Choose the correct option.

1. For a reaction $A \longrightarrow xp$, when $[A] = 2.2$ M. The rate was found to be 2.4 mMs^{-1}. On reducing concentration of A to half, the rate change to 0.6 mMs^{-1}. The order of the reaction with respect to 'A' is
   - (a) 1.5
   - (b) 2.0
   - (c) 2.5
   - (d) 3.0

2. The gas 'A' bleaches the colour of flowers by reduction while gas 'B' bleaches by oxidation. The gas 'A' and 'B' respectively are
   - (a) CO and Cl_2
   - (b) H_2S and Br_2
   - (c) SO_2 and Cl_2
   - (d) NO_3 and SO_3

3. Match the items of Column I and Column II.

	Column I		Column II
A.	$k = Ae^{-Ea/RT}$	(i)	First order
B.	$t_{1/2} = \dfrac{[R]_o}{2k}$	(ii)	Bimolecular
C.	$t_{1/2} = \dfrac{0.693}{k}$	(iii)	Zero order
D.	$2HI\,(g) \longrightarrow H_2\,(g) + I_2\,(g)$	(iv)	Arhenius equation

   - (a) A–(i), B–(ii), C–(iii), D–(iv)
   - (b) A–(ii), B–(i), C–(iii), D–(iv)
   - (c) A–(iv), B–(iii), C–(ii), D–(i)
   - (d) A–(iv), B–(iii), C–(i), D–(ii)

4. Which of the following statement is correct?
   - (a) Stronger the oxidising agent, greater is the standard reduction potential.
   - (b) Stronger the oxidising agent, greater is the standard oxidation potential.
   - (c) Stronger the oxidising agent, greater is its ionic nature.
   - (d) None of the above

5. The reaction $H^+ + OH^- \longrightarrow H_2O$ is
   - (a) very slow
   - (b) slow
   - (c) fast
   - (d) moderate in speed

6. **Which of the following is a redox reaction?**
   (a) Reaction of H_2SO_4 and NaOH.
   (b) Conversion of O_3 from O_2 in the atmosphere.
   (c) Conversion of nitrogen in nitric oxide by the action of electric sparks or high temperature.
   (d) Evaporation of water.

7. **When alum is added to muddy water, coagulation takes place because**
   (a) clay particles are oxidised.
   (b) there is decrease in density of water.
   (c) charge carried by clay particles are neutralised.
   (d) clay particles are further subdivided.

8. **Which of the following sol acts as a protective colloid?**
   (a) As_2S_3
   (b) Gelatin
   (c) Au
   (d) $Fe(OH)_3$

9. **Given below are two statements labelled as Statement P and Statement Q:**
   Statement P : Iron is protected from corrosion by connecting magnesium metal with it.
   Statement Q : Iron acts as a cathode and magnesium as anode gradually disappears.
   (a) P is true, but Q is false
   (b) P is false, but Q is true
   (c) Both P and Q are true
   (d) Both P and Q are false

10. **A gas X at 1 atm pressure is bubbled through a solution containing a mixture of 1M Y^- ions and 1M Z^- ions at 25°C. If reduction potentials of Z > Y > X then**
    (a) Y will oxidise Z and not X.
    (b) Y will oxidise X and not Z.
    (c) Y will oxidise X and Z.
    (d) Y will be reduced by X and Z.

11. **The crystal with metal deficiency defect is**
    (a) NaCl
    (b) FeO
    (c) KCl
    (d) ZnO

12. **Osmotic pressure of a sugar solution at 24°C is 2.5 atm. The concentration of the solution in moles/litre is**
    (a) 10.25
    (b) 1.025
    (c) 1025
    (d) 0.1025

13. **Ferrous oxide has a cubic structure and each unit cell edge is 5.0 Å. Assuming the oxide density is 4.0 g/cm³, the amount of Fe^{2+} and O^{2-} ions in each unit cell will be**
    (a) four Fe^{2+} and four O^{2-}
    (b) two Fe^{2+} and four O^{2-}
    (c) four Fe^{2+} and two O^{2-}
    (d) three Fe^{2+} and three O^{2-}

