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**1 SEM TDC CHMH (CBCS) C 1**

**2 0 2 4**

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

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(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)  $Br < I < F < Cl$

(e) The geometrical shape of  $\text{SF}_4$  molecule is

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

(f) Which of the following is paramagnetic?

- (i) CO
- (ii)  $\text{NO}^+$
- (iii)  $\text{CN}^-$
- (iv)  $\text{O}_2^-$

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

(a) Write the physical significance of  $\psi$  and  $\psi^2$ . 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  $\text{H}_2\text{O}$  is lower than  $\text{NH}_3$ . Why? 2

(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 : 1×2=2

(i)  $\text{ClF}_3$

(ii)  $\text{XeF}_2$

(h) Using Fazans' rule, explain that—  
“ $\text{AlF}_3$  is high-melting solid while  $\text{AlCl}_3$  is low-melting solid”. 2

(i) Arrange the following in the increasing order of bond length : 2

$\text{O}_2, \text{O}_2^-, \text{O}_2^+, \text{O}_2^{2+}$

3. Answer any *two* of the following questions : 4×2=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  $1.375 \times 10^{-25}$  J.

(Given,  $h = 6.626 \times 10^{-34}$  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 : 3×2=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

- (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  $1.41 \times 10^{-10}$  m and its dipole moment is  $0.79 \times 10^{-29}$  cm. Calculate the percentage of ionic character of HBr molecule. (Given, electronic charge =  $1.602 \times 10^{-19}$  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  $C_2$  ( $599 \text{ kJ mol}^{-1}$ ) decreases slightly on forming  $C_2^{\oplus}$  ( $513 \text{ kJ mol}^{-1}$ ) and increases greatly on forming  $C_2^{\ominus}$  ( $818 \text{ kJ mol}^{-1}$ ). Why? 1+2=3

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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.  $1 + 1\frac{1}{2} + 1\frac{1}{2} = 4$

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