10CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2019
Engineering Chemistry

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, choosing at least TWO from each part.*

PART – A

1 a. Choose the correct answers for the following :   (04 Marks)
   i)   When a metal rod is dipped in a solution containing its own ions, the potential developed depends on .
        A) Concentration of the solution   B) Temperature of the solution
        C) Nature of the metal   D) All of these
   ii) In a cell with Cu/Cu^{2+} coupled with Ag/Ag^+.
        A) Cu is positive electrode   B) Ag is negative electrode
        C) Ag undergoes oxidation   D) Cu is oxidized to Cu^{2+}.
   iii) $Ag/AgCl$ electrode is an example of
        A) Metal – Metal insoluble salt electrode. B) Metal – Metal ion solution electrode
        C) Ion selective electrode   D) Gas electrode
   iv) In Calomel electrode construction , a paste is made by grinding
        A) Hg with Mercurous chloride   B) Hg with silver chloride
        C) Hg with zinc chloride   D) Hg with Mercuric chloride
   b. Derive Nernst equation for single electrode potential and explain the terms involved in it.
                                                                                             (06 Marks)
   c. Calculate the e.m.f of the following concentration cell at 25^0C.
        $Zn(s)|Zn^{2+}$ (0.1M) $\|$ Zn^{2+} (0.01M) $|$ Zn (04 Marks)
   d. Write the construction, cell reactions and advantages of Calomel electrode.   (06 Marks)

2 a. Choose the correct answers for the following :   (04 Marks)
   i)   Which of the following batteries is not rechargeable
        A) Lead/Acid battery   B) Ni/Cd battery
        C) Metal hydride battery   D) Zn / MnO_2 Battery
   ii) Cycle life is applicable only to ,
        A) Primary battery   B) Secondary battery C) Fuel cells   D) Reserve battery
   iii) The battery which is activated just before using it in
        A) Lead/Acid battery   B) Lithium / MnO_2 battery
        C) Ni/Cd battery   D) Reserve battery
   iv) The capacity of a battery is often expressed in the terms of
        A) Volts   B) Ampere hours   C) Ergs   D) Joules
   b. Describe with a neat diagram, the construction of Lead / Acid battery. Write the cell reactions involved in it.   (06 Marks)
   c. Explain capacity and cycle life with respect to a battery.   (04 Marks)
   d. What are Fuel cells? Describe the construction of $H_2 – O_2$ fuel cell. Write the cell reactions.
                                                                                             (06 Marks)

3 a. Choose the correct answers for the following :   (04 Marks)
   i)   The corrosion of metals and alloys in the presence of air and water is explained by
        A) Dry corrosion   B) Electro chemical theory
        C) Wet corrosion   D) None of these
   ii) Stainless steel undergo following type of corrosion
        A) Stress corrosion   B) Pitting corrosion
        C) Aeration corrosion   D) None of the above

iii) Galvanisation is a process of,
   A) Coating of Zn on Fe   B) Coating of Sn on Fe
   C) Coating of Zn on Cu   D) Coating of Mg on Fe
iv) Buried oil pipes are prevented from corrosion by
   A) Sacrificial anodic protection   B) Sacrificial cathodic protection
   C) Impressed voltage protection   D) Anodic protection

b. Define Corrosion. Explain the electrochemical theory of corrosion taking iron as an example.   (06 Marks)

c. How are the following factors affect the rate of corrosion :
   i) Anodic area and Cathodic area   ii) Nature of corrosion product.   (06 Marks)

d. Write a note on Galvanisation.   (04 Marks)

4 a. Choose the correct answers for the following :   (04 Marks)
   i) Metal finishing can be visualized as
      A) Method of preventing corrosion   B) Heat treatment of metals
      C) Painting of metals   D) None of these
   ii) Platinum metal readily electrolysis water to H_2 & O_2 gases at low voltage because,
      A) It has very low hydrogen over voltage   B) It is a noble metal
      C) It does not undergo corrosion   D) It has high electrode potential
   iii) When a mixture of Cu & Zn ions are subjected to electro plating
      A) Cu is deposited first   B) Zn gets deposited first
      C) both are deposited together   D) Only Zn is deposited
   iv) Gold plating highly useful in semi conductor industry because
      A) It is good conductor
      B) It is good conductor and does not undergo corrosion
      C) It is a noble metal   D) It is a shinning metal.

b. Define Throwing power of a plating bath? Explain the experimental method of determining the throwing power of a electrolytic bath.   (06 Marks)

c. Define Electroless plating. Explain the method of electroless plating of copper. Write the reaction involved in it.   (06 Marks)

d. Explain the role of i) Wetting agents   ii) Brightners in electro plating.   (04 Marks)

