2014

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 alternative for the following : **[10×1=10]**

   i) F centres are found in crystals due to

      (a) electrons trapped in cation vacancies

      (b) electrons trapped in anion vacancies

      (c) presence of interstitial cations

      (d) none of these

   ii) Joule-Thomson expansion of a gas is

      (a) isothermal   (b) isoenthalpic

      (c) isobaric   (d) isochoric

   iii) An example of thermosetting plastic is

      (a) PVC   (b) Nylon

      (c) Polythene   (d) Bakelite

iv) The condition for spontaneity of a process at all temperature is

(a) $\Delta H > 0$ and $\Delta S > 0$ (b) $\Delta H < 0$ and $\Delta S > 0$

(c) $\Delta H > 0$ and $\Delta S < 0$ (d) $\Delta H < 0$ and $\Delta S < 0$

v) Hydrolysis of ethyl acetate follows the

(a) second order reaction kinetics

(b) first order reaction kinetics

(c) zero order reaction kinetics

(d) pseudo first order reaction kinetics

vi) During mixing, entropy

(a) increases   (b) decreases

(c) remains unchanged   (d) can not be predicted

vii) Cetane number of α-methyl naphthalene is

(a) 100   (b) 0

(c) 50   (d) 75

viii) The highest ranking coal is

(a) anthracite   (b) bituminous

(c) lignite   (d) peat

ix) The ion conductance of an ion depends on its

(a) charge only

(b) speed only

(c) charge and speed

(d) charge, speed and hydration

x) The strength of an acid depends on the

(a) number of H atoms present in its molecule

(b) concentration of protons given by it on ionisation

(c) concentration of water

(d) concentration of acid

GROUP - B

2. (a) What is a Carnot cycle? Derive the expression for the efficiency of a reversible Carnot cycle working between the temperatures T_2 and T_1 where $T_2 > T_1$.

   (b) Calculate the change in Gibbs free energy when two moles of an ideal gas expands from 10 to 20 dm^3 at 27^0C.

   (c) Write down the mathematical form of Lambert-Beer's Law and explain each term.

   (d) State two applications of IR spectroscopy.

$$(2+4)+2+2+2 = 12$$

3. (a) How do you show that for an ideal gas $C_P - C_V = R$?

   (b) What do you mean by chemical potential? Using the concepts of chemical potential derive Gibbs-Duhem equation.

   (c) On passing monochromatic light through a 0.5M solution in a cell of 2 cm thickness, the intensity of the transmitted light was reduced to 40%. Calculate the molar extinction coefficient. $3+(2+5)+2 = 12$

GROUP - C

4. (a) Draw the conductometric titration curve of strong acid vs weak base and explain the salient features of the curve.

   (b) Describe the principle of a Daniel Cell. Write seperately the electrode reactions and overall cell reaction.

   (c) Write down Arrhenius equation for the activation energy of a reaction and explain the terms used. Plot lnK vs l/T and write significance of the slope.

$$(1+4)+4+3 = 12$$

5. (a) Explain a pseudounimolecular reaction with an example.

   (b) Give an example of a reference electrode. Write the half cell reaction.

   (c) State and explain Kohlrausch's Law of independent migration of ions.

   (d) Distinguish between order and molecularity of a reaction.

   $5+2+3+2 = 12$

Group - D

6. (a) Predict the hybridisation and shape of BCl_3, CO_2, SF_6.

   (b) Arrange the following in increasing order of bond lenghts: O_2, O_2^+, O_2^-.

   (c) Give an example of acidic buffer and write the Henderson equation for it.

   (d) Disscuss the role of solvent on S_N^1 reaction.

   (e) Phosphorous forms both PF_3 and PF_5 but nitrogen forms only NF_3 — Explain. $3+2+2+2+3 = 12$

7. (a) "The color of ZnO crystal is white cold and yellow when hot" — Explain.

   (b) Distinguish between Frenkel defects and Schottky defect.

   (c) Differentiate between Markownikoff and anti-Markownikoff addition of HBr on propene.

   (d) Explain that alcohols are weaker acids than phenols but are stronger nucleophiles. $2+3+4+3 = 12$

GROUP - E

8. (a) Distinguish between addition and condensation polymerization.

   (b) Define GCV and NCV.

   (c) Write the synthesis and uses of Bakelite.

   (d) What is LPG? Why is it used as a domestic fuel?

   $$3+4+3+(1+1) = 12$$

9. (a) Write a short note on vulcanization of natural rubber.

   (b) A coal sample has the following composition by weight, C=90%, O=3%, S=0.5%, N=0.5%, and H=4.6%. Calculate the GCV and NCV.

   (c) Define isotactic, syndiotactic & atactic polymers with examples.

   (d) Write the mathemetical expressions for weight average molecular weight and number average molecular weight of a polymer. $$4+3+3(1+1) = 12$$