CHEMISTRY QUESTION PAPER

Time Duration: 2Hrs

Maximum Marks:40

Note : (i) All questions carry equal marks.

(ii) Write balanced chemical equations and draw neat diagrams wherever necessary.

(iii) Use of logarithmic table is allowed.

(iv) Figures to the right hand side indicate full marks.

(v) Answer to every question must be written on a new page.

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question : [8]

(i) The chemical formula of Ziegler-Natta catalyst is (1)

(a) $CuCl_2$ (b) $NiCl_2$

(c) $CrCl_3$ (d) $TiCl_4$

(ii) Isotonic solutions have the same (1)

(a) Density (b) Osmotic pressure

(c) Molality (d) Normality

(iii) The molecularity and order of the reaction, $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ are respectively (1)

(a) one and one (b) two and two

(c) three and three (d) two and three

(iv) Which of the following is an extensive property?

(a) Heat capacity (b) Density

(c) Surface tension (d) Specific heat

(v) The values of 'X' and 'Y' in the following transformation reaction are respectively

$$^{218}_{84}Ra \rightarrow {}^{206}_{82}Pb + X\left[{}^{4}_{2}He\right] + Y\left[{}^{0}_{-1}e\right] \quad (1)$$

(a) 4, 3 (b) 3, 4

(c) 2, 4 (d) 4, 2

(vi) Which of the following is NOT a Lewis acid? (1)

(a) $AlCl_3$ (b) $SnCl_4$

(c) CO_2 (d) NH_3

(vii) The time required to liberate one gram equivalent of an element by passing one ampere current through its solution is (1)

(a) 6·7 Hrs (b) 13·4 Hrs

(c) 19·9 Hrs (d) 26·8 Hrs

(viii) Heat of formation of CO gas at 300 K is –110 kJ at constant pressure. Its heat of formation at the same temperature but at the constant volume is

(Given : $R = 8{\cdot}314\ Jk^{-1}mol^{-1}$) (1)

(a) – 108·753 kJ (b) – 110 kJ

(c) 111·247 kJ (d) – 112·249 kJ

Q. 2. (A) Attempt any ONE **[8]**

(i) State and explain van't Hoff–Charles' law. (2)

(ii) Define and explain translational energy. (2)

(B) Attempt any ONE :

(i) Derive an expression for Ostwald's dilution law for acetic acid. (2)

(ii) Distinguish between electrolytic cell and galvanic cell. (2)

(C) Answer the following :

(i) Define and explain the term 'molecularity of a reaction' with suitable example. (2)

(ii) Write 'two' names and their chemical formulae of ores of zinc. (2)

Q. 3. (A) Attempt any ONE : **[8]**

(i) Define hydrolysis. Show that the degree of hydrolysis of salt of weak acid weak base is independent of concentration. (3)

(ii) What is natural radioactivity? Give 'four characteristics' of radioactivity. (3)

(B) Attempt any ONE :

(i) What is rate constant? Write 'two applications' of rate law. (3)

(ii) Transition elements show tendency to form large number of complexes. Explain. (3)

(C) Answer the following :

Define : (i) Colligative property

(ii) Standard electrode potential (2)

Q. 4. (A) Answer the following : **[8]**

Write 'two statements' of first law of thermodynamics.

Derive Kirchhoff's equation. (4)

(B) Answer any ONE :

(i) Describe the construction and working of Calomel electrode. (4)

(ii) Describe cryoscopic method to determine the molecular mass of a non-volatile solute. (4)

Q. 5. (A) Attempt any ONE **[8]**

(i) Calculate the heat of formation of diborane $[B_2H_{6(g)}]$ at 298 k if the heat of combustion of it is – 1941 kJ/mol and heats of formations of $B_2O_{3(s)}$ and $H_2O_{(g)}$ are –2368 kJ/mol and –241·8 kJ/mol respectively. (4)

(ii) Calculate hydrolysis constant, degree of hydrolysis and pH of 0·02 M potassium acetate solution at 298 K.
(Given : For acetic acid $K_a = 1{\cdot}8 \times 10^{-5}$ and $K_w = 1 \times 10^{-14}$.) (4)

(B) Attempt any TWO :

(i) Calculate the osmotic pressure of 4·5 g of glucose (Molar mass = 180) dissolved in 100 ml of water at 298 K.
(Given : R = 0·0821 L atm mol^{-1} k^{-1}) (2)

(ii) A solution of metal salt was electrolysed for 15 minutes, with a current of 1·5 A. The mass of a metal deposited was 0·00783 kg. Calculate the equivalent mass of metal. (2)

(iii) Calculate the binding energy of $^{209}_{83}Bi$ if its isotopic mass is 208·98 amu.
(Given : $M_H = 1{\cdot}0078$ amu , $M_n = 1{\cdot}0086$ amu.) (2)