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3 (Sem-1/CBSC) CHE HC 1.....

2020

(Held in 2021)

CHEMISTRY /sta

(Honours)

Paper : CHE-HC-1016

(Inorganic Chemistry-I)

Full Marks : 60

Time : Three hours

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

1. Choose the correct answer from the following: 1×7=7

(a) The number of unpaired electrons present in the ground state electronic configuration of chromium is —

(i) 4

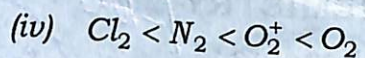
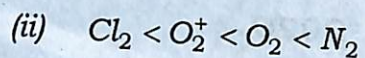
(ii) 5

(iii) 3

(iv) 6.

Contd.

(b) Arrange the following in the increasing order of the bond energy :



(c) Predict the shape of the molecule/ion of ClF_3 and I_3^- :

(i) ClF_3 : Planar triangular,
 I_3^- : pyramidal

(ii) ClF_3 : Planar triangular,
 I_3^- : linear

(iii) ClF_3 : T-shaped, I_3^- : V-shaped

(iv) ClF_3 : T-shaped, I_3^- : linear.

(d) The four quantum numbers of the unpaired electron of fluorine atom is —

(i) $n = 2, l = 1, m = -1, s = +\frac{1}{2}$

(ii) $n = 2, l = 2, m = -1, s = +\frac{1}{2}$

(iii) $n = 2, l = 1, m = -1, s = 1$

(iv) $n = 2, l = 1, m = -2, s = +\frac{1}{2}$

(e) Which of the following is used as redox indicator during the quantitative analysis of iron by $K_2Cr_2O_7$?

(i) Phenolphthalein

(ii) Methylene blue

(iii) Diphenylamine

(iv) Acid orange.

(f) Effective nuclear charge (Z_{eff}) experienced by an 4d electron of Fe atom is —

(i) 3.75

(ii) 6.25

(iii) 5.60

(iv) 7.30.

(g) Radius of Na^+ and Cl^- are 95 pm and 181 pm respectively. Coordination number of Na^+ ion is —

(i) 4

(ii) 6

(iii) 12

(iv) 8.

(e) Write briefly about the band theory of metallic bonding. With the help of this theory, define semiconductor and insulators. 2+3=5

4. Answer the following questions :

10×3=30

[Answer **either** (a) **or** (b), **either** (c) **or** (d) and **either** (e) **or** (f)]

Either

(a) (i) Define lattice energy. Deduce the Born-Landé equation for calculation of lattice energy. 2+4=6

(ii) Explain the use of hydration energy and lattice energy to describe the solubility of alkali halides in water. 4

Or

(b) (i) Van der Waals' radius of Cl is more than that of its covalent radius. Explain. 2

(ii) Explain why the absolute size of an atom or ion cannot be defined in an exact manner. 2

(iii) In between Fe^{2+} and Fe^{3+} , select the most electronegative one and give reason. 1

(iv) What is ionization enthalpy? What are the factors affecting ionization energy? Define successive ionization energy. 1+2+2=5

Either

(c) (i) Define normalized and orthogonal wave function. Normalize the function $\psi = x^2$ over the interval $0 \leq x \leq k$ (k is a constant). 2+2+3=7

(ii) State Pauli's Exclusion Principle and give its application for arrangement of electron in an orbital. 1+2=3

Or

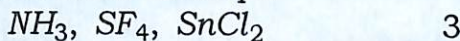
(d) (i) Explain radial and angular wave function of hydrogen atom. Give the significance of radial and angular distribution function of hydrogen atom. 2+3=5

- (ii) What are contour boundary and probability diagrams of atomic orbital? Explain why s orbital is spherical in shape. 3+2=5

Either

- (e) (i) Define electron gain enthalpy. Describe various factors on which the electron gain enthalpy of an atom depends. Suggest the trend of the electron gain enthalpy value of halogen atoms. 2+3+2=7

- (ii) Explain the shape of the following molecules with the help of hybridization concept.



Or

- (f) Write notes on :

- (i) Radius ratio rule and its limitations 3

- (ii) Quantum numbers and its significance 4

- (iii) Valence bond theory. 3