**Chapter I. ELECTRODE POTENTIAL AND CELLS**

1. Define the following: a)Galvanic cell b)Electrolytic cell

2. Why is the anode of galvanic cell –ve and cathode +ve ? Write the different electrode reactions occur at the electrodes.[Mar01]

3. Discuss the origin of electrode potential? Derive Nernst equation for single electrode potential.[July04]

4. What is single electrode potential? Derive Nernst equation for single electrode potential.[ July03]

5. Define single electrode potential& standard electrode potential? Derive Nernst equation for electrode potential.[Jan 03]

6. Using Nernst equation calculate the electrode potential of Sn2+ + 2e `Sn when [Sn2+]=0.5M (E?Sn2+/Sn= -0.14V)

7. Compute the cell potential of the Ag+/Ag couple with respect to Cu2+/Cu if the concentration of Ag+ and Cu2+ are 4.2\*10-6 M and 1.3\*10-3 M respectively. Eo of Ag&Cu are 0.8 V & 0.34V.

8. Calculate the voltage of the cell Mg/Mg2+(aq soln.)// Cd2+(aq soln.)/ Cd at 250 C. when[Cd2+]=7.0\*10-11 M,[Mg2+]=1.0 M and E0cell=1.97V (Aug2000)

9. Write the half cell and net cell reactions for the cell , Cd(s)/ Cd2+(0.01M)// Cu2+ (0.5M)/Cu (s) the standard reduction potentials of cadmium and copper are -0.4 V and 0.34 V respectively. Calculate the EMF of the cell.

10. An electrochemical cell consists of iron electrode dipped in 0.1M FeSO4and silver electrode dipped in 0.05M AgNO3.Write the cell representation,cell reaction and caculate emf of the cell at 298K. Given the standard reduction potentials of iron &silver electrodes are –0.44&+0.80V[July04]

11. Derive Nernst equation for single electrode.Explain the method of determining electrode potential using hydrogen electrode?[Feb05]

12. Write brief notes on:
i) Calomel electrode
ii) Glass electrode[Feb05]

13. Describe the construction of calomel electrode? why it is called a secondary reference electrode?

14. Explain the construction & working of calomel electrode? Mention its advantages. [Jan 03]

15. How is potential of an electrode measured using a calomel electrode?

16. Explain the construction and working of Ag/AgCl electrode.(Aug99)

17. Give the principle of glass electrode?How is it constructed.

18. What is glass electrode?How is it constructed? Describe the experimental determination of pH of a solution using glass electrode.[July 05]

19. Write a note on ion-selective electrode.[Jan 03]
20. What are ion selective electrodes?Give the construction of glass electrode and explain the experimental method of determining pH using glass electrode.[July 03,04]

21. Define the terms
a)Standard electrode potential
b) e.m.f. of a cell

22. What are concentration cells?Derive an expression for the e.m.f of a concentration cell.(March00)

23. What are concentration cells? Explain with an example,calculate the EMF of the given cell at 298 K. Ag(s)/ AgNO3(0.018M)// AgNO3(1.2M)/Ag(s) (Aug 2000,Feb02)

24. Derive Nernst equation for the potential of a single electrode from thermodynamic principle. From this, deduce an expression for the emf of a copper concentration cell in which the copper Ions ratio is 10.Calculate the emf of this cell at 250C.[July05]

**Chapter II. BATTERY TECHNOLOGY**

1. What is the difference between a cell and battery?Give the classification of cells with examples.[Mar01]

2. Discuss the following battery characteristics:
i).Voltage ii).Capacity iii).Power density iv).Energy efficiency[July03]

3. Discuss on shelf life &cycle life of a battery. Explain the construction & working of Zn-MnO2 cell[Feb05].

4. Discuss any three important characteristics of a battery. [Feb03]

5. What are reserve batteries? Describe the construction & working of Pb-acid battery with reactions occurring during charging &discharging [Feb05]

6. What are primary batteries? Explain the construction & working of dry cell[July04]

7. Describe the construction of Pb storage battery.Give the reactions that occur during discharge.Mention its applications. [Feb03]

8. Calculate the potential of Daniell cell at 250C given the electrode potentials of Cu&Znare 0.34V&-0.76V respectively. [Feb04]

9. Describe the construction, working& applications of Ni-Cd cell. [Feb03]

10. Give the construction,working of Ni-Cd battery.Comment on the capacity & cycle life of a lead acid battery. [July05]

11. What are fuell cells? Indicate the advantages of fuel cells.Explain methanol-oxygen fuel cell with the reactions involved. [July04]

