UNIT-I

Electrochemical Cells, Battery Technology and Fuel Cells

1. The one, which converts chemical energy into electrical energy
   a) Galvanic Cell
   b) Electrolytic Cell
   c) Anode
   d) Cathode
   Ans: a
2. The one, which converts electrical energy into chemical energy
   a) Galvanic Cell
   b) Electrolytic Cell
   c) Both
   d) None of the above
   Ans: b
3. Function of salt bridge is
   a) To avoid liquid junction potential
   b) To reduce polarization of the electrodes
   c) To prevent accumulation of charges around the electrodes
   d) All of the above
   Ans: d
4. Salt bridge is a U-tube filled with jelly containing
   a) Either KOH or NH_4OH
   b) Either KCl or NH_4NO_3
   c) Either KF or NH_4Cl
   d) None of the above
   Ans: b
5. A working concentration cell is made of two half cells having
   a) Identical electrodes
   b) Identical electrolytes
   c) Identical reactive ion concentrations
   d) Only a & b
   Ans: d
6. Calomel electrode is an example for
   a) Metal-metal ion electrode
   b) Metal- metal salt ion electrode
   c) Ion selective electrode
   d) Primary reference electrode
   Ans: b

7. The calomel electrode is represented as
   a) Hg | Hg_2Cl_2 (s) | KCl (saturated or standard)
   b) Ag | AgCl (s) | KCl (saturated)
   c) Hg | Hg_2Cl_2 (s) | KCl (saturated or standard) || AgCl (s)|Ag
   d) Ag | AgCl (s) | HCl (0.1M) | glass
   Ans: a
8. Potential of the calomel electrode depends on concentration of
   a) Hg
   b) Hg_2Cl_2
   c) KCl
   d) KOH
   Ans: c
9. The reference electrode, that can be used to determine potential of zinc electrode is
   a) Glass electrode
   b) Platinum electrode
   c) Copper electrode
   d) Calomel electrode
   Ans: d
10. pH of the solution can be determined using the following electrode combination
   a) Glass-calomel electrode
   b) Glass-Zinc electrode
   c) Platinum-Calomel electrode
   d) Zinc- Calomel electrode
   Ans: a
11. Glass electrode is an example for
   a) Ion selective electrode
   b) Membrane electrode
   c) H^+ ion sensitive electrode
   d) only a&c
   e) all a, b & c
   Ans: e
12. Which of the following is an example for ion selective electrode
   a) Platinum electrode
   b) Gas electrode
   c) Calomel electrode
   d) Glass electrode
   Ans: d
13. Which of the following is the example of the electrolytes?
   a) Acids
   b) Metals
   c) Alloys
   d) Oxides
   Ans: a

14. If a galvanic cell uses zinc anode (E^{o}_{Zn} = -0.76V) and copper cathode (E^{o}_{Cu} = 0.34V), standard emf of the cellis
    a) -0.42V
    b) 1.01V
    c) 1.10V
    d) -1.10V
    Ans: c

15. If $E^{0}_{Ni^{++}/Ni}$ and $E^{0}_{Ag^{+}/Ag}$ are - 0.25V and 0.80V respectively, the standard emf of Ni-Ag cell is
    a) 0.55V
    b) 1.05V
    c) 1.55V
    d) 1.50V
    Ans: b

16. If $E^{0}_{Fe^{++}/Fe}$ = -0.44V and $E^{0}_{Mn^{++}/Mn}$ = - 1.18V respectively, the standard emf of Mn-Fe cell is
    a) -1.59V
    b) 0.74V
    c) -0.74V
    d) 1.59
    Ans: b

17. If the cell potential of Ag-Zn cell at 298ºK is 1.5V and 1 faraday = $96.5kJV^{-1}mole^{-1}$, the change in free energy ΔG for the reduction of 1mole of Ag^{+} is ()
    a) -144.75 kJ
    b) -289.5 kJ
    c) -122.25 kJ
    d) 96.5 kJ

    Ans: a

18. If the cell potential of Ag-Zn cell at 298ºK is 2V and 1 faraday = $96.5kJV^{-1}mole^{-1}$, the change in free energy ΔG for the reduction of 2mole of Ag^{+} is ()
    a) -144.75 kJ
    b) -289.5 kJ
    c) -386 kJ
    d) -96.5 kJ
    Ans: c

19. If the cell potential of Cu-Zn cell at 298ºK is 1.5V and 1 faraday = $96.5kJV^{-1}mole^{-1}$, the change in free energy ΔG for the reduction of 1mole of Cu^{+2} is
    a) 144.75 kJ
    b) -289.5 kJ
    c) -122.25 kJ
    d) 96.5 kJ

Ans: b

20. If the cell potential of Cu-Zn cell at 298ºK is 2V and 1 faraday = 96.5kJ$V^{-1}$$mole^{-1}$, the change in free energy ΔG for the reduction of 2mole of Cu^{+2} is
    a) -386 kJ
    b) -289.5 kJ
    c) -122.25 kJ
    d) -772 kJ

    Ans: d

21. Representation of the cell formed by dipping Zn rod in 0.01M $ZnSO_4$solution and Cu rod in 0.5M $CuSO_4$ solution is
    a) Zn|$CuSO_4$ (0.5M) || Cu|$ZnSO_4$ (0.01M)
    b) Zn| $ZnSO_4$ (0.01M) || $CuSO_4$ (0.5M)|Cu
    c) Zn| $ZnSO_4$ (0.01M)|| Cu| $CuSO_4$(0.5M)
    d) Cu| $CuSO_4$ (0.01M) || $ZnSO_4$ (0.01M)|Zn

