3 Yr. Degree/4 Yr. Honours 2nd Semester Examination, 2024 (CCFUP)

Subject : Chemistry

Course: CHEM2011

(Basic Chemistry)

Time: 2 Hours **Full Marks: 40**

The figures in the right hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions from the following: 2×5=10

(a) Calculate the formal charge on central S atom in $S_2O_3^{2-}$.

(b) What do you mean by mean free path?

(c) Give one example of ring-chain tautomer.

(d) Differentiate between chiral centre and stereogenic centre.

(e) Give the names of two redox indicators.

(f) For very small value of radius ratio (r^+/r^-), the molecule becomes less stable. Why?

(g) What is ambident nucleophile? Give one example.

(h) Explain the nature of variation of surface tension with temperature.

2. Answer *any two* questions from the following: 5×2=10

(a) What is Bent's rule? From this rule explain the geometry of $^{\cdot}CH_3$ and $^{\cdot}CF_3$. 2+3

(b) PH_5 does not exist but PCl_5 does. — Justify. Dipole moment of NF_3 is much lesser than that of NH_3. Explain. 3+2

(c) What is inversion temperature in Joule-Thomson experiment? If hydrogen is used in Joule-Thomson expansion, what will happen? Justify your answer. Explain the factor(s) on which the efficiency of Carnot engine depends. 1+(1+1.5)+1.5

(d) A particle of mass 10^{-12}g at 27°C is maintaining kinetic molecular theory. What will be the *rms* speed of that particle? What are collision frequency and compressibility factor? 3+(1+1)

3. Answer *any two* questions from the following: 10×2=20

(a) (i) At NTP, 19.6 L of hydrogen is mixed with 2.8 L of oxygen. Calculate the change of entropy.

(ii) $C_p - C_v = \alpha^2 TV/\beta$ (Symbols are of usual meaning.)

(iii) From the given data, comment on the spontaneity of the vaporisation of water. What will be the boiling point of water at this condition?
(Given $\Delta H = 9735$ Cal, $\Delta S = 25$ Cal/°C, T = 300 K, Pressure = 1atm) 2+3+(2+3)

(b) (i) Br^- can be oxidised by $KMnO_4$ in lower H^+ concentration but to oxidise Cl^- much higher concentration of H^+ is required. Why?

(ii) What is Latimer diagram? Mention its utility.

(iii) Why is addition of $SnCl_2$ done dropwise in estimation of Fe(III) by $K_2Cr_2O_7$? Why is excess $HgCl_2$ added at a time in this process? 3+(2+1)+(2+2)

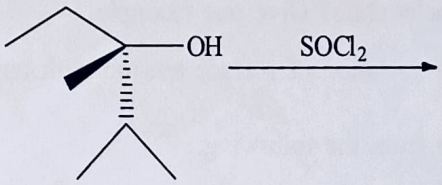
(c) (i) What do you mean by pseudoasymmetric centre? Explain with proper example.

(ii) Mention and show what type of symmetry present in the following molecules (a) $CHCl_3$ (b) C_6H_6

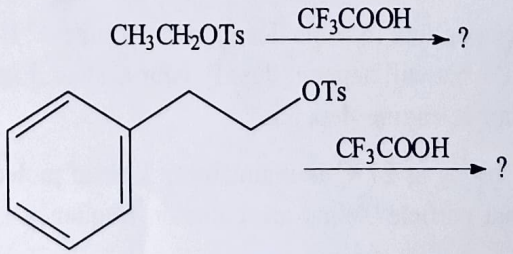
(iii) What is symmetry number? What is the symmetry number of CH_4?

(iv) What is *meso* compound? What is specific rotation of a compound? How can we decide whether an observed rotation of an optically active compound is +110° or –250°?
(1+1)+(1.5+1.5)+(1+1)+(1+1+1)

(d) (i) What do you mean by S_Ni reaction? Give the product of the following reaction with mechanism. If the reaction is carried out in pressence of pyridine, what will be the product?



(ii) Give the product(s) of the following solvolysis reaction with mechanism. Compare the rate of the solvolysis of the two cases and justify your answer.



(iii) Dehydrohalogenation of *Erythro*-1-bromo-1, 2-diphenylpropane by action of sodium ethoxide in ethanol yields (Z)-1-methyl-stilbene. Similar dehydrohalogenation of another enantiomeric forms of 1-bromo-1, 2-diphenylpropane yields (*E*)-1-methyl-stilbene. Provide an explanation for the results. (1+2+1)+(1+2)+3