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Chemical kinetic :-

Very fast reactions :- This type of reactions which occurs almost . The rate of such reactions cannot be determined easily. The reason for a very fast rate of such reactions that no chemical bond are two be broken among the reactants.

Example :- $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl + NaNO_3$

Very slow reactions :- A reactions which occur at a very slow rate these reactions may require months or even years. together for their Completation.

Modirately slow reactions :- This type refurs to reactions in between the very fast and very slow reactions. These reactions proceed at modirate speed which Can be easily measured.

Example :- $C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_2O_5$

Rate of chemical reactions :- The rate of chemical reaction is the speed or velocity with which a reaction take place it Can be expressed palitatively as well as quantitatively.

① qualitative rate :- It is based on certain visual parameter like this apperance of reactants, colourchange etc.

(2) Quantitative rate :- The quantitative rate of chemical reactions provide us with much better information about the rate data and the accurate rate of reactions.

In quantitatively the rate of chemical reaction may be expressed in two way :-

1) The rate of decrease in concentration of anyone of the reactant.
2) The rate of increase in concentration of anyone of the product.

For a hypothetical reaction :- $R \longrightarrow P$

One mole of reactant (R) produce one mole of product. If R_1, P_1 are the concentration of R and P at time T_1 and R_2, P_2 are their concentration at time T_2

$$\Delta t = t_2 - t_1$$
$$\Delta R = R_2 - R_1$$
$$\Delta P = P_2 - P_1$$

Rate of disapperance of R = $\dfrac{\text{Decrease in Concentration of R}}{\text{Time taken}}$

$$= \frac{-\Delta R}{\Delta T}$$

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Rate of apperance of P =

$$= \frac{\text{Increase in Concentration of P}}{\text{Time Taken}}$$

$$= \frac{\Delta P}{\Delta T}$$

In general

$$aA + bB \longrightarrow cC + dD$$

Rate of reaction

$$= \frac{-1}{a}\frac{\Delta A}{\Delta t} = \frac{-1}{b}\frac{\Delta B}{\Delta T} = \frac{1}{c}\frac{\Delta C}{\Delta t} = \frac{1}{d}\frac{\Delta D}{\Delta t}$$

Average rate and its determination :-
It is defined as the rate of change of Concentration per unit time it is Calculated by dividing the total change in Concentration of the reactant or product by the total time taken.

Average rate = $\frac{\text{change in Concentration of given time}}{\text{Time taken}}$

$$= \frac{-\Delta R}{\Delta T} = \frac{+\Delta P}{\Delta T}$$

Insta rate and its determination:

The rate of reaction is defined as the decrease in Concentration of anyone of the reactants or increase Concentration of anyone of the product at a particular instant of time for given temperature.

$$r_{ins} = \frac{-\Delta R}{\Delta t} = \frac{+\Delta P}{\Delta t}$$

$$\Delta t \Rightarrow 0$$

Factors affect rate of reaction:

① Concentration of reactants: The rate of reaction is directly proportional the Concentration of reactants.

② Temperature of reactants: The rate of reaction increase with increase in temperature.

③. Pressure of the reaction: Increase in pressure decrease volume and increase in Concentration increase rate of reaction.

④ Presence of Catalyst :- In the presence of Catalyst the activation energy of a reaction decrease hence reaction proceeds very fasted.

Law of mass Action :- At a given temperature the rate of chemical reaction is directly proportional to the product of molar Concentration of reacting species with each Concentration turn rise to the power equal to numerical Coefficient of that species in the chemical equation.

For any general According to the law of mass -

$$aA + bB = cC + dD$$

then rate of reaction according to law of mass action

$$Rate \propto [A]^a [B]^b$$

$$Rate = k [A]^a [B]^b$$

where k is rate Constant

Characteristic of rate Constant :-

1) The value of rate constant give in Idea about the speed of reaction.
2) Each reaction has definite value of rate Constant.

(3) The value of k depends on temperature.
(4) The unit of rate Constant depends on the order of reaction.

Difference between Rate of reaction and Rate Constant

Rate of reaction	Rate Constant
(1) It is the speed at which the reactants are converted into the product at any moment of time.	(1) It is constant of proportionality in the rate law expression
(2) It depends upon the Concentration of reactants species.	(2) Does not depend on Concentration of reactants.
(3) It Generally decreases with the progress of reaction	(3) It is constant and does not depend on the progress of reaction.
(4) Its unit is mol L⁻¹ T⁻	(4) Its unit depends on order of the reaction

Molecularity: Number of species which Collide together in elementary reaction to give product is called molecularity of the reaction.