14. **Molal depression constant for water is 1.86 °C/m. The freezing point of a 0.05 molal solution of a non-electrolyte in water is**
    (a) −1.86° C
    (b) −0.93° C
    (c) −0.093° C
    (d) 0.93° C

15. **The total number of voids in 0.5 moles of a compound forming hexagonal close-packed structure are**
    (a) 6.022×10^{23}
    (b) 3.011×10^{23}
    (c) 9.033×10^{23}
    (d) 4.516×10^{23}

16. **The solubility of a solid in liquid does not depend upon**
    (a) nature of solute and solvent
    (b) temperature
    (c) pressure
    (d) all of the above

17. **The reaction of bromine water with SO_2 forms**
    (a) H_2SO_4 and HBr
    (b) S and H_2O
    (c) H_2O and HBr
    (d) HBr and S

18. **Zinc and mercury do not show variable valency like d-block elements because**
    (a) they are soft.
    (b) their d-subshells are completely filled.
    (c) they have only two electrons in the outermost subshell.
    (d) their d-subshells are incompletely filled.

19. **The refining method which is useful for low melting metals is**
    (a) distillation
    (b) liquation
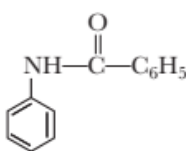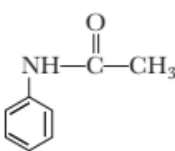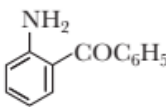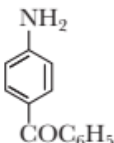   (c) electrolytic refining
    (d) vapour phase refining

20. In the Froth Floatation process, zinc sulphide and lead sulphide can be separated by
  (a) using froth stabiliser.
  (b) adjusting the proportion of oil to water.
  (c) using depressant.
  (d) both (b) and (c)

21. Given below are two statements labelled as Assertion and Reason:

  Assertion (A) : Hydrometallurgy involves dissolving the ore in a suitable reagent followed by precipitation by a more electropositive metal.

  Reason (R) : Sodium is extracted by hydrometallurgy.

  (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
  (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
  (c) Assertion is correct statement but reason is wrong statement.
  (d) Assertion is wrong statement but reason is correct statement.

22. The properties of Zr and Hf are similar because
  (a) both belong to d-block.
  (b) both belong to same group of the periodic table.
  (c) both have similar radii.
  (d) both haver same number of electrons.

23. The noble gas which shows radioactivity is
  (a) Radon
  (b) Krypton
  (c) Helium
  (d) Argon

24. Given below are two statements labelled as Assertion and Reason:

  Assertion (A) : The transition temperature of sulphur is 369 K.

  Reason (R) : At 369 K, both α-sulphur and β-sulphur are stable. Below 369 K, only α-sulphur is stable whereas above 369K, only β-sulphur is stable.

  (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
  (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
  (c) Assertion is correct statement but reason is wrong statement.
  (d) Assertion is wrong statement but reason is correct statement.

25. Alkyl halide + Mg $\longrightarrow$ (A) $\xrightarrow[H_2O]{Boil}$ Propane

  The alkyl halide is
  (a) n-propyl chloride
  (b) ethyl bromide
  (c) t-butyl chloride
  (d) n-butyl chloride

26. C—Cl bond of chlorobenzene in comparison to C—Cl bond in methyl chloride is
  (a) Longer and weaker
  (b) Shorter and weaker
  (c) Shorter and stronger
  (d) Longer and stronger

