Qualitative Chemistry

Angular Momentum of Electron, $\boxed{mvr = \frac{nh}{2\pi}}$

m=mass of electron
v=linear velocity of electron
r=radius of orbit
n=number of orbit
h=Plank's Constant
=6.626×10^{-34} Js
=6.626×10^{-27} erg sec

If an electron travels from one orbit to another orbit , electron either consumes or leaves energy.
If electron is traveling from an orbit having energy of $\mathbf{E_1}$ to $\mathbf{E_2}$ then the consumed or left energy of electron is ,
$\mathbf{\Delta E = E_2 - E_1 = h\nu}$

h=Planks constant
ν= frequency of the energy consumed or left my electron

Energy of Hydrogen's n-th orbit: $\boxed{E_n = \frac{-2\pi^2 me^4}{n^2 h}}$

Radius of power shells: $\boxed{r_n = \frac{n^2 h^2}{4\pi^2 mZe^2}}$

Velocity of Electron, $\boxed{v = \frac{nh}{2\pi mr}}$

m = mass of electron = 9.109×10^{-31} kg
= 9.109×10^{-28} g
e = charge of electron = 1.602×10^{-19} C
= 4.8×10^{-10} esu
c = speed of light = 3×10^{8} ms^{-1}
h = Plank's Constant
n = number of shell
Z = Atomic number

Equation of de-Broglie: $\boxed{\lambda = \frac{h}{mv}}$

Common terms about waves:

$\boxed{c = \nu\lambda}$

$\boxed{\bar{\nu} = \frac{\nu}{c} = \frac{1}{\lambda}}$

Here, c = speed of light ,$\bar{\nu}$=wave number,
ν = frequency, λ = wave length

$\bar{\nu}$=wave number
n_1 or n_2 is the number of orbital from where and to where the electron travels..
Tip: always n_1 is the higher orbit number and n_2 is always lower, because the value of $\bar{\nu}$ always has to be positive
R_H = **Rydberg Constant**
= 1.097×10^{7} m^{-1}

Rydberg Equation: $\boxed{\bar{\nu}=R_H\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)}$

Solubility:

$S=\frac{Moles\ of\ Solute}{Volume\ of\ Solvent}$; Unit: mole/L or M

$S=\frac{100\times Mass\ of\ solute\ \text{in}\ grams}{Mass\ of\ solvent\ \text{in}\ gram}$

Effect of Pressure in Solubility (Henry's Law):

If applied pressure in a Gaseous Solute solution is *P*

$S\propto P$

$S=K_H\times P$

$$\boxed{\frac{S_1}{P_1}=\frac{S_2}{P_2}=\frac{S_3}{P_3}=.................}$$

K_H = Henry's Proportional Constant

= S/P

Unit of K_H in SI standard is: M atm^{-1}

Solubility Product (K_{sp} and K_{ip}):

Suppose, $MgCl_2$ is dissolved in water. Hence the ionic equation as follow-

$MgCl_2 \rightleftharpoons Mg^{2+}+2Cl^-$

$K_{sp}=[Mg^{2+}]+[Cl^-]^2$

***Note: In IUPAC standard the Solubility of a solution with a specific solute and solvent is measured I mole/Liter which essentially means the Molarity of the solution. So K_{sp} is the Ionic Product of the product ion. For example: in the example above shows how to find Ksp of a Solution. Which needs the molarity of Mg^{2+} and Cl^- . But because solubility is the molarity of the solution so we can say $[Mg^{2+}]$ = $[Cl^-]$ = Solubility or S*

K_{sp} in the above reaction is, $K_{sp}=S\times S^2=S^3$

***In order to use this equation the given Solubility must be converted to mole L^- or M. For example if the Given solubility is : $5x10^{-4}$ g/L we have to covert g/L to mole/L. In order to convert g/L to mole/L we have to divide the g/L by the Molar mass of solute*

**** The equation of K_{ip} and K_{sp} is the same . Difference between K_{ip} and K_{sp} is K_{sp} is the constant Ionic product for a solution in saturated state. It means we can identify K_{sp} only for saturated solutions. And it's value is constant in a specific solution and at a specific Temperature.
But K_{ip} is essentially the ionic product of solute . K_{ip} can be changed if the Concentration of the solution is changed . Also K_{ip} can be calculated at any solution (saturated , unsaturated or over-saturated).

Relation between K_{sp} and K_{ip} :
if, $K_{ip} = K_{sp}$: The solution is saturated
if, $K_{ip} > K_{sp}$: The solution is over-saturated .
if, $K_{ip} < K_{sp}$: The solution is unsaturated .

UNIT CONVERSION REQUIRED FOR THIS CHAPTER

Name	**SI**	**CGS**
Length	meter(m)	Centimeter (cm)
Mass	kilogram(kg)	dyne
Energy	joule(J)	erg
Charge	Coulomb(C)	esu
Time	sec	sec

Unit Conversions:

1mm = 10^{-3} m
1µm = 10^{-6} m
1nm = 10^{-9} m
1Å = 10^{-10} m
1J = 10^{7} erg