21_02_06

HW04: Questions related to the "energy" of bonds.

1.

On blank piece of paper and without using notes derive the following equation

$$\Delta H = \frac{EV_{mole}}{4\pi^2} Z \qquad (1)$$

•The equation may also be written in terms of the molecular weight (g/mol) and the density (g/cm ^{3}).

•Show that the units on both sides of the equation are balanced.

2.

The equation may be written in terms of

$\Delta H \rightarrow$ Heat of fusion, ΔH_f

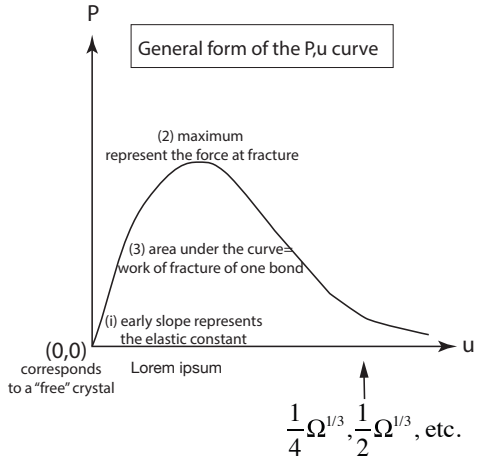
or

$\Delta H \rightarrow$ Heat of evaporation, ΔH_{evap}

Application of (1) usually gives a closer agreement with experiment with ΔH_f

Can you give an argument for that?

3.

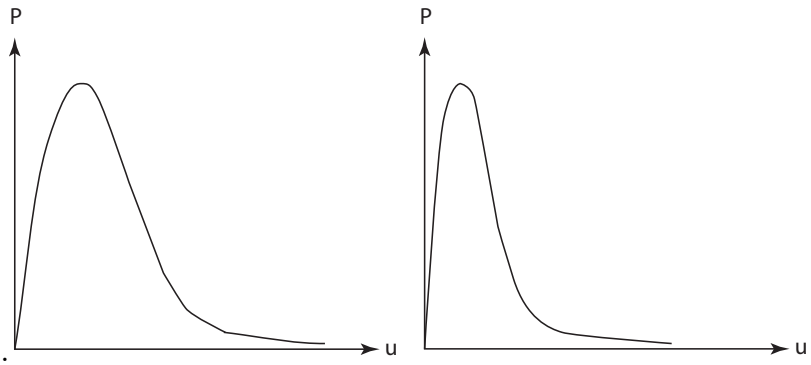


The length scale for "u" is related to the interatomic spacing, that is to $\Omega^{1/3}$

Which of the three curves would you expect to have the highest value of

$\frac{\Delta H}{E}$ assuming that in all cases the density and the molecular weight are the same.

3.



4. Pick five elements* (solids) from the left hand side of the periodic Table and make two plots

(a) Plot handbook values of the left and the right hand side of the equation

$E = 4\pi^2 \frac{\Delta H_f \rho}{M_W Z}$. Here M_W is the molecular weight, ρ is the density, and Z is the coordination number

(b) Make a similar plot but this time replace the heat of fusion by the heat of vaporization (ΔH_{evap}).

*for example: Al, Cu, Fe, Li, Ti

Caution: please be consistent with the units on both sides of the equation.