

REV-01  
BSC/02/05



**B.SC. CHEMISTRY  
FIRST SEMESTER  
INORGANIC CHEMISTRY-I  
BSC – 101 OLD COURSE [REPEAT]  
[USE OMR FOR OBJECTIVE PART]**

2023/12

**SET  
A**

Duration : 3 hrs.

Full Marks : 70

[ Objective ]

Time : 30 min.

Marks : 20

*Choose the correct answer from the following:*

**1X20=20**

- The number of radial nodes present in 2p orbital is
  - 0
  - 1
  - 2
  - 3
- The energy of electron in first Bohr's orbit of H-atom is
  - 1312 kJ mol<sup>-1</sup>
  - 1312 kJ mol<sup>-1</sup>
  - 13.6 kJ mol<sup>-1</sup>
  - 13.6 kJ mol<sup>-1</sup>
- Which set of quantum numbers is not possible?
  - n = 3, l = 2, m = -1, s = - 1/2
  - n = 1, l = 0, m = 1, s = - 1/2
  - n = 2, l = 0, m = 0, s = + 1/2
  - n = 4, l = 3, m = 3, s = + 1/2
- The angular wave function depends on the quantum numbers
  - l and m
  - n and l
  - l and s
  - m and n
- The effective nuclear charge felt by a 2p electron of fluorine is
  - 4.85
  - 5.20
  - 5.55
  - 4.90
- The electronegativity is highest for
  - Cl
  - Br
  - F
  - I
- The correct order of size is
  - S<sup>2+</sup> > S<sup>+</sup> > S<sup>0</sup> > S<sup>-2</sup>
  - S<sup>2+</sup> > S<sup>+</sup> > S<sup>0</sup> > S<sup>-2</sup>
  - S<sup>2+</sup> > S<sup>0</sup> > S<sup>+</sup> > S<sup>-2</sup>
  - S<sup>+</sup> > S<sup>2+</sup> > S<sup>0</sup> > S<sup>-2</sup>
- Which element has the highest ionization energy
  - B
  - C
  - N
  - O
- The correct representation of electron affinity is
  - X (g) + e<sup>-</sup> → X<sup>-</sup> (g) + Energy (EA)
  - X (g) + e<sup>-</sup> → X<sup>-</sup> (g) - Energy (EA)
  - X (s) + e<sup>-</sup> → X<sup>-</sup> (g) + Energy (EA)
  - X (s) + e<sup>-</sup> → X<sup>-</sup> (s) + Energy (EA)

10. Allred-Rochow electronegativity of an element is
- |  |  |
|--|--|
| a. Directly proportional to covalent radius  | b. Directly proportional to square of covalent radius  |
| c. Inversely proportional to covalent radius | d. Inversely proportional to square of covalent radius |
11. The molecule in which the bond order increases upon addition of an electron is
- |                   |                   |
|-------------------|-------------------|
| a. O <sub>2</sub> | b. B <sub>2</sub> |
| c. P <sub>2</sub> | d. N <sub>2</sub> |
12. According to VSEPR theory, the molecule/ ion having ideal tetrahedral shape is
- |                                   |                                    |
|-----------------------------------|------------------------------------|
| a. SF <sub>4</sub>                | b. SO <sub>4</sub> <sup>2-</sup>   |
| c. S <sub>2</sub> Cl <sub>2</sub> | d. SO <sub>2</sub> Cl <sub>2</sub> |
13. The decreasing order of dipole moment of molecule is
- |   |   |
|---|---|
| a. NF <sub>3</sub> > NH <sub>3</sub> > H <sub>2</sub> O | b. NH <sub>3</sub> > H <sub>2</sub> O > NF <sub>3</sub> |
| c. H <sub>2</sub> O > NH <sub>3</sub> > NF <sub>3</sub> | d. NF <sub>3</sub> > H <sub>2</sub> O > NH <sub>3</sub> |
14. The shape of XeO<sub>2</sub>F<sub>2</sub> is
- |                          |                  |
|--------------------------|------------------|
| a. Distorted tetrahedral | b. Square planer |
| c. Trigonal bipyramidal  | d. Tetrahedral   |
15. The oxidation state of oxygen in peroxide is
- |       |       |
|-------|-------|
| a. -2 | b. -1 |
| c. 0  | d. 2  |
16. The dipole moment of BeF<sub>2</sub> is
- |      |                  |
|------|------------------|
| a. 1 | b. 0             |
| c. 2 | d. None of these |
17. The oxidation state of boron in NaBH<sub>4</sub>
- |       |       |
|-------|-------|
| a. +3 | b. -3 |
| c. 2  | d. -2 |
18. Among the following the iso electronic and iso structural pair is
- |  |   |
|--|---|
| a. CO <sub>2</sub> and SO <sub>2</sub>               | b. SO <sub>3</sub> and SeO <sub>3</sub>                             |
| c. NO <sub>2</sub> <sup>+</sup> and TeO <sub>2</sub> | d. SiO <sub>4</sub> <sup>4-</sup> and PO <sub>4</sub> <sup>3-</sup> |
19. The bond order of C<sub>2</sub> molecule is
- |      |      |
|------|------|
| a. 0 | b. 1 |
| c. 2 | d. 3 |
20. The hybridization in [Ni(CN)<sub>4</sub>]<sup>2-</sup>
- |                    |                     |
|--------------------|---------------------|
| a. Sp <sup>3</sup> | b. dsp <sup>2</sup> |
| c. Sp <sup>2</sup> | d. None of these    |

