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) 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) none of these.

(ii) Phenol formaldehyde is an example of
(a) addition polymer (b) isotactic polymer
(c) thermoplastic polymer (d) thermosetting polymer

(iii) The conductance and specific conductance of a solution is the same if the cell constant is
(a) 0 (b) 1 (c) 10 (d) 100.

(iv) Which type of radiation has the highest energy?
(a) UV (b) IR (c) Microwave (d) X-ray.

(v) The molecule having see saw structure is
(a) XeF_4 (b) SiF_4 (c) SF_4 (d) CF_4.

(vi) The boiling point of p-nitrophenol is greater than o-nitrophenol because of
(a) ionic bonding (b) intermolecular H-bonding
(c) van der Waals attractive force (d) intermolecular H-bonding.

(vii) Which statement is not correct regarding reversible process?
(a) It is imaginary process (b) It takes infinite time
(c) Work obtained is maximum (d) It is spontaneous.

(viii) The function of electrolytic cell is to
(a) To convert chemical energy into electrical energy
(b) To convert electrical energy into chemical energy
(c) To convert chemical energy into heat energy
(c) To convert heat energy into chemical energy.

(ix) Entropy of the universe is
(a) increasing (b) decreasing
(c) remaining same (d) dependent on conditions.

(x) Leakage of LPG cylinder can be detected by adding
(a) octane (b) 1,2-dibromoethane
(c) mercaptan (d) n-heptane.

Group – B

2. (a) Show that for a reversible expansion of an ideal gas the work obtained $W = nRT \ln V_2/V_1$

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

(c) Calculate the change in entropy accompanying the isothermal expansion of 4 moles of an ideal gas at 300K until its volume increased to three times.

(d) What are the applications of IR-spectroscopy?

4 + (1 + 1) + 4 + 2 = 12

3. (a) What do you mean by a reversible & irreversible process? What are the limitations of first law of thermodynamics?

(b) Explain Gibbs free energy.

(c) Derive the expression for entropy change of an ideal gas as a function of volume and temperature.

(4 + 2) + 3 + 3 = 12

Group – C

4. (a) Distinguish between carbocation and carbanion providing suitable example.

(b) Aniline is a weaker base than methyl amine-explain?

(c) Differentiate between Schottky and Frenkel defects.

(d) Derive Henderson equation for an acidic buffer solution and explain the terms.

3 + 2 + 4 + 3 = 12

5. (a) Draw the molecular orbital energy level diagram of N_2 molecule and calculate its bond order.

(b) What are the differences between S_N1 and S_N2 reaction?

(c) Which one of the following is more acidic and why?
(i) CCl_3COOH (ii) CH_3COOH

(d) Derive an expression connecting dissociation constant of a weak monobasic acid and its degree of dissociation.

4 + 3 + 2 + 3 = 12

Group – D

6. (a) What is pseudo-unimolecular reaction? Give one example.

(b) Show that half-life period for first order reaction is independent of the initial concentration of the reactants.

(c) The limiting equivalent conductances of KCl, KNO_3, and $AgNO_3$ are 149.9, 145.0 and 133.4 $ohm^{-1}\ cm^2\ eq^{-1}$ at 25ºC. Calculate the limiting equivalent conductance of AgCl at this temperature.

(d) Construct galvanic cell and calculate the emf at 25ºC from the following pair of half-cells
$Pb(s)|PbCl_2(1M)$, $E^o_{Pb^{2+}|Pb} = -0.13V$
$Fe(s)|FeSO_4\ (1M)$, $E^o_{Fe^{2+}|Fe} = -0.44V$

2 + 3 + 4 + 3 = 12

7. (a) Write down the Arrhenius equation for the temperature dependence of specific rate and explain the terms used.

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

(c) What are the differences between an electrolytic cell and a galvanic cell?

(d) What is reference electrode? Give two examples.

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

Group – E

8. (a) Write differences between addition and condensation polymerization.

(b) Explain vulcanization of rubber.

(c) What is CNG? What are the advantages of using CNG over petrol in automobile engines?

(d) What are the constituents of water gas?

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

9. (a) What is tacticity? Classify polymers based on its tacticity by taking suitable examples.

(b) Explain octane number and cetane number with their significances.

(c) What are the main constituents of LPG? What is the source of the foul smell during the leakage of LPG?

(d) What do you mean by GCV and NCV of a solid fuel?

(1 + 3) + 4 + (1 + 1) + 2 = 12

Department & Section	Submission Link
BACKLOG	https://classroom.google.com/c/Mzc0MzQ5MDQ3NTA3?cjc=6ghfxnq