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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) The uncertainty in position of a stationary electron is

(i) zero

(ii) 9.1×10^{-31} m

(iii) 1.6×10^{-19} m

(iv) undefined

(2)

(b) The maximum number of hydrogen bonds that a water molecule can form is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(c) The pair of species with the same bond order is

(i) O_2^{2-} , B_2

(ii) O_2^+ , NO^+

(iii) NO , CO

(iv) N_2 , O_2

(d) The correct order of electronegativities of N, O, F and P is

(i) $F > N > P > O$

(ii) $F > O > P > N$

(iii) $F > O > N > P$

(iv) $N > O > F > P$

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(Continued)

(3)

(e) In which of the following pairs of species, both species have similar geometry?

(i) CO_2 , SO_2

(ii) NH_3 , BH_3

(iii) CO_3^{2-} , SO_3^{2-}

(iv) SO_4^{2-} , ClO_4^-

(f) The species in which the N-atom is in a state of sp -hybridization is

(i) NO_2^+

(ii) NO_2^-

(iii) NO_3^-

(iv) NO_2

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

(a) Write Schrödinger's wave equation and give the meanings of the symbols used there. 1+1=2

(b) At normal temperature, H_2O is liquid but H_2S is gas. Explain. 2

24P/3

(Turn Over)

(4)

- (c) IE_1 of beryllium is higher than IE_1 of boron but IE_2 of beryllium is lower than IE_2 of boron. Explain. 2
- (d) What are normalized and orthogonal wave functions? 1+1=2
- (e) The formation of $F^-(g)$ from $F(g)$ is exothermic while that of $O^{2-}(g)$ from $O(g)$ is endothermic. Explain. 2
- (f) Discuss the conditions necessary for the formation of electrovalent bond. 2
- (g) Using VSEPR theory, predict the structures of the following : 1×2=2
(i) ClF_3
(ii) PCl_5
- (h) Write a note on partial ionic character of covalent bond. 2
- (i) Predict the shape of the molecule when the valence shell of the central atom contains—
(i) two bond pairs and one lone pair;
(ii) four bond pairs and one lone pair. 1+1=2

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(Continued)

(5)

3. Answer the following questions (any two) : 4×2=8
- (a) (i) State and explain Pauli's exclusion principle. 2
(ii) Write the all possible quantum numbers for the valence shell electron of sodium. 2
- (b) (i) State Heisenberg's uncertainty principle. Give its mathematical expression. 2
(ii) Write the electronic configurations of Fe^{2+} and Mn^{2+} ions. 1+1=2
- (c) (i) Write the radial and angular wave functions for hydrogen atom. 2
(ii) Write a note on contour boundary. 2
4. Answer the following questions (any two) : 3×2=6
- (a) What is effective nuclear charge? Calculate the effective nuclear charge for—
(i) 3d-electron of chromium;
(ii) 2p-electron of fluorine. 1+1+1=3

24P/3

(Turn Over)

(6)

(b) What do you mean by electronegativity of an element? Discuss the Allred-Rochow scale of measurement of electronegativity of an atom. $1+2=3$

(c) State and explain the Slater's rules for calculating the effective nuclear charge of an atom. 3

5. Answer the following questions (any two) : $3 \times 2 = 6$

(a) Draw the molecular orbital energy level diagram for N_2 -molecule. Explain the magnetic property and bond order of N_2 -molecule. $2 + \frac{1}{2} + \frac{1}{2} = 3$

(b) Write the importance required for the linear combination of atomic orbitals (LCAO) to form molecular orbitals. 3

(c) Predict the shapes of SF_6 , SF_4 and SF_2 molecules on the basis of hybridization. $1+1+1=3$

6. Write short notes on (any two) : $2\frac{1}{2} \times 2 = 5$

(a) Fajan's rule

(b) Hydrogen bond

(c) Born-Haber cycle

24P/3

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(7)

7. What is 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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