Complex reaction: Reactions which proceed through more than one ~~stage~~ stage are termed as Complex reaction.

Elementary reactions :- Reactions which get Completed in one stage are Called elementary reactions

Rate law :- The rate of reaction in term of reactants which actually influence the rate is Called Rate law for a general reaction.

$$aA + bB \longrightarrow cC + dD$$

$$Rate \propto [A]^x [B]^y$$

where x and y may or many not be equal to a and b

$$\frac{-dR}{dt} = k [A]^x [B]^y$$

Rate Controlling State :- Slowest stake of the Complex reaction is Called the rate Controlling state of rate determining state.

Rate law v.s. law of mass action

Rate law	law of mass action
(1) The rate law gives the mathematical expression which gives the actual rate of expression.	(1) where is the law of mass action gives the rate on the basis of stoichiometry of the balance equation.

Order of reaction :- It may be defined as the sum of power of Active ma

For a hypothetical reaction

$$aA + bB \longrightarrow cC + dD$$

$$Rate = k [A]^x [B]^y$$

Units of rate constant of different orders -

(1) Zero order reaction -

$$Rate = k [A]^0$$

$$\frac{mol\ L^{-1}}{sec} = k \cdot 1$$

$$k = \frac{mol\ L^{-1}}{sec}$$

(2) First order reaction

$$Rate = k [A]^1$$

$$\frac{mol\ L^{-1}}{sec} = k [mol\ L^{-1}]^1$$

$$k = \frac{mol\ L^{-1}}{sec} \times \frac{1}{mol\ L^{-1}}$$

$$k = s^{-1}$$

③ Second order reaction :-

$$Rate = k [A]^2$$

$$\frac{mol\ L^{-1}}{s} = k [mol\ L^{-1}]^2$$

$$k = \frac{mol\ L^{-1}}{Sec} \times \frac{1}{[mol\ L^{-1}]^2} = mol\ L^{-1}\ Sec^{-1}$$

④ Three order reaction

$$Rate = k [A]^3$$

$$\frac{mol\ L^{-1}}{Sec} = k [mol\ L^{-1}]^3$$

$$k = \frac{mol\ L^{-1}}{Sec} \times \frac{1}{[mol\ L^{-1}]^{3}} = mol^{-2}\ L^{2}\ Sec^{-1}$$

⑤ For nth order

$$Rate = k [A]^n$$

$$\frac{mol\ L^{-1}}{Sec} = k [mol\ L^{-1}]^n$$

$$k = \frac{mol\ L^{-1}}{Sec} \times \frac{1}{[mol\ L^{-1}]^n} = mol^{1-n}\ L^{n-1}\ Sec^{-1}$$

Difference between molecularity and order

	Molecularity	Order
1	It is the number of reacting species undergoing collision in the reaction.	① It is the sum of the power of concentration terms in the rate law expression.
2.	It is a theoretical concept.	② It is determined experimentally.
3	It cannot be zero.	③ It can be zero.
4	It doesn't change with change in temperature and pressure.	④ A change with change in temperature and pressure.

Zero order reaction :- A reaction is zero order if its rate is independent of the concentration.

For a zero order reaction of the form

$$R \longrightarrow P$$

$$Rate = k \cdot [R]^0$$

$$-\frac{d[R]}{dt} = k \times 1$$

$$-d[R] = k\,dt$$

$d[R] = -k\,dt$

Integrating both sides.

$\int d[R] = -k \int dt$

$[R] = -kt + I$

I is constant of Integrating

At $t = 0$

$I = [R]_0$ where R_0 is the initial Concentration of reaction

$[R] = -kt + [R_0]$

$-kt = [R] - [R_0]$

$$k = -\frac{[R] - [R_0]}{t}$$

$$\boxed{k = \frac{[R_0] - [R]}{t}}$$

First order reaction :- First order reaction means that the rate of reaction is proportional to one power of Concentration of reactants.

For first order reaction of the form

$r \longrightarrow P$

For first order reaction

$$Rate = k[R]^1$$

$$-\frac{d[R]}{dt} = k[R]$$

$$-\frac{d[R]}{[R]} = k\,dt$$

Integrating both sides

$$-\ln[R] = k\int dt + I$$

$$-\ln[R] = kt + I$$

$$-\ln[R]_0 = I$$

$$-\ln[R] = kt - \ln[R]_0$$

$$kt = \ln[R]_0 - \ln[R]$$

$$kt = \ln\frac{[R]_0}{[R]}$$

$$k = \frac{\ln}{t}\frac{[R]_0}{[R]}$$

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

Half life of reaction :- It is defined as the time during which the concentration of reactants is reduced to half of the initial concentration.