    Ans: b

22. Representation of the cell formed by dipping Fe rod in 0.01M $FeSO_4$solution and Ag rod in 0.01M $AgNO_3$ solution is
    a) Fe|$FeSO_4$ (0.01M) || Ag| $AgNO_3$ (0.01M)
    b) Ag| $AgNO_3$ (0.01M)|| Fe|$FeSO_4$ (0.01M)
    c) Fe|$FeSO_4$ (0.01M)|| $AgNO_3$ (0.01M)| Ag
    d) Fe,$FeSO_4$ (0.01M) | $AgNO_3$ (0.01M), Ag

Ans: c

23. Voltage available from a battery depends upon
    a) Difference in the standard electrode potential
    b) Conductivity of the electrolyte
    c) Reaction quotient for the cell reaction
    d) All the above

    Ans: d

24. Capacity of the battery is measured in
    a) Ampere (A)
    b) Volts (V)
    c) Ampere hours (Ah)
    d) Watts (W)

    Ans: c

25. Which of the following statement is true
    a) Capacity is the amount of electricity that may be obtained from the battery
    b) Energy density is the ratio of the energy available from a battery to its weight
    c) Electricity storage density is the capacity per unit weight of the battery
    d) All the above

    Ans: d

26. During discharging of the battery
    a) Voltage decreases

b) Concentration of the reactant species decreases
c) Power density decreases
d) All the above

Ans: d

27. The common reasons for a battery to fail to achieve a high cycle life include
a) Corrosion at contact points
b) Shedding of the active materials
c) Shorting between the electrodes
d) All the above

Ans: d

28. Which of the following is not the characteristic feature of a reserve battery
a) Provides unlimited shelf life
b) Provides unlimited power supply
c) Highly reliable performance
d) Variety of design options

Ans: b

29. Special properties of 'Li' metal that make it advantageous as an electrode material include
a) Light weight
b) Low electrode potential
c) High electrical conductivity
d) All the above

Ans: d

30. Which of the following is a right Anode-Cathode-Electrolyte combination of a lithium-ion battery
a) Lithium intercalated graphite-$LiCoO_2$ -$LiClO_4$ in ether
b) Lithium intercalated graphite-$LiNiO_2$ – aqueous KOH
c) Lithium-Copper- $LiBF_4$ in ether
d) VH_2-$LiMn_2O_4$ – $LiPF_6$ in ether

Ans: a

31. Which of the following is correct statement for a fuel cell
a) Fuel cells need constant supply and removal of both reactants and the products.
b) They do not store chemical energy
c) They are not rechargeable
d) All the above

Ans: d

32. Methanol is one of the most electroactive organic fuels in the low temperature range because
a) It has low carbon content
b) It possesses a readily oxidisable-OH group

c) It has high solubility in aqueous electrolytes
d) All the above

Ans: d

33. Anadvantageous use of an acid electrolyte in methanol-oxygen fuel cell is that
a) Product CO_2 can be removed easily
b) Converts produced CO_2 into carbonate
c) Prevents diffusion of methanol into the cathode
d) Reduces CO_2 emission

Ans: a

34. In methanol-oxygen fuel cell, a membrane is inserted adjacent to the cathode on the inner side to
a) Minimize diffusion of methanol into the cathode
b) Minimize diffusion of sulphuric acid into the cathode
c) Minimize diffusion of methanol into the anode
d) Remove produced CO_2

Ans: a

35. Which one of the following is false statement?
In a flow battery
a) Chemical energy stored in the form of active materials in electrolytes
b) Electrolytes supplied at anode and cathode are separated by ion elective membranes
c) Electrolytes are stored externally, generally in tanks
d) Shedding of active materials stored at electrodes decrease its shelf life

Ans: d

36. Choose the battery which is not suitable for running electric vehicles
a) Zinc-Manganese dioxide battery
b) Nickel-Metal hydride battery
c) Lithium ion battery
d) Flow batteries

Ans: a

37. Which of the following is suitable for powering portable devices such as smartphones and laptops?
a) Lead-acid battery
b) Lithium ion battery
c) Methanol-oxygen fuel cell
d) Vanadium flow battery

Ans: b

38. Continuous power supply is possible with
a) Lead-acid battery
b) Nickel- metal hydride battery
c) Lithium ion battery
d) Methanol-Oxygen fuel cell

Ans: d

39. Which one of the following is suitable and safer for load balancing in electric grids and stand-alone power system
a) Nickel-metal hydride battery

b) Lithium ion battery
c) Flow-batteries
d) All the above

Ans: c

40. Battery, that do not undergo self-discharge is
a) Primary battery
b) Secondary battery
c) Reserve battery
d) None of the above

Ans: c

Corrosion science and Metal finishing

1. Dry corrosion is also called as.....

a) Chemical corrosion
b) Electrochemical corrosion
c) Wet corrosion
d) Oxidation corrosion

Ans: (a)

2. Corrosion involves

a) conversion of metallic ions to metal
b) only electrochemical reactions
c) the reactivity of the surrounding environment
d) all of the above

Ans: (c)

3. The rusting iron is the.....

a) Oxidation corrosion
b) Liquid metal corrosion
c) Wet corrosion
d) Corrosion by other gases

Ans: (a)

4. Corrosion between the dissimilar metals is called as.....

a) Galvanic corrosion
b) Dry corrosion
c) Oxidation corrosion
d) Concentration cell corrosion

Ans: (a)

5. Lower is pH, corrosion is.....

a) Greater
b) Lower
c) Constant
d) None of above

Ans: (a)

6. Electrochemical corrosion takes place .....

a) on anodic surface
b) on cathodic surface
c) in the bulk of metal
d) cannot be said

Ans: (a)