27. Which of the following complex will show optical activity?
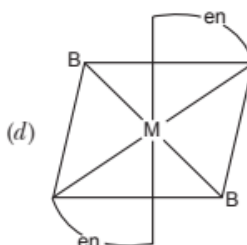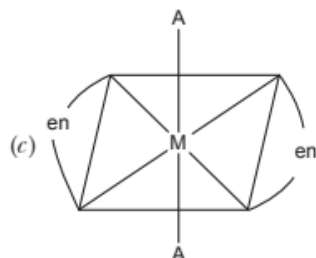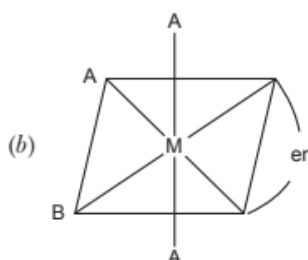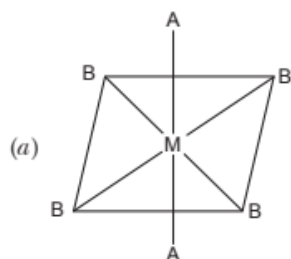
28. According to Werner's theory, the secondary valencies of the central metal atom correspond to its
    (a) oxidation state
    (b) coordination number
    (c) either (a) or (b)
    (d) neither (a) or (b)

29. Which among MeX, RCH_2X, R_2CHX, R_3CX is most reactive towards S_N1 reaction?
    (a) MeX
    (b) RCH_2X
    (c) R_2CHX
    (d) R_3CX

30. The most powerful oxidising agent is:
    (a) fluorine
    (b) chlorine
    (c) bromine
    (d) iodine

31. What is the coordination number of Cr in $K_3[Cr(Ox)_3]$?
    (a) 6
    (b) 5
    (c) 4
    (d) 3

32. Which of the following reagents gives pure acid chloride from monocarboxylic acid?
    (a) PCl_3
    (b) PCl_5
    (c) SO_2Cl_2
    (d) $SOCl_2$

33. Reduction of nitroalkanes yields which of the following compound?
    (a) Acid
    (b) Alcohol
    (c) Amine
    (d) Diazo compounds

34. $C_6H_5N_2^+Cl + CuCN \longrightarrow C_6H_5CN + N_2\uparrow$

    The above reaction is known as
    (a) Baltz Schiemann reaction
    (b) Gattermann reaction
    (c) Schotten-Baumann reaction
    (d) Sandmeyer reaction

35. Which of the following acids has the smallest dissociation constant?
    (a) $CH_3CHFCOOH$
    (b) FCH_2CH_2COOH
    (c) $BrCH_2CH_2COOH$
    (d) $CH_3CHBrCOOH$

36. When benzenesulphonic acid and p-nitrophenol are treated with $NaHCO_3$, the gases released respectively are
    (a) SO_2, NO_2
    (b) SO_2, NO
    (c) SO_2, CO_2
    (d) CO_2, CO_2

37. Which of the following is Lucas reagent?
    (a) $ZnCl_2$/conc. HCl
    (b) Br_2/CCl_4
    (c) Ammoniacal silver nitrate
    (d) Cold alkaline $KMnO_4$

38. The IUPAC name of CH_3—CH—CHO is
    $\quad\quad\quad\quad\quad\quad\quad$ |
    $\quad\quad\quad\quad\quad\quad\quad$ OCH_3
    (a) 2-methoxy propanal
    (b) α-methoxy propionaldehyde
    (c) 2-methoxy butanal
    (d) 3-methylpropanal

39. Two aromatic compounds having formula C_7H_8O which are easily identifiable by $FeCl_3$ solution test(violet colouration) are
    (a) o-cresol and benzyl alcohol
    (b) m-cresol and p-cresol
    (c) o-cresol and p-cresol
    (d) methyl phenyl ether and benzyl alcohol

