



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

**CS/B.TECH(OLD)/SEM-2/CH-201/2012**

**2012**

**ENGINEERING CHEMISTRY**

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 :

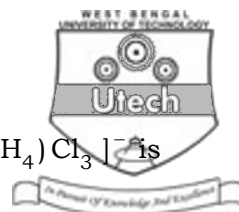
$$10 \times 1 = 10$$

- i) For an endothermic reaction

- a)  $\Delta H$  is positive                      b)  $\Delta H = 0$   
c)  $\Delta H$  is negative                      d)  $\Delta U$  is negative.

- ii) The dimension of the rate constant for second order rate equation is

- a)  $\text{mole litre sec}^{-1}$                       b)  $\text{mole}^{-1} \text{ litre}^{-1} \text{ sec}^{-1}$   
c)  $\text{mole litre}^{-1} \text{ sec}^{-1}$                       d)  $\text{mole}^{-1} \text{ litre sec}^{-1}$ .



- iii) The oxidation number of Pt in  $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]^-$  is
- a) + 2                                      b) + 3  
c) + 1                                      d) + 4.
- iv) Which of the following is not an electrophile ?
- a)  $\text{BF}_3$                                       b)  $\text{AlCl}_3$   
c)  $\text{NH}_3$                                       d)  $\text{Hg}^{2+}$ .
- v) Phenol-formaldehyde resin is commonly known as
- a) PVC                                      b) Nylon  
c) Bakelite                                      d) Rubber.
- vi) Suitability of diesel fuel is determined by
- a) octane number                      b) cetane number  
c) carbon percentage              d) none of these.
- vii) Excessive solubility of alcohol in water is due to
- a) coordinate bond                      b) covalent bond  
c) hydrogen bond                      d) ionic bond.
- viii) Conductance of a weak electrolyte
- a) decreases sharply with concentration  
b) increases sharply with concentration  
c) increases slowly with concentration  
d) none of these.



- ix) Calorific value of a coal sample is higher, if
- ash content is high
  - moisture content is high
  - fixed carbon is high
  - volatile matter is high.
- x) Which one is not a thermoplastic polymer ?
- Polymethyl methacrylate (PMMA)
  - Polyvinyl chloride (PVC)
  - Ureaformaldehyde resin (UF)
  - Polystyrene (PS).
- xi) Markownikoff's rule provides guidance of addition of HBr on
- $\text{CH}_2 = \text{CH}_2$
  - $\text{CH}_3\text{CH} = \text{CH}_2$
  - $\text{CH}_3\text{CH} = \text{CHCH}_3$
  - $\text{CH}_3\text{CH} = \text{CHBr}$ .
- xii) The IUPAC name of  $\text{K}_3 [\text{Fe} (\text{CN})_6]$  is
- potassium ferrocyanide
  - potassium hexacyanoferrate (III)
  - potassium ferricyanide
  - potassium hexacyanoferrate (II).

a) NiBr                                      b) NaBr

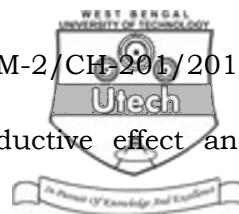
c) CuBr                                      d) AgBr.

a) isochoric process      b) isobaric process  
c) isenthalpic process    d) isothermal process.

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2.
  - a) What is hybridization ?
  - b) What are the shapes of  $\text{BeF}_2$  and  $\text{NH}_3$  ?
  - c) H-O-H bond angle in  $\text{H}_2\text{O}$  is lower than H-N-H bond angle  $\text{NH}_3$ . Explain. 1 + 2 + 2
3.
  - a) What is enthalpy ? Prove that change in Enthalpy is equal to the heat absorbed by the system at constant pressure.
  - b) Prove that adiabatic  $P$ - $V$  curve is steeper than isothermal  $P$ - $V$  curve. ( 1 + 2 ) + 2
4.
  - a) What is meant by ligand ? Name a bidentate and a hexadentate ligand.
  - b) Explain why the anion  $[\text{COF}_6]^{3-}$  is paramagnetic but the anion  $[\text{CO}(\text{CN})_6]^{3-}$  is diamagnetic. 2 + 3



