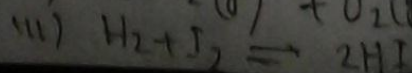
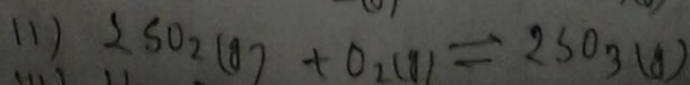
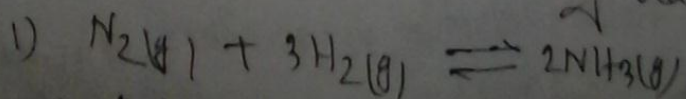


Section: A

Chemical Equilibrium

- \*\* Define chemical equilibrium? why chemical equilibrium is dynamic process.
- \*\* Discuss briefly the various factors which influence the equilibrium constant.
- \*\* State and explain the law of mass action / thermodynamic derivation.
- \*\* What do you mean by equilibrium constant or equilibrium law.
- \*\* What do you mean by  $K_c$ ,  $K_p$  &  $K_x$
- \*\* Relation between  $K_c$ ,  $K_p$  &  $K_x$
- \*\* State and explain Le Chatelier's principle.
- \*\* Discuss the effect of temperature, pressure & concentration on the following reaction



\* For dissociation of water  $\text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$  at 1773 K the value of  $K_p$  is  $1.87 \times 10^6 \text{ atm}$ . Assuming ideal behaviour of gases calculate  $K_c$ .

\* At 500°C the reaction bet<sup>n</sup>  $\text{N}_2$  &  $\text{H}_2$  to form  $\text{NH}_3$   $K_c = 6.0 \times 10^{-2}$  what is the value of  $K_p$ .

\*  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$  establish the relation bet<sup>n</sup>  $K_p$  &  $K_c$   
 $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO} + \text{O}_2$

\* The value of  $K_p$  for  $\text{H}_2\text{O}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{HCl}(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$  is 0.035 at 673 K. Calculate  $K_c$

\* van't Hoff equation or reaction isotherm

## Chemical Kinetics

\* what do you mean by the rate of a reaction? Factors that affect the rate of a reaction.

\* what is meant by order of a reaction. Derive integrated form of 1st order reaction.

\* what order of a reaction. Distinguish between order & molecularity

\* Integrated rate equation of a second order reaction

\* Integrated rate equation of a zero order reaction

\* Distinguish bet<sup>n</sup> first and 2nd order reaction

\* What is half life? Derive half life of 1st order reaction



30210) a. Half-life of first order reaction independent on initial concentration  
PROVE THAT OR  $t_{1/2} \propto \frac{1}{k}$

Explain half-life of second order reaction depends on initial concentration of the reactants. OR  $t_{1/2} \propto \frac{1}{a}$

\*X what is meant by energy of activation and how it is determined?

\*X Name the methods for determination of the order of chemical reactions. Describe one of them

\*X what is temperature coefficient of a reaction. write down

\*X Show that first order reaction does not finish.

\*X what is rate law? verify by the 1st order reaction

\*X Define the term: catalyst, promoter, inhibitor

\*X what is transition state theory.

\*X Math: A reactant is 50% consumed in 4 minutes at a given temperature. How much of the reactant will remain after one hour?

\*X Calculate the activation energy of a reaction whose rate constant at  $47^\circ\text{C}$  gets doubled for  $10^\circ\text{C}$  rise in temperature.

\*X Show that in every first order reaction time for 75% reaction is double the time required for 50%.

\*X Calculate the time required for 90% completion of a first order reaction which is 50% complete in one hour?

\*X A first order reaction is one-fifth completed in 40 min. Calculate the time required for its 100% completion.

\* Discuss the origin of charge on colloidal particles.

\* what is meant by electric double layer?

\* Discuss how the electrolyte affects the behaviour of lyophobic sols.

\* Discuss one method for the preparation of colloid

\* Purification of colloids by Dialysis or electrodialysis.

\* How can you prove that colloidal particles are electrically charged? How do the colloidal particles acquire electrical charge?

## Section: B

### Periodic table

- \*x) what are s, p, d block elements? characteristics of them
- \*x) Define ionization energy. The first ionization energy of nitrogen is higher than that of oxygen - explain
- \*x) How does atomic radius change as you go from left to right across the period & from top to bottom in a group.
- \*x) what is meant by electron affinity? Arrange the following elements in order of their increasing order F, Na, Cl, K, Br & I
- \*x) what is periodic law? Discuss classification of the elements on the basis of electronic configuration of their atoms.
- \*x) what is electron affinity. Explain why the electron affinity of F-atom is higher than that of O-atom



what is electronegativity?

\* Arrange the following elements in the increasing order of their first ionization energy.

i) Li, Be, B ii) N, O, F iii) C, N, O, F

\* Electronic configuration of atomic no [1-30]

\* why the first ionization energy is lower than second ionization energy.

\* what is diagonal relationship

\* why the value of ionization decrease in the same group from top to bottom?

## Chemistry of transition elements, Lanthanides and Actinides

What are lanthanides? Discuss their position in the periodic table?

$\text{Cu}^{2+}$  complexes are coloured while those of  $\text{Zn}^{2+}$  are colourless. Why?

Explain why transition metals show variable oxidation states.

$\text{Fe}^{3+}$  is more stable than  $\text{Fe}^{2+}$

What are transition elements? Describe general characteristics of transition elements.

Which of the following species exhibit paramagnetic behaviour:  $\text{Ti}^{4+}$ ,  $[\text{Ni}(\text{CN})_4]^{2-}$ ,  $\text{Co}^{3+}$  and  $\text{Ni}$ ?

Describe some important uses of lanthanides.

Transition metals are capable of forming complex compounds. — Explain

Most of the transition metals form paramagnetic

Q.11) most of the transition metal show ~~variable~~ ions form  
colored compound - Explain



## Atomic Structure

\*\* write down the fundamental particles.

\*\* Postulates of Bohr model? Limitations of Bohr model.

\*\* write a short note on

- i) Aufbau principle
- ii) Hund's principle
- iii) Pauli's exclusion principle

\*\* Derive an expression for the radius of Hydrogen atom for any orbit

\*\* Expression for the energy of Hydrogen atom.

\*\* what is Bohr radius? Calculate the first orbit of

\*\* 
$$[\text{Bohr radius} = (r_n = \frac{n^2 h^2}{4\pi^2 m_e e^2})] \text{ He}^+ \text{ ion.}$$

\*\* Rutherford's atomic model with drawbacks.

\*\* what is quantum numbers? classify quantum numbers.

\*\* Find the value of four quantum numbers of 13th electron of P, S, Cl

\* find out the value of four quantum number of  $\text{Cl}(17)$ -  
\* find the value of  $n, l, m, s$  for  $n = 1, 2, 3$   
\* write down the name of first five spectral line series of hydrogen spectrum.

\* Calculate the wave number number and wave length of the spectral line observed in hydrogen spectrum when  $n_1 = 2$  &  $n_2 = 3$ .

$$R = 109.686 \times 10^5 \text{ m}^{-1}$$

\* what are quantum numbers? what is the subshell designation for each of the following cases?

i)  $n = 2, l = 0$  ii)  $n = 5, l = 1$  iii)  $n = 4, l = 3$

\* The quantum number of an atomic orbital is 6. what are the possible values of  $l$ ? what are the possible values of  $m$  if  $l = 5$