1. half time zero order reaction

$$k = \frac{[R_0] - [R]}{t}$$

$t_{1/2}$. $R = \frac{[R_0]}{2}$

$$kt = [R_0] - \frac{[R_0]}{2}$$

$$t = \frac{[R_0]}{2k}$$

$$t \propto [R_0]$$

2. Half life of first order reaction

$$k = \frac{2.303}{t} \log \frac{[R_0]}{[R]}$$

$t_{1/2}$ = $R = \frac{[R_0]}{2}$

$$k = \frac{2.303}{t_{1/2}} \log \frac{[R_0]}{\frac{[R_0]}{2}}$$

$$t_{1/2} = \frac{2.303}{k} \log \frac{[R_0]}{[R_0]} \times 2$$

$$\frac{2.303}{k} \log 2$$

$$t_{1/2} = \frac{2.303 \times 0.3010}{k}$$

$$t_{1/2} = \frac{0.693}{k}$$

Amount of substance after N half lifes

The amount of substance which is left in a reaction after N half lifes.

Initial Concentration = $[R]_0$

Concentration after 1st half life

$$= \frac{[R]_0}{2}$$

Concentration after 2nd half life

$$= \frac{\frac{[R_0]}{2}}{2}$$

$$= \frac{[R_0]}{2 \cdot 2}$$

$$= \frac{[R_0]}{2^2}$$

Concentration after nth half life

$$= \frac{[R_0]}{2^n}$$

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Activation energy :- Minimum amount of extra energy required by a reacting molecule to get Converted into a Product.

Activation energy = Threshold energy - Average energy of reactants

Threshold energy :- The minimum energy that are colloiding molecule must pushes in order to make Callison effective and succesful.

Effect of Catalyst on rate of reaction -

1. Catalyst speeds up a reaction but it must be involve chemically however temperory is some way.
2. Catalyst work by providing an alternative reaction path way of lower activation energy.

D block elements :- The elements whose atoms has there last electron in d orbital are called d block elements.

Example :- Cu (29)

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

Transition element :- Elements with partially fill d orbitals are known as transition element.

Classification of d block element :-

3d transition series for first transition series.

1^{st} transition series have Ten elements from scandium 21 to zinc 30. In this series electrons start filling up in 3d sub shell

$3d^{1-10}$, $4s^{1-2}$

Elements	atomic no.	Configuration	Trick
Scandium Sc	21	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d$	
Ti	22		
V	23		
Cr	24		
Mn	25		
Fe	26		
Co	27		
Ni	28		
Cu	29		
Zn	30		

Exception :- Zn, Cd, Hg are not transition metals because they have completely filled d orbital

General properties :-

① Atomic radius :- The atomic radius of elements of first transition series decrease on moving from left to right till in the middle, these become almost constant and then increases towards the end of period.

Explanation :-

nucleus effect $Z_{effect} >$ shielding effect

$Z_{eff} = S.E$

$Z_{eff} < S.E$

② Ionic radius :- The ionic radius follow the same trend as the atomic radius since the metals have different oxidation states so the radius of ions also differ. Ionic radius decrease with increase in oxidation state it also decrease with increase in nuclear charge.

Density :- All these metals have high density as we go left to right density increase and as we move down density increase it is due to less screening effect.

Metallic character And enthalpy of atomisation:- All the transition elements are metal they have all characteristic of metals this is due to their relatively low Ionisation enthalpy and no. of vacant orbitals in the outermost shell in generally greater no. of unpaired electrons greater in the no. of bonds.

Melting and boiling point :- Transission metals have high melting point and boiling point this is due to strong metallic bond we move along a series the metallic strength increase up to middle and then decrease.

Zinc, Cadmium and mercury are soft due to non availability of unpared electrons Magnesium and technetium have low melting point due to stable configuration

Ionisation enthalpy :- Ionisation ethalpy of d block are greater then s block and less then p block. it is increases slowly from left to right due to the increase in nucleus charge.

Oxidation state :- The transition metals have large no. of oxidation state this is due to participation of inner n-1 electrons because the energy of ns (n-1)d are almost equal floride and oxide have large oxidation state.

Some important points regarding oxidation state -

(1) Except sodium the most common oxidation state of first row transition elements is +2.

(2) The elements which show the greatest number of oxidation states are or near the middle of the series.

(3) +2 and +3 oxidation state, ionic bond +4, +5, +6, +7, +8 oxidation state covalent bond.

(4) Maximum oxidation state increase with atomic number.

(5) Transition metals also formed compounds in low oxidation states such as +1, 0 or negatively.