**( Descriptive )**

Time : 2 hrs. 30 min.

Marks : 50

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

1. a. (i) Mention two postulates of Bohr's theory. 3+2=5  
(ii) State the Pauli's exclusion principle.
  
- b. (i) Define hydrogen bonding. What are different types of hydrogen bonding? Explain with examples. 3+2=5  
(ii) Write the difference between p-type and n-type semiconductor.
  
2. a. (i) What is the significance of the principal quantum number? 3+3+2+2  
(ii) Hydrogen spectrum is an example of what type of spectrum. =10  
Explain.
  
- b. State the Fajan's rule.
  
- c. (i) Why  $\text{NH}_3$  has more dipole moment than  $\text{NF}_3$ ?  
(ii) Why alcohol is soluble in water?
  
3. a. (i) What is a normalized wave function? Discuss. 3+1+6  
(ii) What is the significance of the radial wave function? =10
  
- b. Write the electronic configuration of following species and calculate the bond order for each.  
 $\text{O}_2^+$ ,  $\text{O}_2^-$  and  $\text{N}_2^+$
  
4. a. (i) How can we express electron density with the help of Schrodinger wave equation? 3+2+5  
(ii) Mention two conditions that a wave function  $\Psi$  must satisfy to give meaningful solutions to the Schrodinger equation. =10
  
- b. Explain the different types of crystal defects in solids.
  
5. a. (i) State the Heisenberg uncertainty principle. 1+2+2+3  
(ii) Matter has both particle and wave nature. Justify the statement. +2=10  
(iii) Define van der Waals radius.

- b. (i) Write the postulates of Valence Shell Electron Pair Repulsion (VSEPR) theory.  
(ii) What are the difference between sigma ( $\sigma$ ) bond and pi ( $\pi$ ) bond?
6. a. (i) Explain on the basis of electronegativity why acetylene is more acidic than ethylene. 2+3+2+3  
=10  
(ii) How does the ionization energy of elements vary along a period and a group? Give reasons.
- b. (i) Write the radius rule and limitation.  
(ii) Explain the molecular orbital energy level diagram for CO molecule and calculate bond order for  $\text{CO}^+$  species.
7. a. (i) For a molecule AB, if  $X_A = 3.1$  and  $X_B = 2.1$ , what is the percent ionic character of A-B bond? 2+1+2+3  
+2=10  
(ii) Why do noble gases have zero electron affinity?  
(iii) Why is the bond angle of  $\text{NF}_3$  more than  $\text{PF}_3$ ?
- b. (i) Represent the cell which the following reaction takes place  

$$\text{Mg(s)} + 2\text{Ag}^+(0.0001\text{M}) \longrightarrow \text{Mg}^{2+}(0.130\text{M}) + 2\text{Ag(s)}$$
And Calculate its  $E_{\text{cell}}$  if  $E^{\circ}_{\text{cell}} = 3.17\text{V}$   
(ii) Calculate the equilibrium constant of the reaction  

$$\text{Cu(s)} + 2\text{Ag}^+(\text{aq}) \longrightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$$

$$E^{\circ}_{\text{cell}} = 0.46\text{V}$$
8. a. Calculate the effective nuclear charge 2+1+2+3  
+2=10  
(i) for a 2p electron of Cl  
(ii) for a 3d electron of Mn  
(iii) at the periphery of  $\text{Fe}^+$  ion.
- b. Complete the following the reaction  
(i)  $\text{Cr}_2\text{O}_7^{2-} + \text{NO}_2 + \text{H}^+ \longrightarrow$   
(ii)  $\text{MnO}_4^- + \text{I}^- + \text{H}_2\text{O} \longrightarrow$
- c. Define disproportionation reaction with one example.

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