1B2A23018B

(Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

**Second Semester B.Sc Chemistry Degree Examination, April 2023**

**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. State Wein displacement law. What is its use?
2. Calculate the radius of first Bohr orbit of $He^+$.
3. Discuss de-Broglie's concept of matter waves for microscopic and macroscopic bodies.
4. What are Hermitian operators? What is their significance?
5. Determine whether the functions $1/x$ and $tan^{-1}x$ in the interval $(0, \infty)$ are acceptable or not.
6. What is meant by variation method in quantum mechanics?
7. Draw the potential energy diagram of hydrogen molecule.
8. Discuss briefly the valance bond theory of hydrogen molecule.
9. What are the conditions for the linear combination of atomic orbitals to from molecular orbitals?
10. Write down the molecular orbital configuration of NO and CO.
11. What is meant by hybridization? Why is it important?
12. Name the hybridization and geometry of $IF_7$ and $SF_6$.

**[Ceiling of marks: 20]**

**Section B (Paragraph)**

**(Answer questions up to 30 marks. Each question carries 5 marks)**

13. Explain Einstein's interpretation of photoelectric effect. When Sodium is irradiated with a light of 3700 Å, the stopping potential was observed to be 1 V. Calculate the threshold potential of Sodium.
14. How did Bohr incorporate quantum theory in his atom model? What were the drawbacks of Bohr's atom model?
15. Discuss briefly the concept of particle in 1 D box. Calculate the ground state energy of an electron confined in a 1D box of length 2 Å, guarded by walls of infinite height.
16. What are quantum numbers? What is their significance ?
17. What are radial distribution functions? Draw the radial distribution functions of 2s, 2p and 3p orbitals.

18. Describe Born-Oppenheimer approximation? How does it simplify the Schrödinger equation of a molecule?

19. Define commutator of two operators.

Evaluate $\left[\left(\frac{d}{dx} - x\right), \left(\frac{d}{dx} + x\right)\right]$ and $\left[\left(\frac{d^2}{dx^2} - x\right), \left(\frac{d}{dx} + x^2\right)\right]$.

**[Ceiling of marks: 30]**

## Section C (Essay)

**(Answer any one. Each question carries 10 marks)**

20. Draw the MO diagrams of $O_2$, $O_2^+$, $O_2^-$ and $O_2^{2-}$. Calculate the bond order and comment on the relative stability of these molecules.

21. Discuss the quantum mechanical description of hybridization in $BeH_2$, $BH_3$ and $CH_4$.

**[1 X 10 = 10]**

1B2A23019 (Pages : 2) Reg. No:.....

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

**Second Semester B.Sc Degree Examination, April 2023**

**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. Define entropy. What is meant by entropy of sublimation.
2. What is the unit of viscosity? How does it vary with temperature ?
3. Give the statement of first law of thermodynamics. What is its mathematical formulation?
4. A crystal plane makes an intercept of (1/2a,1/2b, c). What are the miller indices of the plane ?
5. The conductivity of decimolar solution of an electrolyte is 0.0024 $ohm^{-1}cm^{-1}$. It offers a resistance of 350 ohm when taken in a conductivity cell. Calculate cell constant.
6. Define vapour pressure of a liquid. How does it vary with temperature?
7. Explain reverse osmosis. Mention one of its applications.
8. Define Henry's Law .Mention one of its applications.
9. Mention the physical significance of free energy. What are the conditions for equilibrium and spontaneity based on $\Delta G$ values?
10. What are buffer solution. Give one example.
11. Calculate average velocity of $O_2$ molecule at 273K
12. Explain the factors affecting surface tension of a liquid.

**[Ceiling of marks: 20]**

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

13. Define Kohlrausch's law. Discuss any two applications of it.
14. How do Frenkel defect arise? What is the cause of Schttky effect?
15. Explain the construction and working of Standard Hydrogen Electrode.
16. Explain the entropy criteria for reversible and irreversible processes.
17. What are internal energy change and enthalpy change of a system. Derive the relationship between $\Delta U$ and $\Delta H$.
18. What are the laws of osmotic pressure? How will you determine molecular mass of a polymer using osmotic pressure?
19. State and explain laws of symmetry with regard to crystals.

**[Ceiling of marks: 30]**

## Section C (Essay)

**(Answer any one. Each question carries 10 marks)**

20. (a) Give van der Waal's equation for one mole of a gas and explain the terms. Give the units and significance of van der Waals constants.

    (b) Derive Bragg equation.

21. Give the construction and working of fuel cell. What are its uses and advantages ?