7. Chemical formula of rust is .....

a) Fe_2O_3
b) FeO
c) Fe_3O_4
d) $Fe_2O_3.xH_2O$

Ans: (d)

8. Which of following metals could provide cathodic protection to Fe?

a) Al & Cu
b) Al & Zn
c) Zn & Cu
d) Al & Ni

Ans: (b)

9. Which of the following gases accelerates rusting of iron?

a) CO_2
b) SO_2
c) NO_2

d) All of above

Ans: (d)

10. Which of the following metal does not resist the corrosion process?

a) Al
b) Pt
c) Fe
d) Sn

Ans: (c)

11. Which of the following represents correct sequence for caustic embrittlement?

(i) Dissolution of metal (ii) hydrolysis of sodium carbonate to form sodium hydroxide

(iii) Formation of rust (iv) trickling of alkaline water in to crevices

a) (ii), (iv), (i). (iii)
b) (i), (ii), (iii), (iv)
c) (ii), (i), (iv), (iii)
d) (iv), (ii), (i), (iii)

Ans: (a)

12. Corrosion due to the formation of cavities around the metal is called as the.....

a) Pitting corrosion
b) Water line corrosion
c) Galvanic corrosion
d) Soil corrosion

Ans: (a)

13. Corrosion due to the flow of the..... between the cathodic and anodic areas is called as the electro chemical corrosion by evolution of hydrogen ad absorption of oxygen.

a) Proton current
b) Ion current
c) Electron current
d) Neutron current

Ans: (c)

14. Corrosion due to difference in water level is.....

a) Soil corrosion

b) Oxidation corrosion
c) Pitting corrosion
d) Water line corrosion

Ans: (d)

15. Dry Corrosion is also called as.....

a) Direct corrosion
b) Indirect corrosion
c) Pitting corrosion
d) Water line corrosion

Ans: (a)

16. Pitting corrosion is an example of .....

a) Water line corrosion
b) Galvanic corrosion
c) Stress corrosion
d) Differential aeration corrosion

Ans: (d)

17. The corrosion is the reverse process of _____

a) Metal extraction
b) Metal production
c) Metal heating
d) Metal moulding

Ans: (a)

18. Which of the following is lost during corrosion?

a) Malleability
b) Ductility
c) Conductivity
d) all of the above

Ans: (d)

19. Which of the following is true for galvanic series?

a) Metals/alloys are arranged in increasing order of E°.
b) As we go down the series, passivity decreases.
c) Metals/alloys are arranged in decreasing order of corrosion resistance.
d) None of the above

Ans: (d)

20. Iron undergoes corrosion to produce_____coloured hydrated ferric oxide.

a) Red
b) Brown
c) Green
d) Blue

Ans: (b)

21. Wet corrosion of metals involves _____

a) Physical interactions
b) Redox reactions
c) Liquid infiltration
d) None

Ans: (b)

22. The following factors play vital role in corrosion process _____

a) Temperature
b) Impurities
c) Both
d) None

Ans: (c)

23. Corrosion can be prevented by _____

a) Alloying
b) Tinning
c) Galvanizing
d) All

Ans: (d)

24. Metal with low hydrogen overvoltage on its surface is.....susceptible for corrosion.

a) Less
b) more
c) both
d) none

Ans: (b)

25 .When the hydrogen overvoltage on the metal surface is high, cathodic reaction is.....

a) Higher

b) Slower
c) constant
d) all

Ans: (b)

26. The protective coatings are used to

a) Corrode the metal
b) Prevent from corrosion
c) Increase the corrosion
d) Slightly increase the corrosion

Ans: (b)

27. In anodic coatings, the coating metals possess_____reduction potential than base metal.

a) Higher
b) Lower
c) Cannot be said
d) same

Ans: (b)

28. Tinning is the example of

a) Anodic coatings
b) Cathodic coatings
c) Neither anode nor cathode
d) Both anode and cathode

Ans: (b)

29. In pickling and etching_____acids are used.

a) Sulphuric acid
b) Hypo chlorous acid
c) Phosphoric acid
d) Phosphorous acid

Ans: (a)

31. The process of coating iron or steel sheet with a thin coat of zinc to prevent iron from rusting is called _____

a) Tinning
b) Galvanisation

c) Metal cladding
d) Electroplating

Ans: (b)

32. Electrolyte used for electroless tin plating is _____

a) Sulphide ore
b) Stannous sulphate
c) Hydrogen sulphate
d) sodium chloride

Ans: (b)

33. Conditions for good electroplating are _____

a) low current density
b) low temperature
c) high concentration of metal in electrolyte
d) absence of additives in electrolyte

Ans: (a)

34. Process used to deposit one metal over another metal is called _____

a) electrolysis
b) electroplating
c) carbon plating
d) none of above

Ans: (b)

35. When zinc is plated on steel, the anode is made up of

a) steel
b) oxygen
c) zinc
d) carbon

Ans: (c)

36. Anodising is.....

a) A zinc diffusion process
b) An oxidising process used for aluminium and magnesium articles
c) A process used for making thin phosphate coating on steel to act as a base or primer for enamels and paints
d) Is the process of coating of zinc by hot dipping

Ans: (b)

37. Electroplating of chromium uses_____as anode.

a) Pb coated with PbO_2
b) Chromium metal
c) Inert Pt metal
d) Carbon nanotubes

Ans: (a)

38. Which of the following is not a metal finishing technique

a) Electrolysis
b) Electro deposition
c) Electro less plating
d) Electroforming

Ans: (a)

39. Throwing power is the ability of the electrolyte to produce

a) Uniform deposit on an article of regular shape
b) Uniform deposit on an article of irregular shape
c) Non - uniform deposit on an article of regular shape
d) Non - uniform deposit on an article of irregular shape

