require 5ml of 0.1(N) NaOH for neutralisation. Calculate the % of N present in the coal sample.

(e) What is sweetening of petrol?

$$2 + 3 + 2 + 3 + 2 = 12$$

9. (a) Write down the differences between thermoplastic and thermosetting polymer.

(b) Draw the structural unit and uses of Natural rubber.

(c) What is TEL? How it can be used to reduce knocking in internal combustion engine?

(d) What are the main constituents of water gas and coal gas?

$$3 + 2 + 3 + (2 + 2) = 12$$

CHEMISTRY - I
(CHEM 1001)

Time Allotted : 3 hrs **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) Entropy of the universe is
   (a) increasing
   (b) decreasing
   (c) remaining same
   (d) dependent on conditions.

   (ii) Schottky defect is found in
   (a) NaCl
   (b) ZnS
   (c) AgCl
   (d) FeS.

   (iii) Structure of PF_5 is
   (a) planar
   (b) octahedral
   (c) trigonal bipyramidal
   (d) square pyramidal.

   (iv) At 25°C, the standard hydrogen electrode has been assigned electrode potential
   (a) positive
   (b) negative
   (c) zero
   (d) no definite value.

   (v) Which of the following polymers is used for non-stick coating?
   (a) Polythene
   (b) Teflon
   (c) Bakelite
   (d) Polyaniline.

   (vi) Leakage of LPG cylinder can be detected by adding
   (a) oxane
   (b) 1,2-dibromoethane
   (c) mercaptan
   (d) n-heptane.

   (vii) The function of electrolytic cell is to
   (a) convert chemical energy into electrical energy
   (b) convert electrical energy into chemical energy
   (c) convert chemical energy into heat energy
   (d) convert heat energy into chemical energy.

(viii) The half-life period of a reaction is found to be independent 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) Cellulose is a
(a) natural polymer   (b) synthetic polymer
(c) semisynthetic polymer   (d) none of (a), (b) & (c).

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 50 L to 100 L.

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

(d) Depict the stretching modes of vibration of carbon dioxide molecule and from then select the IR active stretching mode.

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

3. (a) What are the limitations of first law of thermodynamics?

(b) What do you mean by entropy? Derive the expression for entropy change of an ideal gas undergoing reversible isothermal expansion from initial volume V_1 to final volume V_2.

(c) At NTP, 11.2 litre of oxygen were mixed with 36 gm of Helium. Calculate the entropy change due to mixing of these gases. [M.W. of dioxygen and helium are 32 and 4, respectively]

(d) Write down the applications of UV spectroscopy.

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

Group – C

4. (a) Differentiate between Schottky and Frenkel defect with example.

(b) Water is liquid while hydrogen sulphide is gas at room temperature though oxygen and sulphur belong to same group in the periodic table-explain.

(c) Aniline is a weaker base than methyl amine-why?

(d) Write down the electronic configuration of peroxide ion using MOT. From then find out the bond order and magnetism.

$$4 + 2 + 2 + (2 + 1 + 1) = 12$$

5. (a) State and explain Ostwald's dilution law for a weak electrolyte

(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.
$(CH_3)_3C^*, (CH_3)_2CH^*, CH_3CH_2^*$

(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.

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

Group – D

6. (a) Deduce the expression for the rate constant of a 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) What are the differences between an electrolytic cell and a galvanic cell?

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

7. (a) Write the Arrhenius equation and explain the terms, from then find out the activation energy of a reaction?

(b) Define specific conductance and equivalent conductance. Show how they are related?

(c) Explain the working principle of calomel electrode.

(d) Write the half cell reaction and construct the galvanic cell for the following spontaneous reaction:
$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

$$3 + 3 + 3 + 3 = 12$$

Group – E

8. (a) Define weight average molecular weight of a polymer 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 25 ml of 0.1(N) H_2SO_4 and the excess acid