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06CHE12/22

First/Second Semester B.E. Degree Examination, December 2010
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 on 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. Select the correct answer:

i) The tendency of knocking is more in ..... hydrocarbons.
A) Aromatic B) Straight chain C) Olefins D) Cyclic

ii) Catalyst used in fluidized-bed catalytic cracking is
A) $ZrO_2 + CeO_2$ B) $Al_2O_3 + Fe_2O_3$
C) Fluidized Al_2O_3 and SiO_2 D) $Al_2O_3 + CeO_2$

iii) Petrol obtained from petroleum oil is subjected to reforming because
A) To remove impurities and water B) For structural modification
C) For degradation of high mol. weight hydrocarbons D) To reduce weight.

iv) ..... junction is used in the conversion of solar energy into electrical energy.
A) p – n – p B) n – p – n C) p – n D) none of these. **(04 Marks)**

b. Define net and gross calorific value of a fuel. Describe how calorific value of a solid sample is determined. **(07 Marks)**

c. Explain the terms 'octane' and 'cetane' numbers. **(05 Marks)**

d. Calculate the gross calorific of a sample of coke from the following data:
Mass of coke: 0.73×10^{-3}kg Water equivalent of the calorimeter: 0.328 kg
Mass of water: 1.25 kg Specific heat of water: 4.187 kJ $kg^{-1}K^{-1}$
Rise in temperature: 1.9 K. **(04 Marks)**

2 a. Select the correct answer:

i) Glass electrode can not be used in the presence of fluoride ions because
A) alkaline error B) loss its activity
C) glass membrane dissolves D) leads to asymmetric potential.

ii) The value of EMF is ..... , if ΔG = -212.3 kJ/mol, T = 298 K and Faraday constant = 9.65 kJ/V/mol.
A) 11.0 V B) 1.1 V C) 2.2 V D) 22.0 V

iii) EMF of a cell mainly depends on
A) Size of the cell B) Quantity of the electrolyte
C) Weight of the cell D) Difference between $E_{cathode}$ and E_{anode}.

iv) Use of secondary reference electrode is preferred over primary reference electrode becasue
A) it is light weight B) it is compact
C) it is reversible with electrolyte D) it gives constant and reproducible potential. **(04 Marks)**

2 b. What are ion-selective electrodes? Explain the principle, construction and working of a glass electrode. **(06 Marks)**

c. Derive the Nernst equation for a single electrode. Write Nernst equation for the given cell:

$$Cu\,(s)\,|\,Cu^{2+}\,(aq)\;\overrightarrow{||}\;Ag^{+}\,(aq)\,|\,Ag$$ **(05 Marks)**

d. Calculate $E^{0}_{Zn^{2+}/Zn}$, if the emf of $Zn\,|\,Zn^{2+}\,(a=1)\,||\,Ni^{2+}\,(a=1)\,|\,Ni$ is 0.51 and $Ni\,|\,Ni^{2+}\,(a=1)\,||$ SCE is 0.49 V. Given $E^{0}_{SCE} = 0.24V$. **(05 Marks)**

3 a. Select the correct answer:

i) The electrolyte used in Li-MnO_2 battery is
A) 30% H_2SO_4 B) 6M KOH
C) Li-halide and organic solvents D) $NH_4Cl + ZnCl_2$

ii) Hot KOH solution should be used in H_2O_2 fuel cell
A) to increase conductivity B) to enhance the absorption of hydrogen on anode
C) for better reduction of O_2 D) to avoid dilution of KOH.

iii) In some batteries, graphite is used as an additive, because
A) it reduces the total weight B) it absorbs the moisture
C) it improves the conductivity D) to increase the surface area of the electrode.

iv) Lithium metal is used as anodic material in Lithium batteries because
A) it readily looses the electrons B) its reduction potential is very high
C) its size is very small D) it readily reacts with water. **(04 Marks)**

b. What are the modern batteries? Explain the construction, reactions and applications of a Ni-MH battery. **(06 Marks)**

c. Explain the following characteristics of a battery:
i) Capacity ii) Cycle life. **(05 Marks)**

d. How is a fuel cell, in which chemical energy is converted into electrical energy, more advantageous over the conventional batteries? Justify – "fuel air is only an energy conversion device and not an energy storage device". **(05 Marks)**

4 a. Select the correct answer:

i) Appropriate corrosion control for a buried pipeline is
A) Painting B) Cathodic protection C) Cathodic coating D) Metallic coating

ii) Cathodic coating is
A) coating of tin on iron B) coating of zinc on iron
C) conversion of whole specimen into cathode D) immersion into hot $ZnCl_2$ soln.

iii) A bolt and a nut made of the same metal is preferred in practice to avoid
A) stress corrosion B) differential aeration corrosion
C) differential metal corrosion D) caustic embrittlement.

