USN

First/Second Semester B.E. Degree Examination, May/June 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. i) In Fischer-Tropsch process, petrol is synthesized using
A) Producer gas B) Water gas C) Coal gas D) Natural gas

ii) Lead tetra ethyl is added to gasoline to
A) Increase the octane number B) Minimize knocking
C) Increase the efficiency of IC engine D) All of these.

iii) A reference mixture used to find the octane number of gasoline is
A) n-heptane and n-octane B) n-heptane and isooctane
C) n-heptane and isobutene D) n-heptane and n-cetane

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

b. Define gross calorific value and net calorific value. Calculate GCV and NCV from the following data:
Mass of the fuel sample used for combustion = 0.85×10^{-3} kg
Mass of water in the copper calorimeter = 2.35 kg
Water equivalent of calorimeter = 0.45 kg
Specific heat of water = 4.187 kJ/kg/K
Increase in temperature of water = 3.2°C
Latent heat of condensation of steam = 2457 kJ/kg
Percentage of hydrogen in the fuel sample = 2.5. **(06 Marks)**

c. What is reformation? How reformation enhances octane rating? Illustrate with examples. **(05 Marks)**

d. What is photo-voltaic cell? Explain the construction and working of PV cell. **(05 Marks)**

2 a. i) The reference electrode used in the measurement of standard reduction potential is
A) Saturated calomel electrode B) Ag/AgCl electrode
C) Glass electrode D) Standard hydrogen electrode

ii) The electrode with –ve sign for its SRP acts as
A) Anode with respect to SHE B) Cathode with respect to SHE
C) Acts as both D) None of these

iii) Potentiometer used for measurement of emf is calibrated using
A) Ni-Cd cell B) Li-MnO_2 cell
C) Daniell cell D) Weston standard Cd-cell

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 origin of single electrode potential and derive Nernst equation. **(07 Marks)**

2 c. A galvanic cell is constructed by coupling Ag and Cd electrodes dipped in 0.5 M $AgNO_3$ and 0.25 M $CdSO_4$ respectively at 25°C. Write the cell scheme, cell reaction, and calculate emf of the cell. Given that SRPs of Ag and Cd are +0.80 V and –0.40 V respectively. **(04 Marks)**

d. Give the principle involved in the determination of p^H using glass electrode and explain the method of determining p^H using glass electrode. **(05 Marks)**

3 a. i) Which of the following is not a rechargeable battery?

A) Ni - Cd B) Zn – MnO_2 C) Li – MnO_2 D) Zn - air

ii) Li – MnO_2 has higher emf than Zn – MnO_2 battery because

A) Li is more electro +ve then Zn B) SRP of Li is less then Zn
C) Li undergoes oxidation readily D) All of these.

iii) In H_2 - O_2 fuel cell the electrolyte KOH is kept in warm condition to

A) Increase the efficiency B) Increase the conductivity
C) Maintain the electrolyte concentration D) Increase the emf

iv) The fuel cell involving solid electrolyte is

A) Molten carbonate B) Solid oxide
C) Polymer electrolyte D) None **(04 Marks)**

b. Explain the following battery characteristics:
i) Energy efficiency – ii) Cycle life. **(04 Marks)**

c. Why secondary batteries are considered as storage batteries? Explain the construction and working of Nickel-metal hydride battery. Give the reactions involved during discharge and recharge modes. **(06 Marks)**

d. How does a fuel cell differ from a battery? Explain the construction and working of methanol-oxygen fuel cell with H_2SO_4 as electrolyte. Indicate the advantage of H_2SO_4 as electrolyte over alkali electrolyte. **(06 Marks)**

4 a. i) Pitting corrosion can be explained on the basis of

A) Differential aeration B) Size of anode and cathode
C) Localized corrosion D) All

ii) In anodized aluminum, the corrosion protection is due to

A) Passive oxide coating B) Phosphate coating
C) Chromate coating D) None

iii) Polarisation of anode results in

A) Increase in the rate of corrosion
B) Decrease in the rate of corrosion
C) Increase in the rate of cathodic reaction
D) Increase in the rate of anodic reaction.

iv) Anodic protection can be applied to

A) All the metals
B) Metals which undergo active-passive transition
C) More electro +ve metals
D) Less electro +ve metals. **(04 Marks)**

b. Explain rusting of iron based on electro chemical phenomenon. **(05 Marks)**

c. What is cathodic protection? Explain sacrificial anode and impressed current techniques. **(05 Marks)**

d. What are corrosion inhibitors? Explain corrosion inhibition by cathodic inhibitors. Give the reactions involved. **(06 Marks)**

