Consider the dissociation of PCl_5 into PCl_3 and Cl_2 in a container of volume 1 litre, given by the reaction $PCl_5(g)$ -----> $PCl_3(g) + Cl_2(g)$. Suppose at the time of equilibrium, the vapour density of the equilibrium mixture is found to be 80.25. If the equilibrium constant for the reaction is K_c then find the value of $125K_c$ to the nearest integer.

Suppose we started with 1 mole of PCl_5 and x be the degree of dissociation.

	$PCl_5(g)$ ----->	$PCl_3(g)$ +	$Cl_2(g)$
At t=0	1	0	0
At t=eqm.	1-x	x	x

Initially, the mixture was pure PCl_5. So the initial molecular weight of the mixture was 208.5amu (weight of PCl_5). The final molecular weight of the system is 2*vapour density, ie, 2*80.25 = 160.5amu.

Moles in the final state = 1-x+x+x = 1+x.

Since mass remains conserved in a reaction the product of moles and molecular weight is constant.

=> (1+x)*160.25 = 1*208.5

=> x = 0.3

Now since volume of container is 1 liter, concentration of each species is equal to moles/1 = moles.

So equilibrium constant $K_c = [PCl_3][Cl_2]/[PCl_5]$

$\Rightarrow K_c = (x*x)/(1-x)$

$= (0.3*0.3)/0.7$

$= 0.128$ mol/l

So the required answer is 125*0.128 = 16.