[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1556 C **Roll No.....**

Unique Paper Code : 217461

Name of the Course : B.Sc. (Prog.) Physical Science

Name of the Paper : Paper 13 – CHPT404 : Inorganic and Physical Chemistry

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Use of Scientific calculator is permitted.

Values of some Physical Constants :

Physical Constants (h) = 6.626×10^{-34} Js

Velocity of Light (c) = 3×10^{8} ms $^{-1}$

Mass of Electron (m_e) = 9.109×10^{-31} kg

Avagadro Number (N) = 6.023×10^{23} mol $^{-1}$

Gas Constant (R) = 8.314 JK $^{-1}$ mol $^{-1}$

Boltzmann Constant (k) = 1.38×10^{-24} JK $^{-1}$

1amu = 1.661×10^{-27} kg

SECTION A (37½)

(Inorganic Chemistry)

Attempt any **three** *questions.*
Question No. **1** *is compulsory.*

1. Explain the following :

   (a) Electronegativity of an element increases as s-character increases in the hybrid orbitals of its atom.

P.T.O.

(b) Ionisation energy of transition metals does not show any appreciable variation.

(c) The trends of variation of valency in groups and periods of s & p block of elements.

(d) Solubility order in water : LiI, NaI, KI, RbI, CsI.

(e) $MgSO_4.7H_2O$, is soluble in water whereas $BaSO_4$ is insoluble. (3,3,3,3,1½)

2. (a) What do you understand by Inert Pair Effect ? Explain the concept by taking group 14 elements as an example.

(b) Explain, graphite is soft whereas diamond is very hard.

(c) Explain, any **two** of the following :

(i) Zone Refining

(ii) Cupellation

(iii) Hydrometallurgy (4,2,6)

3. (a) Draw the resonating structures of N_3.

(b) Be forms covalent compounds, explain.

(c) KOH is a stronger base than $Ba(OH)_2$, explain.

(d) Explain, briefly the electronegativity in terms of Pauling's scale and Mullikan's scale.

(e) Write short notes on : Allotropes of Phosphorous. (2,2,2,3,3)

4. (a) Explain, the bond angles and basicity in NF_3 & NH_3.

(b) Explain, hybridization and shapes of the following species : ClF_3, I_3 , XeF_4.

(c) Write short notes on : ionic hydrides. (3,6,3)

SECTION B (37½)

(Physical Chemistry)

Attempt any **four** *questions.*
Question No. **1** *is compulsory.*

1. Attempt the following question briefly :

   (a) The gas with van der Waals constant a = 0 cannot be liquefied. Explain.

   (b) Differentiate between wetting and non-wetting liquids.

   (c) Differentiate between the order and molecularity of a reaction.

   (d) What is the effect of temperature on viscosity of gases and liquids ?

   (e) Explain law of rational indices. (2,2,2,2½,2)

2. (a) Calculate the temperature at which the average velocity of oxygen equals that of hydrogen at 20 K.

   (b) Derive the equation for collision frequency Z_{11} in the case of a gas.

   (c) Discuss the Andrew's isotherms of CO_2. (2,3,4)

3. (a) for a second order reaction A + B $\longrightarrow$ Products, Show that

$$kt = \frac{1}{b-a}\left[\ln\frac{b-x}{a-x} - \ln\frac{b}{a}\right]$$

   Where a and b are the initial concentrations of A and B respectively ? Is it possible to deduce there from that

$$kt = \frac{x}{a(a-x)} \text{ when } a = b \text{ ?}$$

   (b) Show that for a first order reaction time required for 75% reaction to complete is twice that for 50% reaction.

   (c) Explain the Van't Hoff differential method for the determination of the orders of reactions. (4,2,3)

P.T.O.

4. (a) What is crystallography ? What are the fundamental laws of crystallography ?

(b) When a certain crystal was studied using X-rays of wavelength 0.229 nm; an X-ray reflection was observed at an angle of 23° 20' (a) What is the corresponding interplanar spacing ? (b) When another X-ray source was used, a reflection was observed at 15° 26'; what was the wavelength of these X-rays ?

(c) In a surface tension experiment using a stalagmometer, equal volume of two liquids A and B gave 55 and 25 drops respectively, their densities being 0.80 and 0.996 g cm^{-3} respectively. Determine the surface tension of A if that of B is 72 mN m^{-1}. (3,4,2)

5. Write short note on any **three** :

(a) The law of corresponding states and its significance.

(b) The collision theory of reaction rates

(c) Defects in solids

(d) Effect of temperature on surface tension and viscosity of liquids (3,3,3)