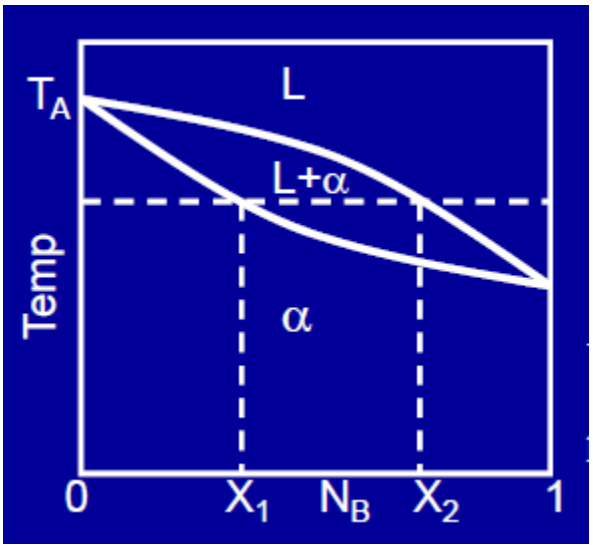
Experiment-6

Title: *Write a program to calculate & plot the isomorphous phase diagram*

Theory:



Concept: At any given temperature on the solidus & liquids the chemical potentials of A or B in the phases on either side will be equal.
The equation for chemical potentials of A in α-solid solution & in liquid solution are given below:

A (pure solid at T) = A (in solid solution; α) $\mu_A^\alpha = RT\ lnN_A^\alpha$

A (pure solid at T) = A (in liquid solution; L) $\mu_A^L = \frac{\Delta H_{mA}}{T_{mA}}(T_{mA} - T) + RT\ lnN_A^L$

Since $\mu_A^\alpha = \mu_A^L$; $\therefore ln\left(\frac{N_A^\alpha}{N_A^L}\right) = ln\left(\frac{1-N_B^\alpha}{1-N_B^L}\right) = \frac{\Delta H_{mA}}{RTT_{mA}}(T_{mA} - T)$ = F(A)

Similarly: $\mu_B^\alpha = \mu_B^L$; $\therefore ln\left(\frac{N_B^\alpha}{N_B^L}\right) = \frac{\Delta H_{mB}}{RTT_{mB}}(T_{mB} - T)$ = F(B)

Given:

Melting point of A: T_{ma}= 800 K

Melting point of B: T_{mb}= 500 K

ΔH_{ma}=30,000 J/mol

ΔH_{mb}=20,000 J/mo

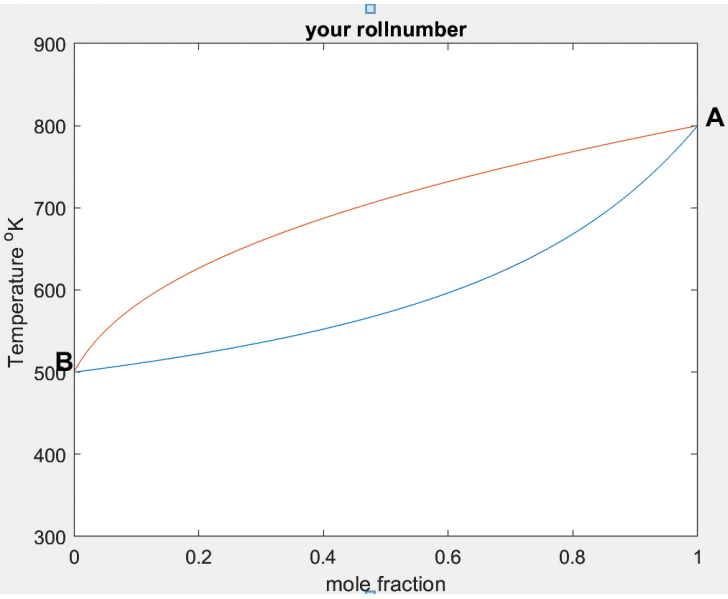
R=8.314 J/mol/K

Use step size of 0.5K (or any other appropriate step size)

Program

```
tma=800; hma=30000; tmb=500; hmb=20000;
R=8.314;
T=799:-0.5:500;
fa=(hma./(R*T*tma)).*(tma-T);
fb=(hmb./(R*T*tmb)).*(tmb-T);
lhsa=exp(fa);
lhsb=exp(fb);
nbl=(1-lhsa)./(lhsb-lhsa);
nal=1-nbl;
nbalfa=nbl.*lhsb;
naalfa=1-nbalfa;
plot(naalfa,T)
hold on
plot(nal,T)
xlabel('mole fraction')
ylabel('Temperature ^oK ')
```

Output



Conclusion: The isomorphous phase diagram is plotted successfully