Phys 344

Lecture 6. Ref. 1.6,

- Enthalpy. $H = U + PV$.

- In an isobaric process, $P = \text{const}$.

If there is only mechanical work. $W = -P\Delta V$

expansion/compression

Then. $\underline{\Delta H} = \Delta U + P\Delta V = \Delta U - W = Q$

change in enthalpy = Heat absorbed.

If there is other form of work. $W = -P\Delta V + W_{other}$.

Then $\Delta H = \Delta U + P\Delta V$

$= \Delta U - (-P\Delta V)$

$= Q + W_{other}$. $\underbrace{(Q - P\Delta V + W_{other} = \Delta U)}_{\text{1st Law}}$

e.g. electric work.

chemical work.

~~e.g. / For d mol of water at 1 atm,~~

e.g. Handbook data:

Under 1atm pressure,

ΔH for vapourizing 1 mole of water =

$$\Delta H = 40{,}660\ J$$

That's the latent heat.

2 parts:
- Vapour has more energy, ΔU.
- Vapour occupies more space: pV or $p\Delta V$. ~8%.

e.g. Handbook data.

Burning H_2 gas and producing $\underset{liquid}{\underline{\text{water}}}$ under 1atm pressure.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

ΔH for producing 1 mole of water:

$$\Delta H = \underbrace{-286\ kJ}_{\text{output heat}}.$$

again 2 reasons:

① $2H_2$, O_2 contains more energy than $2H_2O$. ΔU

② Gases occupy more space than water. $p\Delta V \approx pV$

- C_p — Heat Capacity at constant P.

$$C_p = \left(\frac{\partial H}{\partial T}\right)_p = \left(\frac{\partial U}{\partial T}\right)_p + P\left(\frac{\partial V}{\partial T}\right)_p .$$

A better name for C_p would be: "Enthalpy Capacity"

(Not: ΔH could include heat and other work!)

Note: $\left(\frac{\partial H}{\partial T}\right)_p$ is different from $\left(\frac{\partial H}{\partial T}\right)_V$

↑ Fixed P.　　　↑ Fixed V.

In general, for a function $F = f(x, y, z)$.

$$\left(\frac{\partial F}{\partial x}\right)_y \neq \left(\frac{\partial F}{\partial x}\right)_z .$$

Don't omit the subscript!

That's an important difference in thermodynamics!

Note: specific enthalpy: $h = \frac{H}{m}$. (per unit mass)