6. Electrode potential :- Elements of transition series don not show specific variation in their electrode potential. The only element having positive reduction electrode potential is copper. Standard electrode potential shows the reactivity of elements greater the negative value of potential greater in their reactivity.

* Magnesium and zinc have higher negative electrode potential due to stable d^5 and d^{10} configuration.

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6. Formation of Coloured ion :- Most of transition metals ions and their compounds are coloured. It is due to incompletely filled d orbitals. Those elements in which d electron are not present or d shell is completely filled form colourless ions and the compounds formed by them are white. When these substances exposed to light then the electrons from d orbitals of lower energy are excited to higher energy levels. The transition metal ions capture certain wavelength radiation and rest of the wavelength are transmitted. The transmitted light has the colour of the substance.

Magnetic property :- The magnetic property of compounds are a measure of no. of unpaired electrons in it. There are two main types of substances.

① Paramagnetic :- The substance which are attached by magnetic field are called paramagnetic and this is due to unpared electrons.

② Di-magnetic :- The substance which are repel by magnetic field are called Di-magnetic substance and this is due to presence of pared electrons.

Magnetic moment $\mu = \sqrt{n(n+2)}$

Unit 5 B.M (Bohr magnetron)

Tendency of form complexes.

Complex :- The compounds formed by two or more the two salts and do not give the test of same.
This is due to
1. Small size of atoms and ions.
2. High nuclear charge
3. Availability of vacant d orbital.

Catalytic properties :- The main reason for the catalytic activity of transition metal.

1. Presence of vacant orbitals or different oxidation state provide activation energy for the reaction.
2. Provide a large surface area on which the reactants may be absorb.
3. Formation of Interstitial compounds

Latice :- Arrangment of atoms

Inertial Compounds :- Compounds formed by entering the outer atoms in vacant space of latice due to having unpared electrons. They have following characteristics

1. High melting point.
2. Metallic Conductivity.
3. They are very hard.
4. They are chemically inert.

Alloy formation :- The transition metals are quite similar in size therefore atoms of one metal can substitute the atoms of other metal in its Crystal of ~~two~~ or more ~~transition~~ metals latice. Thus on cooling a mixture solution of two or more transition metals solid alloys are formed.

Property atomic radius
The atomic radius of element of first transition series decrease in moving from left to right till in the middle the become almost constant and then increase towards the end of ~~pre~~ periods.

Cu^{+} is colourless and Cu^{2+} is coloured why

If the d-orbit completely filled it is colourless and if the d orbit is partially filled it absorb energy in visible light and reflected coloured light so they are coloured.

M.IMP

Give difference between lanthanide and actinide.

Lanthanide	actinide
15 Conjicutive chemical elements in the periodical table from lanthanum 57 to lutetium 71	15 Consecutive chemical elements in the periodic table from actinium 89 to lawrencium 103.
The extra electron enters 4 f orbitals	The extra electron enters 5 f orbital.
The exhibit mainly +3 oxidation state but +2, +4 oxidation states are also exhibit by some elements.	Actinide so +4, +5 and +6 oxidation states in addition to +3.
Except promethium all elements are non-radioactive	All actinides are radio-active.
There compounds are less basic.	There compounds are ~~more~~ comparatively more basic
Poor tendency to form complex.	Greater tendency to form calmplexes then the lanthanide

what are lanthanides? why it is difficult to separate them

Ans:- In these elements increasing the atomic number electrons enter into f-sub-shell of the atom hence, these elements are also called F-block elements or inner transition elements. Due to lanthanides contraction and due to the same electronic configuration of two outer-most shell these elements have similarities in the chemical properties hence, it is difficult to separate them in pure state.

Q. what is lanthanides contraction?

Ans:- Decrease in atomic or ionic radius with increase in atomic number of lanthanides is called lanthanides contraction.

Region is with increase atomic no. electron increases in 4f subshell with increase in nuclear charge shielding effect due to electrons of 4f subshell is negligible they exhibit minimum shielding effect No change in shielding effect increasing electrons. Increase nuclear charge attracts the outermost shell with greater force of attraction

Q. write general electronic configuration of f-block elements, also write two uses of lanthanide and actinides.

Ans:- General electronic configuration of f-block element $(n-2)f^{0 to 14}$ $(n-1)D^{0 to 2}$ ns^2

Uses of lanthanides

1. They are used in night vision goggles.
2. In petroleum defining.
3. As Catalyst.
4.

Uses of Actinides

1. Alloy of serium in manufacturing lighter.
2. Thorium in manufacturing gas mantles.

what are inner transition elements.

