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06CHE12/22

First/Second Semester B.E. Degree Examination, June/July 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 (04 Marks)
- i) Ignition point of fuel depends on
A) Hydrogen content B) Oxygen content
C) Sulfur content D) Nitrogen content
- ii) Mention the catalyst and working temperature required for fluidized bed catalytic cracking process.
A) Clays and 350^oC B) Clays and 550^oC
C) Zeolites and 550^oC D) Zeolites and 350^oC
- iii) Reformation is a process of
A) Structural rearrangement of hydrocarbon
B) Breaking of heavier hydrocarbon to lower hydrocarbon
C) Structural rearrangement without altering the number of carbon atoms
D) None of these
- iv) Mention the catalyst used to convert carbon monoxide and hydrogen at 180 – 250^oC to form a mixture of aliphatic hydrocarbons
A) Copper B) Tin C) Zinc D) Iron
- b. Define calorific value of fuel. Explain the determination of calorific value of solid fuel sample. (06 Marks)
- c. Define octane number. Explain the methods of improving octane number. (05 Marks)
- d. Explain the construction and working of photovoltaic cell. (05 Marks)
2. a. Choose the correct answer (04 Marks)
- i) Galvanic cells can convert
A) Chemical energy into electrical energy
B) Electrical energy into chemical energy
C) Solar energy into chemical energy
D) None of these
- ii) Electrochemical reactions are spontaneous when change in free energy is
A) Positive B) Negative C) Zero D) None
- iii) Cell potential of a concentration cell is positive only if
A) $C_2 < C_1$ B) $C_2 = C_1$ C) $C_2 > C_1$ D) None
- iv) Glass electrode exchanges
A) Fluoride ions B) Hydrogen ions
C) Chloride ions D) None
- b. Define single electrode potential. Derive Nernst equation for single electrode. (06 Marks)
- c. What are reference electrodes. Explain the construction and working of coloured electrode. (05 Marks)

PART – B

5. a. Choose the correct answer (04 Marks)
- Polarization effect will be minimum during metal finishing if
 - Rate of anode reaction is equal to cathode reaction.
 - Rate of anode reaction is smaller than that of cathode.
 - Rate of anode reaction is greater than that of cathode
 - None of these.
 - Which anode is used in chromium electroplating?
 - Soluble chromium anode
 - Insoluble anodes
 - Inert anodes
 - None of these
 - When the metal structure to be plated is irregular, the process employed is :
 - Electroplating
 - Electroless plating
 - Electropolishing
 - None of these
 - Reducing agent used in electroless plating of copper is :
 - Sodium hypophosphite
 - Formaldehyde
 - Sodium acetate
 - Sodium Succinate
- b. Define the term metal finishing. Mention any four technological importance of metal finishing. (06 Marks)
- c. Explain the process of electroplating of gold. (04 Marks)
- d. What is electroless plating? Explain the process of electroless plating of nickel. (06 Marks)
6. a. Choose the correct answer (04 Marks)
- The mesophases which are formed by heating and cooling are called
 - Lyotropic phases
 - Thermotropic phases
 - Monotropic phases
 - None of these
 - Mention the electrodes used in conductivity cell
 - Platinum electrode
 - Glass electrode
 - Both are platinum electrode
 - Glass electrode and platinum electrode
 - In the estimation of FAS by potentiometry, the indicator electrode used is
 - Calomel electrode
 - Glass electrode
 - Platinum electrode
 - None of these
 - An ion selective electrode used in the determination of pH of a solution is
 - Calomel electrode
 - Glass electrode
 - Ag – AgCl electrode
 - None of these
- b. Define thermotropic and lyotropic liquid crystal with suitable example. (06 Marks)
- c. What are homologous series? Explain the liquid crystalline behaviour in PAA series. (05 Marks)
- d. Explain the nature of conductometric graph for the following titrations :
 i) Strong acid with strong base ii) Strong acid with weak base. (05 Marks)
7. a. Choose the correct answer (04 Marks)
- Temporary hardness of water is caused due to the presence of dissolved salts of
 - Calcium and magnesium carbonates
 - Calcium and magnesium bicarbonates
 - Calcium and magnesium sulfate
 - Calcium nitrate

