



ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE - 2008

ENGINEERING CHEMISTRY

SEMESTER - 2

Time : 3 Hours]

[Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following : 10 x 1 = 10

i) A living system is thermodynamically an example of

- a) an isolated system.
- b) a closed system.
- c) an adiabatically closed system
- d) an open system.

ii) For an ideal gas undergoing free expansion

- a) $\Delta T = 0$ and $\Delta S > 0$
- b) $\Delta T = 0$ and $\Delta S = 0$
- c) $\Delta T < 0$ and $\Delta S > 0$
- d) $\Delta T < 0$ and $\Delta S = 0$.

iii) Structure of SF₆ is

- a) planar
- b) octahedral
- c) trigonal bipyramidal
- d) square pyramidal.

iv) Two elements, whose electronegativities are 1.2 and 3.0, form

- a) ionic bond
- b) covalent bond
- c) co-ordinate bond
- d) metallic bond.

v) Germanium is an example of

- a) intrinsic semiconductor
- b) n-type semiconductor
- c) p-type semiconductor
- d) insulator.

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- vi) Proton NMR is useful for investigating structure of organic molecules because
- a) organic molecules contain carbon atoms
 - b) organic molecules are mostly covalent
 - c) hydrogen atoms are found in most of the organic molecules
 - d) organic compounds are low boiling.
- vii) The half-life of a first order reaction is 20 minutes. The time required for 75% completion of the reaction is
- a) 30 minutes
 - b) 40 minutes
 - c) 50 minutes
 - d) 60 minutes.
- viii) Which one has the largest bond angle ?
- a) H_2O
 - b) H_2S
 - c) PH_3
 - d) NH_3 .
- ix) Which of the octahedral complexes (M = metal atom, A and B are ligands) exhibits geometrical isomerism ?
- a) $[MA_6]$
 - b) $[MA_5B]$
 - c) $[MA_4B_2]$
 - d) $[MA_3B_3]$.
- x) The most stable carbonium ion is
- a) $(CH_3)_2CH^+$
 - b) Ph_3C^+
 - c) $CH_3CH_2^+$
 - d) $CH_2=CH-CH_2^+$.
- xi) An example of thermosetting plastic is
- a) PVC
 - b) nylon
 - c) polythene
 - d) bakelite.
- xii) The calorific value is highest for
- a) water gas
 - b) LPG
 - c) producer gas
 - d) carburetted water gas.

II-221835 (B)

**GROUP - B****(Short Answer Type Questions)**Answer any *three* of the following.

3 × 5 = 15

2. Show that for an ideal gas undergoing reversible adiabatic expansion or compression $PV^\gamma = \text{constant}$. A diatomic ideal gas ($\gamma = 1.4$), initially at 600 K and 10 atm undergoes reversible adiabatic expansion till the final pressure becomes 2 atm. Find out its final volume.
3. Explain why the anion $[\text{CoF}_6]^{3-}$ is paramagnetic while the anion $[\text{Co}(\text{CN})_6]^{3-}$ is diamagnetic.
4. Write down the Arrhenius equation for the temperature dependence of specific rate and explain the terms used. What is the unit of the frequency factor for a first order reaction? Plot $\log k$ vs $\frac{1}{T}$ and explain the significance of the slope of the plot.
5. Predict the shape of the following molecules using VSEPR theory :
 BF_3 , CO_2 , PCl_5 , SF_6 , XeF_4 .
6. Account for the following :
 - i) SN^2 reaction occurs with inversion of configuration and SN^1 reaction occurs with retention of configuration.
 - ii) Formic acid is more acidic than acetic acid and acetic acid is more acidic than phenol.

GROUP - C**(Long Answer Type Questions)**Answer any *three* questions.

3 × 15 = 45

7.
 - a) What are raw rubber and vulcanized rubber? 3
 - b) Give the outlines of preparation, structure and uses of SBR and NBR. 6
 - c) Explain number average and weight average molar mass of a polymer. 4
 - d) Define intrinsic and extrinsic semiconductors. 2

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8. a) What is meant by transport number of an ion? How is it related with ionic conductance? The ionic radius of Li^+ is less than that of K^+ . However, in aqueous solution Li^+ ions are less mobile than K^+ ions. How can you explain this observation? 1 + 1 +

b) Draw the conductometric titration curve for HCl vs NH_4OH and explain the features of the curve.

c) What do you mean by half-decomposition period of a reaction?

Consider a second order reaction $\text{A} + \text{B} \rightarrow \text{products}$. Assuming the initial concentrations of both the reactants to be same, show that the half-decomposition period of the reaction is inversely proportional to the initial concentration. 1 +

d) Rate constants of a reaction at 300 K and 310 K are $4.5 \times 10^{-5} \text{ s}^{-1}$ and $9 \times 10^{-5} \text{ s}^{-1}$ respectively. Evaluate the activation energy and the pre-exponential factor (frequency factor) of the reaction. What is the order of the reaction?

9. a) Explain optical isomerism in case of co-ordination compounds with suitable examples.

b) Write down the order of the bond energy of the following bonds and give reasons for your answer:

$\text{C}=\text{O}$, $\text{C}=\text{N}$, $\text{C}-\text{I}$, $\text{C}-\text{F}$.

c) Explain the term 'hyperconjugation', citing examples.

d) Distinguish between coking coal and caking coal.

10. a) How do the properties such as (i) tensile strength (ii) physical state of the polymer (iii) impact strength (iv) melt viscosity of a polymer vary with degree of polymerization?

b) Discuss the difference among isotactic, syndiotactic and atactic polymers.

c) Degree of polymerization of a sample of polymethylmethacrylate (PMMA) is found to be 1000. What is the number average and the weight average molecular masses of PMMA?

d) What is the importance of 'functional group region' in IR spectroscopy? What are the different absorption peaks possible for methanol and ethanol? 1 +

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11. Write notes on any *three* of the following :

- a) Joule-Thomson expansion and inversion temperature.
- b) Chemical potential and its significance in explaining equilibrium of reacting systems.
- c) Hydrogen bonding and its effect on properties of compounds.
- d) Non-stoichiometric defects.
- e) Carburetted water gas and semi-water gas
- f) Perfect and imperfect complexes.

END

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