**Question 1**

1. We know the peng robinson equation of state

P =

Here a,b are functions of critical temp& press i.e. constants for a particular compound.

The values of are also given in the problem.

1. Here the only unknown is alpha. Alpha is a function of Psat, Tsat,

We can get Psat, by calculations from the equations

= psat = exp(c1 + c2/T + c3\*lnT + c4\*t^5)

For calculating psat and we can import data from perrys data sheet. A small code is written in the file attached for importing data.

Only unknowns are m and n. we must fit m and n by curve plotting.

1. To fit m,n we should have value of alpha at different T.
2. So we can write code in following manner.
3. First , assume different range of temperature lets say 200K to 2000K with temperature difference 1 K.
4. Then write ‘for loop’ for calculating Psat at all T from Psat equation as the value of constants c1,c2.. is given.
5. Then write ‘for loop’ for calculating Dsat (Molar density) at all T from equation as value of constants c1,c2… is given.
6. Now, D=n/V(D=molar density, V=molar Volume)
7. Assuming n=1, Thus V=1/D
8. So write ‘for loop’ to find Vsat at all temp.
9. Now form an array of [Psat,Vsat,Tsat]
10. As we got Psat, Vsat at Tsat. Now define function which is peng Robison equation. a,b are calculated above.
11. Now only unknown in peng robinson equation is alpha. So we can solve Defind function and find alpha at different temperature and we can get array of alpha at different Temperature.
12. Then form array of Tr from the “for loop” as Tc is known.
13. Then form array of [alpha, Tr] as alpha at T we get from peng-robison equation of state.
14. Than use the “data fit function “ in python to find m,n by fitting alpha and T at different Temperatures.

**Question 2:**

1. Since it is an isentropic compression so change in entropy will be zero.
2. Let us consider Temperature change from T to Tf where Tf is a fixed reference value.
3. As we know the c1 c2 c3 c4 c5 values, we can calculate Cp,ig

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| C1 | C2 | C3 | C4 | C5 |
| 2.9100E+04 | 1.0040E+04 | 2.5265E+03 | 9.3600E+03 | 1.1538E+03 |

1. Use the Cpig in the entropy equation, integrate the equation using ipython command and from Tf to T value
2. We can calculate Cp at every temperature. We can assume temperature range for every 1K change.
3. We will have S for every temperature T
4. A plot of S v/s T will be a non-trivial plot.