MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CH-201

CHEMISTRY-I

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Bakelite is an example of

a) metal b) thermoplastic

c) rubber d) thermoset.

ii) The unit of specific conductance is

a) ohm-cm b) ohm/cm

c) mho d) mho/cm.

iii) If a system interacts with the surroundings by exchanging energy only, then it is called a

a) open system b) closed system

c) isolated system d) none of these.

iv) Which of the following compounds have the least bond angle ?

a) NH_3 b) CH_4

c) BeF_2 d) H_2O.

v) The shape of a carbanion is

a) linear b) planar

c) pyramidal d) None of these.

vi) The hybridized orbital in $XeOF_4$ is

a) sp^3d^2 b) sp^3d

c) sp^3 d) sp^2.

vii) Colour of KCl crystal due to metal excess defect changes to

a) Yellow b) Red

c) Violet d) Pink.

viii) Most stable alkene is

a) 2, 3-dimethyl-2-butene

b) 2-methyl-2-butene

c) E-2-butene

d) propane.

ix) *n*-type semiconductor conducts electricity by

a) electrons b) holes

c) ions d) none of these.

x) The polydispersity index of a commercial polymer is

a) 1·0 b) 5·0

c) 50 d) 100.

xi) Which of the following is a negative catalyst ?

a) TEL b) MnO_2

c) V_2O_5 d) Fe + Mo.

xii) Rate constant of a zero order reaction is

a) dimensionless b) $L\ mole^{-1}s^{-1}$

c) s^{-1} d) $mole\ L^{-1}s^{-1}$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Define specific and equivalent conductance and show how they are related.

b) Define transport number and ionic mobility. 3 + 2

3. a) Why carboxylic acid is stronger acid than phenol ?

b) All the carbon-carbon distance in benzene are equal. Explain. 3 + 2

4. a) Discuss in brief the second law of thermodynamics.

b) Prove that for ideal gas in adiabatic reversible process

$$w_{ad} = \frac{P_1V_1 - P_2V_2}{\gamma - 1}$$ 2 + 3

5. Give mathematical expression and the physical significance of

(i) number-average molecular weight (ii) weight-average molecular weight for synthetic polymers.

6. Draw the structure of the following compounds :

a) SF_6

b) IF_7

c) ClF_3

d) CO_2

e) XeF_4.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Which one is more stable and why ?

$(CH_3)_3C^+$ and $(CH_3)_2C^+H$

b) Predict the products :

$$CH_3-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow[KOH]{\text{alcoholic}} A + B$$

Which one is major product ?

c) In aprotic solvents, the basic character of amines follows the order : $(CH_3)_3N \rangle (CH_3)_2NH \rangle CH_3NH_2$. Comment this statement.

d) What is hyperconjugation ? Explain it with one example.

e) Aniline is less basic than ethylamine. Explain.

f) Nitrobenzene is less reactive than benzene in electrophilic substitution reactions. Why ?

2 + 3 + 3 + 3 + 2 + 2

8. a) What is degree of polymerisation ? If the degree of polymerization of polystyrene is 1000 what is its molecular weight ?

b) Distinguish thermoplastic polymers and thermosetting polymers.

c) What are addition and condensation polymerization ? Explain with suitable examples.

d) What is glass transition temperature (T_g) ? What are the factors that influence the T_g value ?

e) Distinguish between HDPE and LDPE.

3 + 3 + 3 + 3 + 3

9. a) Explain Hoffmann and Saytzeff rule for elimination reaction.

b) What will be the hydrolysis products of isobutyl chloride ?

c) What is electromeric effect ? Malonic acid is a dibasic acid with two different pKa values ($pKa_1 = 2 \cdot 83$ and $pKa_2 = 5 \cdot 69$). Why ?

d) Discuss the construction of Hydrogen half cell. What is Reference electrode ? 3 + 2 + 2 + 2 + 3 + 3

10. a) What is conductometric titration ? Discuss the conductometric titration of $AgNO_3$ with KCl with graphical representation.

b) What is Calomel electrode ? How can you measure pH of a solution using Calomel electrode ?

c) Write down the Maxwell's relations. Prove that Joule-Thomson effect is iso-enthalpic.

2 + 2 + 3 + 3 + 2 + 3

11. What are the major fractions obtained from the refining of crude petroleum ? Specify the temperature ranges at which these fractions distil over. Mention the important uses of these fractions. What is meant by cracking ? What is the role of catalyst in catalytic cracking of petroleum fractions ? 4 + 3 + 4 + 2 + 2

12. a) State Hess's law of constant heat summation. How does it follow from the First Law of Thermodynamics ?

    b) A diatomic ideal gas ($\gamma = 1 \cdot 4$), initially at 600 K and 10 atm undergoes reversible adiabatic expansion till the final pressure becomes 2 atm. Find out its final volume.

    c) What are the differences between inductive effect and mesomeric effect ?

    d) Explain the conditions of heating and cooling.

(2 + 3) + 4 + 4 + 2

C1-C..