Course - CHEM- 333 (physical and inorganic chemistry)

Section: A

Chemical Equilibrium

- Define chemical equilibrium? why chemical equilibrium is dynamic process.
- Discuss briefly the various factors which influence the equilibrium characteristics of chemical 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

i) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

ii) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

iii) $H_2 + I_2 \rightleftharpoons 2HI$

** For dissociation of water $H_2O(l) \rightleftharpoons H_2(g) + \frac{1}{2}O_2(g)$ at 1773 K the value of K_p is 1.87×10^{-6} atm. Assuming ideal behaviour of gases calculate K_c.

** At 500°c the reaction betⁿ N_2 & H_2 to form NH_3 $K_c = 6.0 \times 10^{-2}$ what is the value of K_p.

** $N_2(g) + H_2(g) \rightleftharpoons 2NH_3$ establish the relation for K_p & K_c

$N_2O_4 \rightleftharpoons 2NO + O_2$

** The value of K_p for $H_2O(g) + Cl_2(g) \rightleftharpoons 4HCl(g) + O_2(g)$ 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 affects 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 a second order reaction

** Integrated rate equation of a zero order reaction

** Distinguish betⁿ first and 2nd order reaction

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

Half-life of first order reaction independent on initial concentrati
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 $t_{1/2} \propto \frac{1}{a}$

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

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

what is temperature coefficient of a reaction. write down

Show that first order reaction does not finish.

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

Define the term: catalyst, promotar, inhibitor

what is transition State theory.

Math: A reactant is 50% consumed in 4 minute at a given temp
How much of the reactant will remain after one hour?

Calculate the activation energy of a reaction whose rate constant at 27°c gets doubled for 10°c rise in temperatu

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

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

A first order reaction is one-fifth completed in 90 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 lyphobic sols.

** Discuss one method for the preparation of colloid

** Purification of colloids by Dialysis or electrodialysis.

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

Section: B

Periodic table

** what are s, p & d block elements? characterstics of them

** Define ionization energy. The first ionization energy of nitrogen is higher than that of oxygen- explain

** How does atomic radius change as you go from left to right across the period & from top to bottom in a group.

** what is meant by electron affinity? Arrange the following elements in order of their increasing order F, Na, Cl, K, Br & I

** what is periodic law? Discuss classification of the elements on the basis of electronic configuration of their atoms.

** what is electon affinity. Explain why the electon 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?

** Cu^{2+} complexes are coloured while those of Zn^{2+} are colorless. why

** Explain why transition metals show variable oxidation states.

** Fe^{3+} is more stable than Fe^{2+}

** what are transition elements? Describe general characteristic of transition elements.

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

** Describe some important use of lanthanides.

** Transition metals are capable of forming complex compounds. — Explain

** Most of the transition metals form paramagnetic

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) Hunds 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/2nd orbit of Hetion.
[Bohr radius $= \left(r_n = \frac{n^2 h^2}{4\pi^2 m z e^2}\right)$]
** Rutherford's atomic model with drawbacks.
** what is quantum numbers? classify quantum numbers.
** Find the value of four quantum numbers of 13th electon of P & Cl

** Find out the value of four quantum number of 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 spectra.

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

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

** 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_l if $l = 5$