First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
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)   The reference electrode used in the measurement of standard reduction potential is,
        A) Saturated Calomel electrode   B) Hydrogen electrode
        C) Ag-AgCl electrode   D) SHE
   ii) For an electrochemical cell, the overall reaction occurs spontaneously when dissimilar metals dipped in solutions of their respective ions. This type of cell is referred to as,
        A) Galvanic cell   B) Fuel cell   C) Electrolytic cell   D) None of these
   iii) At lab temperature, the potential of calomel electrode depends on,
        A) Conc of Hg^{2+} ions   B) Conc of $H_{g_2}^{2+}$ ions   C) Hg_2Cl_2 D) Conc of Cl^- ions
   iv) A metal rod is dipped in a solution of its ions. Its electrode potential is independent of,
        A) Temperature of the solution   B) Concentration of the cell
        C) Area of the metal exposed   D) Nature of the metal

   b. Consider an electrochemical cell F_e/F_e^{2+} (0.02M) $\parallel$ cd^{2+} (1M) $\mid$ cd . (i) Write the half cell and net cell reactions   (ii) Calculate the EMF of the cell. Given the standard reduction potentials of iron and cadmium are $-0.44V$ and $-0.40V$ respectively.   (05 Marks)

   c. What are reference electrodes? Explain the construction and working of a calomel electrode.   (06 Marks)

   d. What are concentration cells? Derive an expression for the EMF of a concentration cell.   (05 Marks)

2 a. Choose the correct answers for the following :   (04 Marks)
   i)   In which of the following, the net cell reaction is irreversible.
        A) $Zn - MnO_2$ B) $pb - H_2SO_4$ C) $Ni - MH$ D) $Ni - cd$
   ii) In Ni-MH cell, the anode of the cell is,
        A) Ni metal   B) An alloy of iron   C) Metal hydride   D) Cd
   iii) In which battery, a key component is separated from rest of the battery prior to activation.
        A) Primary battery   B) Secondary battery C) Reseve battery   D) None of these
   iv) The basic components of fuel cells are,
        A) Fuel and oxidant   B) Electrolyte and electrocatalyst
        C) Electrodes   D) All of these

   b. What is a secondary battery? Explain he construction and working of Lead-acid battery. Write the reactions involved in it.   (05 Marks)

   c. What is a fuel cell? Explain the construction and working of $H_2 - O_2$ fuel cell.   (05 Marks)

   d. Discuss the following battery characteristics:
       (i) Cycle life   (ii) Energy efficiency   (iii) Voltage   (06 Marks)

3 a. Choose the correct answers for the following :   (04 Marks)
   i)   During corrosion of metal, H_2 is liberated at the,
        A) Cathode   B) Anode   C) Anode and Cathode   D) None of these
   ii) A iron boat floats half dipped in nearly neutral salt water. If corrosion is observed, which area of the boat gets corroded first?
        A) Above the water level   B) Entire area of the boat
        C) At and below the water line   D) None of these.

iii) If Iron is coated with Zn, which metal gets corroded in corrosive environment?

    A) Iron   B) Zinc   C) Both Iron and zinc   D) Both are protected from corrosion

iv) During Galvonic corrosion, the noblest metal acts as,

    A) Anode   B) Cathode   C) Both Anode and Cathode   D) Corroding metal.

b. What is cathodic protection? Explain corrosion control by sacrificial anode method with any two suitable examples. **(05 Marks)**

c. How does the following factors affect the rate of corrosion: (i) Relative anodic and cathodic areas (ii) Nature of corrosion product (iii) Temperature. **(06 Marks)**

d. Write a note on (i) Water line corrosion (ii) Stress corrosion. **(05 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**

    i) When the metal structure to be plated is irregular, the process preferred is _____

    A) Electroplating   B) Electroless plating

    C) Electropolishing   D) None of these

    ii) In electroplating of chromium, chromium is not used as anode because it,

    A) Becomes passive   B) Increases the concentration of C_r^{3+} ions

    C) Gives a black deposit   D) All of these

    iii) In electroless plating of copper, formaldehyde is used as,

    A) Complexing agent B) Reducing agent   C) Buffer   D) Electrolyte

    iv) One of the primary technical importance of metal finishing is to impart,

    A) Deterioration of metal surface   B) Weak strength and resistance

    C) Good surface finish, strength and durability   D) None of these

b. Define the term metal finishing. Mention any four technological importance of metal finishing. **(05 Marks)**

c. Explain the process of electroplating of gold. **(05 Marks)**

d. What is electroless plating. Explain the electroless plating of copper. **(06 Marks)**

