Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (NEW)/SEM-1/CH-101/2010-11

2010-11
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) The quantity $T \Delta S$ may be expressed in units of

a) J b) K

c) JK d) JK^{-1}.

ii) A reaction is at equilibrium in a closed rigid vessel at constant temperature when

a) $\Delta S = 0$ b) $\Delta H = 0$

c) $\Delta U = 0$ d) $\Delta A = 0$.

iii) Change of internal energy is equal to heat change in case of

a) isochoric process

b) isothermal process

c) isobaric process.

iv) At inversion temperature Joule-Thomson Coefficient is

a) zero b) positive

c) negative d) all of these.

v) The half-life period of a reaction is found to be directly proportional to the initial concentration. The order of the reaction is

a) zero b) one

c) two d) three.

vi) If the rate of a reaction becomes twice for every 10° C rise in temperature, by what factor does the rate of the reaction increase when temperature is raised from 30° C to 80° C ?

a) 16 b) 32

c) 64 d) 128.

vii) ZnO is white when cold and yellow when hot. This is due to

a) charge transfer b) *d-d* transition

c) metal excess defect d) Schottky defect.

viii) When ice melts into water, entropy

a) becomes zero b) remains same

c) increases d) decreases.

ix) The human body is an example of a

a) closed system b) open system

c) isolated system d) none of these.

x) An example of step-growth polymer is

a) PVC b) Teflon

c) Bakelite d) Poly-butadiene.

xi) Which of the following is used as fuel in jet engine ?

a) Petrol b) Diesel

c) Kerosene d) Power alcohol.

xii) Which one of the following is not a primary fuel ?

a) Wood b) Natural gas

c) Coke d) Crude oil.

GROUP – B

(Short Answer Type Questions)

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

2. Define ionic mobility and equivalent conductance with their units. How does equivalent conductance vary with concentration for both strong and weak electrolytes ? 2 + 3

3. What is catalysis ? Derive the kinetic expression of 'homogeneous catalysis' with example. 1 + 4

4. Give the outline of preparation, structure and uses of SBR. How is HDPE manufactured ? What are its uses ? 3 + 2

5. a) Explain that alcohols are weaker acids than phenols but are stronger nucleophiles.

   b) The degree of polymerization of polyethylene is 1000. Find the molecular weight of polyethylene. 3 + 2

6. a) What is CNG and what is its composition ?

   b) What are the advantages of CNG over other fuels ? 2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. a) Prove that $C_p - C_v = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P$ (Symbols have usual significances).

   b) Consider a 1st order reaction $A \rightarrow B$, where A is reactant and B is product. Assuming a is the initial concentration of the reactant and x is the concentration of the product after time t, show that half-life decomposition period of the reaction is independent of a.

   c) Write the chemical structures of the repeat units of Nylon 6, 6 and Nylon 6. Why are they so named ?

   d) Explain Octane Number and Cetane Number with their significances. 4 + 4 + 4 + 3

8. a) Explain the order of acid strength HCOOH>Cl-CH_2COOH>CH_3COOH>Phenol>Ethanol.

   b) Distinguish between SN^1 and SN^2 reactions giving examples.

   c) Explain why benzoic acid is weaker than formic acid.

   d) Write down the products of the following reaction with mechanism :

   $$CH_3 - CH = CH_2 \xrightarrow[\text{Benzoyl peroxide}]{HBr}$$ 5 + 5 + 2 + 3

9. a) Distinguish between Order and Molecularity.

   b) A first order reaction is never complete. Justify.

   c) What is activation energy ? Write down its physical significance.

   d) Write the main features of Transition State theory.

   e) Write down Arrhenius equation for the temperature dependent on specific rate. Plot log K *vs* 1/T and explain the significance of the slope of the plot. 2 + 3 + 3 + 4 + 3

10. a) Distinguish between intensive and extensive properties.

    b) Show that Joule–Thomson expansion is an isenthalpic process.

    c) State the significance of Gibbs free energy.

    d) State the differences between molecularity and order of a chemical reaction.

    e) The half-life period of the decomposition of a compound is 5 min. If the initial concentration is halved, the half-life period is reduced to 25 min. Find the order of reaction. 2 + 4 + 2 + 3 + 4

11. Write short notes on any *three* of the following : 3 × 5

a) Bio-diesel

b) Reference electrode

c) Storage cell

d) Resonance and Hypercojugation

e) Role of germanium as semiconductor

f) Carbonisation of coal and its utility.