53 (CY 201) ENCH

2013C

(December)

ENGG. CHEMISTRY

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Write short notes on : 3×2=6

   (i) Terglene

   (ii) Goverment Regulated Rubber

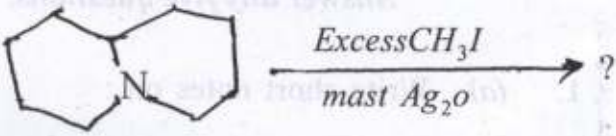
   (iii) Nylon-6,6

   (b) How the molecular weight of a polymer can be determined by Viscosity measurement methods ? Draw the necessary plot explaining Intrinsic Viscosity. 3+2=5

(c) A solution contains equal number of particles with molar masses $1\times10^{8}\ gmol^{-1}$ and $20\times10^{6} kgmol^{-1}$ respectively. Calculate the number average molecular weight $(\overline{M}_N)$ and weight average molecular weight $(\overline{M}_w)$. 3+3=6

(d) Distinguish between homopolymer and copolymer. 1+2=3

2. (a) What is the product of the following reaction ? Give the proper mechanism for this elimination reaction 1+4=5



(b) Two reactions are given

$$CH_3Br + OH^{\ominus} \longrightarrow CH_3OH + Br^{\ominus}$$

$$(CH_3)_3 - Br + OH^{\ominus} \longrightarrow (CH_3)_3 - OH + Br^{\ominus}$$

give the mechanism for both the reactions explaining nucleophilic substitution, Draw the Energy-Profit diagram for both the reactions. 3×2+2=8

(c) Write short notes on : 3×2=6

(i) Addition Reactions

(ii) Saytzeff's rule

(d) What is the main difference between unimolecular elimination and bimolecular elimination reaction ? 1

3. (a) Define activation energy. Give the Arrhenius equation for activation energy determination. 1+2=3

(b) From the following data at a certain temperature show that decomposition of H_2O_2 in aqueous solution is first order reaction 6

Time (in seconds)	0	300	600
$KMnO_4$ solution (ml)	22.8	17.7	13.8

(c) For a second order reaction, 6

$A+B \longrightarrow P$ Show that

$$k=\frac{2.303}{bt} log \frac{a}{a-x}$$

when B is present in large amount.

a and b are the initial concentrations of reactant A and B respectively.

(d) In the reduction of nitric oxide 50% of reaction was completed in 140 seconds when initial pressure was 258 *mm Hg* and in 224 seconds when initial pressure was 202 *mmHg*. Find the order of the reaction. 5

4. (a) Define Chemical Shift. Explain the instrumentation of NMR-spectrometer. 2+8=10

(b) State the crystal lattice and unit cell. 2

(c) Distinguish between *hcp* and *ccp* structures. 5

(d) State and explain Bronstead acid-base theory. 3

5. (a) Find out the number of components, number of phases and evaluate degrees of freedom for the following equilibria : 2×3=6

(i) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

(ii) A dilute solution of sulphuric acid in water

(iii) $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$ when $P_{NH_3} \neq P_{HCl}$

(b) Explain the phase diagram for H_2O molecule. What is the meta-stable stage ? 6+2=8

(c) If three elements P, Q and R crystallize in a cubic solid lattice with P-atoms at the corners Q-atoms at the cube centre and R-atoms at the centre of the faces of the cube, then write the formula of the compound and explain. 2

(d) Draw the structures of PCl_5, XeF_2 using *VSEPR* theory. 2×2=4

6. (a) Explain the following : 3×2=6

(i) Calomel Electrode

(ii) Gas electrode

(b) The standard electrode potential for $Hg_2^{2+}|H_g$ and $Hg^{2+}|H_g$ are $0.799V$ and $0.855V$ respectively. Calculate at $298K$ the equilibrium constant for the reaction.

$$Hg^{2+} + Hg \rightleftharpoons Hg_2^{2+}$$ 6

(c) What do you mean by ionic strength ? Find out the ionic strength of $^{1-1}$type, $^{1-2}$type and $^{2-1}$type electrolyte with proper example. 2+6=8

7. (a) Fill in the blanks : 1×5=5

(i) The monomer _____ undergo polymerisation to give addition polymer in presence of $AlCl_3 + TiCl_4$.

(ii) Dimethyle terephthalate is the monomer of _____ polymer.

(iii) The slope of the reaction $k = exp^{-E_{\alpha/PT}}$ is _____.

(iv) The value of Mark-Houcoink exponent lies between _____.

(v) Anchimeric assistance is observed in _____ substitution reaction.

(b) Write short notes on octane number and Cetane number. 2+2=4

(c) Explain Anchimeric Assistance of Nucleophilic substitution reaction with proper example. 5

(d) If for a chemical reaction : 5

$$ln[k(min^{-1})] = -11.06k/T + 30 \cdot 5;$$

Evaluate k, E and A for the reaction.

(e) What is the Debye-Huckel limiting equation ? 1