

Total No. of Printed Pages—7

1 SEM TDC CHMH (CBCS) C 1

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(March)

CHEMISTRY

(Core)

Paper : C-1

(Inorganic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Find out the correct answer from the following : 1×6=6

(a) The de Broglie wavelength of a tennis ball of mass 66 g moving with a velocity 10 m s^{-1} is approximately

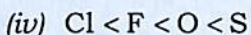
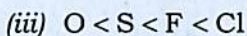
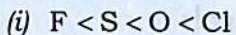
(i) 10^{-31} m

(ii) 10^{-35} m

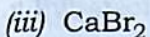
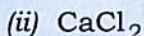
(iii) 10^{-34} m

(iv) 10^{-33} m

(b) The correct order of increasing electron affinity of elements F, Cl, O and S is



(c) Which of the following has the minimum melting point?



(d) The shape of XeO_2F_2 molecule is

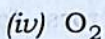
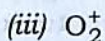
(i) trigonal bipyramidal

(ii) square planar

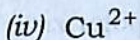
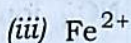
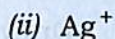
(iii) seesaw

(iv) tetrahedral

(e) Which of the following has the maximum bond length?



(f) Standard reduction potentials (E°) of Cd^{2+} , Ag^+ , Fe^{2+} and Cu^{2+} are -0.40 V, $+0.80$ V, -0.44 V and $+0.34$ V respectively. Which is the strongest reducing agent?



2. Answer the following questions : $2 \times 9 = 18$

(a) Discuss the physical significances of ψ and ψ^2 .

(b) Give all the possible values of quantum numbers l , m_l and m_s for electron when $n = 3$.

- (c) The second ionization energy of sulphur is higher than that of phosphorous. Explain.
- (d) Arrange O_2^{2-} , F^- , Na^+ and Mg^{2+} ions in the increasing order of size giving the proper explanation for the trend.
- (e) Write the favourable factors for the formation of ionic bond.
- (f) Using VSEPR theory, give the structure of the following molecules : 1+1=2
- (i) ClF_3
- (ii) PCl_5
- (g) Write a short note on shielding effect.
- (h) What is resonance? Draw the resonating structure of NO_3^- ion. 1+1=2
- (i) What do you mean by polarizing power of a cation? Explain.

3. Answer any two questions from the following : 4×2=8

- (a) (i) State Heisenberg's uncertainty principle. Give the mathematical expression for the same and explain.
- (ii) State and explain Pauli's exclusion principle. 2+2=4

(b) What are quantum numbers? What permitted values can these have? Give the significance of each quantum number. 1+1+2=4

(c) Draw the radial probability distribution curve for the orbitals with quantum numbers $n = 1, 2$ and 3 indicating the nodes. 4

4. Answer any *two* questions from the following : 3×2=6

(a) What is effective nuclear charge? Calculate the effective nuclear charge at the periphery of a Cu atom. 1+2=3

(b) Define electronegativity of an element. Calculate the electronegativity of oxygen atom using Allred-Rochow equation (covalent radius of O = 0.74 \AA). 1+2=3

(c) Give reasons for the following : $1\frac{1}{2} + 1\frac{1}{2} = 3$

(i) Size of Cl^- ion is greater than Cl atom while that of Na^+ ion is smaller than that of Na atom.

(ii) Electron affinity of fluorine is less than that of chlorine.

5. Answer any four questions from the following : 3×4=12

(a) What is lattice energy of a crystal?
Calculate the lattice energy of MgF_2
from the following data : 1+2=3

Sublimation energy of magnesium
 $= 146.4 \text{ kJ mol}^{-1}$

Dissociation energy of fluorine
 $= 158.8 \text{ kJ mol}^{-1}$

Ionization energy of magnesium (IE_2)
 $= 2186.0 \text{ kJ mol}^{-1}$

Electron affinity of fluorine
 $= -327.9 \text{ kJ mol}^{-1}$

Enthalpy of formation of MgF_2
 $= -1096.5 \text{ kJ mol}^{-1}$

(b) Draw the molecular orbital energy level diagram for CO molecule and calculate the bond order. 2+1=3

(c) What is dipole moment of a molecule? How does it affect the polarity of the molecule? Each C—O bond in CO_2 molecule is polar but CO_2 molecule is non-polar. Explain. 1+2=3

(d) Explain the following : $1\frac{1}{2}+1\frac{1}{2}=3$

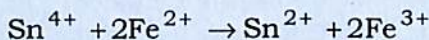
(i) *p*-nitrophenol has high-boiling point than *o*-nitrophenol.

(ii) Schottky defect lowers the density of ionic crystal while Frenkel defect does not.

(e) What is hybridization? On the basis of hybridization, discuss the formation of NH_3 and NH_4^+ . $1+2=3$

6. Answer the following questions : $1\frac{1}{2}+1\frac{1}{2}=3$

(a) Predict whether the reaction



will occur or not?

Given :

$$E_{\text{Sn}^{4+}/\text{Sn}}^{\circ} = 0.1 \text{ V and } E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^{\circ} = 0.77 \text{ V}$$

(b) Discuss the principle involved in quantitative estimation of Fe (II) by KMnO_4 .
