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D2BCH2201 (PAGES 2) Reg.No.....

Name: .....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023

(Regular/Improvement/Supplementary)

CHEMISTRY

GCHE2B02T: THEORETICAL AND INORGANIC CHEMISTRY- II

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 Marks)

1. Explain de Broglie's concept of matter waves with evidences.
2. What will be the minimum uncertainty in the position of electron when the uncertainty in the momentum is 1×10^{-4} g cm s^{-1} ($h = 6.624 \times 10^{-34}$ Js).
3. What are (i) a well behaved function and (ii) a normalised wave function?
4. If l = 2 for an electron, what are the permitted values of m?
5. Mention the important limitation that Rutherford atom model was supposed to have immediately after its proposition.
6. State the variation theorem.
7. Give an appropriate trial function for H_2 molecule in VB theory?
8. Explain the term bond order. How is bond order related to bond strength?
9. The atomic number of Flourine is 9. Write the MO electronic configuration of F_2 molecule and calculate its bond order.
10. Why is the bond formed from a hybrid orbital stronger than that from a pure atomic orbital?
11. What are the shapes of the BH_3 and BeH_2 molecules?
12. Write the expressions in terms of the linear combination of wave functions for the two sp hybrid orbitals of Be in the BeH_2 molecule.

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 Marks)

13. Calculate and compare the energies of two radiations, one with wavelength 800 nm and other 400 nm ($h = 6.626 \times 10^{-34}$ Js).
14. Calculate the radius of the first Bohr orbit of a hydrogen atom and calculate the velocity and energy of an electron revolving in it. Given $h = 6.626 \times 10^{-34}$ Js, $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 m^{-1} J^{-1}$, mass of electron = 9.109×10^{-31} kg, and electronic charge = 1.602×10^{-19}C.
15. Explain the Stern – Gerlach experiment.

(PTO)

16. Describe the LCAO method of constructing molecular orbitals. Sketch the molecular orbitals formed by combination of two *s* orbitals and combination of two *p* orbitals.
17. Give a diagrammatic representation of the s-orbital and five d-orbitals.
18. Discuss sp hybridization and the consequent geometry with an illustrative example.
19. Discuss the molecular orbital theory of H_2^+ ion?

SECTION C: Answer any *one* question. Each carries *ten* marks.

20. Compare the bond length, magnetic behaviour and bond energy of O_2, O_2^+, O_2^{2+}, O_2^- and O_2^{2-} on the basis of MOT.
21. Set up the Schrödinger wave equation for a particle in a one dimensional box, solve it and get expression for the energy of electron. Explain the term zero-point energy. Briefly explain one application of the particle in a box model.

(1 x 10 = 10 Marks)