Ans: (b)

40. Electroplating is done

a) To protect the metals against corrosion
b) To give shiny appearance to articles
c) To repair the worn out materials
d) All of these

Ans: (d)

41. Caustic embrittlement is a ..... type of corrosion.

a) Stress corrosion
b) Galvanic corrosion
c) Waterline corrosion
d) Pitting corrosion

Ans: (a)

42. Galvanizing (Galvanization) process carried out at ..... °C

a) 425-430°C
b) 100-200°C
c) 30-50°C

d) 1000°C

Ans: (a)

43. Anodic metal coating is a process of coating the base metal with.....

a) more reactive metal
b) less reactive metal
c) inert metal
d) none

Ans: (a)

44. Cathodic metal coating is a process of coating the base metal with .....

a) less reactive metal
b) more reactive metal
c) inactive metal
d) all

Ans: (a)

45. The minimum potential required for electroplating of a metal under a given set of bath conditions is known by .....

a) polarization
b) decomposition potential
c) overvoltage
d) none

Ans: (b)

46. For evolution of hydrogen gas, the potential difference is called_____

a) hydrogen over voltage
b) voltage
c) current
d) polarization

Ans: (a)

47.involves painting on electrically charged conducting surface.

a) electrophoretic painting
b) Electroplating
c) electroless plating
d) inorganic coating

Ans: (a)

48. Chemical conversion coating is..... type of coating

a) organic
b) inorganic
c) metal
d) alloy

Ans: (b)

49.type of coating is used in the preparation of printed circuit boards.

a) Electroplating
b) Electrolessplating
c) Inorganic coating
d) Organic coating

Ans: (b)

50. The..... potential required for continuous electrolysis is called decomposition potential.

a) minimum
b) maximum
c) constant
d) none

Ans: (a)

UNIT- II
Polymers

1. A simple molecule having two or more bonding sites through which each can link to other to form a polymer chain is called…….
   a) Polymer
   b) Monomer
   c) Initiator
   d) All of these

Ans: b

2. The total number of functional groups or bonding sites present in a monomer molecule is called……..……..
   a) Functionality
   b) Degree of polymerization
   c) Molecular weight
   d) Polymer

Ans: a

3.is defined as the number of repeating units in a polymer chain.
   a) Functionality
   b) Degree of polymerization
   c) Molecular weight

d) Monomer.

Ans: b

4. A polymer formed by linking of bifunctional monomer units is called…….
   a) Branched chain polymer
   b) Cross linked polymer
   c) Graft copolymer
   d) Linear polymer

Ans: d

5. Copolymer having one kind of monomers in their main chain and another kind of monomers in their side chain is called……..
   a) Block copolymers
   b) Graft copolymer
   c) Cross linked polymer
   d) None of these

   Ans: b

6. The head to tail configuration, in which the substituent groups are all on the same side of the chain is called… .....polymer.
   a) Isotactic
   b) Syndiotactic
   c) Atactic
   d) None of these

Ans: a

7. If the arrangement of substituent groups are alternately on both sides of the polymer chain, then it is called……..
    a) Isotactic
    b) Syndiotactic
    c) Atactic
    d) None of these

    Ans: b

8. ……polymerization process takes place by linking together of monomer molecules and is accompanied by without elimination of small molecules like H_2O, NH_3 etc.
    a) Substitution
    b) Addition
    c) Condensation
    d) None of these

Ans: b

9. A polymerization which is brought by linking together of similar unsaturated molecules is called……
    a) Co-polymerization
    b) Addition polymerization
    c) Condensation polymerization
    d) None of these

    Ans: b

10. Name the initiator used in addition polymerization.
    a) Dibenzoyl peroxide
    b) Nylon
    c) Adipic acid
    d) PVC

    Ans: a

11. Micelles are formed in .....type of polymerization.
    a) Bulk polymerization
    b) Supension polymerization
    c) Emulsion polymerization
    d) Solution polymerization

    Ans: c

12. In Emulsion polymerization, each micelle contain non-polar tail of emulsifier molecule……. and polar head……
    a) Outwards and outwards
    b) outwards and inwards
    c) inwards and outwards
    d) inwards and inwards

    Ans: c

13. Tg of PVC is higher than Polyethylene because ……..
    a) Increase in freedom of C-Cl bond rotation
    b) Strong polar attraction between the molecules
    c) Higher free volume in PVC
    d) Flexible backbone

    Ans: b

14. Glass transition temperature of Polyethylene is lesser than polypropylene because…….
    a) Flexible backbone
    b) Higher molecular mass
    c) Strong polar attraction
    d) None of these

    Ans: a

15. Thermoplastics exhibits plasticity. Why?
    a) Polymer molecules are held together by secondary forcers
    b) Polymer molecules are held together by primary covalent bonds
    c) Polymer molecules are held together by coordination bonds
    d) All of these

    Ans: a

16. Plexiglass is obtained by subjecting methylmethacrylate to..... polymerization.
    a) addition
    b) condensation
    c) substitution
    d) None of these

    Ans: a

17. Polymer which is used in manufacture of safety goggles is……..
    a) Polycarbonate
    b) Polyurethane
    c) Phenol-formaldehyde
    d) Silicone rubber

    Ans: a

18. Isoprene is a monomer of…… ..
    a) Natural rubber
    b) Synthetic rubber
    c) Starch
    d) PVC

    Ans: a

19. Natural rubber is the polymerized form of …….
    a) Neoprene
    b) Isoprene
    c) Guttapercha
    d) Chloroprene

    Ans: b

20. A plastic which can be softened on heating and hardened on cooling is called……..
    a) Thermoelastic
    b) Thermoplastic
    c) Thermosetting
    d) Thermite