iv) The reaction at an anode during corrosion is
A) Oxidation B) Reduction C) Redox D) Conversion. **(04 Marks)**

b. Define metallic corrosion. Discuss the following factors which influence the rate of corrosion: i) Nature of corrosion products ii) Hydrogen over-voltage **(05 Marks)**

c. What is anodizing? Explain the anodizing of aluminium. **(06 Marks)**

d. Write a note on phosphating. **(05 Marks)**

PART – B

5 a. Select the correct answer:

i) 'Pickling' is
A) alkali cleaning B) acid cleaning C) organic solvent cleaning D) water cleaning

ii) As temperature increases the electro-deposition
A) decreases B) increases
C) no effect D) first decreases and then increases

iii) The experimentally determined discharge potential of an electrode is 2.58V and its theoretical discharge potential is 1.53V; then over-voltage is
A) 3.345 V B) -1.05 V C) 4.11 V D) 1.05 V

iv) As over-voltage increases, electroplating
A) decreases B) increases C) no change D) increases and decreases.

(04 Marks)

b. Explain the significance of the following electroplating:
i) Polarization ii) Over-voltage. **(08 Marks)**

c. Differentiate between electroplating and electroless plating. **(04 Marks)**

d. Explain the surface propagation and electroplating of chromium on a steel material. **(04 Marks)**

6 a. Select the correct answer:

i) The molecular ordering in nematic phase is
A) No positional order and orientational order
B) Perfect positional and orientational order
C) No positional but orientational order
D) Total loss in molecular ordering.

ii) The layered structure is found in ..... phase.
A) nematic B) discotic C) meso D) smectic

iii) In potentiometric acid-base titration, the indicator electrode is
A) calomel B) Ag-AgCl C) Glass-electrode D) platinum

iv) Mathematical expression of Beer-Lambert law is
A) $A = -\log T = C\ell$ B) $A = \log T = C\ell$
C) $\log (I_0 / I_t) = \in C\ell$ D) $\log (I_t / I_0) = \in C\ell$ **(04 Marks)**

b. What are the liquid crystals? Discuss the classification, with examples. **(07 Marks)**

c. Explain the liquid crystalline behaviour in PAA homologous series. **(04 Marks)**

d. Explain the theory behind the conductometric titration. Draw and explain the conductometric titration curve for the following titrations:
i) A strong acid and a strong base ii) A strong acid and a weak base. **(05 Marks)**

7 a. Select the correct answer:

i) A polymer of high optical clarity used in preparation of lenses is
A) Teflon B) Phenol-formaldehyde C) Neoprene D) PMMA

7 a. ii) The glass transition temperature (T_g) depends on
A) type of monomer used B) type of polymerization
C) chemical resistance D) molecular weight

iii) Monomer used in Teflon is
A) fluorine B) bisphenol C) tetrafluoroethylene D) epichlorohydrin

iv) The molecular weight of addition polymer is integral multiple of the molecular weight of monomer used because
A) it is a linear polymer B) no solvent in added
C) it involves a catalyst D) no elimination of byproducts **(04 Marks)**

b. What is polymerization? Explain the solution polymerization. **(05 Marks)**

c. Justify the following :
i) Crystalline polymers possess higher strength than amorphous polymers.
ii) Thermal control is rather difficult in bulk polymerization. **(05 Marks)**

d. What are resins? Give the synthesis, properties and uses of phenol-formaldehyde. **(06 Marks)**

8 a. Select the correct answer:
i) The purest form of water is
A) river B) Borewell C) Rain D) Spring

ii) In chloride analysis (Argentometric), the end point is brick-red, due to
A) $AgCr_2O_7$ B) $AgNO_3$ C) AgCl D) Ag_2CrO_4

iii) Complexing agent for spectrophotometric analysis of nitrate is
A) SPADNS B) Ammonia C) Phenol sulphonic acid D) Phenol disulphonic acid

iv) The method removing temporary hardness is
A) soda process B) boiling C) distillation D) reverse osmosis **(04 Marks)**

b. Define alkalinity. If 'P' represents the phenolphthalein alkalinity and 'M' represents the methyl orange alkalinity, for a given sample of water, how do you predict the types of alkalinity, when (i) P = M (ii) P = ½ M (iii) P > ½ M (iv) P < ½ M ? **(05 Marks)**

c. A river courses first through a terrain rich in limestone and through a terrain rich in gypsum. Identify the type of hardness it accumulates in its path. Explain the need for maintaining a constant pH and the colour changes that occur, when the hardness of this water is being determined by titration against EDTA, using Eriochrome black-T as the indicator. **(05 Marks)**

d. Give an account of the following:
i) COD is higher than BOD.
ii) $HgSO_4$ and Ag_2SO_4 are to be added during COD analysis.
iii) Chlorine is a powerful disinfectant only at lower pH values. **(06 Marks)**

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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 0.96×10^{-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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