5. a) What is the difference between Inductive effect and Electromeric effect ?  
b) Alcohols are weaker acids than phenols but are stronger than nucleophiles. Justify. 3 + 2
6. a) What is tacticity ? How a polymer can be classified based on tacticity ?  
b) Degree of polymerization of polystyrene is 1000. Find the molecular weight of polystyrene. 3 + 2
7. a) What are the differences between *p*-type and *n*-type semiconductor ?  
b) i) What are the advantages of Instrumental methods of analysis ?  
ii) What is main objective of IR studies ? 2 + ( 2 + 1 )

### GROUP – C

#### ( Long Answer Type Questions )

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

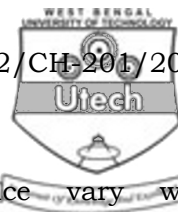
8. a) What is the difference between order and molecularity of a reaction ?  
b) Deduce the expression for second order kinetics where the initial concentration of the two reactants are same. Hence, show the time for half decomposition of the reaction is dependent on the initial concentration of the reactant.



- c) A certain first order reaction is 20% complete in 15 minutes at 20°C. How long will it take to complete 40% of the reaction at 40°C ?

The energy of activation = 23.03 kcal/mole. 2 + 4 + 4 + 5

9. a) i) What is Heat of Neutralization ?  
 ii) "Heat of neutralization of any strong acid and strong base in dilute solution is always the same, but the value deviates in case of a weak acid or a weak base." Justify the statement.
- b) Show that  $\left(\frac{\delta H}{\delta P}\right)_T = V - T\left(\frac{\delta H}{\delta P}\right)_P$ , where  $H$  is the enthalpy of the system.
- c) 2 litres of CO<sub>2</sub> (behaving ideally) at 0°C and 5 atm are expanded isothermally until the pressure is 1 atm. Calculate  $w$ ,  $q$ ,  $\Delta U$  and  $\Delta H$ . Also find out the values if the process were adiabatic ( $\gamma = 1.3$ ). 5 + 4 + 6
10. a) i) What is the Carbonization of coal ?  
 ii) What is the difference between HTC & LTC ?
- b) What is knocking ? How can it be avoided ? How can the knocking tendency of petrol can be determined ?
- c) Calculate the weight and volume (at NTP) of air required for the combustion of 1 kg of carbon ( Air containing 23% by wt. and 21% by volume of O<sub>2</sub>). 2 + 4 + 5 + 4



11. a) i) What is equivalent conductance ?  
 ii) How do equivalent conductance vary with concentration for strong and weak electrolyte ?  
 b) Explain the nature of conductometric titration curve when  
 i) weak acid is titrated by strong base  
 ii) NaCl solution is titrated by AgNO<sub>3</sub> solution.  
 c) Calculate pH of the following half-cell, Pt H<sub>2</sub> (1 atm) / H<sub>2</sub>SO<sub>4</sub>. The oxidation of electrode potential is + 0.3 V.
- 5 + 2 + 2 + 6
12. a) What are the differences between Addition and Condensation polymerization ?  
 b) Name and draw the structures of two initiators used in addition polymerization.  
 c) What is glass transition temperature of a polymer ?  
 d) Discuss the preparation, structure and uses of Nylon 6,6 or Polyester.
- 5 + 2 + 2 + 6
13. Write short notes on any *three* of the following : 3 × 5
- Clausius-Clapeyron equation
  - Schottky and Frankel Defects
  - Ultimate analysis of Coal
  - Molecular weight distribution of a polymer
  - SN<sup>1</sup> and SN<sup>2</sup> reaction mechanisms.

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