**Question #60983 – Chemistry – Physical Chemistry**

**Question:**

One mole of N2 and 3 moles of PCl5 are placed in a 100 litre vessel heated to 227ºC. The equilibrium pressure is 2.05 atm. Assuming ideal behaviour, calculate degree of dissociation of PCl5 and KP

**Solution:**

Dissociation of $PCl_5$:

$PCl_5 \rightarrow PCl_3 + Cl_2$

Ideal gas law:

$PV=nRT$

$P(N_2)=1\ mol * 8.314\ Joule/Kmol * (227+273)\ K/ 100\ l=37.413\ kPa =0.37\ atm$

$P(PCl_5+Cl_2+PCl_3)=(2.05-0.37)\ atm =1.68\ atm$

If $n(PCl_5)$ after dissociation is 3-x, $n(PCl_3)=n(Cl_2)=x$

$P(PCl_5)=(3-x)*RT/V$

$P(PCl_3)=P(Cl_2)=x*RT/V$

$P(PCl_5+Cl_2+PCl_3) = (3+x)*RT/V=1.68\ atm$

$x=1.55\ mol$

Degree of $PCl_5$ dissotiation = $x/3=1.55mol/3\ mol = 0.52=52\%$

$K_P=P(PCl_3)*P(Cl_2)/P(PCl_5)=(RT/V)*(x^2/(3-x))=61.99\ kPa$

**Answer:**

degree of $PCl_5$ dissotiation = 52%

$K_P=61.99\ kPa$