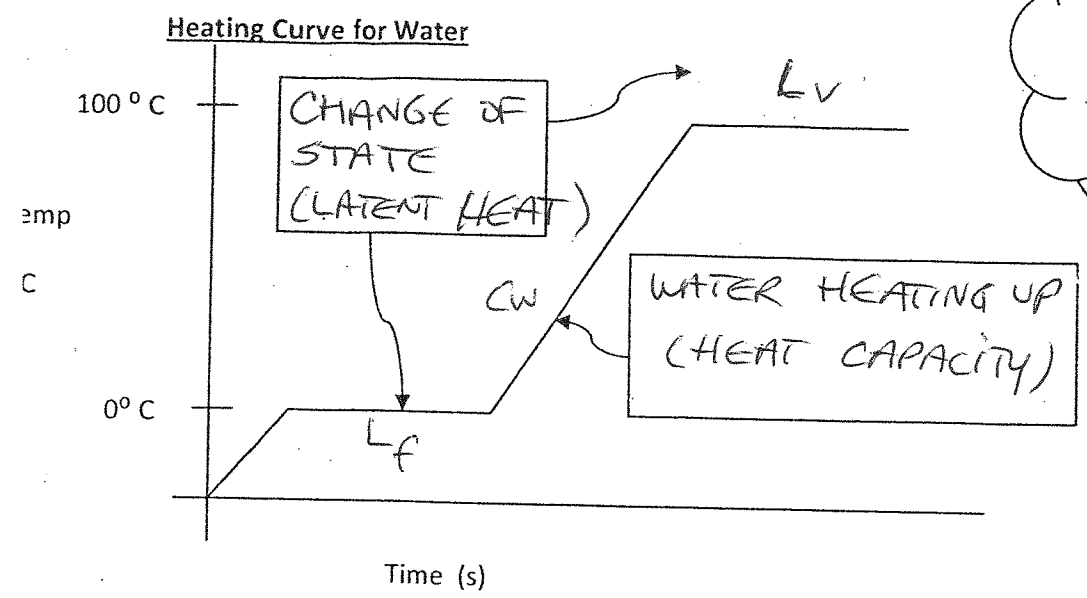


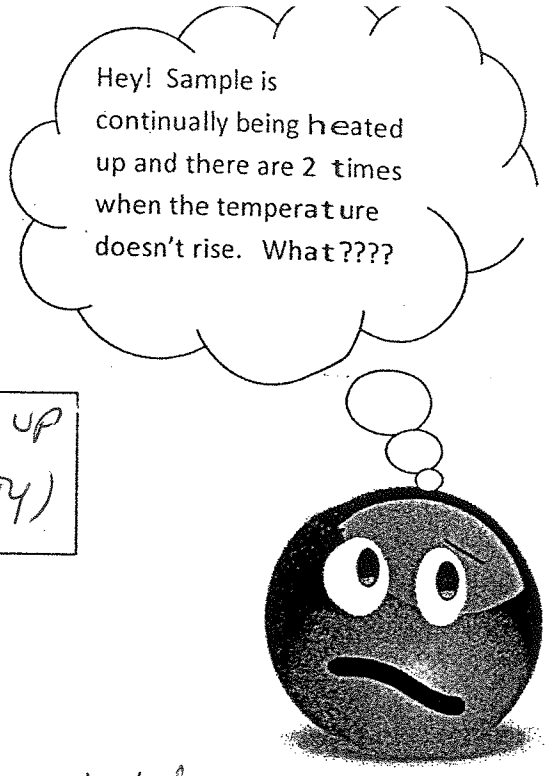
* Note: Sublimation = change of state from solid to gas ...or...gas to solid without becoming a liquid in either case.

Latent Heat

Latent Heat – is often called hidden because it does not result in a change in temperature.

Remember: Thermal Energy = kinetic energy + potential energy (energy of chemical bonds)





When the temperature rises, the thermal energy added goes to a gain in potential energy of molecules.

When the temperature doesn't rise (and yet the burner is still on!), the thermal energy added goes to changing the BONDS of the molecules. This is what is necessary to change state! Remember: there are 2 components to the thermal energy of an object: Ek (movement of molecules) and Ep (bonding energy). Only E_k affects the temperature! When temperature does not increase, you need to use latent heat formulas.

Latent Heat (Q) = The total thermal energy absorbed or released when a substance changes state

Latent heat of fusion = (Lf) = the amount of thermal energy (J) required to change a solid into a liquid or a liquid into a solid.

Latent heat of vapourization = (Lv) = the amount of thermal energy (J) required to change a liquid into a gas or a gas into a liquid.

Specific latent heat – Each substance has its own specific latent heats. This is a physical property determined experimentally by analytical scientists. Chart on page 291 lists values for some substances.

WATER: Water's latent heat of fusion is 3.4×10^5 J/kg (ie: takes 340,000 J to melt or freeze 1kg) and water's latent heat of vapourization is 2.3×10^6 J/kg (ie: takes 2,300,000 J to boil or condense 1 kg)

Add these formulas to formula sheet AND the specific values for water.

$Q = mL_f$ $\quad Q = mLv$ $\quad m$ = mass (kg)

Lf (water) = 3.4×10^5 J/kg

Lv (water) = 2.3×10^6 J/kg