1B2A24019   (Pages : 2)   Reg. No:............ ....

                                                        Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Chemistry Degree Examination, April 2024

BCH2B02 - Theoretical and Inorganic Chemistry-II

(2022 Admission onwards)

Time: 2 hours   Max. Marks : 60

Section A (Short answers)
(Answer questions up to 20 marks. Each question carries 2 marks)

1. What is meant by ultraviolet catastrophe?

2. Show that the ground state energy of hydrogen atom is equal to the energy of He^+ in its first excited state if their Rydberg constants are equal.

3. Calculate the uncertainty in momentum of an electron whose position can be determined with an uncertainty of 50 pm.

4. What is meant by a well-behaved wave function?

5. What is an eigen function? Find the eigenvalue when d^2/dx^2 operates on $\cos \omega x$.

6. What is Hamiltonian Operator?

7. State variation theorem.

8. Differentiate between bonding and antibonding molecular orbitals.

9. State Born Oppenheimer approximation.

10. Show that He_2 molecule does not exist.

11. Draw the potential energy diagram of H_2 molecule formation.

12. Draw the structure of PCl_5. Mention the type of hybridization involved.

[Ceiling of marks: 20]

Section B (Paragraph)
(Answer questions up to 30 marks. Each question carries 5 marks)

13. How did Bohr's quantization principle ensured the stability of atom model? Derive an expression for the radius of Bohr orbits.

14. Explain wave particle duality. Calculate the energy and wavelength associated with an α particle that has fallen through a potential of 4.0 V (Mass of α particle is 6.64×10^{-27} kg)

15. What is the radius of maximum probability for Hydrogen atom at its ground state? Sketch the radial probability distribution curves for 3s and 3d orbitals.

16. Explain the significance of quantum numbers n, l and m.

17. Draw the MO diagrams of CO and O_2. Calculate the bond order.

18. Explain the concept of LCAO of central atom. Give the coefficients of linear combination of atomic orbitals for sp^2 and sp^3 hybridization.

19. Explain the hybridization and structure of IF_7 .

[Ceiling of marks: 30]

Section C (Essay)
(Answer any one. Each question carries 10 marks)

20. Explain the quantum mechanical treatment for the calculation of a free particle constrained in a one-dimensional box. Explain the difference in probability of finding particle at the midpoint of box at ground state and first excited state.

21. Compare the VB and MO theory of boding using H_2 molecule as an example.

[1 x 10 = 10 marks]

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2024

BCH2C02 - Physical Chemistry

(2022 Admission onwards)

Time: 2 hours   Max. Marks : 60

Section A (Short answers)
(Answer questions up to 20 marks. Each question carries 2 marks)

1. What are the causes of deviation of real gases from ideal behaviour ?

2. What is the effect of increasing temperature on the solubility of a gas in a liquid ?

3. In a certain process, 750 J of heat is absorbed by a system while 400 J of work is done on the system. Calculate the internal energy change in the process.

4. The resistance of 0.01M solution of weak acid is 5×10^3 ohms, when taken in a conductivity cell of cell constant $0.5 cm^{-1}$. Calculate the molar conductance of the solution

5. At what temperature will the RMS velocity of O_2 gas be equal to that of H_2 molecule at 27^0C?

6. What is meant by space lattice ?

7. Define the term standard potential.

8. What is reverse osmosis ?

9. Define most probable velocity of a gas.

10. What is meant by buffer action?

11. Define Gibbs free energy. What is its physical significance ?

12. Differentiate between extrinsic and intrinsic imperfections in crystals.

[Ceiling of marks: 20]

Section B (Paragraph)
(Answer questions up to 30 marks. Each question carries 5 marks)

13. How do the molar conductivities of strong and weak electrolytes vary with dilution ? Explain.

14. Write a note on Maxwell's equation for the distribution of molecular velocities.

15. Explain the construction and working of calomel Electrode.

16. ΔH and ΔS for the reaction $2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$ at 500 K are -223.6KJ and -187.8 JK^{-1}. Calculate ΔG and predict whether reaction is spontaneous or not at 500K.

17. State and explain Henry's law. Mention any two applications of the law.

18. Derive Bragg's equation and mention its application.

19. What are the laws of Osmotic pressure? Derive an expression for osmotic pressure.

[Ceiling of marks: 30]

Section C (Essay)
(Answer any one. Each question carries 10 marks)

20. (a) At 25^0C, the conductivity of 0.1M KCl is 0.01291 ohm^{-1}. Its resistance in a conductivity cell at the same temperature is found to be 192.4 ohm. A solution of another electrolyte BA with concentration 0.01M offers a resistance of 250 ohms in the same cell. Calculate the molar conductance of BA

    (b) Derive Ostwald's dilution law and mention its limitations.

21. Discuss the stoichiometric defects found in crystal

(1 x 10 =10 Marks)