2023/01

SET A

B.Sc. CHEMISTRY
FIRST SEMESTER
INORGANIC CHEMISTRY-I
BSC – 101 [REPEAT]

[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 min. **Marks: 20**

Choose the correct answer from the following: ***1X20=20***

1. The value of $4\pi\varepsilon_o$ (permittivity factor) is
   a. $1.11\times10^{-10}\ C^2N^{-1}m^{-2}$ b. $1.11\times10^{-8}\ C^2N^{-1}m^{-2}$
   c. $1.11\times10^{-10}\ CN^2m^{-1}$ d. $1.11\times10^{-8}\ CN^2m^{-1}$
2. Which of these elements has the highest value of ionization energy
   a. N b. O
   c. F d. Ne
3. Which of these elements has the lowest value of electron affinity
   a. C b. N
   c. O d. F
4. The most electronegative element is
   a. H b. Li
   c. Na d. K
5. The molecule with the highest bond angle is
   a. NF_3 b. PF_3
   c. AsF_3 d. SbF_3
6. The effective nuclear charge felt by a 1s electron of beryllium atom is
   a. 3.65 b. 3.70
   c. 1.95 d. 1.60
7. The radial wave function depends on the quantum numbers
   a. l and m b. n and l
   c. n and m d. l and s
8. Which set of quantum numbers is not permissible
   a. n = 5, l = 4, m = 0, s = ½ b. n = 3, l = 0, m = -1, s = -½
   c. n = 3, l = 1, m = 0, s = ½ d. n = 2, l = 1, m = +1, s = -½
9. Strength of dipole-dipole forces effect some parameters, which by nature are-
   a. Thermodynamic b. Volume
   c. Pressure d. Light

10. When positive end of molecules attract negative end, the electrostatic forces are named as-
    a. London dispersion forces
    b. Dipole-dipole forces
    c. Weak forces
    d. Gaseous forces

11. The bond order for O_2^+ ion is
    a. 2.5
    b. 2
    c. 1.5
    d. 1

12. The dipole moment for BeH_2 is
    a. 1
    b. 3
    c. 0
    d. 2

13. The oxidation number of Al in $NaAlH_4$ is
    a. 2
    b. 3
    c. 0
    d. 1

14. Which of the following is paramagnetic in nature
    a. N_2
    b. O_2^{2+}
    c. O_2
    d. None of these

15. The oxidation state of oxygen in Na_2O_2
    a. -1
    b. 1
    c. 2
    d. -2

16. The magnetic moment of oxygen molecule is
    a. 2.00BM
    b. 2.82BM
    c. 3.00BM
    d. None of these

17. The bond order for CO molecule is
    a. 2
    b. 3
    c. 1
    d. None of these

18. The formal charge for O_3 molecule is
    a. 1,-1,0
    b. 1,1,0
    c. -1,-1,0
    d. 0,0,1

19. The following reaction is example of

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

    a. Combination reaction
    b. Disproportionation reaction
    c. Displacement reaction
    d. None of these

20. Which of the following has more dipole moment
    a. NH_3
    b. NF_3
    c. BeF_2
    d. BF_3

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Descriptive

Time : 2 hrs. 30 min. Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. a. Why are the ionization energy values of nitrogen and beryllium higher than expected? State the Aufbau's principle and discuss its limitations. **5+2+3 =10**

   b. Calculate the formal charge for O_3 molecule.

   c. Why the dipole moment of BeF_2 and BF_3 are zero?

2. Mention two applications of Bohr's theory. Discuss the atomic spectrum of hydrogen. Discuss the de Broglie equation. State the Heisenberg uncertainty principle. This principle holds good for all objects but it is of significance only for microscopic objects. Explain. **2+3+2+3 =10**

3. What are orthonormal wave functions? What are Eigen functions? Define covalent radius. How is the covalent radii of A and B in a molecule A-B related to the electronegativities of A and B? Calculate the effective nuclear charge for 3d electron and 4s electron of chromium atom. **2+1+1+2 +4=10**

4. Why is the electron affinity of fluorine less than chlorine? Discuss the variation of ionization energy of elements along a period and in a group. How did Allred and Rochow define electronegativity? Calculate the electronegativity of carbon atom following Allred-Rochow approach (covalent radius of carbon = 0.77 Å). Why is acetylene more acidic than ethylene? **2+2+2+2 +2=10**

5. a. Write the difference between oxidation and reduction. **2+6+2 =10**

   b. Complete and balance the following reaction

   i) $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow$

   ii) $MnO_4^- + NO_2^- + H^+ \longrightarrow$

   c. Define disproportionation reaction with examples.

6. a. What is H-bonding? What are the required conditions to form H-bond? 2+2+6 =10

b. Explain why H_2O is liquid whereas H_2S is a gas?

c. Write short notes on-

i. Ion induced dipolar interaction

ii. Instantaneous dipolar interaction

iii. Ion dipole interaction

7. a. Why He_2 molecule does not exist? 2+3+3+2 =10

b. How O_2 molecule is paramagnetic explain with molecular orbital energy level diagram.

c. Calculate the bond order for N_2 molecule using molecular orbital energy level diagram.

d. Why ortho nitrophenol is more volatile than para nitrophenol?

8. a. Expain the formation of CO and NO molecule on the basis of molecular orbital theory. 6+4=10

b. Define lattice enthalpy. Calculate the lattice enthalpy of NaCl using Born Haber's Cycle.

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