40. The compound that reduces Tollen's reagent is
    (a) CH_3COCH_3
    (b) CH_3CHO
    (c) CH_3COOH
    (d) CH_3CH_2OH

41. How many C-atoms are there is a pyranose ring?
    (a) 3
    (b) 5
    (c) 6
    (d) 7

42. Antiseptics and disinfectants either kill or prevent growth of microorganisms. Identify which of the following statements is not true?
    (a) Chlorine and iodine are used as strong disinfectants.
    (b) Dilute solutions of boric acid and hydrogen peroxide are strong antiseptics.
    (c) Disinfectants harm the living tissues.
    (d) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant.
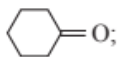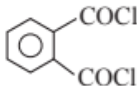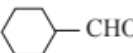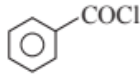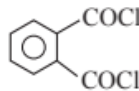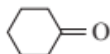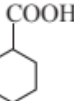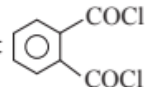
43. **Cellulose is polymer of**
    (a) Ribose
    (b) Fructose
    (c) Glucose
    (d) Sucrose

44. **The anomeric carbon in D (+) glucose is**
    (a) C-1 carbon
    (b) C-2 carbon
    (c) C-5 carbon
    (d) C-6 carbon

45. **The product 'A' in the reaction is**

46. **Phenol on reaction with CCl_4 in presence of alkali at 340 K produces**
    (a) salicylic acid
    (b) salicylaldehyde
    (c) o–chlorophenol
    (d) p–chlorophenol

47. **Complete the following:**
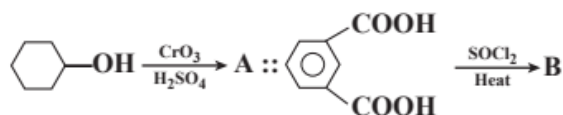
48. **Proteins are found to have two different types of secondary structures viz. α-helix and β-pleated sheet structure. α-helix structure of protein is stabilised by :**
    (a) peptide bonds
    (b) hydrogen bonds
    (c) van der Waals forces
    (d) dipole-dipole interactions

49. **Which of the following is a chain growth polymer?**
    (a) Nucleic acid
    (b) Polystyrene
    (c) Protein
    (d) Starch

50. **Arsphenamine, also known as Salvarsan is an arsenic containing drug. It was first used for the effective treatment of _____.**
    (a) Meningitis
    (b) Syphilis
    (c) Typhoid
    (d) Dysentery

Answers

1. (b)	2. (c)	3. (d)	4. (a)	5. (c)	6. (c)	7. (c)
8. (b)	9. (c)	10. (b)	11. (b)	12. (d)	13. (a)	14. (c)
15. (c)	16. (c)	17. (a)	18. (b)	19. (b)	20. (d)	21. (c)
22. (c)	23. (a)	24. (a)	25. (a)	26. (c)	27. (b)	28. (b)
29. (d)	30. (a)	31. (a)	32. (d)	33. (c)	34. (d)	35. (c)
36. (d)	37. (a)	38. (a)	39. (a)	40. (b)	41. (b)	42. (b)
43. (c)	44. (a)	45. (a)	46. (a)	47. (a)	48. (b)	49. (b)
50. (b)						

Solutions

**1. (b)** For the reaction $A \longrightarrow xp$, the rate of reaction $r = k[A]^x$

Now $r_1 = k[A]^x$ $r_1 = 2.4$ and $r_2 = k[A/2]^x$ $r_2 = 0.6$

$$\frac{r_1}{r_2} = \frac{[A]^x}{\left[\frac{A}{2}\right]^x} \Rightarrow \frac{2.4}{0.6} = 2^x$$

$$\Rightarrow 2^2 = 2x \Rightarrow x = 2$$

2. (c) Sulphur dioxide and chlorine gas are the two gases that bleach the colour of flower by reduction and oxidation. Chlorine reacts with water and produces a single oxygen atom also called nascent oxygen. This nascent oxygen when combines with any colour make it colourless. Sulphur dioxide when reacts with water produces nascent hydrogen. This nascent hydrogen when combines with coloured substance forms colourless substance.

4. (a) Greater the value of standard reduction potential, greater is the tendency for reduction to occur and thus, stronger is the oxidising agent.