12. What is a fuel cell? How is it differ from the commercial galvanic cells? Calculate the standard e.m.f of the hydrogen-oxygen fuel cell given E value as –0.40V and 0.83V for the hydrogen and oxygen half cells respectively.[Aug00,Mar01]

13. Give the advantages of fuel cells . Describe the construction & working of H2-O2 fuel cell. [July03]

14. Describe the construction & working of methanol-oxygen fuel cell [Feb05].

15. What are alkaline batteries? Explain with an example.

16. Mention the anode,cathode&electrolyte in Zinc-air battery?Give the anodic &cathodic reactions taking place during discharge. [Feb04]

17. Describe the construction & working of Ni-Metal hydride battery with uses.

18. Explain the construction & working of Li-MnO2 cell.Mention the uses.

19. Write a note on different types of fuel cells.

20. Give the classification of fuel cells based on electrolyte & Explain.

21. Explain fuel cell containing polymer electrolyte&molten corbonate. [Feb03]

22. Write a note on hydrogen-oxygen fuel cell. [Feb03]

**Chapter III. CHEMICAL FUELS**

1. What are chemical fuels ? Give the classification of fuels with examples?[Feb05]

2. Define gross & net calorific value of a fuel.Describe how the calorific value of a solid fuel is determined by bomb calorimeter? [July04,Feb05]

3. Write a note on hydrocarbon fuels?

4. Define Calorific value of a solid fuel?How is it determined experimentally using bomb calorimeter?

5. Calculate the calorific value of a fuel sample of the coal with the following data Mass of the coal : 0.6g, Water equivalent of calorimeter:2200g Specific heat of water :4.187KJ Kg-1 ?C-1 Rise in temperature : 6.52?C

6. Define Calorific value of a fuel?Descibe the Boy's calorimetric method of determining the calorific value of a gaseous fuel.[July05]

7. What is meant by cracking? Describe with neat diagram fluidized bed catalytic cracking. [July03]

8. Explain the process fluidized bed catalytic cracking of petroleum.[Jan03]

9. What is knocking ?What are its ill effects ?Give the mechanism of knocking? How knocking can be prevented?[Feb05]

10. what is reformation of petroleum? How does reforming increases octane number? Give the reforming reactions.

11. what is reformation of petroleum? Give any three reactions involved in reforming[Jan04]

12. Define a)Octane number b)Cetane number

13. What is octane number? Explain with equations how reformation of gasoline enhances its octane rating?[July04]

14. Write a note on antiknocking agents?

15. What is power alcohol? Give its advantages as a fuel.[Jan04]

**Chapter IV. CORROSION ENGINEERING**

1. Discuss the electrochemical theory of corrosion[Mar01,Jan03]

2. What is metallic corrosion?Explain the electrochemical theory of corrosion of iron taking iron as an example.[Feb05]

3. Illustrate the reactions involved in differential aeration corrosion with reference to the iron metal.[Aug00]

4. Explain the electrochemical mechanism of rusting of iron in humid atmosphere.Mention any four factors that affect the rate of corrosion.[July05]

5. Explain the type of corrosion occurring in the following cases
i.Bolt and nut made from different metals are in contact with each other
ii.Deposition of small particles of dust on iron surface[Mar99]

6. Explain what type of corrosion occurs when
i.Screw &washer are made of different metals
ii.Presence of NaOH in mild steel boiler under stress.[Feb05]

7. Explain the mechanism of differential aeration corrosion.Give two examples where differential aeration effect as seen.[Mar00]

8. Write a note on i) Stress corrosion ii)Water line corrosion[Jan03]

9. Discuss the influence of following factors on the rate of metallic corrosion.]
i)Nature of corrosion product.[Jan03] ii) Polarisation of the electrode surface.[Aug01]
iii)Electrode potential iv)pH[Jan03] v) Anodic and cathodic areas[Jan04]
vi)Temperature[Jan03] vii) Nature of metal[July04]

10. What is metallic corrosion?Pin holes on tin coated iron are more prone to corrosion of iron than those on zinc coated iron.why?[Mar99]

11. Explain how corrosion can be minimised using the following techniques :
i)design and selection of materials, ii) cathode protection.[Mar01]

12. Discuss the following corrosion controls methods: i) Galvanizing ii) Tinning.Feb02]

13. What is cathodic protection?Explain the sacrificial anode and impressed current techniques for prevention of corrosion[July 03,04]