PART – B

5 a. i) In the process of electroplating there is
A) Electrolysis B) Discharge of metal ions at cathode
C) Redox reaction D) All

ii) The practical decomposition is greater than the theoretical decomposition potential because of
A) Ionisation B) Dissociation
C) Polarisation of electrodes D) None

iii) When an electrolytic mixture containing Zn^{++}, Cd^{++}, Cu^{++} and Ag^{+} is electrolysed, the ion which is going to be discharged first is
A) Zn^{++} B) Cu^{++} C) Cd^{++} D) Ag^{+}

iv) The function of the complexing agent in the electrolytic bath is to
A) Increase the conductivity
B) Maintain metal ion concentration at an optimum level
C) Increase in the metal ion concentration
D) None. **(04 Marks)**

b. Explain the effect of the following on the nature of electro deposit:
i) Current density ii) p^H iii) Throwing power. **(06 Marks)**

c. Explain the process of electroplating of chromium for engineering applications. Indicate the reasons for not employing chromium as anode. **(05 Marks)**

d. What is electroless plating? Explain electroless plating of nickel. **(05 Marks)**

6 a. i) Para Azoxy Anisole is an example for
A) Cholestric B) Smectic
C) Chiral nematic D) Nematic

ii) In potentiometer calomel electrode is used in combination with
A) Glass electrode B) Ag/AgCl electrode
C) Pt-electrode D) Quinhydrone electrode

iii) Liquid crystals are
A) Isotropic B) Optically anisotropic
C) Optically isotropic D) All

iv) In flame photometry the emitted radiation lies in
A) IR range B) UV range
C) Visible range D) All the three. **(04 Marks)**

b. What are thermotropic and lyotropic liquid crystals? Give examples. **(04 Marks)**

c. Define specific conductance. Explain conductometric estimation of HCl using standard solution of NaOH. **(05 Marks)**

d. State and explain Lambert's law and Beer's law. Explain in brief the estimation of copper by colorimetric method. **(07 Marks)**

7 a. i) Natural rubber is the polymerized form of
A) Chloroprene B) Isoprene C) Propene D) Styrene

ii) Condensation polymerization is
A) Homo polymerisation B) Chain polymerisation
C) Copolymerisation with elimination D) Copolymerisation without elimination

iii) Glass transition temperature of polymer is
A) First order transition B) Second order transition
C) Inner transition D) Poly order transition.

7 a. iv) In suspension polymerization the monomer droplets are stabilized by using

A) Emulsifying agent B) Coagulants

C) Anticoagulants D) Deemulsifying agent (04 Mar

b. Explain free radical mechanism of addition polymerization taking ethane as monomer. (04 Mar

c. Give the polymerization reaction involved in the synthesis of the following polymers:

i) Plexiglass ii) Polyurethane iii) Epoxy resin iv) Butyl rubber (08 Mar

d. What are conducting polymers? Explain conduction mechanism in doped poli acetylene. (04 Mar

8 a. i) Permanent hardness of water is due to

A) $Ca(HCO_3)_2$ B) $CaCO_3$ C) $CaSO_4$ D) $MgCO_3$

ii) Indicator used in the determination of chloride using $AgNO_3$ is

A) $K_3[Fe(CN)_6]$ B) $K_4[Fe(CN)_6]$ C) K_2CrO_4 D) $K_2Cr_2O_7$

iii) Excessive fluoride in water leads to

A) Dental carries B) Silicosis C) Fluorosis D) All

iv) The method adopted to convert saline water into potable water is

A) Demineralisation B) Ion exchange process

C) Permutit process D) Electrodialysis (04 Mar

b. Explain Winkler's method of determining dissolved oxygen. Give the reactions involved. (05 Mar

c. What is desalination? Explain desalination of water by reverse osmosis. (06 Mar

d. While analyzing a water sample to determine alkalinity, 100 ml of sample water consum 12.4 ml of $\frac{N}{50}$ H_2SO_4 till phenolphthalein end-point. On further titration of the reac mixture using methyl orange indicator, the total consumption of $\frac{N}{50}$ H_2SO_4 was 17.8 Determine the type and extent of alkalinity. (05 Mar

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