- ii) The products that are formed under anaerobic oxidation in BOD experiment are
 A) Carbon dioxide and water B) Ammonia and hydrogen sulfide
 C) Both A and B D) None of these
- iii) Role of oxidizing agent in determination of COD of waste water
 A) It helps to reduce wastes present in water
 B) It helps to oxidize wastes present in water
 C) Both A and B
 D) None of these
- iv) Which indicator is used in determination of chloride ions present in water using silver nitrate solution?
 A) Potassium dichromate B) Potassium nitrate
 C) Potassium sulfate D) Potassium chromate
- b. Explain the determination of total hardness of water sample. (06 Marks)
- c. What is meant by desalination? Explain the process of reverse osmosis. (05 Marks)
- d. 25cm^3 of sewage sample for COD is reacted with 10cm^3 of $\text{K}_2\text{Cr}_2\text{O}_7$ solution and the unreacted $\text{K}_2\text{Cr}_2\text{O}_7$ requires 8.5cm^3 of 0.025N FAS solution. Under similar conditions, in blank titration 15cm^3 of same FAS is used up. Calculate the COD of the sample. (05 Marks)
8. a. Choose the correct answer (04 Marks)
- i) Phenol – formaldehyde resin is commercially called as
 A) PVC B) Nylon C) Bakelite D) Teflon
- ii) Hexamethylene diamine and adipic acid gives the following polymer.
 A) Nylon 66 B) PVC C) Nylon D) None
- iii) Sulfur is used particularly in
 A) Compounding of resins B) Vulcanization of rubber
 C) Both A and B D) None of these
- iv) Which types of polymer is used in smart window material.
 A) Teflon B) PVC C) Polyaniline D) Buna S
- b. Explain the free radical mechanism of addition polymerization. (06 Marks)
- c. Explain the preparation and mention the application of the following polymers :
 i) Polymethyl methacrylate ii) Teflon (06 Marks)
- d. Define the term glass transition temperature of a polymer. Mention the factors which affect the same. (04 Marks)

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Note: 1. Answer any FIVE full questions, choosing at least two from each part.
2. Answer all objective type questions on OMR sheet only.

PART – A

- 1 a. i) If the direction of flow of electrons in a galvanic cell is left to right then the name of cell reaction is
A) Reversible B) Irreversible C) Non – spontaneous D) Spontaneous.
- ii) Standard hydrogen electrode cannot be used in the presence of
A) Reducing agent B) Oxidising agent C) Water diluting agent D) All of these.
- iii) Calomel electrode is reversible with respect to
A) Calomel B) Mercury C) Chloride ions D) None of these
- iv) Glass electrode can be used with out an error upto a P^H of
A) 4 B) 14 C) 9 D) 12. (04 Marks)
- b. Derive Nernst equation for the potential of an electrode. (05 Marks)
- c. Calculate the voltage of a cell which consists of a rod of iron immersed in a 1.0 M solution of $Fe SO_4$ and a rod of manganese immersed in a 0.1 M solution of $Mn S_4$ at $25^\circ C$. Write the cell reaction. Give $E^\circ_{Fe^{2+}/Fe} = - 44 V$ and $E^\circ_{mn^{2+}/mn} = -1.18 V$. (05 Marks)
- d. Discuss the construction and working of glass electrode to determine the P^H of a solution. (06 Marks)
- 2 a. i) Double sulphate theory of lead - acid battery is proposed by
A) Nernst B) Faraday C) Glaston and taube D) Melmholtz.
- ii) Oxidation of methanol in methanol – oxygen fuel cell is a process of
A) one electron B) Four electrons C) two electrons D) Six electrons
- iii) Active material for anode in Nickel – Metal hydride battery is
A) $Ni.OH$ B) $Ni(OH)_2$ C) H_2 D) None of these
- iv) Electrolyte used in lithium batteries is
A) Aqueous B) Mixture of aqueous and non aqueous C) Non – aqueous
D) None of these. (04 Marks)
- b. Discuss the construction and working of zinc– air battery. (05 Marks)
- c. Explain the following battery characteristics
A) Voltage B) cycle life C) Energy efficiency. (06 Marks)
- d. Discuss the construction and working of hydrogen – oxygen fuel cell. (05 Marks)
- 3 a. i) Alkali and alkaline earth metals form an oxide
A) Protective B) Highly adherent C) Non – porous D) Porous.
- ii) Caustic embrittlement is an example of corrosion of
A) Differential metal B) differential aeration C) Stress D) Waterline.
- iii) Intense corrosion takes place when
A) Smaller cathodic area B) Larger anodic area C) Larger cathodic area
D) Smaller anodic area.
- iv) Copper containers to store the foodstuffs are coated with
A) Zn B) Al C) Sn D) Ni. (04 Marks)
- b. Discuss the electrochemical theory of corrosion taking iron as corroding metal. (05 Marks)
- c. Explain the following types of corrosion
A) Differential metal B) Waterline C) stress. (06 Marks)
- d. Discuss the sacrificial anode and impressed current methods of corrosion control. (05 Marks)