PART – B

5 a. Choose the correct answers for the following :   (04 Marks)
   i) In order to calculate NCV of a fuel
      A) Percentage of hydrogen in fuel should be known
      B) Moisture content is required
      C) GCV of the fuel is required   D) (a) & (c) are required
   ii) The breaking of long chain hydro carbons into smaller chain is called
      A) Pyrolysis   B) Cracking
      C) Knocking   D) Splitting of hydrocarbons
   iii) Unleaded gasoline contains
      A) Diethyl ether   B) Methyl tertiary butyl ether
      C) Ethyl alcohol   D) n – Heptane
   iv) In a Photo voltaic cell a potential is produced because of the formation of
      A) Free electrons   B) Electron hole pair   C) Conduction band   D) Protons

b. Explain the terms GCV and NCV with respect to a fuel.   (04 Marks)

c. Describe with a neat diagram the determination of colorific value of a coal sample using bomb calorimeter.   (07 Marks)

d. Calculate the GCV and NCV of a fuel sample from the following experimental data of bomb calorimetric experiment.
   (i) Weight of coal sample = 0.9 g
   (ii) Weight of water in copper calorimeter = 2200 g
   (iii) Water equivalent of calorimeter = 550 g
   (iv) Rise in temperature = 2.5°C
   (v) Percentage of Hydrogen in coal sample = 6%
   (vi) Specific heat of water = 4.2 J/kg/K
   (vii) Latent heat of steam = 2454 J/kg. **(05 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**
   i) In water system where all the three phases coexist at a point if
      A) Invariant B) Bivariant C) Univariant D) None of these
   ii) The condensed phase rule is applicable to
      A) Pb & Ag system B) Water system
      C) System with no vapour pressure D) (a) & (c)
   iii) Pb / Ag alloy system at the eutectic point both metals have
      A) Lowest melting point B) Highest melting point
      C) Same melting point of even metal D) Average melting point of both
   iv) The electrodes used in potantiometric titration of FAS against $K_2Cr_2O_7$ are,
      A) Two Platinum electrodes B) Platinum and Calomel electrode
      C) Glass and Calomel electrode D) Silver and Platinum electrode

   b. State Gibb's Phase rule. Explain the lines across and triple point for the system. **(07 Marks)**
   c. Explain the principle of conductometric filtration. Describe the estimation of HCℓ acid by conductometric method. **(06 Marks)**
   d. Explain the terms Phase and component w.r.t phase rule. **(03 Marks)**

7 a. Choose the correct answers for the following : **(04 Marks)**
   i) The Polymer having highest softening point is
      A) Bakelite B) Teflon C) Nylon D) Butyl rubber
   ii) Bakelite is an example of
      A) Thermo plastic B) Thermo setting plastic
      C) Homo polymer D) Solution Polymarisation
   iii) The important application of butyl rubber is in the manufacture of
      A) Tyres B) Inner tube of tyre
      C) Rubber sheets D) Vulcanised rubber
   iv) Plexi glass is used for making
      A) Cable wires B) Contact lens and Artificial denture
      C) Tyres D) Sheets

   b. What is Glass transition temperature (Tg)? Explain the factors which affects Tg of a polymer. **(06 Marks)**
   c. Give the manufacture and uses of (i) Teflon ii) Polymethyl methane acrylate. **(06 Marks)**
   d. Explain the polymerisation of ethylene by free radical mechanism. **(04 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**
   i) The maximum permissible amount of fluoride in the drinking water is
      A) 10 mg/dm^3 B) 5 mg/dm^3 C) 0.7 – 1.2 mg/dm^3 D) 3 mg/dm^3
   ii) The alkalinity of water is not due to
      A) $OH^{\ominus}$ B) $H CO_3^{\ominus}$ C) $CO_2^{2\ominus}$ D) H^+ ions

iii) The presence of fluoride in water is determined by
    A) Calorimetric method   B) Volumetric method
    C) Gravimetric method   D) Precipitation method

iv) Sea water is converted into Potable water by
    A) Reverse Osmosis B) By Filteration   C) Distillation   D) None of these

b. What is Electro dialysis? Explain the electro dialysis process of desalination of water. **(07 Marks)**

c. Explain the method estimation of chloride ions in water by Mohr's method. **(06 Marks)**

d. $25 cm^3$ of waste water consumes $6 cm^3$ of 0.05N Potassium dichromate solution for complete oxidation. Calculate the COD of the waste water. **(03 Marks)**

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