    Ans: b

21. Which one of the following is an elastomer?
    a) PVC
    b) Bakelite
    c) Natural Rubber
    d) Nylon

    Ans: c

22. Which of the following is a synthetic polymer?
    a) Cellulose
    b) PVC
    c) Proteins
    d) Nucleic acids

    Ans: b

23. Functionality of phenol is …….
    a) One
    b) Two
    c) Three
    d) Four

    Ans: c

24. Functionality of formaldehyde is ……..…….
    a) One
    b) Two
    c) Three
    d) Four

    Ans: b

25. Polymer composites are made of two components, namely……
    a) Fibre and matrix
    b) Matrix and silicone
    c) Fibre and butyl rubber
    d) All of these

Ans: a

26. Carbon fibre is obtained from heating …….
    a) Polyvinylchloride
    b) Polyvinyl alcohol
    c) Polymethylmethacrylate
    d) Polyacrylonitrile
    Ans: d

27. Which one is not a copolymer?
    a) Butyl rubber
    b) Plexiglass
    c) Polyurethane
    d) Epoxy resin
    Ans: b

28. Epoxy resin prepared by the condensation of ……..
    a) Epichlorohydrin and Bisphenol-A
    b) Epichlorohydrin and Diphenyl carbonate
    c) Bisphenol-A and Diphenyl carbonate
    e) Epichlorohydrin and Butane diol
    Ans: a

29. In oxidative doping of conjugated polymer, the removal of an electron from pi-system of the backbone producing free radical and a positive charge is called…….
    a. Cation
    b. Anion
    c. Polaron
    d. Soliton
    Ans: c

30. A conjugated polymer consists of……..
    a) Only double bonds
    b) Only single bonds
    c) Alternating double and single C-C bonds
    d) Triple bonds
    Ans: c

31. Rubber that is used for making cycle and automobiles tubes is……
    a) Buna- S
    b) Butyl rubber
    c) Silicone rubber
    d) Neoprene rubber
    Ans: b

32. A silicone rubber is formed by the condensation polymerization of……..
    a) Dimethyl silanol
    b) Dimethyl chlorosilane
    c) Dichlorosilanol
    d) Dichlorosilane
    Ans: a

33. One of the important uses of polymethylmethacrylate is……..
    a) Cushions for furniture
    b) Glazing automobiles and airplanes
    c) Lubricants
    d) Light weight boat hulls

    Ans: b

34. Polymer with large number of aromatic groups commonly dissolve in……..
    a. Polar solvents
    b. Nonpolar solvents containing aliphatic groups
    c. Nonpolar solvents containing aromatic groups
    d. Nonpolar solvents containing halide groups

    Ans:c

35. Greater the degree of cross linking.....will be the solubility.
    a) greater
    b) lesser
    c) same
    d) none of these

    Ans: b

36. Condensation polymerisation of epichlorohydrin and bisphenol-A in the presence of alkali gives……
    a) Polyacetylene
    b) Polyaniline
    c) Epoxy resin
    d) Polycarbonate

    Ans: c

37. If degree of polymerization of polyethylene is 100, the molecular weight is……..
    a) 2000
    b) 2500
    c) 2700
    d) 2800

    Ans: d

38. Polycarbonate is prepared by the condensation of bisphenol-A and …….
    a) Epichlorohydrin
    b) Methylmetharylate
    c) Diphenylcarbonate
    d) Phenol

    Ans: c

39. A polymeric substance used to bind together two or more similar or dssimilar material is referred as……
    a) Elastomer
    b) Composite
    c) Adhesive

d) Lubricant

Ans: c

Water Chemistry, Nano materials

1) An example for dissolved impurity is ……..

   (a) CO_2

   (b) HCO_3^-

   (c) NaCl

   (d) All of these

Ans: (d)

2) The purest form of water is ……..

   (a) Rain water

   (b) Lake water

   (c) Sea water

   (d) River water

Ans: (a)

3) Which of the following gives rise to temporary hardness?

   (a) $CaCl_2$

   (b) $Mg(HCO_3)_2$

   (c) $MgSO_4$

   (d) $CaSO_4$

Ans: (b)

4) Which of the following gives rise to permanent hardness?

   (a) $MgCl_2$

   (b) $CaSO_4$

   (c) Both (a) & (b)

   (d) Neither (a) nor (b)

Ans: (c)

5) On heating, temporary hardness gets converted to ……..

(a) $Ca(OH)_2$

(b) $MgCO_3$

(c) $Ca(HCO_3)_2$

(d) $CaCO_3$

Ans: (d)

6) Which of the following statements are incorrect?

i. Calcium chloride can be easily removed by boiling.

ii. Magnesium sulphate gives rise to permanent hardness.

iii. Total hardness is the summation of carbonate and non-carbonate hardness.

iv. Dissolved acids cannot cause hardness in water.

(a) i& iv

(b) ii

(c) i, ii and iv

(d) iii and iv

Ans: (a)

7) 1 ppm = …….

(a) 100 mg/L

(b) 1 mg/L

(c) 1000 g/L

(d) 1 mg/ml

Ans: (b)

8) The indicator used in hardness determination is

(a) Phenolphthalein

(b) Starch

(c) Eriochrome Black T

(d) $KMnO_4$

Ans: (c)

9) The role of EDTA in hardness determination is

(a) Indicator

(b) Buffer

(c) Oxidizing agent

(d) Chelating agent

Ans: (d)

10) During hardness determination, ...buffer is used to maintain the pH at ……

(a) NH_4OH-NH_4Cl; 10

(b) NaOH-NaCl; 12

(c) NH_4OH-NH_4Cl; 8

(d) CH_3COOH-CH_3COONa; 5

Ans: (a)

11) Which of the following statements is correct for Winkler's method?

i. Azides are added to destroy nitrates.

ii. The colour change at end-point is blue to colourless.

iii. Winkler's method is used to determine the amount of dissolved gases in water.

iv. Winkler's method is an example of Iodometric titration.

