This question paper contains 7 printed pages]

Your Roll No. .....

5193

B.Sc. Prog./Life Science/Physical Science-IV Sem. B

Paper—CHPT-404

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A **37½**

Attempt *Three* questions in all.

Question No. **1** is compulsory.

1. (*a*) Justify any *three* of the following statements : 3×3=9

(*i*) Viscosity of sulphur first increases and then decreases on heating.

(*ii*) Though the sum of first and second ionization enthalpies of magnesium is about four times of its first ionization enthalpy, it forms $MgCl_2$ instead of MgCl.

P.T.O.

(*iii*) Acid character of aqueous solution of hydrogen halides is in the following order

$$HI > HBr > HCl > HF$$

(*iv*) Graphite is soft whereas diamond is very hard.

(*b*) Attempt any *three* questions $3\times1\frac{1}{2}=4\frac{1}{2}$.

(*i*) Explain why $PbCl_2$ is more stable than $PbCl_4$.

(*ii*) Why the covalent radius of germanium is almost the same as that of silicon, even though germanium has 18 more electrons than silicon.

(*iii*) Explain why the slope in the Zn-ZnO Ellingham diagram changes twice.

(*iv*) Give at least *three* important properties of interstitial hydrides.

2. (*a*) Give the structures of Marshall's acid and Caro's acid. Also illustrate *one* important property of each of the acids with chemical equation. 4

(*b*) Explain why direct reduction with carbon may not be appropriate for the extraction of titanium from its oxide ore. 2

(*c*) Give balanced chemical equation for what happens when, for any *three* of the following : 6

(*i*) Phosphorus trichloride reacts with water

(*ii*) Ammonia reacts with oxygen in presence of catalyst

(*iii*) Hydroxylamine reacts with hydrochloric acid

(*iv*) Thionyl chloride reacts with water.

3. (*a*) Give the structure and *one* important use of any *three* of the following : 6

(*i*) SO_2Cl_2

(*ii*) PCl_5

(*iii*) $H_4P_2O_7$

(*iv*) $H_2S_2O_3$.

(*b*) Arrange the following oxoacids of chlorine in the order of increasing acidity : $HClO_4$, $HClO_2$, $HClO_3$, HClO. Justify your answer. 3

(*c*) Explain briefly Pauling's scale of electronegativity and Allred-Rochow scale of electronegativity. 3

(*a*) Write short notes on any *two* of the following :

(*i*) Hydrometallurgy

(*ii*) Allotropes of phosphorus

(*iii*) Ionic hydrides. 4

(*b*) What is diagonal relationship ? Give at least *three* significant examples to explain how Li resembles Mg much more than its congeners. 4

(*c*) CO is a better reducing agent for metal oxides than carbon, below a temperature of 983K, but above this temperature the reverse is true. Explain why. 4

Section B 37½

Attempt *Four* questions.

Question No. 1 is compulsory.

Log tables to be provided.

1. Answer the following questions briefly :

(*a*) Can we liquefy a gas for which the van der Waals constant $a = 0$. 2

(*b*) Which is more viscous ethyl alcohol or dimethyl ether ? Why ? 2

(*c*) Can a reaction have zero activation energy ? Why ? 2

(*d*) How many symmetry axes, planes and centre of symmetry are present in a simple cube ? 2½

(*e*) Explain why the viscosity of gases increases with increase in temperature while the viscosity of liquids decreases with increase in temperature ? 2

2. (*a*) State and explain the law of corresponding states. 2

(*b*) What are critical constants of a gas ? Starting with van der Waals equation derive expressions for P_C, V_C and T_C in terms of the van der Waals constants. 4

(*c*) At 20°C pure water with an absolute viscosity of 1.002×10^{-3} Nm^{-2} s requires 102.2 s to flow through the capillary of an Ostwald viscometer while toluene requires 68.9 s. If the densities of water and toluene are 0.998 g cm^{-3} and 0.866 g cm^{-3}, respectively. Calculate the viscosity of toluene. 3

(*a*) Explain briefly :

(*i*) Law of rational indices.

(*ii*) First law of Crystallography

(*iii*) Miller indices. 3

(*b*) Using X-rays of wavelength 154.1 pm, first order diffraction from silver crystal was found to occur at $\theta = 22.20°$. Calculate the spacing between the planes of silver atoms. (sin 22.20° = 0.3778). 3

(*c*) What is capillary action ? Derive the expression $\gamma = \frac{1}{2} \rho g h r_c$ for the surface tension of a liquid. 3

4. (*a*) What do you mean by the half life time of a reaction ? Describe the half life time method to determine the order of a reaction. 3

(*b*) Can the molecularity of a reaction be greater than three ? Why ? 2

(*c*) Write down the Arrhenius equation relating the rate constant with the activation energy. The rate constant of a second order reaction is 5.70×10^{-5} dm^3 mol^{-1} s^{-1} at 25°C and 1.64×10^{-4} dm^3 mol^{-1} s^{-1} at 40°C. Calculate the activation energy and the Arrhenius pre-exponential factor. 4

5. Write short notes on any *three* : 3×3

(*a*) Bragg's law of X-ray diffraction.

(*b*) Collision theory of Bimolecular reaction.

(*c*) Cleansing action of soap.

(*d*) Maxwell's distribution of speeds of molecules of a gas.