CS/B.Tech/OLD/SEM-2/CH-201/2013

2013
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 ideal gas, the change in internal energy (ΔU) in a reversible isothermal process is

        a)   Positive   b)   Zero

        c)   Negative   d)   None of these.

    ii)   A *Px* orbital can accommodate

        a)   2 electrons with parallel spin

        b)   6 electrons

        c)   2 electrons with opposite spin

        d)   4 electrons.

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iii) Schottky defect arises due to

    a) missing of anion from the crystal lattice

    b) missing of cation from the crystal lattice

    c) missing of cation and anion both from the crystal lattice

    d) none of these.

iv) The minimum energy necessary to permit a reaction is

    a) Internal energy   b) Free energy

    c) Threshold energy   d) Activation energy.

v) Which of the following is a bidentate ligand ?

    a) Ammonia

    b) Ethylene diamine

    c) Triethylene tetramine

    d) none of these.

vi) Which of the following is not a nucleophile ?

    a) NH_3 b) OH^-

    c) HSO_3^- d) BF_3 .
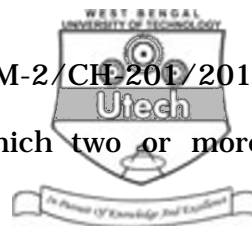
vii) The method of polymerization in which two or more monomers take part is called

    a) addition polymerization

    b) condensation polymerization

    c) co-polymerization

    d) none of these.

viii) Suitability of a diesel fuel is determined by

    a) Octane number

    b) Carbon percentage

    c) Cetane number

    d) none of these.

ix) Stronger the oxidizing agent, greater the

    a) reduction potential   b) oxidation potential

    c) ionic behaviour   d) none of these.

x) For an exothermic reaction

    a) ΔH is positive   b) ΔH is negative

    c) $\Delta H = 0$ d) ΔU is negative.

xi) The process in which heat is allowed to enter and leave the system but the temperature remains constant is known as

a) Adiabatic
b) Isobaric

c) Isochoric
d) Isothermal.

xii) Which of the following polymers is not a plastic ?

a) Polyethylene
b) Polypropylene

c) Polyvinyl chloride
d) Isoprene.

xiii) The conductivity of strong electrolyte

a) decreases on dilution

b) increases on dilution

c) does no change considerably with dilution

d) depends on density.

xiv) Calorific value of a coal sample is higher, if

a) ash content is high

b) moisture content is high

c) fixed carbon is high

d) volatile matter is high.

GROUP – B
(Short Answer Type Questions)
Answer any *three* of the following. $3 \times 5 = 15$

2. What do you mean by paramagnetic complex ? What is the difference between 'Double salt' and 'Coordination compound' ? $2 + 3$

3. What is 'Mesomeric effect' ? Explain with example. What are the differences between 'Electromeric effect' and 'Inductive effect' ? $2 + 3$

4. What is NMR ? What is the main objective of NMR Spectrometer ? What are the applications of IR Spectroscopy ? $1 + 1 + 3$

5. What do you mean by 'reversible process' in a thermodynamic system ? Prove that work done in a reversible process is more than irreversible one. $2 + 3$

6. What is hybridization ? Predict the shape of BeF_2 and CO_2. $1 + 2 + 2$

7. Write short notes on the following : $2\frac{1}{2} + 2\frac{1}{2}$

    i)   Schottky defect

    ii) Frankel defect.

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following. 3 × 15 = 45

8. a) What is enthalpy or heat content ? Prove that change in enthalpy at constant pressure is equal to the heat absorbed by the system. Explain the significance of Carnot cycle.

   b) Prove that dq is not a state function but dq/T or entropy is a state function.

   c) 70 gms of N_2 was initially at 50 atm. and 25°C.

      i) It was allowed to expand isothermally against a constant external pressure of 1 atmosphere. Calculate ΔU, ΔH, ΔQ and W, assuming the gas to behave ideally.

      ii) Find out the maximum work that would be obtained if the gas expanded reversibly and isothermally to one atmosphere.

      (1 + 2 + 2) + 5 + 5

9. a) What do you mean by 'EMF' of an Electrochemical cell ? What is the difference between Electrolytic cell and Electrochemical cell ? Costruct the cell in which following reactions are taking place.

      i) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

      ii) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

   b) How does equivalent conductance vary with concentration both for strong and weak electrolytes ?

c) The equivalent conductnace of 0.01(N) solution of acetic acid was found to be 16.30 ohm^{-1} cm^2 at 25°C. The ion conductance of hydrogen and acetate ions at infinite dilution are 349.8 ohm^{-1} cm^2 and 40.9 ohm^{-1} cm^2 respectively at the same temperature. What percentage of acetic acid is dissociated at this concentration ?

(1 + 3 + 3) + 4 + 4

10. a) What is meant by calorific value of fuel ? Distinguish between Gross or Higher and Net or Lower calorific value.

b) What is the significance of proximate analysis ? What is the difference between HTC and LTC ?

c) Calculate the mass of air needed for complete combustion of 5 kg of coal containing 80% carbon, 15% hydrogen and rest oxygen. (1 + 2) + (3 + 5) + 4

11. a) What are the differences between Rubber, Plastics and Fibres ?

b) Give an example of addition polymerization with reaction. What types of compounds are generally used as initiator for polymerization ?

c) In a polymer, there are 100 molecules of molecular weight 100, 200 molecules of molecular weight 1000 and 300 molecules of molecular weight 10000. Calculate the weight average, number average molecular weight and polydispersity index (PDI).

3 + (6 + 2) + 4
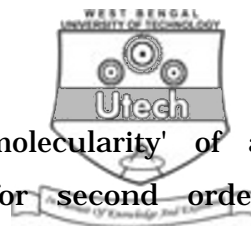
12. a) Distinguish between 'order' and molecularity' of a reaction. Deduce an expression for second order kinetic where the initial concentrations of two reactants are same.

b) How the activation energy of a chemical reaction can be obtained from Arrhenius equation ?

c) At 25°C, the half life period for the decomposition of N_2O_5 is 5.7 hr. and is independent of the initial concentration of N_2O_5. Calculate

   i) the specific rate constant

   ii) the time required for the reaction to 90% completion. (3 + 4) + 4 + 4

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

   a) Clausius-Clapeyron equation

   b) Conducting polymers

   c) Cetane number

   d) Calomel electrode

   e) Kirchhoff's equation.

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