CHEMISTRY   2016

Time: 20 Minutes   Max. Marks: 17

SECTION A (MULTIPLE CHOICE QUESTIONS)

1.   **Choose the correct answer for each from the given options.**

(i)   The bond angle is maximum in this molecule:
* CH_4 * <u>CO_2</u>   * H_2O * NH_3

(ii)   Gases behave ideally at these conditions:
* High pressures and high temperatures
* High pressures and low temperatures
* <u>Low pressures and high temperatures</u>
* Low pressures and low temperatures

(iii)   Glass is a/an:
* Crystalline solid   * <u>Amorphous solid</u>
* Covalent solid   * Ionic solid

(iv)   Bond Energy is the greatest for:
* CH_4 * O_2 * <u>N_2</u>   * Cl_2

(v)   The bulk properties of a system, which are easily measurable, are known as:
* Microscopic properties   * Chemical properties
* <u>Macroscopic properties</u>   * Physical properties

(vi)   The characteristic of IO_3 is:
* 2   * <u>3</u>   * 4   * 5

(vii)   This molecule has zero dipole moment:
* NH_3 * <u>CO_2</u>   * H_2O * HCl

(viii)   The molarity of a solution containing 20g NaOH dissolved into 1 dm^3 solution will be:
* 0.1   * <u>0.5</u>   * 1   * 2

(ix)   The Octet rule is not valid for this molecule:
* N_2 * CO_2 * O_2 * <u>H_2</u>

(x)   The yield of Ammonia in Haber's process is favoured by:
* High pressure and high temperature
* <u>High pressure and low temperature</u>
* Low pressure and low temperature
* Low pressure and high temperature

(xi)   This ion has greatest degree of hydration:
* Na^+ * Mg^{+2} * <u>Al^{+3}</u>   * K^+

(xii)   The volume of 3.01×10^{23} molecules of N_2 gas at S.T.P. will be:
* $3dm^3$ * <u>$11.2dm^3$</u>   * $22.4dm^3$ * $28dm^3$

(xiii)   Rate = K $[NH_3]^2$. Keeping the other conditions same, if the concentration of NH_3 is increased by four times, then the initial rate of reaction X will be:
* 2X   * 4X   * 8X   * <u>16X</u>

(xiv)   This is not extensive property:
* Entropy   * <u>Viscosity</u>   * Enthalpy   * Internal Energy

(xv)   The extent of reaction will be maximum for this K_c value:
* 10^{-13} * 0.1   * 10   * <u>10^3</u>

(xvi)   This Hydrogen halide has the highest percentage of ionic character:
* <u>HF</u>   * HCl   * HBr   * HI

(xvii)   These have low values of activation energy:
* Slow reactions   * <u>Fast reactions</u>
* Moderate reactions   * Ionic reactions

CHEMISTRY   2016

Time: 2 Hours 40 Minutes   Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten part questions.   (40)

2.(i)   Differentiate any Two of the following:
   (a)   Continuous spectrum and Line spectrum
   (b)   Isomorphism and Polymorphism
   (c)   Polar bond and non-polar bond

(ii)   What volume of CO_2 measured at 20°C and 720 torr pressure will be produced by the reaction between 200 gm of Na_2CO_3 and HCl?
   $Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$

(iii)(a)   Simplify the following by using rules of significant figures:
$$\frac{92 \times 751 \times 173}{760 \times 297}$$

(b)   Draw the electronic structures of :
* Phosphorrus oxychloride   * Nitromethane

(iv)(a)   10 gm H_2SO_4 has been dissolved in excess of water to dissociate it completely into ions. Calculate the:
* Number of molecules in 10 gm of H_2SO_4
* Number of positive ions.

(b)   Define the following:
* Limiting Reactant   * Random Error

(v)   Calculate the heat of formation of M_2A at 25°C:
* $2M + \frac{1}{2} A_2 \rightarrow M_2A$ ($\Delta H = ?$)
* $M + Y_2A \rightarrow MAY + \frac{1}{2} Y_2$ ($\Delta H = -43.2$ KJ / mole)
* $Y_2 + \frac{1}{2} A_2 \rightarrow Y_2A$ ($\Delta H = -68.5$ KJ / mole)
* $M_2A + Y_2A \rightarrow 2MAY$ ($\Delta H = -63.2$ KJ / mole)

(vi)   1100 ml of CO_2 at a pressure of 500 torr, 1500 ml N_2 at a pressure of 400 torr and 800 ml of O_2 at a pressure of 600 torr are placed together in a container of 1000 ml capacity. Find the partial pressure of each gas.

(vii)   Define solubility. The solubility of Mg $(OH)_2$ at 25°C is 4.6 $\times 10^{-3}$ gm / $100cm^3$. What is the solubility product of Mg $(OH)_2$?

(viii)   For the reaction: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ the equilibrium mixture contains 0.25 M Nitrogen and 0.15 M Hydrogen gas at 25°C. Calculate the concentration of NH_3, given $Kc = 9.6$. The volume of the container is $1dm^3$.

(ix)(a)   If 16 ml of hydrogen diffuse in 30 sec, what volume of SO_2 will diffuse in the same time (30 sec.) under similar conditions?

(b)   If 1800 cals of heat is added to a system while the system does work equivalent to 2800 cals by expanding against the surrounding, what is the value of ΔE for the system?

(x)   Give scientific reasons for the following:
(a) H_2O forms concave meniscus while mercury forms convex meniscus.
(b)   Rate of diffusion of CO_2 and C_3H_8 gases are same.
(c)   Electron Affinity of noble gases is zero.
(d)   powdered Zinc reacts more vigorously with HCl than chunks of Zinc.

(xi)   Define Hydrogen bonding. State its characteristics and effects on the physical properties of a molecule.

(xii) a)   Write the electronic configuration of the following:
* Cu^+ (Z = 29)   * Br^- (Z = 35)

(b)   Using n + 1 rule, arrange 4d, 7s and 4f energy levels in ascending order of energy.

(xiii)   Enumerate the rules of assigning oxidation number for the elements.

(xiv)   The aqueous solution of 0.3M Mg $(OH)_2$ is 60% ionized. Calculate its pH.

(xv)(a)   Give the relationship between K_p and K_c.

(b)   For the reaction: $2N_2O_5 \rightarrow 4NO_2 + O_2$, calculate the rate constant when the initial concentration of N_2O_5 is 10.8g/dm^3 while the initial rate is 2.96 $\times 10^{-4}$ mole / dm^3.sec.

SECTION 'C' (DETAILED- ANSWER QUESTIONS)(28)

NOTE: Answer 2 questions from this section.

3.(a)   With the help of experiment of scattering of α – rays, explain the atomic model and conclusions.

(b)   Derive an expression for the radius of nth orbit for Hydrogen atom using Bohr's atomic midel.

(c)   Explain the origin of X-rays and describe the relationship between their wavelength and atomic number.

4.(a)   Define Electrovalent bond. Explain the formation of NaCl alongwith the energy changes involved. Also write three characteristics of Ionic compounds.

(b)   Explain the shapes of the following molecules on the basis of Electron pair repulsion model and Hybrid orbital model: (i) H_2O (ii) $BeCl_2$

(c)   State Boyle's, Charles' and Avogadro's Laws and derive an expression for the equation of state. Calculate the value of Gas constant in two different units.

5.(a)   State and explain the First Law of Thermodynamics. Show that $W = P\Delta V$ and $\Delta H = \Delta E + P\Delta V$.

(b)   Define standard Electrode potential. How is the electrode-potential of Zn determined?

(c)   State and explain the law of Mass action. Derive the expression of K_c for a general reversible reaction.