14. What is anodizing ? Explain anodizing of aluminium. [Mar01,Aug01,Feb02]

15. Write a brief note on corrosion inhibitors.[July05]

16. Explain the following corrosion control methods: a)Phosphating b)Organic coatings

17. Explain the anodic protection given to metals exposed to corrosion product? [Aug99]

**Chapter V. METAL FINISHING**

1. Define the following terms:
i. Polarization; ii. Decomposition potential; iii. Over voltage [Aug99,July03]

2. Explain the term decomposition potential. Mention its significance with reference to electrodeposition of metals.[Aug01]

3. Explain the term over voltage.Mention the factors that affect over-voltage.[Feb02]

4. What is meant by electrode polarisation?Mention any two factors that affect polarisation?[Mar00]

5. What is metal finishing?Mention the technological importance of metal finishing.Mar99Aug00]

6. Explain the effect of the following plating variables on the properties of electrodeposit:
i.Current density[Mar00,Aug01,July03, July05] ii. Throwing power of the plating bath
[Mar00,Aug01,July03, July05] iii.pH[Mar00] iv.Temperature [July05]
v.Metal ion concentration[July03]

7. Explain the functions of following addition agents in electroplating
i)Complexing agents.ii)Brighteners.iii)Levellers. iv)Wetting agents v)Structure modifiers

8. What is hydrogen over voltage ? What is its importance in electroplating.

9. Calculate the throwing power of the plating bath solution in a Haring-Blum cell if the distances between the two electrodes are 2.2 cm and 3.5 cm from the anode and the weights of the plating on the cathodes are 60mg and 65mg respectively?

10. Explain the methods of pretreatment of the electrode surface for plating?

11. What are the components of an electroplating process?

12. What are the objectives of electroplating? Explain Nickel plating.[Aug99,00,Aug01,Feb02]

13. What is known as metal finishing? Give a brief account of electroplating of copper.[Mar01]

14. Justify the following statements:
i) Prior to electroplating, the metal to be plated needs surface cleaning.
ii)Chromium anodes are not used in chromium plating[Aug99]

15. Explain the methods employed to clean the surface of metal to be electroplated[Jan03]

16. Discuss the electroplating of copper[Jan03]

17. What is electroplating?What are the advantages of electroless plating over electroplating? Explain the electroplating of Ni.[Feb05]

18. Discuss the electroless plating of nickel and its applications.[Jan03]

19. Distinguish between electroplating and electroless plating. Describe the electroless plating of nickel. [Mar99,July03]

20. What are the advantages of electroless plating ? Describe the electroless plating of nickel. [Mar00]

21. What is electroless plating? Describe the electroless plating of copper on printed circuit boards.[Mar99,Aug00,Feb02]

**Chapter VI. ENVIRONMENTAL CHEMISTRY**

1. What are the sources of oxides of nitrogen &sulphur ?Mention their harmful effects.Indicate the measures to control them.[Feb05]

2. What are the sources of air pollution? Give the effect and control of SO2 pollution?[Mar01,Feb02]

3. Mention the sources and ill effects of each
i.sulphur dioxide ii.Oxides of nitrogen iii.Photochemical oxidants. [Jan 03]

4. What are the sources of oxides of sulphur in air?Mention their harmful effects.Write the method to control these gases.[July04]

5. Discuss the harmful effects and prevention of CO pollution.

6. What is particulate matter? Mention the sources of particulate matter and their ill effects.[Mar99]

7. Give two reactions that cause acid rain and mention the ill effects of acid rain[Jan04]

8. Explain with a neat sketch how particulate matter in the atmosphere can be removed by cottrell or electrostatic precipitator.[Jan04]

9. Give the ill effects and prevention ozone depletion and greenhouse effect.[Mar01]

10. Give an account of the causes ill effects&preventive measures to control ozone depletion.[July03]

11. What is green house effect?How is it caused?What are its adverse effects.[Mar00]

12. Name the green house gases and explain their effect on global warming.[Mar99]

13. What is the importance of Ozone layer? Explain the causes of ozone depletion.[Feb02]

14. Write brief notes on: i)Ozone depletion ii)Global warming [Feb05]

15. Mention the sources of water pollution. Explain the terms of BOD and COD[Aug00,Feb02]

16. Explain the terms of BOD and COD.What are the steps involved in the tertiary treatment of sewage.[July05]

17. Calculate the COD of the effluent sample when 25 cm3 of an effluent requires 8.3 cm3 of 0.01M K2Cr2O7 for oxidation.{Given molecular mass of K2Cr2O7 =294} [Aug00]