- 4 a. i) Technological importance of metal finishing is to impart
 A) Corrosion resistance B) Solderability C) Thermal resistance D) all of these.
 ii) The moderate temperature range of the bath composition for good electrodeposit is
 A) 20 - 30°C B) 70 - 80° C) 35 - 60°C D) none of these.
 iii) Use of complexing agent during electrodeposition is to
 A) Obtain lustrous deposit
 B) Release the gas bubbles from the deposit surface
 C) Reduce the concentration of plating ions if high
 D) Increase the current density.
 iv) Driving force of electroless plating is
 A) Power supply B) Oxidising agent C) Autocatalytic redox reaction D) None of these. (04 Marks)
- b. Explain the following variables which influence the nature of deposit
 A) Current density B) P^H of the electrolytic bath
 C) Throwing power of the plating bath. (06 Marks)
- c. Explain the process of electroplating of chromium for decorative chromium. (04 Marks)
- d. Discuss the process of electroless plating of copper and explain its application in the manufacture of PCB. (06 Marks)

PART - B

- 5 a. i) Catalyst used in fluidized catalytic cracking is
 A) Pt B) Cr_2O_3 C) Al_2O_3 D) Al_2O_3 and SiO_2 .
 ii) Reformation of petrol involves
 A) Hydrogenation B) Oxidation C) Hydrocracking D) None of these.
 iii) Antiknocking value of petrol can be increased by
 A) amyl nitrite B) Acetone peroxide C) Ethyl nitrite D) Ethyl - t - butyl ether.
 iv) Photovoltaic cell devices convert
 A) Chemical energy into electrical energy
 B) Electrical energy into chemical energy
 C) Sunlight energy into electrical energy
 D) None of these. (04 Marks)
- b. Discuss the process of fluidized catalytic cracking of heavy oil. (06 Marks)
- c. Explain the working of photovoltaic cell. (05 Marks)
- d. On burning 1.15g of a coal sample in a bomb calorimeter, the temperature of 3.5 kg of water in the calorimeter increased from 26.5°C to 28.5°C. Water equivalent of calorimeter is 325 g. Specific heat of water is 4.187 J/g/k and latent heat of steam is 2458 J/g. If the fuel contains 4% hydrogen, calculate its gross and net calorific values. (05 Marks)
- 6 a. i) The number of degree of freedom of a system having equilibrium with ice, liquid water and water vapour is
 A) 1 B) 3 C) 2 D) zero.
 ii) The process of raising the relative proportion of silver in the alloy is known as
 A) Gibb's process B) Pattinson's process C) Beer's process D) Plante's process.
 iii) The equation of condensed phase rule is
 A) $F = C - P + 2$ B) $F = C - P + 3$ C) $F = C - P + 1$ D) None of these.
 iv) The law states that current flowing in a conductor is directly proportional to the resistance of the conductor is known as
 A) Lambert's law B) Bedworth's law C) Ohm's law D) Faraday's law. (04 Marks)
- b. Explain the terms phase, component and degree of freedom involved in the statement of phase rule. (06 Marks)
- c. Explain the applications of phase rule over lead - silver system. (05 Marks)
- d. Discuss the theory and instrumentation of conductometric electroanalysis. (05 Marks)

- 7 a. i) Termination of polymerization is by
 A) Combination of growing chains
 B) Combination of growing chain with free radical of initiator
 C) Disproportionation
 D) All of these.
- ii) As flexibility of polymer increases, T_g
 A) Increases B) Ceases C) Decreases D) None of these.
- iii) Polyurethanes are characterized by the presence of
 A) $-\text{CH}_2-\text{O}-\text{CH}_2-$ B) $-\text{NH}-\text{CO}-$ C) $-\text{O}-\text{CO}-\text{O}-$ D) $-\text{NH}-\text{CO}-\text{O}-$.
- iv) Neoprene is closely related to
 A) Nitrile rubber B) Butyl rubber C) Natural rubber D) Buna - S rubber. (04 Marks)
- b. Discuss the free radical mechanism of polymerization taking ethylene as a monomer. (04 Marks)
- c. Give the synthesis of
 A) PMMA B) EPOXY resin C) Butyl rubber. (06 Marks)
- d. What are conducting polymers? Discuss the mechanism of oxidative doping of polyacetylene. (06 Marks)
- 8 a. i) Permanent hardness of water is caused by
 A) Sodium chloride
 B) Calcium bicarbonate
 C) Potassium sulphate
 D) Magnesium sulphate.
- ii) Sea water can be desalinated by
 A) Boiling B) Limesoda process C) Electrodialysis D) None of these.
- iii) Alkalinity of water is due to the presence of
 A) OH^- ions B) CO_3^{2-} ions C) HCO_3^- ions D) All of these.
- iv) General impurities present in water are
 A) Organic matters
 B) Pathogenic bacterias
 C) calcium sulphate
 D) All of these. (04 Marks)
- b. Discuss the determination of sulphate in water by using benzidine hydrochloride. (06 Marks)
- c. Define BOD and COD. Calculate the BOD when 1 litre of effluent from sugar industry containing 150 mg of glucose was completely oxidized into CO_2 and H_2O . (06 Marks)
- d. Explain the desalination of water by reverse osmosis process. (04 Marks)

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