UNIT—101 – P

4. Deduce Ideal gas equation using kinetic gas equation. Show that $C_{P,\,m}/C_{V,\,m} = 1.167$ for SO_2 (assuming it behaves ideally). 4

(OR)

Define compressibility factor (Z) of a gas. On what factors does it depend? How can you explain the plot of Z vs. pressure for hydrogen and helium with the help of van der Waals equation? 4

5. Why does a wetting liquid rise in a capillary tube? How does viscosity of a liquid change with temperature? 4

(OR)

Calculate the limiting radius ratio of cation to anion in a body-centred cubical structure. Though both NaCl and KCl have fcc lattice structure but X-ray pattern of KCl looks like that of primitive cubic lattice – explain. 4

6. How can you explain that I_2 is solid, Br_2 is liquid and Cl_2 is gas at room temperature? 2

(OR)

Express molar polarization for non-polar molecules illustrating the terms used. 2

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B. Sc. CHEMISTRY EXAMINATION, 2024

(1st Semester)

CHEMISTRY – I

PAPER : UG/MAJOR/TH/11/101

Time : *Two Hours* *Full Marks* : 40

Use a separate answer scripts for each Unit.

UNIT—101 – I

1. *(a)* State Pauli exclusion principle and illustrate with suitable example. 1

(b) What will be the values of *J* if L = 2 and S = 3/2? 1

(c) Determine the appropriate term symbol for the ground state of Ni^{2+}ion. 1

(d) Sketch the *(i)* radial wave function and *(ii)* radial probability functions of 2s and 2p orbitals for the hydrogen atom. 2

(e) Calculate the wavelength (in angstrom unit) and energy (in electron volt unit) of a body with a mass of 1 g moving with a velocity of 1 cm/sec. 1

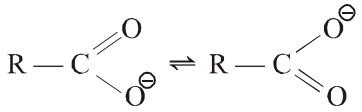
(f) Arrange F, Cl, Br and I in their decreasing order of electron affinity with appropriate justification. 2

(g) What do you mean by wave function? Provide physical interpretation of the wave function by taking into consideration both wave as well as particle characteristics of electron. 2

UNIT—101 – O-a and 101 – O-b

2. (a) Draw the bonafide Lewis structure of CH_3NO_2 indicating formal charge(s) on nitrogen and oxygen atoms. 1½

(b) State with reasons whether the following representation is correct or not :



1

(c) Which one of the following cations is more stable and why?

$\overset{\oplus}{C}H_3$ and $\overset{\oplus}{C}F_3$ 1½

(d) Heats of hydrogenation of cyclohexene and benzene are 28·4 k Cal mol^{-1} and 49·3 k Cal mol^{-1} respectively. Show how you can calculate the resonance energy of benzene from these data. 2

(e) 1, 3-Butadine is more stable compared to ethylene as well as it is more reactive than ethylene towards the electrophile. Rationalize the aforesaid statement. 3

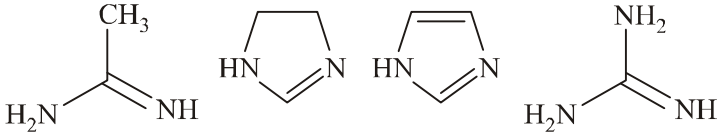
(f) 7-Bromo–1,3,5–cycloheptatriene is a solid compound which is insoluble in diethyle ether and freely soluble in water — Account for this observation. 1

3. (a) Cyclopropanation of 2-butene with diazomethane in liquid phase is stereoselective whereas in gas phase it is non-stereoselective. Explain. 2

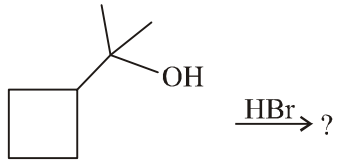
(b) Predict the kinetically controlled and thermodynamically controlled products for HCl addition to 4-methyl 1,3 pentadiene. Give reason. 1½

(c) 1-butene reacts faster that 2-butene with HBr. Explain the statement using Hammond postulate and energy profile diagram. 2

(d) Arrange the following compounds in order of decreasing basicity. Give reason. 1½



(e) Predict the product with suitable mechanism. 1½



(f) pK_a^1 of fumaric acid and maleic acid are 3.02 and 1.92 respectively whereas pK_a^2 of fumaric acid and maleic acid are 4.38 and 6.23 respectively. Explain the phenomena with reason. 1½