18. Describe the primary and secondary methods of treatment of sewage. [Aug99]

19. What are the sources & ill effects of Cd,Pb,Hg as pollutants in water.[Jan03]

20. What are the sources & ill effects of Inorganic species(CN,NH3,H2S)

21. Write a note on pesticide pollution?

**Chapter VII. LIQUID CRYSTALS AND BIOTECHNOLOGY**

1. What are liquid crystals?Explain the molecular ordering in the following liquid crystal phases
i.Nematic phase ii. Chiral Nematic phase iii.Smectic phase [Feb 05]

2. Explain the applications of liquid crystals in display systems & thermography. [Feb 05]

3. Describe the biosynthesis of acetic acid. [Feb 05]

4. Describe the nematic & cholestric phases of thermotropic liquid crystals. [Feb 03]

5. Write a note on bio-fertilizers. [Feb 03]

6. Distinguish between thermotropic & lyotropic liquid crystals] .[July03]

7. Explain with suitable examples the liquid crystalline behavior based on chemical constitution.[July03]

8. what is a biosensor? Explain its functioning. Give the applications of biosensors. [July03]

9. Give an account of industrial enzymes used in food beverages. [July03]

10. Explain the effect of electric field on liquid crystals.[Jan04]

11. What is biotechnology? How is ethanol biosynthesized from molasses?[July04]

12. Describe the production of acetone from starch by biochemical process.[July05]

13. Describe the production of lactic acid from sugar by biochemical process

14. What are discotic liquid crystals?

15. With suitable examples Explain the liquid crystalline behavior in the following homologous series.
i.Para azoxyanisole(PAA)series. Ii.MBBA series

16. Explain the electro-optic effect of liquid crystals?How is it utilized in display systems?

17. Distinguish between nematic discotic & smectic discotic phases.

18. What is the role of sterilized soya beanoil in the biotechnological production of vitamin B12?

19. What are biopsensors?How are they classified?

20. Name the sourses of biofuels.

21. How is rapeseed oil converted in to a biofuel?

22. Write a note on biofertilizers and biosurfactants?

23. Write a note on i. Asymbiotic nitrogen fixation ii.Symbiotic nitrogen fixation

**Chapter VIII. HIGH POLYMERS**

1. What are polymers? How are they classified?

2. Define the following terms: Functionality(Aug99),Monomer, Degree of polymerization(Aug99)

3. Explain the number average and weight average molecular weight of polymers.(Mar00,01,Aug01)

4. Discuss the addition and condensation polymerization with examples.[Jan03]

5. Describe any two methods of polymerization.Explain the mechanism of addition polymerization of ethylene.[July05]

6. Distinguish between thermoplastics and thermosetting polymers.

7. Explain the following techniques of polymerization:
Bulk polymerization[Feb 02,04] Solution polymerization
Emulsion polymerization[Feb 02,04] Suspension polymerization[March01]

8. Explain the free radical mechanism of addition polymerization taking ethylene as an example?[July04)

9. What is glass transition temperature(Tg)? Discuss the factors affecting glass transition temperature.(Jan04)

10. Define glass transition temperature and mention its significance.[Jan03]

11. Describe the manufacture of following polymers with uses and properties:
i)LDPE[Jan04] ii)HDPE iii) Plexiglass(PMMA)[Mar99,01,July03]
iv)Phenol formaldehyde(Bakelite)[Feb05] v) Teflon(PTFE)[Feb02] vi) Plycorbonates
vii) polyurethane (July04) viii) Buna-S(SBR)[July03,04,05,Feb05] ix) butyl rubber

12. Give the synthesis and applications of butyl rubber and epoxy resins.[Jan03]

13. Give the manufacture & applications of polyurethane, epoxy resin and Buna-S.[July04]

14. What are epoxy resins? How are they synthesized? Mention uses? [Mar99,Aug00,Mar01]

15. What are plastics? Explain the compounding of resins in to plastics. [Aug99,01,Feb02]

16. What are elastomers? What are the deficiencies of natural rubber and advantages of synthetic rubber?(Mar99,01,Feb02)

17. Discuss the relationship between the structure and following properties of a polymer: i) Strength [Mar00] ii) Crystallinity [Mar00,Aug01] iii) Elasticity iv) Plastic deformation v) Chemical resistance

18. Define the term adhesive? Write the structures natural rubber and gutta-percha.(Aug99)

19. Write a note on polymer composites?[July03,Feb04]

20. What is conducting polymer?Give the synthesis of polyanilinie and mention its applications.[July04]