

## 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<sub>4</sub>OH
- b) Either KCl or NH<sub>4</sub>NO<sub>3</sub>
- c) Either KF or NH<sub>4</sub>Cl
- 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)  $\text{Hg} | \text{Hg}_2\text{Cl}_2(\text{s}) | \text{KCl}$  (saturated or standard)
  - b)  $\text{Ag} | \text{AgCl}(\text{s}) | \text{KCl}$  (saturated)
  - c)  $\text{Hg} | \text{Hg}_2\text{Cl}_2(\text{s}) | \text{KCl}$  (saturated or standard) ||  $\text{AgCl}(\text{s}) | \text{Ag}$
  - d)  $\text{Ag} | \text{AgCl}(\text{s}) | \text{HCl}(0.1\text{M}) | \text{glass}$

Ans: a

8. Potential of the calomel electrode depends on concentration of
- a) Hg
  - b)  $\text{Hg}_2\text{Cl}_2$
  - 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)  $\text{H}^+$  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 ( $E^\circ_{\text{Zn}} = -0.76\text{V}$ ) and copper cathode ( $E^\circ_{\text{Cu}} = 0.34\text{V}$ ), standard emf of the cell is

- a) -0.42V
- b) 1.01V
- c) 1.10V
- d) -1.10V

Ans: c

15. If  $E^\circ_{\text{Ni}^{++}/\text{Ni}} = 0.25\text{V}$  and  $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80\text{V}$  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  $E^\circ_{\text{Fe}^{++}/\text{Fe}} = -0.44\text{V}$  and  $E^\circ_{\text{Mn}^{++}/\text{Mn}} = -1.18\text{V}$  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  $298^\circ\text{K}$  is 1.5V and 1 faraday =  $96.5\text{kJ V}^{-1}\text{mole}^{-1}$ , the change in free energy  $\Delta G$  for the reduction of 1mole of  $\text{Ag}^+$  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  $298^\circ\text{K}$  is 2V and 1 faraday =  $96.5\text{kJ V}^{-1}\text{mole}^{-1}$ , the change in free energy  $\Delta G$  for the reduction of 2mole of  $\text{Ag}^+$  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  $298^\circ\text{K}$  is 1.5V and 1 faraday =  $96.5\text{kJ V}^{-1}\text{mole}^{-1}$ , the change in free energy  $\Delta G$  for the reduction of 1mole of  $\text{Cu}^{+2}$  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 298°K is 2V and 1 faraday = 96.5kJV<sup>-1</sup>mole<sup>-1</sup>, the change in free energy  $\Delta G$  for the reduction of 2mole of Cu<sup>+2</sup> 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<sub>4</sub>solution and Cu rod in 0.5M CuSO<sub>4</sub> solution is

- a) Zn|CuSO<sub>4</sub> (0.5M) || Cu|ZnSO<sub>4</sub> (0.01M )
- b) Zn| ZnSO<sub>4</sub> (0.01M ) || CuSO<sub>4</sub> (0.5M)|Cu
- c) Zn| ZnSO<sub>4</sub> (0.01M )|| Cu| CuSO<sub>4</sub>(0.5M)
- d) Cu| CuSO<sub>4</sub> (0.01M ) || ZnSO<sub>4</sub> (0.01M )|Zn

Ans: b

22. Representation of the cell formed by dipping Fe rod in 0.01M FeSO<sub>4</sub>solution and Ag rod in 0.01M AgNO<sub>3</sub> solution is

- a) Fe|FeSO<sub>4</sub> (0.01M) || Ag| AgNO<sub>3</sub> (0.01M )
- b) Ag| AgNO<sub>3</sub> (0.01M )|| Fe|FeSO<sub>4</sub> (0.01M )
- c) Fe|FeSO<sub>4</sub> (0.01M)|| AgNO<sub>3</sub> (0.01M )| Ag
- d) Fe,FeSO<sub>4</sub> (0.01M ) | AgNO<sub>3</sub> (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<sub>2</sub> -LiClO<sub>4</sub> in ether
- b) Lithium intercalated graphite-LiNiO<sub>2</sub> – aqueous KOH
- c) Lithium-Copper- LiBF<sub>4</sub> in ether
- d) VH<sub>2</sub>-LiMn<sub>2</sub>O<sub>4</sub> – LiPF<sub>6</sub> 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<sub>2</sub> can be removed easily
- b) Converts produced CO<sub>2</sub> into carbonate
- c) Prevents diffusion of methanol into the cathode
- d) Reduces CO<sub>2</sub> 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<sub>2</sub>

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)  $\text{Fe}_2\text{O}_3$
- b)  $\text{FeO}$
- c)  $\text{Fe}_3\text{O}_4$
- d)  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$

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)  $\text{CO}_2$
- b)  $\text{SO}_2$
- c)  $\text{NO}_2$

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  $E^\circ$ .
- 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<sub>2</sub>
- 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)  $1000^{\circ}\text{C}$

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.....
- Isotactic
  - Syndiotactic
  - Atactic
  - 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  $\text{H}_2\text{O}$ ,  $\text{NH}_3$  etc.
- Substitution
  - Addition
  - Condensation
  - None of these