5. (c) Fast reactions are completed immediately. These reactions are mostly ionic in nature. Precipitation reactions and neutralisation reactions are examples of fast reactions.

6. (c) ● The first reaction is a neutralisation reaction which does not involve either oxidation or reduction.

● O_3 formation from O_2 does not involve either oxidation or reduction.

● The formation of nitric oxide from nitrogen and oxygen in presence of high temperature involves oxidation as well as reduction process. Therefore, it is a redox reaction.
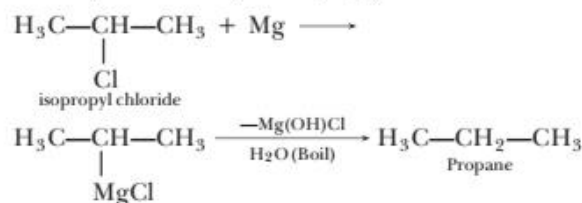
$$\overset{0}{N_2}(g) + \overset{0}{O_2}(g) \xrightarrow[\text{arc}]{\text{Electric}} 2\overset{+2-2}{NO}(g)$$
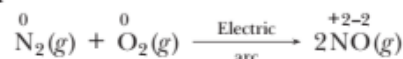
● Evaporation of H_2O is a physical change and not a chemical change.

7. (c) The water from river contains negatively charged clay particles. On addition of alum which yields trivalent Al^{3+} ions in solution, the negative charge on clay particles is neutralised and consequently, they precipitate out and settle down at the bottom. The clear water is left at the top and can be decanted off.

8. (b) A protective colloid is a lyophilic sol that when present in small quantities forms a protective layer around lyophobic sol and thus protect it from precipitating under the coagulating action of electrolytes. Starch and gelatin acts a protective colloid.

10. (b) On the basis of reduction-potential (Z>Y>X), a spontaneous reaction will have the following characteristics: Higher standard reduction potential means stronger is the reducing agent, thus, Y will oxidise X and not Z and Z will oxidise both X and Y.

11. (b) The defect that arises due to the missing of a cation from its lattice site and presence of the cation with higher charge in the adjacent site is called metal deficiency defect. Hence, the

metals showing variable valency. For example, in FeO, as some Fe may be present as Fe^{3+} and for charge neutrality $3Fe^{2+} = 2Fe^{3+}$. Hence, FeO should have metal deficiency defect.

12. (d) Given, $\pi = 2.5$ atm,

$$T = 24 + 273 = 297 \text{ K}$$
$$R = 0.0821 \text{ litre atm K}^{-1} \text{mol}^{-1}$$

$\because \quad \pi = CRT$

$\therefore \quad C = \dfrac{\pi}{RT} = \dfrac{2.5}{0.0821 \times 297}$

$\qquad = 0.1025$ moles/litre

13. (a) $a = 5$ Å or 5×10^{-8} cm

Volume of unit cell $= a^3$

$\qquad = (5 \times 10^{-8})^3 = 1.25 \times 10^{-22} \text{ cm}^3$

Given, Density $= 4$ g/cm^3

The mass of the unit cell $= 4 \times 1.25 \times 10^{-22}$

$\qquad = 5 \times 10^{-22}$ g

The mass of 1 mol of FeO is $= 55.8 + 16 = 71.8$ g

So the mass of 1 molecule of FeO will be

$\qquad = \dfrac{71.8}{6.022 \times 10^{23}} = 1.192 \times 10^{-22}$ g

Number of FeO formula unit per unit cell

$\qquad = \dfrac{5 \times 10^{-22}}{1.192 \times 10^{-22}} \approx 4$

So, the amount of Fe^{2+} and O^{2-} ions in each unit cell will be 4 Fe^{2+} and 4O^{2-}.

