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) The half-life period for a reaction is independent of initial concentration, choose the correct order of the reaction from the following
(a) zero order (b)first order
(c) second order (d) all of the above.

(ii) A spontaneous reaction is impossible if
(a) both ΔH and ΔS are positive
(b) ΔH is positive and ΔS is negative
(c) both ΔH and ΔS are negative
(d) ΔH is negative and ΔS is positive.

(iii) Electrolytic conduction is mainly due to movement of
(a) atoms (b)ions (c) molecules (d)electrons.

(iv) A process in which pressure remains constant is called
(a) isochoric (b) isobaric
(c) isothermal (d) adiabatic.

(v) Lead impurity is removed from the internal combustion engine by adding
(a)1,2-dibromoethane (b) oxane
(c) mercaptan (d) n-heptane.

(vi) At 25◦C, the standard hydrogen electrode has been assigned electrode potential
(a) positive (b) negative
(c) zero (d) one.

(vii) PVC can be reused and reshaped because it is a
(a) copolymer (b) thermosetting resin
(c) thermoplastic resin (d) isotactic polymer.

(viii) The human body is an example of a
(a) closed system (b) Open system
(c) isolated system (d) None of the above.

(ix) Silicon is a
(a) conductor (b) insulator
(c) semiconductor (d) non-conductor.

(x) Which of the following polymers is used for making switch board, heater handle
(a)Polythene (b)Rubber
(c)PET (d)Bakelite

Group – B

2. (a) Show that for a reversible expansion of an ideal gas the work obtained, $W = nRT \ln(V_2/V_1)$ (the term has its usual meaning) and hence prove that the work done in a reversible process is greater than that in an irreversible process.

(b) What do you mean by extensive and intensive properties of a system?

(c) What is enthalpy? What is the relation between internal energy and enthalpy?

(d) Write down the important applications of IR spectroscopy.

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

3. (a) 'The second law of thermodynamics can be stated in different forms.' Justify this statement by giving two statement of the law.

(b) What do you mean by "Entropy of a system"? For a spontaneous process how does it change?

(c) Write down the Gibbs-Helmoltz equation and explain the terms involved.

(d) Explain the term 'chromophore' with example. State the Lambert-Beer's law of light-absorption of medium.

(2+2)+2+2+4= 12

Group – C

4. (a) Predict the geometry of PCl_5 molecule and state the hybridization of central P atom.

(b) Write the electronic configuration of O_2 molecule and calculate its bond order using molecular orbital theory. Find out the number of unpaired electrons in it and hence its magnetic behaviour.

(c) What do you mean by pH scale? Calculate the pH of 0.001(M) HCl solution.

(d) Give a brief comparison of the salient features of S_N1 and S_N2 mechanism.

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

5. (a) Arrange the following hydrides in decreasing order of their boiling points and justify your answer: H_2O, H_2S, H_2Se, H_2Te.

(b) What is the difference between Frenkel defect and Schottky defect in stoichiometric compounds?

(c) Write down the Henderson equation for an acidic buffer solution and explain the terms involved.

(d) Arrange the following cations according to their increasing stability order : $(CH_3)_3C^+$, $(CH_3)_2CH^+$, $CH_3CH_2^+$ and justify your answer.

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

Group – D

6. (a) Distinguish between 'order' and 'molecularity' of a reaction.

(b) How does a homogeneous catalyst increase the rate of a chemical reaction? Explain with an example.

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

(d) Write the half cell reactions 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

7. (a) Deduce the expression for the rate constant of a first order reaction and its half-life.

(b) Taking an example explain a pseudo-unimolecular reaction.

(c) What are reference electrodes? Explain the working principle of standard hydrogen electrode.

(d) What are the differences between an electrolytic cell and the electrochemical cell?

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

Group – E

8. (a) What are GCV and NCV of a fuel? Deduce a relation between GCV and NCV of a coal sample.

(b) Write down the differences between thermoplastics and thermosetting polymers.

(c) Write the expressions of Number Average Molecular Weight (M_n) and Weight Average Molecular Weight (M_w) of a polymer. What is PDI of polymer?

(3+3)+3+3=12

9. (a) What do you mean by knocking? How TEL can be used to reduce knocking in an internal combustion petrol engine?

(b) What are the main constituents of LPG?

(c) Write the structural unit and two important applications of each of the following polymers : i) Teflon, ii) Bakelite.

(d) Explain with example the 'Biodegradable Polymers'.

(2+2)+2+(2+2)+2=12

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