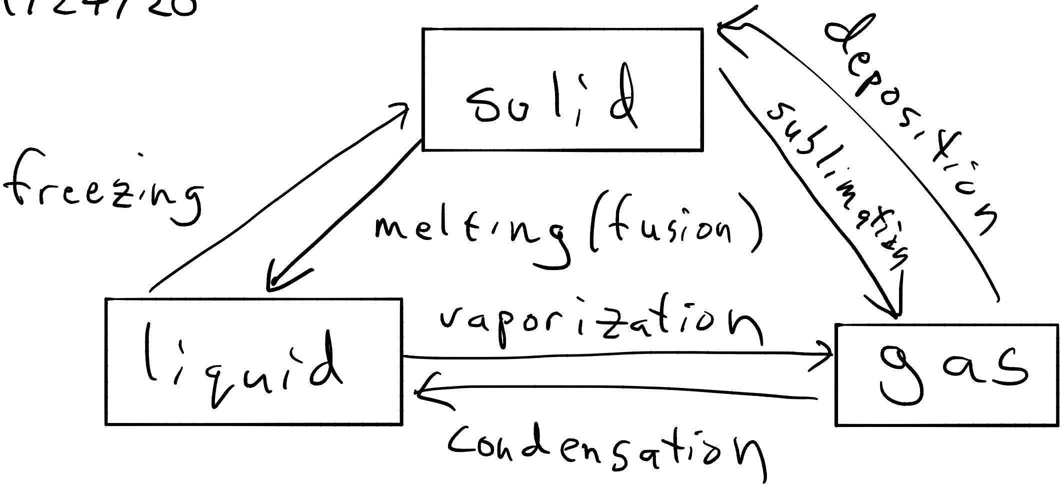
4/27/20



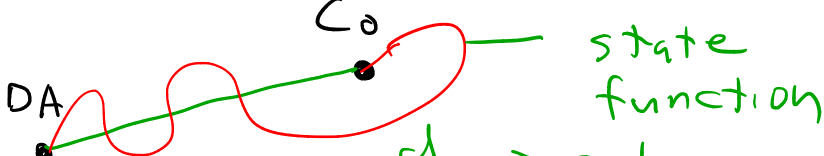
solid $\longrightarrow$ liquid $\longrightarrow$ gas

ΔH_{fus} ΔH_{vap}

solid $\longrightarrow$ gas ? $\Delta H_{sub} = \Delta H_{fus} + \Delta H_{vap}$

Hess's Law

Energy changes in chemical processes do not depend on how they occur, but instead only on the initial reactants and final products.

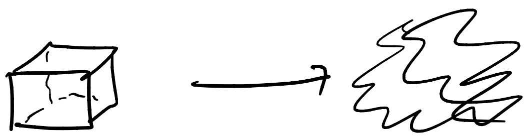


Energy changes in chemical reactions are state functions.

d → only depends on the initial and final states.

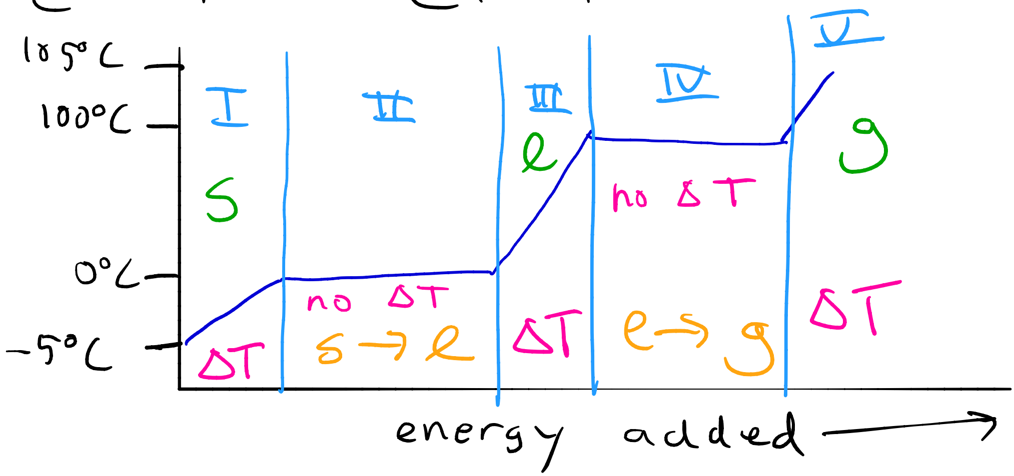
The internal energy of the reactants and products does not depend at all on how they were made, just on what they are. So, if any series of reactions starts and ends at the same points, the energy changes will be the same.

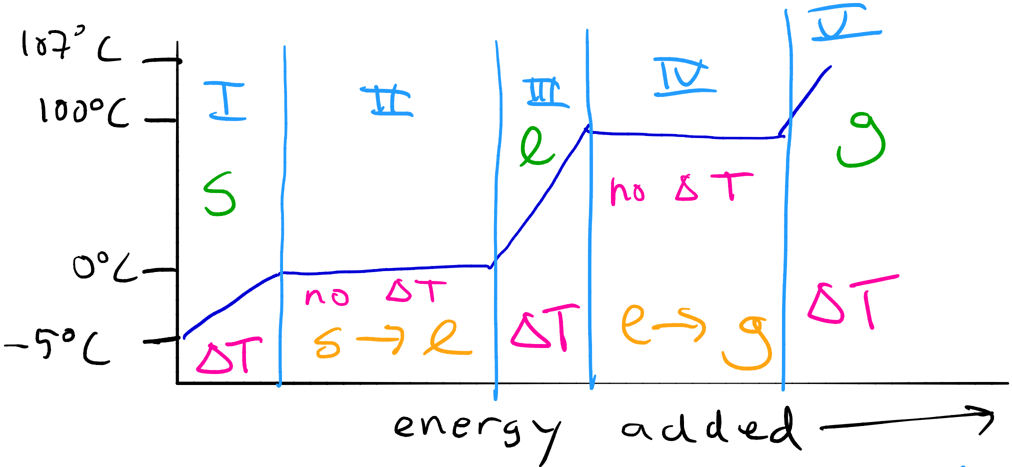
This is why the heat of sublimation can be calculated by adding together the heats of fusion and vaporization.



