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10CHE12

First Semester B.E. Degree Examination, January 2011
Engineering Chemistry

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing at least two from each part.*
2. *Answer all objective type questions only in OMR sheet page 5 of the answer booklet.*
3. *Answer to objective type questions on sheets other than OMR will not be valued.*

PART – A

1 a. Choose the correct answer :

i) The secondary reference electrode, used in the measurement of standard reduction potential is
A) Calomel electrode B) Standard hydrogen electrode
C) Glass electrode D) None of these.

ii) The standard reduction potential of Zn and Ag are -0.76 V and +0.80 V respectively. The emf of the cell, formed by combining the electrodes will be
A) 1.56 V B) – 1.66 V C) 2.0 V D) 1.2 V

iii) The emf of an electrochemical cell, with a non-spontaneons reaction is
A) Positive B) Negative C) Zero D) None of these.

iv) In concentration cells, an electrode in contact with more dilute solution of an electrolyte acts as
A) Cathode B) Anode C) Inert electrode D) None of these.

(04 Marks)

b. Describe the construction of a glass electrode and explain the measurement of pH of a solution. **(06 Marks)**

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

d. An electrochemical cell consists of an iron electrode, dipped in 0.1 M $FeSO_4$ and silver electrode dipped in 0.05 M $AgNO_3$ solution. Write the cell representation, cell reaction and calculate the emf of the cell at 298 K. Given that the standard reduction potentials of iron and silver electrodes are – 0.44 V and +0.80 V, respectively. **(04 Marks)**

2 a. Choose the correct answer :

i) The cell reactions are reversible in
A) Zn – MnO_2 cell B) Zinc – Carbon cell C) Zinc – Air cell D) Ni – MH cell.

ii) The electrolyte used in Ni – MH battery is
A) H_2SO_4 B) NH_4Cl C) $ZnCl_2$ D) KoH

iii) In Pb – acid battery, with increase in electrolyte concentration, the battery voltage
A) Decreases B) Increases C) Remains same D) None of these.

iv) The emf of a concentration cell with 0.05 M and 0.025 M $AgNO_3$ solutions is
A) 0.178 V B) 0.0295 V C) 0.0178 V D) 0.125 V

(04 Marks)

b. Explain the following battery characteristics : i) Cycle life ; ii) Shelf life. **(04 Marks)**

c. Describe the construction and working of Zinc – Air battery. **(06 Marks)**

d. What are fuel cells? Describe the construction and working of a $CH_3OH – O_2$ fuel cell. **(06 Marks)**

3 a. Choose the correct answer :

i) Caustic embrittlement in boilers is due to
A) Excess of Na_2CO_3 B) Excess of $MgCl_2$
C) Excess of $CaSO_4$ D) None of these.

ii) The process of increasing the thickness of oxide layer on nonferrous metals, by electrolytic oxidation is called
A) Anodizing B) Phosphating C) Galvanizing D) None of these.

iii) Water line corrosion is an example of
A) Differential metal corrosion B) Galvanic corrosion
C) Differential aeration corrosion D) Stress corrosion.

iv) Rusting of iron is a process of
A) Reduction B) Oxidation C) Passivation D) None of these.
(04 Marks)

b. What is corrosion? Explain the electrochemical theory of corrosion with reference to iron. **(06 Marks)**

c. Why aluminium is anodized? Explain the process of anodizing. **(05 Marks)**

d. What are metallic coatings? Explain the galvanizing process. **(05 Marks)**

4 a. Choose the correct answer :

i) Addition of non participating electrolytes in an electroplating bath is to
A) Increase the plating rate B) Increase the current density
C) Increase the conductivity D) None of these.

ii) In the electroplating process, the structure modifiers are added to
A) Reduce internal stress B) Reduce passivation of anode
C) Increase metal ion concentration D) None of these.

iii) The process used to manufacture a double sided printed circuit board is
A) Electroless plating B) Electroplating
C) Immersion plating D) Phosphating.

iv) Elextroless plating process is possible only on
A) Catalytically active surface B) Inactive surface
C) Any surface D) None of these. **(04 Marks)**

b. What are the advantages of electroless plating over electroplating? Explain electroplating of chromium. **(06 Marks)**

c. Explain the following factors that influence the nature of the electrodeposit :
i) pH of the electrolytic bath ; ii) temperature. **(04 Marks)**

d. Explain the process of electroless plating of copper, with relevant reactions. **(06 Marks)**

