C 24740 (Pages : 3) Name.....

Reg. No.....

# SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2017

(CUCBCSS—UG)

Core Course—Chemistry

CHE 2B 02—THEORETICAL AND INORGANIC CHEMISTRY—II

Time : Three Hours Maximum : 80 Marks

## Section A

*Answer in one word* **or** *sentence.*
*Answer* **all** *questions.*

1. If $\hat{A} f(x) = c f(x)$, '$c$' is called ————————.
2. Wave functions $\Psi$ is said to be a normalised function when ———————— = 1.
3. A 2s orbital has ———————— radial nodes
4. The electronic configuration of Cr (Z = 24) is [Ar] ————————.
5. Be shows diagonal relationship with ————————.
6. What is the state of hybridization of I in $IF_7$.
7. $NH_4^+$ has ———————— geometry.
8. What is the dipole moment of $BCl_3$ molecule.
9. What is the bond order of $O_2^+$ molecule .
10. Name a compound that shows intramolecular hydrogen bonding.

(10 × 1 = 10 marks)

## Section B

*Answer any* **ten** *questions.*
*Each question carries 2 marks.*

11. Explain the term Hermitian operator.
12. What is meant by a well behaved wave function ?
13. State and explain Hund's rule of maximum multiplicity.
14. Write the designation given to sublevels having (a) $n = 2$ ; $1 = 1$ (b) $n = 4$ ; $1 = 3$.

15. Write the equation for energy and wavefunction for a particle confined to move in a 1D box of length '*a*'.

16. Calculate the effective nuclear charge felt by a 2p electron of nitrogen atom.

17. Mention two differences between a sigma bond and a pi bond.

18. What are the conditions which favour the formation of an ionic compound ?

19. $PCl_5$ is a reactive molecule. Explain.

20. Write the molecular orbital configuration of $F_2$ molecule and calculate its bond order.

21. Write the resonance structures of carbonate ion.

22. What is electron affinity ? Arrange the following elements in the increasing order of electronaffinity. F, Cl, Br, I.

(10 × 2 = 20 marks)

## Section C

*Answer any* **five** *questions.*

*Each question carries* 6 *marks.*

23. What are Laplacian and Hamiltonian operators ? Explain.

24. Calculate the energy difference, between states $n = 2$ and $n = 1$ of an electron confined in a 1D box of side $10A^0$. (mass of electron = $9.1 \times 10^{-31}$ kg ; $h = 6.626 \times 10^{-34}$ Js. Also calculate the wavelength corresponds to spectral transition between the $n = 1$ and $n = 2$ levels.

25. Explain the terms eigen value and eigen function.

26. Define electronegativity of an atom . What are the factors influencing it ?

27. Explain the shape of $XeF_4$ molecule on the basis of VSEPR theory.

28. Draw the MO energy diagram for CO molecule. Calculate the bond order and explain its magnetic behaviour.

29. How does Valence Bond Theory explain the electrical and thermal conductivity of metals ?

30. Write any two applications of dipolemoment measurement for determining molecular structure. Explain with examples.

(5 × 6 = 30 marks)

## Section D

*Answer any* **two** *questions.*

*Each question carries* 10 *marks.*

31. State and explain the postulates of quantum mechanics.

32. (a) Define ionization enthalpy and explain the variation of ionization enthalpy along a period and down a group of the periodic table .

    (b) Account for the shape of $CCl_4$ molecule on the basis of VSEPR theory'.

33. (a) Write the Born — Lande equation and explain the terms.

    (b) State and explain Fajan's rule.

34. (a) Discuss hydrogen bonding in water and explain the unique properties of water.

    (b) How does free electron theory explain the properties of metals ?

(2 × 10 = 20 marks)