10.0 g ice @ −5°C @ 1 atm → steam @ 105°C @ 1 atm

What is the total energy needed?





I, III, V → heat capacity (ΔT)

II, IV → phase change (no ΔT)

I $\Delta E = m \cdot S_{ice} \cdot \Delta T_{ice}$ (specific heat)

*** These values are different for each phase.

+5

II $\Delta E = n \cdot \Delta H_{fus}$ (moles)

III $\Delta E = m \cdot S_{water} \cdot \Delta T_{water}$ (mass)

IV $\Delta E = n \cdot \Delta H_{vap}$ + 100

V $\Delta E = m \cdot S_{steam} \cdot \Delta T_{steam}$

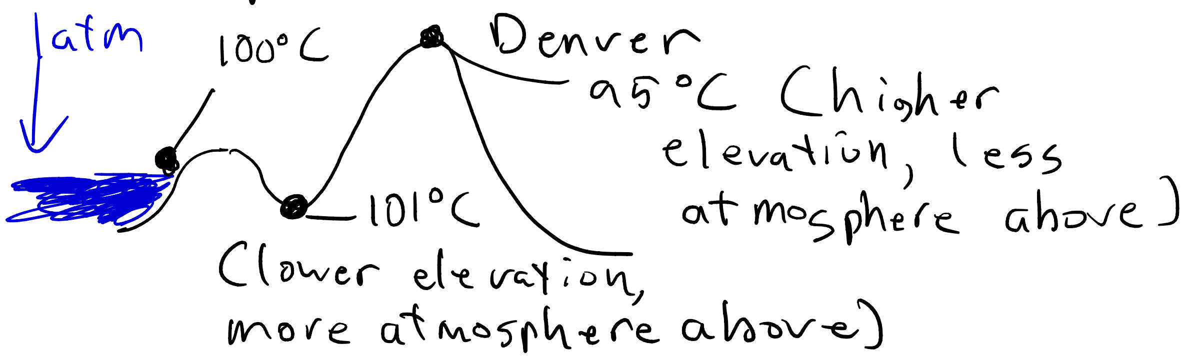
+7

total energy needed

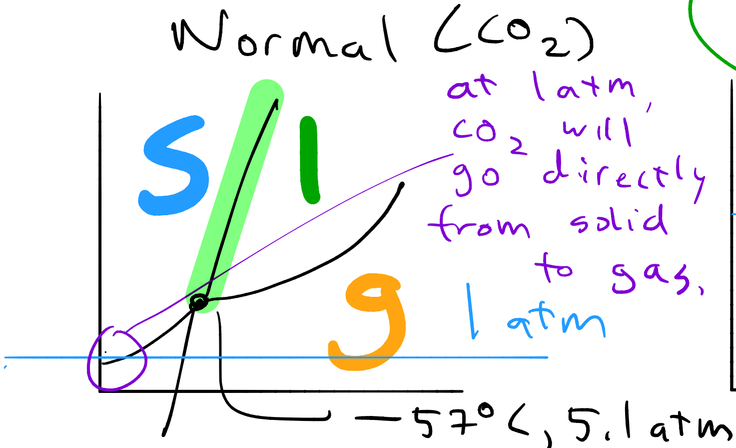
= I + II + III + IV + V

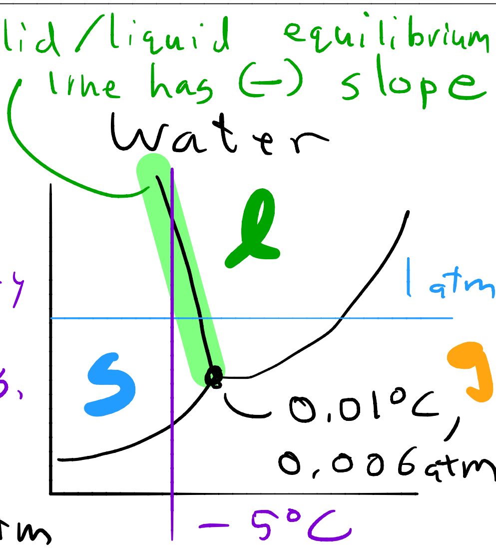
"The Graph" p479

Boiling occurs when the vapor pressure of a substance equals the surrounding atmospheric pressure. This means that boiling point changes with pressure.



Phase diagrams

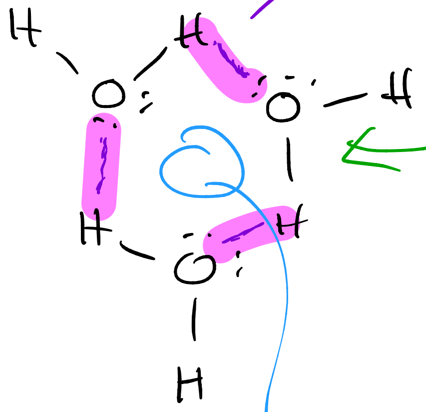




triple point – the temp/pressure at which all three phases exist in equilibrium

Liquid water is more dense than solid water.

hydrogen bonding



hexagonal arrangement

→ snowflakes

space → less dense