(a) i&ii

(b) ii & iv

(c) iii & iv

(d) i, ii &iv

Ans: (b)

12) Sludges are …… precipitate found .....boilers.

(a) Soft; adhered on the inner walls of

(b) Hard; adhered on the inner walls of

(c) Soft; loosely scattered in

(d) Hard; loosely scattered in

Ans: (c)

13) Hydrolysis of $MgSO_4$ gives rise to ……

(a) $MgCO_3 + H_2SO_4$

(b) $Mg(OH)_2 + HCl$

(c) $MgCO_3 + HCl$

(d) $Mg(OH)_2 + H_2SO_4$

Ans: (d)

14) Complete the statement: With increase in temperature,……

(a) Solubility of $CaSO_4$ decreases

(b) $CaSO_4$ dissolves faster

(c) $CaSO_4$ undergoes hydrolysis

(d) Decomposition of $CaSO_4$ takes place

Ans: (a)

15) Which of the following is NOT the cause for scale formation in boiler?

(a) Presence of silica

(b) Deposition of $CaSO_4$

(c) Hydrolysis of acid

(d) Decomposition of $Ca(HCO_3)_2$

Ans: (c)

16) Which of the following is NOT a disadvantage of scales?

(a) Decrease in boiler efficiency

(b) Increase in water boiling rate

(c) Wastage of fuel

(d) Lowering of boiler safety

Ans: (b)

17) Which of the following is TRUE?

(a) Lime removes permanent hardness caused due to calcium salts

(b) Soda removes temporary hardness caused due to calcium salts

(c) Lime removes permanent hardness caused due to magnesium salts

(d) Soda removes permanent hardness caused due to magnesium salts

Ans: (c)

18) Complete the reaction: $MgSO_4 + Ca(OH)_2 \rightarrow$

(a) $MgO + CaO + H_2O$

(b) $CaH_2 + Mg(OH)_2 + SO_2$

(c) $MgCaO_3 + H_2SO_4$

(d) $Mg(OH)_2 + H_2SO_4$

Ans: (d)

19) Anion exchange resin can exchange …….

(a) Cl^-

(b) Ca^{2+}

(c) OH^-

(d) H_2O

Ans: (a)

20) Cation exchange resins can be regenerated by giving..... wash.

(a) Alcohol

(b) acid

(c) alkali

(d) water

Ans: (b)

21) Anion exchange resins can be regenerated by giving .....wash.

(a) Alcohol

(b) acid

(c) alkali

(d) water

Ans: (c)

22) Ion exchange process is carried out to obtain ……..

(a) Soft water

(b) Saline water

(c) Deionized water

(d) Activated water

Ans: (c)

23) Addition of calgon to boiler water results in

(a) precipitation of $CaCO_3$

(b) colloid formation

(c) deposition of $Ca(OH)_2$

(d) formation of soluble complex with $CaSO_4$

Ans: (d)

24) Dissolved CO_2 can be chemically removed by addition of …….

(a) NH_4OH

(b) Na_2S

(c) Na_2SO_3

(d) None of the above

Ans: (a)

25) A major cause for the presence of acid in boiler water is

(a) Decomposition of $Ca(HCO_3)_2$

(b) Hydrolysis of $MgCl_2$

(c) Presence of $CaSO_4$

(d) All of the above

Ans: (b)

26) Which of the following is NOT true for Reverse Osmosis?

(a) Solvent moves from more concentrated solution to less concentrated solution

(b) The movement of solvent occurs through semi-permeable membrane

(c) Applied pressure smaller than osmotic pressure must be applied

(d) The process gives desaline water

Ans: (c)

27) The basic principle of Electrodialysis is

(a) H_2O molecule is broken by applying electric current

(b) Microscopic organisms are removed by applying electric current

(c) Dissolved salts causing hardness are removed by applying electric current

(d) NaCl is removed by applying electric current

Ans: (d)

28) Which of the following is NOT a method of Desalination?

(a) Winkler's method

(b) Reverse Osmosis

(c) Electrodialysis

(d) None of the above

Ans: (a)

29) In electrodialysis process, which of the following is TRUE for ion selective membranes?

(a) Cation selective membrane allows the passage of Cl^- ions

(b) Cation selective membrane allows the passage of Na^+ ions

(c) Anion selective membrane allows the passage of Na^+ ions

(d) Ion selective membranes are not used

Ans: (b)

30) Tertiary waste water treatment is also called as ……

(a) Activated Sludge Process

(b) Biological treatment

(c) Chemical treatment

(d) Physical treatment

Ans: (c)

31) Which of the following is NOT true for secondary treatment of waste water?

(a) Activated sludge containing micro organisms is sprayed to water

(b) Aerobic degradation of organic impurities takes place

(c) A part of the sludge is used as fertilizer

(d) The process take place in the absence of air

Ans: (d)

32) During tertiary treatment of waste water, phosphates are removed by adding ……

(a) Lime

(b) H_2S

(c) activated charcoal

(d) alum

Ans: (a)

33) During tertiary treatment of waste water, heavy metal ions are removed by adding ……

(a) Lime

(b) H_2S

(c) activated charcoal

(d) alum

Ans: (b)

34) During tertiary treatment of waste water, organic impurities are removed by adding ……

(a) Lime

(b) H_2S

(c) activated charcoal

(d) alum

Ans: (c)

35) During tertiary treatment of waste water, colloidal impurities are removed by adding ……

(a) Lime

(b) H_2S

(c) activated charcoal

(d) alum

Ans: (d)

36) Which of the following is NOT suitable for removing dissolved oxygen from water?

