Answer on Question #86237 - Chemistry - Physical Chemistry

Question:

How to derive the relation between Δ_rU and Δ_rH for a chemical reaction and how is this relation given for the condensed phases and ideal gases?

Solution:

Enthalpy is defined as

H = U + PV where U is internal energy of system and PV are pressure and volume of system

H(in) = U(in) + PV(in)

PV = nRT

H(inl) = U(in) + n(in)RT

H(final) = U(final) + PV(final)

H(final) = U(final) + n(final)

D(H) = H(final) - H(initial)

D(H) = D(U) + (n(final) - n(initial))RT

Or we can explain this in more detail in this way, solids and liquids do not show significant changes in volume when heated. So, if volume change, isV is insignificant

H = U + PΔV

H = U + P (0)

H = U

The difference between the change in internal energy and enthalpy becomes significant when the reaction involves gases.

Consider the chemical reaction that occurs at constant temperature, T and constant pressure, P. Now, say, the volume of reagents - VA, and the number of moles in the reagents - nA. Similarly, the volume of products is VB, and the number of moles in the product is nB.

We know that, according to the ideal gas equation,

Pv = nRT

$pv_A = n_ART$; $pv_B = n_BRT$

$pv_B - pv_A = n_BRT - n_ART$

$p (v_B - v_A) = RT (n_B - n_A)$

$p\Delta v = Rn_gRT$

$H = U + p\Delta v$

$H = U + Rn_gRT$