Kc versus Kp

Equilibrium for a reaction where the reactants and products are gaseous can be calculated using equilibrium molar concentration of the gases….Kc (usual way) or by partial pressure of each gas Kp since for a gas,

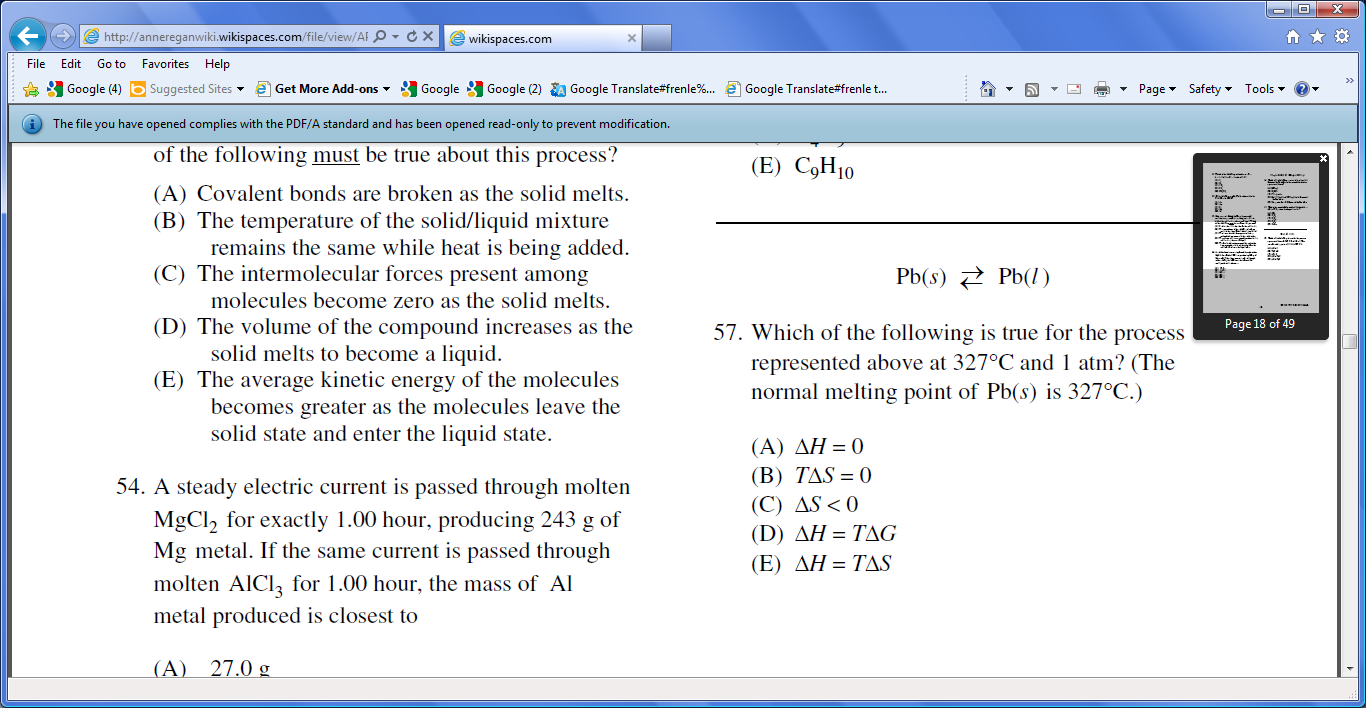
PV= nRT which can be rearranged as n/V= P/RT

Since n/V is molar concentration, this simplifies to c= P/RT

Thus there is a direct correlation between concentration of a gas and its partial pressure. The link beween them is

P= CRT

For an equilibrium expression such as

2NO(g)  + Cl2(g) 2NOCl(g)

If the partial pressures of each gas are known, then the Kp and the Kc can be calculated. It can be derived that