(a) NH_4OH

(b) Na_2S

(c) Na_2SO_3

(d) N_2H_4

Ans: (a)

37) 1 nm = ……

(a) 10^{-7} m

(b) 10^{-9} m

(c) 10^{9} m

(d) 10^{-3} m

Ans: (b)

38) Materials having two dimensions in nano scale are called.....nanomaterials.

(a) Zero Dimensional

(b) One Dimensional

(c) Two Dimensional

(d) Three Dimensional

Ans: (b)

39) An example for zero dimensional nanomaterials is …..

(a) Nanosheets

(b) Nanotubes

(c) Nanospheres

(d) Nanowires

Ans: (c)

40) An example for one dimensional nanomaterials is …..

(a) Nanosheets

(b) Nanoplates

(c) Nanospheres

(d) Nanowires

Ans: (d)

41) An example for two dimensional nanomaterials is …..

(a) Nanosheets

(b) Nanotubes

(c) Nanospheres

(d) Nanowires

Ans: (a)

42) Chose the INCORRECT statement pertaining to Sol-Gel method for nanoparticle synthesis.

(a) Sol is a stable suspension of colloidal particles in a liquid

(b) Metal alkoxides are the preferred precursors in sol-gel process

(c) Urea is used as fuel.

(d) The gel is formed by the polymerization reaction.

Ans: (c)

43) Which is the preferred precursor in sol-gel method?

(a) Metal chlorides

(b) Metal nitrates

(c) Metal hydroxides

(d) Metal alkoxides

Ans: (d)

44) Which of the following is NOT true for Microwave synthetic method?

i. The heating occurs by dipole rotation or ionic conduction

ii. The reaction rate decreases

iii. The temperature rise is slow in in the initial stages

(a) ii & iii

(b) only ii

(c) i& iii

(d) only iii

Ans: (a)

45) CVD stands for

(a) Carbon Vapor Dissolution

(b) Chemical Vapor Deposition

(c) Carbon Vapor Deposition

(d) Chemical Vapor Dissolution

Ans: (b)

46) CVD method is employed to synthesize

(a) Metal oxide nanoparticles

(b) CO and CO_2

(c) Carbon nanotubes

(d) N_2

Ans: (c)

UNIT III

Chemical Energy Sources and Liquid Crystals

1. In presence of which gas is the fuel burnt to generate energy in form of heat?
   a) Oxygen
   b) Hydrogen
   c) Methane
   d) Nitrogen

Ans: a

2. Which are the main constituents of fuel from given options?
   a) Carbon and Nitrogen
   b) Oxygen and Hydrogen
   c) Carbon and Hydrogen
   d) Helium and Oxygen
   Ans: c
3. Fuels are classified as primary and secondary fuel based on the _____
   a) Capacity to burn
   b) Carbon content
   c) State
   d) Occurrence
   Ans: d
4. Which form of fuel is used as domestic form of fuel?
   a) Wood
   b) Gasoline
   c) Diesel
   d) Naphtha
   Ans: a
5. In what forms are liquid fuels available in nature?
   a) Light distillate
   b) Petroleum spirit
   c) Petroleum naphtha
   d) Crude petroleum
   Ans: d
6. Which one of the following is an example for secondary fuel?
   a) Coal
   b) Natural gas
   c) Kerosene
   d) All the above
   Ans: c
7. Which one of the following is having higher calorific value?
   a) Wood

b) Coal
c) Gasoline
d) Crude oil
Ans: c

8. Which gaseous fuel is found dissolved in petroleum under earth's surface in oil and gas bearing areas?
   a) Natural gas
   b) Coal gas
   c) Mond gas
   d) Producer gas
   Ans: a
9. What is necessary for complete combustion of fuels?
   a) There should be no water content in the fuel
   b) Sufficient amount of air is required
   c) High quantity of fuel
   d) High carbon content
   Ans: b
10. The amount of heat liberated by complete combustion of unit quantity of fuel is known as _____
    a) Agitation
    b) Combustion
    c) Calorific value
    d) Thermogenesis
    Ans: c
11. What is the significance of calorific value?
    a) Helps in deciding which fuel is good
    b) Helps in locating fuel
    c) Helps in deciding ignition temperature
    d) Helps in deciding fire point
    Ans: a
12. Which calorimeter is used to find calorific values of solid and liquid fuels?
    a) Boy's calorimeter
    b) Bomb calorimeter
    c) Junker's calorimeter
    d) Calvet-type calorimeter
    Ans: b
13. What accounts for the presence of water in the exhaust leaving as vapor?
    a) Gross calorific value
    b) Flash point value
    c) Ignition temperature value
    d) Net calorific value
    Ans: a
14. Octane number is a rating of _____
    a) petrol knocking

b) diesel knocking
c) petrol cracking
d) diesel cracking
Ans: a

15. How is knocking produced in a petrol engine?
a) Due to the size of the engine
b) Due to spontaneous combustion in the engine
c) Due to the presence of less impurities in the fuel
d) Due to the parts of the engine
Ans: b

16. Which compound is usually added to decrease the knocking in the engine?
a) Sulphur
b) Phosphorous
c) Tetra ethyl lead
d) Vanadium penta-oxide
Ans: c

17. In the given options, which are the best anti knocking reagents of petrol?
a) straight chain alkanes
b) straight chain alkenes
c) alkynes
d) aromatics
Ans: d