PART – B

5 a. Choose the correct answer :

i) Methyl tertiary butyl ether is added to the gasoline to
A) Increase the cetane number B) Minimize the knocling
C) Increase the efficiency of diesel engine D) All of these.

ii) A reference mixture used to find the cetane number of diesel is
A) α - methyl naphthalene – Isooctane B) n – Heptane – Isooctane
C) α - methyl naphthalene – Hexadecane D) n – Heptane – pentane.

iii) A tendency of knocking is high if gasoline contains
A) Straight chain hydrocarbons B) Cycloparaffins
C) Aromatics D) None of these.

iv) Gasohol is a blend of gasoline with
A) Methanol B) Propanol C) Butanol D) Ethanol.
(04 Marks)

b. On burning 0.96 x 10^{-3} kg of a solid fuel, in a bomb calorimeter, the temperature of 3.5 kg of water was increased by 2.7°C. Water equivalent of the calorimeter and latent heat of steam are 0.385 kg and 2455 kJ/kg, respectively. If the fuel contains 5% hydrogen, calculate its gross and net calorific values. **(04 Marks)**

c. What are catalytic converters? Explain the working of catalytic converters. **(06 Marks)**

d. What is knocking? Explain the mechanism involved. **(06 Marks)**

6 a. Choose the correct answer :

i) In potentiometric measurements, platinum electrode is combined with
A) Glass electrode B) Calomel electrode
C) Zinc electrode D) None of these.

ii) Colorimetric estimation is based on
A) Lambert's Beer's law B) Ohm's law
C) Faraday's D) None of these.

iii) Conductivity of a solution is same as specific conductivity, when the cell constant of the conductivity cell is
A) Two B) One C) Zero D) None of these.

iv) The indicator electrode used in the potentiometric measurements is
A) Glass electrode B) Pt electrode
C) Ion selective electrode D) Calomel electrode. **(04 Marks)**

b. State the phase rule and explain the terms involved, with an example. **(06 Marks)**

c. Discuss the phase diagram of the water system and explain application of phase rule to the water system. **(06 Marks)**

d. What is flame photometry? Mention its applications in analytical chemistry. **(04 Marks)**

7 a. Choose the correct answer :

i) Benzoyl peroxide is used as
A) Initiator B) Propagator
C) Terminator D) Chain transfer agent.

ii) Addition polymerization is
A) Step polymerization B) Chain polymerization
C) Self condensation D) None of these.

iii) Addition of a plasticizer to the polymer
A) Increases T_g B) Decreases Tg
C) Decreases cross linking D) None of these.

iv) The commercial name of polymer polymethylmethancrylate is
A) Spandex B) Acrilon C) Plexiglass D) Novolac. **(04 Marks)**

b. What are the various methods of moulding plastics? Explain injection moulding. **(06 Marks)**

c. What are the deficiencies of natural rubber? Explain the vulcanization of rubber. **(06 Marks)**

d. Describe the synthesis and applications of Kevlar fiber. **(04 Marks)**

8 a. Choose the correct answer :

i) Secondary treatment of sewage is carried out to reduce
A) Organic load B) Inorganic load
C) Destroy microorganisms D) None of these.

ii) In reverse osmosis the flow of solvent takes phase form
A) Dilute to concentrated side B) Concentrated to dilute side
C) Solute to solvent side D) None of these.

iii) Temporary hardness of water is due to
A) $Ca(HCO_3)_2$ B) $CaCl_2$ C) $CaSO_4$ D) $MgSO_4$.

iv) The method used for secondary treatment of sewage is
A) Activated sludge process B) Ion – exchange
C) Reverse osmosis D) Electro-dialysis **(04 Marks)**

b. What is desalination? Explain the desalination of water by electro-dialysis. **(05 Marks)**

c. Explain the argentometric method of determination of chloride in water. Write the reactions involved. **(06 Marks)**

d. 50 m*l* of sample of water consumed 15 m*l* 0.01 MEDTA, before boiling and 5 m*l* of the same EDTA, after boiling. Calculate the degree of total hardness, permanent hardness and temporary hardness. **(05 Marks)**

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