Write the following information in the first page of Answer Script before starting answer

ODD SEMESTER EXAMINATION: 2020-21

Exam ID Number_____

Course_____   Semester_____

Paper Code _____Paper Title _____

Type of Exam: _____   (Regular/Back/Improvement)

Important Instruction for students:

1. Student should write objective and descriptive answer on plain white paper.
2. Give page number in each page starting from 1st page.
3. After completion of examination, Scan all pages, convert into a single PDF, rename the file with Class Roll No. **(2019MBA15)** and upload to the Google classroom as attachment.
4. Exam timing from 10am – 1pm (for morning shift).
5. Question Paper will be uploaded before 10 mins from the schedule time.
6. Additional 20 mins time will be given for scanning and uploading the single PDF file.
7. Student will be marked as ABSENT if failed to upload the PDF answer script due to any reason.

B.Sc. CHEMISTRY
FIRST SEMESTER
INORGANIC CHEMISTRY-I
BSC-101

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

(<u>PART-A : Objective</u>)

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

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

1. Stoichiometric compounds are those where the number of different types of atoms are:
    a. Not according to chemical formula
    b. Are as in Berthollide compounds
    c. Exactly according to the chemical formula
    d. None of the above

2. o-nitro phenol has:
    a. Higher melting point than p-nitro phenol
    b. Lower melting point than p-nitro phenol
    c. Has same melting point as p-nitro phenol
    d. None of the above

3. For an ionic compound to dissolve:
    a. The Madelung Energy must be overcome
    b. The two ions must have different lattice energies
    c. Two ions must have equal charges
    d. None of the above

4. Lanthanum is a:
    a. s-block element
    b. p-block element
    c. d-block element
    d. f-block element

5. Radius of a cation is always:
    a. Smaller than that of the atom of the element
    b. Larger than that of the atom of the element
    c. Same as the atom of the element
    d. None of the above

6. According to Fajan, a small positive charge favours:
    a. Coordination
    b. Electrovalency
    c. Covalency
    d. None of the above

7. With increase in atomic number, electron affinity:
    a. Increases along a group
    b. Increases along a period
    c. Remains unchanged in a group or period
    d. None of the above

8. Second ionization potential is:
    a. Smaller than first ionization potential
    b. Larger than first ionization potential
    c. Larger than third potential
    d. None of the above

9. The number of lone pairs in the Lewis diagram of following compounds CH_4, NH_3, H_2O, HF are:
    a. 1, 2, 3, 4
    b. 0, 1, 2, 3
    c. 0, 2, 3, 4
    d. 1, 2, 4, 5

10. The structure of BeH_2 structure can be explained by………. Hybridization in Be-atom.
    a. sp   **b.** sp^2
    c. sp^3 **d.** dsp^2

11. According to VSEPR theory the structure of ClF_3 is:
    a. T-shape   **b.** Tetrahedral
    c. TrigonalPlanar   **d.** Linear

12. According to MO theory, The HOMO of oxygen molecule contains two:
    a. σ-Bonding electron   **b.** σ*-Antibondingelectron
    c. π-Bonding electron   **d.** π*-Antibonding electron

13. A cricket ball weighing 100g is to be located within $0.1A^0$. What is the uncertainty in its velocity?
    a. 5.27×10^{-23} ms-1   **b.** 5.27×10^{-20} ms-1
    c. 4.27×10^{-23} ms-1   **d.** 3.27×10^{-25} m

14. The effective nuclear charge felt by a 3d electron of chromium atom is:
    a. 4.60   **b.** 5.60
    c. 2.50   **d.** 4.00

15. Electrovalent compounds are:
    a. Low melting   **b.** Insoluble in polar solvents
    c. Conductors in the fused state   **d.** None of the above

16. When an element of very low ionization potential reacts with an element of very high electron affinity:
    a. A covalent bond is formed   **b.** An ionic bond is formed
    c. A metallic bond is formed   **d.** No bond is formed

17. Factors affecting the value of lattice energy:
    a. The size of the ion   **b.** The charge of the ion
    c. The size of the ion and the charge of the   **d.** None of these
        ion

18. An electron is confined in a one dimensional box of length $1A^0$. Its ground state energy in electron volts:
    a. 37.6 eV   **b.** 47.6 eV
    c. 32.6 eV   **d.** 35.6 eV

19. An electron has a speed of 300 ms-1 accurate upto 0.001%. What is the uncertainty in locating its position?
    a. 1.93×10^{-2} m   **b.** 2.93×10^{-2} m
    c. 1.93×10^{-3} m   **d.** 4.93×10^{-4} m

20. The effective nuclear charge felt by 1s electron of helium atom?
    a. 1.9   **b.** 2.3
    c. 1.7   **d.** 2.5

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(PART-B : Descriptive)

Time : 2 hrs. 40 min.   **Marks : 50**

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

1. **a.** What are the defects observed in crystals?   2
    b. What is Schottky defect? How does it differ from Frenkel defect?   2+2=4
    c. How do you differentiate among conductor, semi-conductor and   4
    insulator?

2. **a.** Give a brief account of ion-dipole interaction with suitable example.   2
    b. What are screening effect and effective nuclear charge?   2
    c. Calculate the effective nuclear charge of aluminium (13) on the basis   2
    of Slater empirical formula.
    d. Describe how Allred Rochow worked out electronegativity value of   2
    an atom in terms of covalent radius, charge on the electron and
    effective nuclear charge?
    e. How does ionization enthalpy vary along a   2
    (i) group
    (ii) period, and why ?

3. Explain what you mean by Hybridization. Give the details of different   10
    hybridization, bond angle and shape of molecules.

4. **a.** Explain the bonding in H_2 molecule with the help of Molecular   5x2=10
    Orbital theory.
    b. Explain the shape of following molecule with VSEPR theory, SF_4, H_2O,
    NH_3, XeF_2 and PCl_5.

5. **a.** State and derive de Broglie's equation.   3+2+3+2=10
    b. Write the distinction between matter waves and electromagnetic
    waves.
    c. The kinetic energy of an electron has been found to be 5.76×10^{-15} J.
    Calculate the wave length associated with the electron.
    d. Calculate the effective nuclear charge at the periphery of chromium
    atom.

6. **a.** Discuss the basis of Hund's rule.   2+3+2+3=10
    b. What are the difference between the energy level diagram of
    hydrogen atom and that of a multi electron atom?
    c. State and explain Zeeman effect.
    d. What are the conditions of an eigen wave function?

7. **a.** Discuss the postulates of quantum mechanics or wave mechanics.   4+4+2=10
    b. Complete and balance the following redox reaction
    (i) $MnO_4^- + SO_3^{2-} + H^+ \longrightarrow$
    (ii) $Cr_2O_7^{2-} + NO_2^- + H^+ \longrightarrow$
    c. Define disproportionation reaction with examples.

8. **a.** Explain why the boiling points of hydrides of the first member of any   3+3+4=10
    group higher than that of the second member.

b. What is hydrogen bonding? Explain the necessary conditions for the formation of hydrogen bond.

c. How does Band theory explain metallic bonding?

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