2016

CHEMISTRY-1
(CHEM 1001)

Time Alloted : 3 Hours *Full Marks : 70*

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable

GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : **[10×1=10]**

   i) The Joule-Thomson expansion is

   (a) isobaric (b) isoentropic

   (c) isothermal (d) isoenthalpic

   ii) Anti-Markownikoff's addition of HBr is not observed in

   (a) 1-butene (b) 2-butene

   (c) propene (d) 1-pentene

iii) sp^2 hybridization gives rise to

(a) planar structure

(b) tetrahedral structure

(c) trigonal pyramidal structure

(d) octahedral structure

iv) Frenkel defect is found in

(a) NaCl (b) ZnS

(c) AgCl (d) FeS

v) Which of the following polymers is used for non-stick coating?

(a) polythene (b) teflon

(c) bakelite (d) polyaniline

vi) The function of electrolytic cell is to

(a) To convert chemical energy into electrical energy

(b) To convert electrical energy into chemical energy

(c) To convert chemical energy into heat energy

(d) To convert heat energy into chemical energy.

vii) Calomel electrode is reversible with respect to

(a) H^+ (b) Hg^{2+}

(c) CT (d) Hg^+

viii) The half-life period of a reaction is found to be directly proportional to the initial concentration. The order of the reaction is

(a) zero (b) one

(c) two (d) three

ix) Octane number of 2, 2, 4-trimethyl pentane is

(a) 0 (b) 25

(c) 50 (d) 100

x) Vulcainization makes a natural rubber

(a) Hard (b) More elastic

(c) Heat resistant (d) All of these

GROUP - B

2. (a) Show that the work done in a reversible process is greater than that in irreversible process.

(b) Calculate the values of q, w and ΔU for the expansion of 5 moles of an ideal gas reversibly and isothermally at 27°C from an initial volume of 50L to 100L.

(c) What do you mean by extensive and intensive properties of a system?

(d) State and explain Hess's law of constant heat summation.

(e) Depict the stretching modes of vibration of carbon dioxide molecule and from there select the IR active stretching mode. **3+3+2+2+(1+1) = 12**

3. (a) Prove that adiabatic P-V curve is steeper than isothermal P-V cure.

(b) 2.5 moles of an ideal gas expands reversibly and isothermally from a volume of 4 liters to 40 liters at 300K. Calculate ΔS, Given $R=8.314JK^{-1}mo.^{-1}$.

(c) Prove that $C_P-C_V=R$, for one mole of ideal gas.

(d) What are the applications of UV-VIS spectroscopy?

3+3+3+3 = 12

GROUP - C

4. (a) Justify your observation when sodium chloride crystal is heated with sodium vapour?

(b) Give a brief account of the different types of van der Waal forces acting between molecules of covalent compounds.

(c) Arrange the following free radical according to their increasing stability order and justify your answer

Ph_3C, $(Ph)_2CH$, $PhCH_2$

(d) Calculate the pH of a solution when 50ml 0.1 (N) acetic acid is mixed with 50ml 0.1 (N) sodium acetate solution. Given pK of acetic acid is 4.74.

2+6+(1+1)+2 = 12

5. (a) Does Be_2 molecule exist? Justify using molecular orbital theory.

(b) Why does ZnO change colour on heating?

(c) Write down the products with streochemistry when cis-2-butene is treated with bromine in CCl_4.

(d) Write down the major product and explain when ethyl bromide is treated with alcoholic silver cyanide.

(c) Define pH of a solution. The pH of an HCl solution is 2. Find out the amount of acid present in gm/L.

(1+2)+2+2+2+(1+2) = 12

Group - D

6. (a) How does a homogeneous catalyst increase the rate of a reaction, explain with an example.

(b) State the Kohlrausch's law of independent migration of ions and briefly explain its applications.

(c) Write the half cell reactions and total cell reaction and calculate the E°_{cell}, free energy change under standard conditions and the equilibrium constant of the cell reaction for the following cell at 25°C

$Zn(s)|Zn^{2+}(aq)||Cu^{2+}(aq)|Cu(s)$

$E^\circ_{Zn^{2+}|Zn}$ = -0.76V, $E^\circ_{Cu^{2+}|Cu}$=+0.34V

3+(1+3)+5 = 12

7. (a) Deduce the expression for the rate constant of z zero order reaction and its half-life. What is the nature of the plot if concentration of the reactant is plotted against time for a zero order reaction?

(b) Explain the effect of dilution on equivalent conductance for a strong and weak electrolyte.

(c) At 25°C, the EMF of the cell $Zn(s)|ZnSO_4(aq)||\ Hg_2SO_4(aq)|Hg(l),Pt(s)$ is 1.42volt. Calculate ΔG, ΔH and ΔS for the reaction, given $(\delta E/\delta T)_P = -1.2 \times 10^{-3}$ volt/degree at 25°C.

(2+2+1)+(2+2)+3 = 12

GROUP - E

8. (a) Write down the difference between LDPE and HDPE.

(b) Giving suitable example explain the term "Synthetic Metal".

(c) What is the difference between nylon-6 and nylon-6,6?

(d) What do you mean by knocking? How TEL can be used to reduce knocking in an internal combustion petrol engine?

(e) What are the main constituents of aviation gasoline and jet gasoline?

3+2+1+(2+2)+2 = 12

9. (a) Define weight average molecular weight with mathematical expression.

(b) Write down the mechanism of radical polymerization with suitable example.

(c) What do you mean by ultimate analysis of a coal sample?

(d) 2 g of a coal sample in a Kjeldahl experiment produces ammonia, which was completely absorbed in 25ml of 0.1(N) NaOH for neutralisation. Calculate the % of N present in the coal sample.

(e) What is sweetening of petrol? Give chemical reaction involved.

4+4+4 = 12