Ans: b

9. A polymerization which is brought by linking together of similar unsaturated molecules is called.....
- Co-polymerization
  - Addition polymerization
  - Condensation polymerization
  - None of these

Ans: b

10. Name the initiator used in addition polymerization.
- Dibenzoyl peroxide
  - Nylon
  - Adipic acid
  - PVC

Ans: a

11. Micelles are formed in .....type of polymerization.
- Bulk polymerization
  - Suspension polymerization
  - Emulsion polymerization
  - Solution polymerization

Ans: c

12. In Emulsion polymerization, each micelle contain non-polar tail of emulsifier molecule..... and polar head.....
- Outwards and outwards
  - outwards and inwards
  - inwards and outwards
  - 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 forces
  - 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) Gutta-percha
  - 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) Methylmethacrylate
  - c) Diphenylcarbonate
  - d) Phenol

Ans: c

39. A polymeric substance used to bind together two or more similar or dissimilar 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)  $\text{CO}_2$
- (b)  $\text{HCO}_3^-$
- (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)  $\text{CaCl}_2$
- (b)  $\text{Mg}(\text{HCO}_3)_2$
- (c)  $\text{MgSO}_4$
- (d)  $\text{CaSO}_4$

Ans: (b)

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

- (a)  $\text{MgCl}_2$
- (b)  $\text{CaSO}_4$
- (c) Both (a) & (b)
- (d) Neither (a) nor (b)

Ans: (c)

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

- (a)  $\text{Ca}(\text{OH})_2$
- (b)  $\text{MgCO}_3$
- (c)  $\text{Ca}(\text{HCO}_3)_2$
- (d)  $\text{CaCO}_3$

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)  $\text{KMnO}_4$

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<sub>4</sub>OH-NH<sub>4</sub>Cl; 10
- (b) NaOH-NaCl; 12
- (c) NH<sub>4</sub>OH-NH<sub>4</sub>Cl; 8
- (d) CH<sub>3</sub>COOH-CH<sub>3</sub>COONa; 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<sub>4</sub> gives rise to .....

- (a) MgCO<sub>3</sub> + H<sub>2</sub>SO<sub>4</sub>
- (b) Mg(OH)<sub>2</sub> + HCl
- (c) MgCO<sub>3</sub> + HCl
- (d) Mg(OH)<sub>2</sub> + H<sub>2</sub>SO<sub>4</sub>

Ans: (d)

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

- (a) Solubility of  $\text{CaSO}_4$  decreases
- (b)  $\text{CaSO}_4$  dissolves faster
- (c)  $\text{CaSO}_4$  undergoes hydrolysis
- (d) Decomposition of  $\text{CaSO}_4$  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  $\text{CaSO}_4$
- (c) Hydrolysis of acid
- (d) Decomposition of  $\text{Ca}(\text{HCO}_3)_2$

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:  $\text{MgSO}_4 + \text{Ca}(\text{OH})_2 \rightarrow$

- (a)  $\text{MgO} + \text{CaO} + \text{H}_2\text{O}$
- (b)  $\text{CaH}_2 + \text{Mg}(\text{OH})_2 + \text{SO}_2$
- (c)  $\text{MgCaO}_3 + \text{H}_2\text{SO}_4$
- (d)  $\text{Mg}(\text{OH})_2 + \text{H}_2\text{SO}_4$

Ans: (d)

19) Anion exchange resin can exchange .....

- (a)  $\text{Cl}^-$
- (b)  $\text{Ca}^{2+}$
- (c)  $\text{OH}^-$
- (d)  $\text{H}_2\text{O}$

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  $\text{CaCO}_3$
- (b) colloid formation
- (c) deposition of  $\text{Ca(OH)}_2$
- (d) formation of soluble complex with  $\text{CaSO}_4$

Ans: (d)

24) Dissolved CO<sub>2</sub> can be chemically removed by addition of .....

- (a) NH<sub>4</sub>OH
- (b) Na<sub>2</sub>S
- (c) Na<sub>2</sub>SO<sub>3</sub>
- (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<sub>3</sub>)<sub>2</sub>
- (b) Hydrolysis of MgCl<sub>2</sub>
- (c) Presence of CaSO<sub>4</sub>
- (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<sub>2</sub>O 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  $\text{Cl}^-$  ions
- (b) Cation selective membrane allows the passage of  $\text{Na}^+$  ions
- (c) Anion selective membrane allows the passage of  $\text{Na}^+$  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)  $\text{H}_2\text{S}$
  - (c) activated charcoal
  - (d) alum

Ans: (a)

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

- .....
- (a) Lime
  - (b)  $\text{H}_2\text{S}$
  - (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)  $1\text{ nm} = \dots$

(a)  $10^{-7}\text{ m}$

(b)  $10^{-9}\text{ m}$

(c)  $10^9\text{ m}$

(d)  $10^{-3}\text{ m}$

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) Choose 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 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<sub>2</sub>
- (c) Carbon nanotubes
- (d) N<sub>2</sub>

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<sub>4</sub>
  - d) Al<sub>2</sub>O<sub>3</sub>

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 alcohol 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) Cholesteric

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)  $45^\circ$  to electric field
- d)  $60^\circ$  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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