18. In the catalytic cracking, what is the catalyst used?
a) NaCl
b) KCl
c) $ZnSO_4$
d) Al_2O_3
Ans: d

19. Which of the following order of petrol knocking is true?
a) aromatics > branched paraffins> olefins >cycloparaffins> aromatics
b) straight chain paraffins> olefins > branched paraffins>cycloparaffins> straight chain paraffins
c) straight chain paraffins> branched paraffins> olefins >cycloparaffins> aromatics
d) straight chain paraffins> branched paraffins> olefins > aromatics >cycloparaffins
Ans: c

20. In moving bed catalytic cracking, the catalyst is in the form of _____
a) fine powder
b) pallets
c) liquid form
d) gaseous form
Ans: a

21. Power alcohols contains _____
a) 50-60% of petrol
b) 70-80% of petrol

c) 50-60% of ethanol
d) 70-80% of ethanol
Ans: b

22. Ethyl alcohol reduces the _____
    a) oxygen emissions
    b) fuel efficiency
    c) polluting emissions
    d) nitrogen emissions
    Ans: c
23. Power alcohol is _____than petrol.
    a) bad product
    b) less efficient
    c) having greater knocking characteristics
    d) having lesser knocking characteristics
    Ans: d
24. What chemical reaction makes biodiesel?
    a) Transesterification
    b) Sublimation
    c) Polymerization
    d) Fermentation
    Ans: a
25. The full form of LCD is _____
    a) Liquid Crystal Display
    b) Liquid Crystalline Display
    c) Logical Crystal Display
    d) Logical Crystalline Display
    Ans: a
26. Liquid crystals are usually composed of _____
    a) Coil like molecules
    b) Rod like molecules
    c) Oval molecules
    d) Triangular molecules
    Ans: b
27. The optical properties of liquid crystals depend on the direction of _____
    a) Air
    b) Solid
    c) Light
    d) Water
    Ans: c
28. By which properties, the orientation of molecules in a layer of liquid crystals can be changed?
    a) Magnetic field
    b) Electric field

c) Electromagnetic field
d) Gallois field
Ans: b

29. Electro-optic effect is produced in _____
    a) LED
    b) LCD
    c) OFC
    d) OLED
    Ans: b
30. Liquid crystal molecules have _____ structure
    a) Cylindrical
    b) Square
    c) Rod like
    d) triangular

    Ans: c

31. Liquid crystal was first observed by _____
    a) Botanist
    b) Zoologist
    c) Chemist
    d) Physicist

    Ans: a

32. First liquid crystal phase discovered in a compound:
    a) Cholesterylproponoate
    b) Cholesteryl benzoate
    c) Cholesterylethanoate
    d) Cholesterylmethanoate

    Ans: b

33. Liquid crystal molecules possess
    a) Transational order
    b) Vibrational order
    c) Intrinsic order
    d) Orientational order

    Ans: d

34. Mesophase refers to:
    a) Solid state
    b) Liquid state
    c) Liquid crystal state
    d) Gaseous state

Ans: c

35. The point at which solid changes into turbid liquid is known as
    a) Melting point
    b) Transition point
    c) Boiling point
    d) Eutectic point

    Ans: b

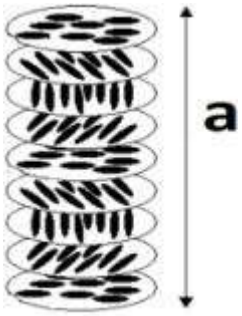
36. The point at which solid changes into clear liquid is called
    a) Melting point
    b) Flash point
    c) Boiling point
    d) Eutectic point

    Ans: a

37. The appearance of nematic phase of liquid crystal is
    a) Gel like substance
    b) Thread like substance
    c) Slippery substance
    d) Much thicker substance

    Ans: b

38. The following arrangement is shown by



    a) Smectic A
    b) Smectic B
    c) Nematic
    d) Cholestric

    Ans: d

39. When electric field is applied, liquid crystal molecules tends to align themselves
    a) Parallel to electric field
    b) Perpendicular to electric field
    c) 45^{o} to electric field
    d) 60^{o} to electric field

Ans: a

40. The array of tiny segments in LCD is
    a) Pixel
    b) Passive
    c) Active
    d) Count

    Ans: a

41. Which of the following is an example of liquid crystal
    a) Silver oxide
    b) Benzene
    c) Sodium benzoate
    d) n-hexane

    Ans: c

42. Which liquid crystals possess helical structure
    a) Smectic
    b) Nematic
    c) Cholesteric
    d) Polymer dispersed

    Ans: c

43. Liquids possess
    a) Anisotropy
    b) Orientational order
    c) Isotropy
    d) Positional order
    Ans: c

44. Thermotropic liquid crystals are obtained by varying
    a) Solvent concentration
    b) Temperature
    c) Pressure
    d) None of the above

    Ans: b

45. Under polarized light, nematic phase appears
    a) Thread like
    b) Fan-like
    c) Disc-like
    d) Wheel-like

    Ans: a

46. In general,Liquid crystal state is also called as
    a) Triple phase
    b) Nematic phase
    c) Mesophase
    d) Polymer dispersed phase

    Ans: c

47. Lyotropic mesophase in a substance is introduced by
    a) Adding solute
    b) Increasing pressure
    c) Increasing temperature
    d) Adding solvent

    Ans: d

48. Liquid crystal molecules for LCD applications must possess
    a) Single index of refraction
    b) No refractive index
    c) Two different indices of refraction
    d) None of the above

    Ans: c

49. Pitch is measured in case of_____liquid crystals
    a) Smectic
    b) Nematic
    c) Cholesteric
    d) Polymer dispersed

    Ans: c

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