

Total No. of Printed Pages—7

1 SEM TDC CHMH (CBCS) C 1

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(November)

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. Choose the correct answer from the following : 1×6=6

(a) Heisenberg's uncertainty principle is

(i) $\Delta x \cdot \Delta p = \frac{h}{4\pi m}$

(ii) $\Delta x \cdot \Delta p = \frac{h}{mv}$

(iii) $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$

(iv) $\Delta x \cdot \Delta p \leq \frac{h}{4\pi}$

(2)

(b) The value of standard hydrogen electrode potential is

- (i) 0.00 volt
- (ii) 1.00 volt
- (iii) 0.10 volt
- (iv) 1.10 volt

(c) Which of the following has the highest lattice energy?

- (i) BeO
- (ii) MgO
- (iii) CaO
- (iv) SrO

(d) The increasing order of electron gain enthalpy among halogens is

- (i) $I < Br < Cl < F$
- (ii) $I < Br < F < Cl$
- (iii) $Br < I < Cl < F$
- (iv) $Br < I < F < Cl$

(3)

(e) The geometrical shape of SF_4 molecule is

- (i) pyramidal
- (ii) T-shaped
- (iii) seesaw
- (iv) tetrahedral

(f) Which of the following is paramagnetic?

- (i) CO
- (ii) NO^+
- (iii) CN^-
- (iv) O_2^-

2. Answer the following questions : 2×9=18

(a) Write the physical significance of ψ and ψ^2 . 1+1=2

(b) Write all possible quantum numbers for—
(i) valence electron of sodium;
(ii) last electron of fluorine. 1+1=2

(c) Bond angle of H_2O is lower than NH_3 . Why? 2

(4)

- (d) What do you mean by ionization potential? Why is the value of second ionization potential higher than the first ionization potential? $1+1=2$
- (e) Define electron affinity. Electron affinity value increases from nitrogen to fluorine in the periodic table. Explain giving reason. 2
- (f) Which of the following orbitals are not possible and why? 2
 $2p, 2s, 1p, 3f$
- (g) Using VSEPR theory, predict the structures of the following : $1 \times 2 = 2$
(i) ClF_3
(ii) XeF_2
- (h) Using Fazans' rule, explain that—
“ AlF_3 is high-melting solid while AlCl_3 is low-melting solid”. 2
- (i) Arrange the following in the increasing order of bond length : 2
 $\text{O}_2, \text{O}_2^-, \text{O}_2^+, \text{O}_2^{2+}$

(5)

3. Answer any *two* of the following questions :

$4 \times 2 = 8$

- (a) (i) State and explain the principles applied to build up the electronic configuration of nitrogen atom. 2
(ii) Determine the values of n, l, m and s for the electron of hydrogen. 2
- (b) Derive de Broglie equation. Calculate the wavelength associated with a moving electron having kinetic energy $1.375 \times 10^{-25} \text{ J}$.
(Given, $h = 6.626 \times 10^{-34} \text{ J-s}$) $2+2=4$
- (c) (i) Write the radial and angular wave functions for hydrogen atom. 2
(ii) Write a note on contour boundary. 2

4. Answer any *two* of the following questions :

$3 \times 2 = 6$

- (a) What is effective nuclear charge? Explain, on the basis of Slater's rule, why 4s-orbital is filled earlier than 3d-orbital taking potassium atom as an example. $1+2=3$
- (b) What do you mean by electronegativity? Calculate the electronegativity of fluorine using Allred-Rochow equation. (Covalent radius of fluorine = $0.72 \text{ \AA}$)

$1+2=3$

(6)

- (c) Nitrogen has positive electron gain enthalpy whereas oxygen has negative. However, oxygen has lower ionization enthalpy than nitrogen. Explain. 3

5. Answer any *two* of the following questions :

3×2=6

- (a) What do you mean by percentage of ionic character? HBr molecule has H—Br bond length 1.41×10^{-10} m and its dipole moment is 0.79×10^{-29} cm. Calculate the percentage of ionic character of HBr molecule. (Given, electronic charge = 1.602×10^{-19} C) .

1+2=3

- (b) What do you mean by hydrogen bond? What are the different types of hydrogen bond? Explain why *o*-hydroxybenzaldehyde is a liquid whereas *p*-hydroxybenzaldehyde is a solid.

$\frac{1}{2} + 1 + 1\frac{1}{2} = 3$

- (c) What do you mean by bond order of a diatomic molecule? The bond dissociation energy of C_2 (599 kJ mol⁻¹) decreases slightly on forming C_2^+ (513 kJ mol⁻¹) and increases greatly on forming C_2^- (818 kJ mol⁻¹). Why? 1+2=3

(7)

6. Write short notes on any *two* of the following : $2\frac{1}{2} \times 2 = 5$

- (a) Solvation energy
(b) Defects in solids
(c) Mulliken scale of electronegativity

7. Explain standard electrode potential. Explain two important applications of it in inorganic reaction. $1 + 1\frac{1}{2} + 1\frac{1}{2} = 4$
