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CL201

ASSN10

Important things to consider while deciding the number of independent relations for a particular process

1. Mostly the number of Independent material balance is equal to the number of component present in the stream.
2. If N_p is the number of process and N_c is the number of components than total number of possible material balance is $N_c(N_p(N_p + 1))/2$
3. If the ratio of some component is remaining the same during entire process than the number of independent equation will not be equal to number of components
4. Be careful if there is any recycle stream because there is a possibility of getting same material balance equation from different processes.
5. In the problem if there is any recycle stream than there might be a chance that for different processes, for one component you are taking two similar material balance equations.
6. In a reactive process, make sure that numbers of reactions added to degree of freedom analysis are independent.
7. Energy Should remain conserve i.e. total energy before the process is equal to total energy after the process.
8. If we are considering energy balance then the number of components will be increased by 1
9. **e = K.E.+ P.E. + U + W(s) + W(f)**
   = K.E.+ P.E. + H(enthalpy) + W(s), where H = U + W(f)
   Enthalpy is always calculated w.r.t. reference
   ΔH = mh, h = specific enthalpy, m=mass of the component
   If the data to calculate K.E. and P.E. is not given then it can be taken as zero
10. **When Explicit Information is given**

$$\Delta h(T_f) = \Delta h(T_{ref}) + \int_{T(ref)}^{T(f)} C_p dT$$

(for gas only)

$$\Delta h(T_f) = \Delta h(T_{ref}) + \int_{T(ref)}^{T(f)} C_p dT + (P_1 - P_{ref})V$$

(for solid and liquid)

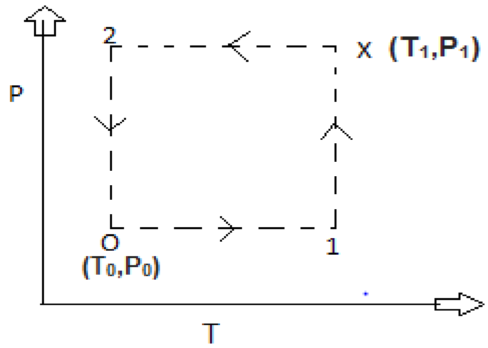
11. When explicit information is unavailable

$F = C – P + 2$

Where F = minimum intensive variable required to explain a particular state

C = Number of Components

P = Number of Phase



If We Know the Enthalpy at O then we can find Enthalpy at X taking anyone simple path as shown

$$\mathbf{h(T_1,P_1) = h(T_0,P_0) + \int_{T(ref)}^{T(f)} Cp(P_0)dT + \int_{P0}^{P1} dpv\ (T=T_1)}$$

and if phase of the component is changing between O and X then one extra term must be added to the left side of the equation which will be either heat of fusion or heat of vaporization depending on the phase change