Sessional Exam, 2022

5th sem, Analytical Methods in Chemistry, DSE-501

Marks: 40, Time: 1 hour 30 min

1. Answer any one

a. What are the various steps involved in atomization of atomic spectroscopic procedure?

- b. Calculate the appropriate number of significant numbers in $(3.2 \times 0.08)/5.01$
- 2. Define the following (any two): [1X2=2]
 - a. Accuracy b. Precision c. Variance
- 3. Answer any two
 - a. What is Q-test? How this test is applied to reject outliers that are present in an analytical measurement?
 - b. State Beer Lambert's Law. What are its limitations?
 - c. Define different types of molecular vibrations?
 - d. Distinguish between the following two isomers having molecular formula (i) CH₃COCH₃ and (ii) CH₃CH₂CHO
- 4. Answer any three of the following: [3x3=9]
 - a. How isotopic substitution is helpful in IR spectroscopy? Vibrational frequency of HF is 845 cm⁻¹. If the H-atom is substituted with deuterium, what will be the vibration frequency of DF?
 - b. What do understand by fingerprint region? Explain combination bands and overtones.
 - c. What is the basic principle of AES? Name the different background correction method in AAS?
 - d. The following masses were recorded for 8 different coins 5.68, 5.54, 5.55, 5.62, 5.53, 5.67, 5.55, 5.61

Report the mean, median and standard deviation.

5. Answer any one

[1]

[2x2=4]

- a. What is UV-visible spectroscopy? What are the main components of a UV-visible spectrophotometer?
- b. How will you determine composition of metal complexes using continuous variation method?
- c. Explain single and double beam spectrophotometers. Which one is better and why?
- 5. What is retention time? State the relation between retention time and the separation of the solute in chromatography? [1+1=2]
- 6. What is the stationary phase and mobile phase in chromatography? [1+1=2]
- What is the distribution coefficient and distribution ratio? State their significance [2+1=3]
- 8. What is the role of electrobalance in TGA instruments? [2]
- 9. What are the types of TGA? [3]
- 10. Describe a TGA graph with example showing different steps? [4]
- 11. Describe the instrumentation of TGA with different component? Write the answer in point wise. [4]

OR

12. What are the feed solution, extractant and reffinate in solvent extraction method? Describe with a schematic diagram.

[4]

Sessional Exam, 2022 3rd Sem, Inorganic Chemistry (M), C-301 Marks: 40, Time: 1 hour 30 min

- 1. Write down the reaction of sodium with water? [1]
- 2. Draw the structure of boric acid? Why is it called as dibasic acid? [1+1=2]
- 3. Write down three preparation of diborane?
- 4. How to prepare Na[BH₄] and LiBH₄ from diborane. [1+1=2]
- 5. Why Li has greater tendency to form covalent bond than other element in the same group. [2]
- 6. Why Li has dissimilarities with other alkali metals. [2]
- Give two examples of diagonally related elements? On what basis they are said to have diagonal relationship? [2+2=4]
- 8. Draw the structure of B₂H₆ with terminal and bridged bond length and bond angles? Show how they form 3c-2e bond? [2+2=4]
- 9. Answer any one: [1]
 - a. Give the formula of inorganic benzene
 - b. Conjugate base of NH₃ is _
- 10. Answer any three of the following: [2x3=6]
 - a. Explain why Cl-OH is an acid and NaOH is a base?
 - b. Justify the following reactions on the basis of HSAB principle
 - i. $Ag^+ + 2F^- \rightarrow AgF_2^-$
 - ii. $HgF_2 + BeI_2 \rightarrow BeF_2 + HgI_2$
 - c. AgI_2 is a stable complex, while AgF_2 is not. Explain.
 - d. Why is it difficult to store XeF₆ in glass or quartz?
 - e. What is inorganic benzene? How is it analogous to benzene?

- 11. Answer any three of the following: [3x3=9]
 - a. Give the shape, geometry and hybridization of XeO_2F_2 and XeF_4 .
 - b. Complete the following reactions:
 - (i) $XeF_6 + H_2O \rightarrow$

[3]

- (ii) $XeF_6 + RbF \rightarrow$
- (iii) XeF₂ + H₂ \rightarrow
- (iv) $B_2H_6 + 2NH_3 \rightarrow$
- (v) $XeF_4 + Pt \rightarrow$
- (vii) $XeF_2 + SbF_5 \rightarrow$
- c. Define Arrhenius definition for acids. Every Arrhenius acid is also Bronsted acid but every Bronsted base is not Arrhenius base. Explain.
- d. What are silicates? Give one example each of pyrosilicate and chain silicates.
- e. Discuss structures of (NPCl₂)₃ and (NPCl₂)₄.
- 12. Answer any one of the following:
 - a. Define Lewis base. Discuss about the four categories in which Lewis acids may be classified?

[4]

b. Define HSAB principle and briefly discuss its limitations. What are characteristics of hard acids?