Kp= (products) coeff/ (reacants)coeff Kc= [products]coeff/[reacants]coeff

() is in atm or kPA

[] is in mol/L

Kp=Kc(RT)Δn

where,

* Δn = (Total moles of gas on the products side) - (Total moles of gas on the reactants side).
* R is the gas constant found in the [ideal gas law](http://chem.libretexts.org/Core/Physical_and_Theoretical_Chemistry/Physical_Properties_of_Matter/States_of_Matter/Gases/Gas_Laws/The_Ideal_Gas_Law) (0.0821LAtm/MolK or 8.314 LkPa/molK))

Also remember,

Pt= (ntRT)/V

If two gases are mixed in the same container,

Pa=(naRT)/V

Pb= (nbRT)/V

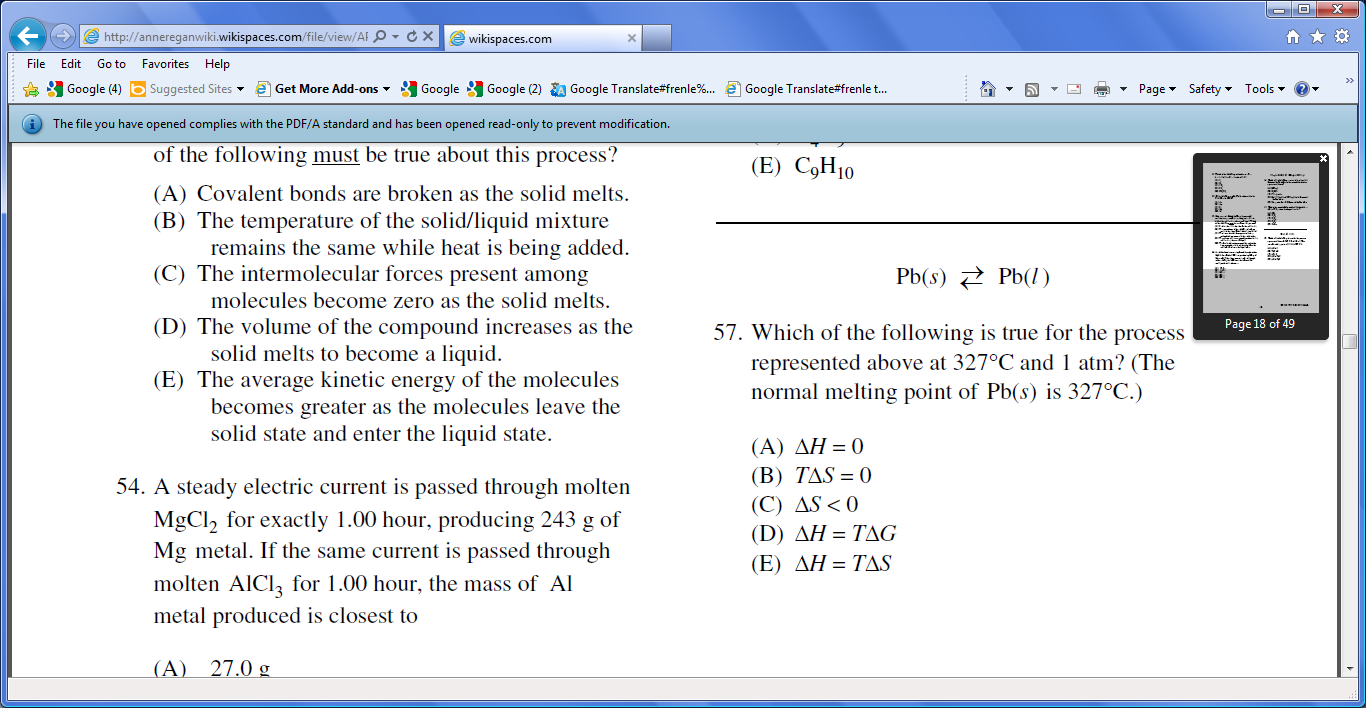
Pa +Pb= Pt

Pa= (na/nt)(Pt)

Pb=(nb/nt)(Pt)

na+nb=nt

For the following equilibrium, calculate Kp and Kc

2NO(g)  + Cl2(g) 2NOCl(g)

|  |  |
| --- | --- |
| Gas | Pressure at equilibrium (Atm) at 25oC |
| NO | 1.2 |
| Cl2 | 0.050 |
| NOCl | 0.30 |

Kp=

Kc=