*Determination of surface area of a solid*

From the value of $v_m$ we can calculate $N_m$.

$$N_m = N_A \frac{pv_m}{RT}$$

At STP $N_m = N_A \frac{v_m}{0.022414\ m^3 / mol}$

$N_A$ is the Avagadro number and $N_m$ is the number of molecules required to cover a unit mass with a monolayer. If the area covered by one molecule is $a$, then

Area/unit mass = Surface area of the solid $S = N_m a$

*Determination of enthalpy change*

The equilibrium constants K and $K_1$ can be written as

$$K_1 = e^{-\Delta G_1^o / RT} \quad \text{and} \quad K = e^{-\Delta G_{liq}^o / RT}$$

where $\Delta G_1^o$ is the standard free energy of adsorption of the first layer and $\Delta G_1^o$ is the standard free energy change of liquefaction. Dividing the first equation by the second equation, we obtain c.

$$c = \frac{K_1}{K} = e^{-[\Delta G_1^o - \Delta G_{liq}^o]/RT}$$

We know

$$\Delta G_1^o = \Delta H_1^o - T\Delta S_1^o \quad \text{and} \quad \Delta G_{liq}^o = \Delta H_{liq}^o - T\Delta S_{liq}^o$$

and assuming that $\Delta S_1^o \approx \Delta S_{liq}^o$, then

$$c = e^{-[\Delta H_1^o - \Delta H_{liq}^o]/RT}$$

The heat of liquefaction is negative of the heat of vapourization. Therefore,

$$c = e^{-[\Delta H_1^o + \Delta H_{vap}^o]/RT}$$

Taking logarithms and rearranging,

$$\Delta H_1^o = -\Delta H_{vap}^o - RT \ln c$$

Since we know the value of $\Delta H_{vap}^o$ of the adsorbate, the value of $\Delta H_1^o$ can be calculated from the measured value of $c$. In all cases, it is found that $c > 1$, which implies that $\Delta H_1^o < \Delta H_{liq}^o$. The adsorption in the first layer is more exothermic than liquefaction.