PART – B

5 a. Choose the correct answers for the following : **(04 Marks)**

    i) For improving anti-knock property of petrol, it is mixed with,

    A) Lead bromide   B) Lead chloride

    C) Allyl bromide   D) Tetra ethyl lead

    ii) If about 20-25% ethyl alcohol is blended with petrol and used as a fuel for internal combustion engine, it is known as,

    A) absolute alcohol B) spirit   C) gasoline   D) power alcohol

    iii) Which of the following is not a secondary fuel,

    A) coal gas   B) water gas   C) producer gas   D) Natural gas

    iv) A change in molecular structure may be produced without much change in molecular mass. The process is called,

    A) Reforming   B) Petrol knocking   C) Cracking   D) None of these.

b. Define Net and Gross calorific values of a fuel. Describe how calorific value of a solid fuel is determined by Bomb calorimeter. **(06 Marks)**

c. What is reformation of petrol? Give any four reactions involved in the reformation process. **(05 Marks)**

d. Explain the construction and working of a photovoltaic cell. **(05 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**

    i) The point in the phase diagram of water where ice, water and vapour co-exist is called

    A) Eutectic point   B) Eutectoid point C) Critical point   D) Triple point

ii) Flame photometer is based on,
A) Absorption   B) Emission   C) Absorbance   D) Transmittance

iii) Redox titrations are preferentially followed by,
A) Conductometric measurements   B) Potentiometric measurements
C) Caorimetric measurements   D) pH-measurements

iv) In the estimation of copper by calorimetric method, wave-length of light selected is,
A) 420 nm   B) 620 nm   C) 570 nm   D) 320 nm

(05 Marks)

b. Explain the application of phase rule to Lead-silver system.   (05 Marks)

c. State phase rule. Explain the terms-phase and component.   (06 Marks)

d. Discuss the experimental method and nature of graph for the conductometric estimation of acid mixture.

(04 Marks)

7   a. Choose the correct answers for the following :
   i) The monomers used in the manufacture of Epoxy Resin are,
      A) Epichlorohydrin and bis-phenol-A   B) Diisocyanate and Glycol
      C) Tetra fluoroethylene and butadiene   D) Phenol and Formaldehyde.

   ii) Polymethyl methacrylate is commercially called,
      A) Teflon   B) Bakeline   C) Plexiglass   D) Araldite

   iii) Natural rubber is the polymerized form of,
      A) Chloroprene   B) Isoprene   C) Propene   D) Styrene

   iv) Which one is a conducting polymer,
      A) Aniline   B) Pyrrole   C) Polyacetylene   D) Polycarbonate

b. Explain the manufacture of following polymers and mention their uses. (i) Teflon
   (ii) Butyl rubber.   (05 Marks)

c. Explain Free Radical mechanism of polymerization of ethylene.   (06 Marks)

d. Explain the mechanism of conduction is polyacetylene.   (05 Marks)

(04 Marks)

8   a. Choose the correct answers for the following :
   i) Flouride content of water is determined by,
      A) Gravimetric method   B) Calorimetric method
      C) Electro-analytical method   D) None of these

   ii) Total hardness of water is expressed in terms of ppm of,
      A) $MgSO_4$ B) CaO   C) $CaSO_4$ D) $CaCO_3$

   iii) In the determination of chemical oxygen demand of water sample mercuric sulphate , is used
      A) To avoid interference of chloride ions
      B) To catalyse oxidation of low molecular weight fatty acids
      C) To oxidize the impurities
      D) All of these.

   iv) In the activated sludge method or treatment process of sewage water, the impurities are oxidized by treating with,
      A) Inorganic chemicals   B) Ozone
      C) Micro-organisms and aerobic bacteria   D) Acidified potassium dichromate.

b. Describe the Argentometric method of estimation of chloride content in a water sample.   (06 Marks)

c. What is Desalination? Explain desalination of water by Reverse osmosis.   (05 Marks)

d. In a COD experiment 20 cm^3 of an effluent sample required 9.8 cm^3 of 0.001 M $K_2Cr_2O_7$ for oxidation. Calculate COD of the sample.   (05 Marks)

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