Ans:- Those elements in which last electron enters the f-orbital in which 4f & 5f orbitals are progressively filled these includes lanthanides & actinides

Region :- The balance electrons is filled into the prepen-ultimate shell $(n-2)f$-orbital which is internal to the pen-ultimate shell $(n-1)(D)$

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Difference between D-Block & f-Block

D - Block	f - Block
① Last electron is present in D sub-orbit	Last electron present in f-sub-orbit.
② These elements are stable	② These elements are less stable.
③ Called transition elements.	③ Called Inner transition elements.
④ Occus in nature in normal quantity.	④ Occur in rear quantity in nature.
⑤ Have low Coordination number in Complexes.	⑤ Have high Cordination number in Complexes.

Q. what do you mean by alloy. write name Composition and uses of four alloys of Copper.

Ans:- Alloys:- Homogenous mixture of two or more then two metals is called alloy.

Alloy	Composition	uses
Brass	Cu 60 to 80 % Zn 20 to 40 %.	domestic utensils, wire manufacturing
German-Silver	Cu 50 %, Ni 30 % Zn 30 %	utensils and statues manufacturing.
Gum-metal	Cu 88 %, Zn 2 % & Sn 10 %	Guns and machine parts manufacturing.
Bronze	Cu 75 % to 90 %, Sn 10-25 %.	Utensils, statues and machine Parts manufacturing.

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Q. write preparation of potassium dichromate from chromate.

$4(FeO.Cr_2O_3) + 8Na_2CO_3 + 7O_2 \xrightarrow{CaO}$
Chromite
$8Na_2CrO_4 + Fe_2O_3 + 8CO_2$
Sodium chromate (yellow)

$2Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$
Sodium dichromate

$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$

In powdered chromite or Sodium Carbonate and Calcium oxide are mixed and heated in furnace mixture is Concentrated after mixing H_2SO_4, Na_2SO_4 and obtained Sodium dichromate by adding KCl pattassium dichromate obtained.

Q. Give the method for preparation of pattassium per-magnet with equation from Pyrolusode ore. MnO_2

$KNO_3 \longrightarrow KNO_2 [O]$ Pottasium magnet
Pyrolusite $\rightarrow MnO_2 + 2KOH + [O] \longrightarrow K_2MnO_4 + H_2O$
$2K_2MnO_4 + Cl_2 \longrightarrow 2KMnO_4 + 2KCl$
pattassium hydroxide   pattasium permagnet

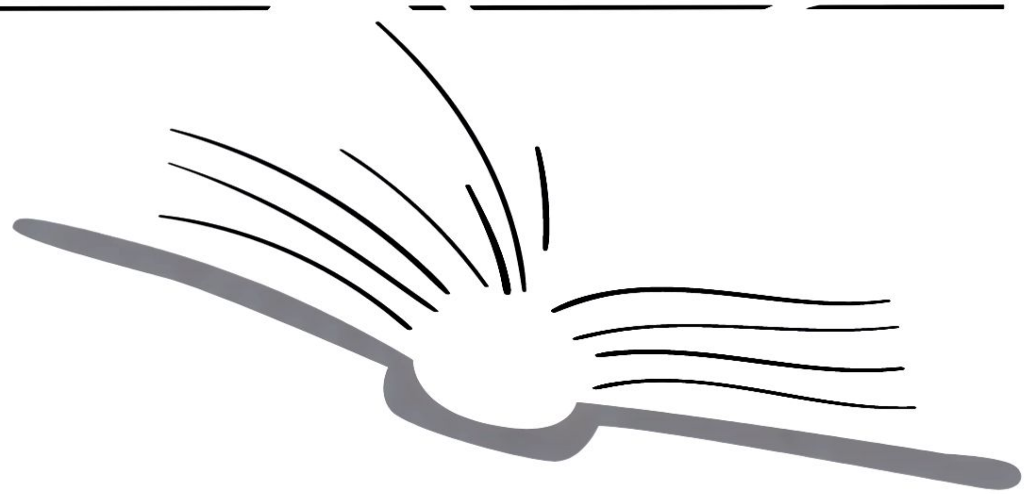
Q. write oxidation reaction of pottasium per-magnet.

(I) $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

(II) $2KMnO_4 + 3H_2SO_4 + 5(COOH)_2 \rightarrow K_2SO_4 + 2MnSO_4 +$
$8H_2O + 10CO_2$

(3) $2KMnO_4 + 3H_2SO_4 + 5HCOOH \rightarrow K_2SO_4 + 2MnSO_4 +$
$5CO_2 + 8H_2O$

(4) $2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \rightarrow K_2SO_4 + 2MnSO_4 +$
$5Fe_2(SO_4)_3 + 8H_2O$



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