Sessional Exam, Inorganic Chemistry 1st Sem, Chemistry (M), C-101, Date: 11-11-2022 Marks: 40, Time: 09:00-10:30

[1x2=2]

- 1. Answer any two
 - i. Oxidation number of Cr in potassium dichromate is?
 - ii. The type of hybridization in NH₄⁺ is _____
 - iii. The shape of SF₄ molecule is _____
 - iv. What is the covalency of Cl in Cl_2O_7 molecule?
- 2. Answer any four of the following: [2x4=8]
 - i. What is hybridization? Give hybridization and structure of XeF₆.
 - ii. Distinguish between Frenkel and Schottky defect
 - iii. Why metals are good conductors of heat and electricity?
 - iv. What is polarizing power and polarizability of ions?
 - v. Define London forces. What is the cause of unusual high boiling point of ammonia and water?
 - vi. Define intrinsic and extrinsic semiconductors
- 3. Answer any two of the following: [2x3=6]
 - i. Define lattice energy and explain the importance of Madelung constant.
 - ii. What is Born-Haber cycle? Give its applications and limitations.
 - iii. Find radius ratio of octahedral complexes and give limitations of radius ratio rules.
 - iv. What is VBT? Explain the bond angles in H_2O and NH_3 using DBT.
- 4. Answer any one of the following: [1x4=4]
 - i. Write the molecular orbital electronic configuration of NO- ion and explain the following:
 - (a) What is the bond order?
 - (b) Will the bond length be shorter or longer than in NO?
 - (c) How many unpaired electrons will be present?

- ii. Calculate the lattice enthalpy of CaCl₂, given that the enthalpy of -Enthalpy of sublimation for Ca (s) \rightarrow Ca(g) = 121 KJ/mole Enthalpy of dissociation of $Cl_2(g) \rightarrow 2Cl(g) = 242.8 \text{ KJ/}$ mole Ionisation energy of $Ca(g) \rightarrow Ca^{2+} = 2422 \text{ KJ/mole}$ Electron gain enthalpy of $2Cl \rightarrow 2 Cl^{-} = 2 \times -355 = -710$ KJ/mole Enthalpy of formation of CaCl₂= -795 KJ/mole. Also show the cycle for the same showing the various steps involved. 5. Who have used the quantum theory to explain the structure of atom? [1] 6. What is the significance of ψ and ψ^2 ? [1+1=2]7. What is operator? Write the total energy operator used in Schrodinger equation? [1+2=3] 8. Write three limitation of Bohr's Theory? [3] 9. What is the mathematical expression for Heisenberg's uncertainty principle? What is its significance? [2+1=3]10. State the orbital from the following quantum number information and find out which combination is not possible? [1X4=4] n=4 l=1 m=0 s=+1/2n=3 l=2 m=1 s=-1/2n=2 l=2 m=0 s=+1/2
 - n=4 l=3 m=2 s=-1/2
- 11. Calculate the Broglie wavelength that has been accelerated through a potential difference of $100 \text{ V}(\text{m}=9.1 \times 10^{-31}, \text{e}=1.6 \times 10^{-19})$ [2]
- 12. Draw the orbital picture of s and p orbitals and state how many nodal planes are there in each orbital? [2]

Sessional Examination, 2022 B.Sc. 1st Sem, Chemistry Generic, GE-101 Marks: 40, Time: 1.30 h

- 1. Answer any four of the following questions. $[4 \times 2 2 = 10]$
 - a. Write down the differences between inductive and electrometric effect.
 - b. "Dipole moment and basicity can be affected by inductive effect." Explain
 - c. Define resonance hybrid and resonating structure with example.
 - d. Write down the resonating structures of CO₂ molecule.
 - e. Define homolysis and heterolysis with example.
 - f. Which of the following compound are aromatic? Explain



- g. Why carbocation intrermediate are unstable. Explain
- h. Which of the following compound have highest pKa value and why?

CI____COOH Br___COOH I___COOH

- 2. Define electrophile and nucleophile. Write example of neutral electrophile and nucleophile. [3]
- Calculate de Broglie wavelength of a body of mass 1kg moving with a velocity of 10ms⁻¹. [3]

- Calculate the uncertainty in the velocity of an electron if the uncertainty in its position is approximately 1 Å. [3]
- 5. What is Hund's rule of maximum multiplicity? Explain by taking N as an example. [1+2=3]
- 6. What is meant by exclusion in Pauli Exclusion Principle? [1]
- 7. What are the types of quantum numbers? State their significance with example? [2+2=4]
- 8. Answer any two of the following: [2x2=4]
 - i. Predict the structure of XeF_6 using VSEPR theory.
 - ii. Write the possible resonating structures of CO_3^{2-} and NO_3^{-} .
 - iii. Describe atomic orbital and molecular orbital.
- 9. Answer any three of the following: [3x3=9]
 - i. What is Fajan's rule? Describe polarizing power and polarizability.
 - ii. Write down the molecular orbital configuration of N₂. Find its bond order and number of unpaired electrons.
 - iii. What is Born-Haber cycle? Give its applications.
 - iv. What is Valence bond theory (VBT)? Discuss the structure of CH₄ using VBT.
 - v. What is molecular orbital theory? Show diagram for bonding and antibonding molecular orbitals.