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1 SEM TDC CHMH (CBCS) C 1

2019

(December)

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

(b) The standard electrode potentials of four electrodes are

Electrode :	$Zn^{2+}\|Zn$	$Cd^{2+}\|Cd$	$Ag^{+}\|Ag$	$Fe^{3+}\|Fe$
E° (V) :	–0·76	–0·40	0·80	–0·44

Which of the following cells is not feasible?

(i) $Zn|Zn^{2+}||Cd^{2+}|Cd$

(ii) $Fe|Fe^{3+}||Zn^{2+}|Zn$

(iii) $Cd|Cd^{2+}||Ag^{+}|Ag$

(iv) $Fe|Fe^{3+}||Ag^{+}|Ag$

(c) The electronegativity of C, N, P and Si increases in the order

(i) C < N < Si < P

(ii) N < Si < C < P

(iii) Si < P < C < N

(iv) P < Si < N < C

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

(i) BeO

(ii) MgO

(iii) CaO

(iv) SrO

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(e) The geometrical shape of ClF_3 molecule is

(i) pyramidal

(ii) trigonal planar

(iii) T-shape

(iv) tetrahedral

(f) Which of the following is paramagnetic?

(i) O_2^-

(ii) CO

(iii) NO^+

(iv) CN^-

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

(a) What are normalized and orthogonal wave functions? 1+1=2

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

(c) Arrange H_2O, H_2S, H_2Se and H_2Te in the increasing order of bond angle, giving the proper explanation for this trend. 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

$1p$, $2s$, $2p$ and $3f$

(g) Using VSEPR theory, predict the structures of the following : 1×2=2

(i) SF_4

(ii) XeF_2

(h) Using Fazans' rule, explain that "AlF_3 is high-melting solid while $AlCl_3$ is low-melting volatile solid". 2

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

O_2, O_2^-, O_2^+, 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 valence shell electron of potassium. 2

(b) Derive de Broglie equation. Calculate the wavelength associated with a moving electron having kinetic energy $1{\cdot}375\times10^{-25}$ J. ($h = 6{\cdot}626\times10^{-34}$ 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 4*s* orbital is filled earlier than 3*d* orbital taking potassium atom as an example. 1+2=3

(b) What do you mean by electronegativity of an element? Calculate the electronegativity of fluorine using Allred-Rochow equation. (Covalent radius of fluorine = 0·72 Å) 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 $1{\cdot}41\times10^{-10}$ m and its dipole moment is $0{\cdot}79\times10^{-29}$ cm. Calculate the percentage of ionic character of HBr molecule. (Given, electronic charge = $1{\cdot}602\times10^{-19}$ 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. ½+1+1½=3

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(c) What do you mean by bond order of a 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

6. Write short notes on any *two* of the following : 2½×2=5

(a) Solvation energy

(b) Defects in solids

(c) Mulliken-Jaffe electronegativity scales

7. What is standard electrode potential? Explain two important applications of its inorganic reaction. 1+1½+1½=4

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