14. (c) $\Delta T_f = K_f m = 1.86 \times 0.05 = 0.093°C$

$T_f° = 0°C$

so, $\Delta T_f = T_f° - T_f$

or $T_f = T_f° - \Delta T_f = 0°C - 0.093°C = -0.093°C$

15. (c) 1 mole of compound $= 6.022 \times 10^{23}$ particles

0.5 mole of compound

$\qquad = 0.5 \times 6.022 \times 10^{23}$ particles

No. of tetrahedral voids

$\qquad = 2 \times$ Number of particles

$\qquad = 2 \times 3.011 \times 10^{23} = 6.022 \times 10^{23}$

No. of octahedral voids $=$ Number of particles

$\qquad = 3.011 \times 10^{23}$

Hence, Total no. of voids

$\qquad = 6.022 \times 10^{23} + 3.011 \times 10^{23}$

$\qquad = 9.03 \times 10^{23}$

16. (c) Pressure has no effect at all on solubility of solid in liquid. However, pressure is an important factor affecting the solubility of gas in liquids.

17. (a) The reaction of bromine water with SO_2 forms sulphuric acid and hydrogen bromide.

$Br_2 + 2H_2O + SO_2 \longrightarrow H_2SO_4 + 2HBr$

18. (b) The electronic configuration of Zn is [Ar] $3d^{10}$ $4s^2$ and mercury is [Xe] $4f^{14}$ $5d^{10}$ $6s^2$. After loosing 2 electrons from 4s-subshell; they have completely filled d-subshells.

19. (b) Liquation method is very useful for low melting metals like tin and lead. The impure metal is heated on the sloping hearth of a furnace when the molten metal flows away from the infusible impurities.

20. (d) In the Froth Floatation process, zinc sulphide and lead sulphide can be separated by using depressant and by adjusting the proportion of oil to water.

21. (c) Hydrometallurgy involves the use of aqueous chemistry for the recovery of metals from ores, concentrates, and recycled or residual materials. This process is used in extraction of less electro positive or less reactive metals like gold and silver.

22. (c) Zr and Hf have almost equal radii because of lanthanoid contraction. Due to this, they show similar properties.

23. (a) Radon is radioactive. It is obtained as a decay product of radium(Ra-226).

25. (a) Since alkane formed is propane, therefore the alkyl halide may be isopropyl chloride.

$$\underset{\text{isopropyl chloride}}{H_3C-\underset{\underset{Cl}{|}}{CH}-CH_3} + Mg \longrightarrow$$

$$H_3C-\underset{\underset{MgCl}{|}}{CH}-CH_3 \xrightarrow[H_2O\,(Boil)]{-Mg(OH)Cl} \underset{\text{Propane}}{H_3C-CH_2-CH_3}$$

26. (c) In chlorobenzene, chlorine group is attached to sp^2 hybridised carbon and in methyl chloride it is attached to sp^3 hybridised carbon so the C—Cl bond is shorter and stronger in chlorobenzene.

27. (b) Optical isomerism is exhibited by chiral molecules. Optical isomers are mirror images that cannot be superimposed on one another. The complexes of the type $[M(AA)_3]$, $[M(AA)_2X_2]$ or $[M(AA)_2XY]$,$[M(AA)X_2Y_2]$ shows this isomerism.

28. (b) The secondary valencies are non ionisable and are satisfied by neutral molecules or negative ions. The secondary valency is equal to the coordination number and is fixed for a metal.

29. (d) The reactivity order of alkyl halide towards S_N1 is Tertiary >Secondary >Tertiary

30. (a) Fluorine is most powerful oxidising agent due to highest electrode reduction potential value.

31. (a) Coordination number of Cr in the given complex is 6 as it contains three bidentate ligands.

32. (d) $SOCl_2$ gives pure acid chloride from monocarboxylic acid because SO_2 and HCl produced are escapable gases.

$R-COOH + SOCl_2 \longrightarrow RCOCl + SO_2 + HCl$

33. (*c*) $\underset{\text{Nitroethane}}{CH_3CH_2NO_2} + 6[H]$

$$\xrightarrow{Sn/HCl} \underset{\text{Ethylamine}}{CH_3CH_2NH_2} + 2H_2O$$

**34.** (*d*) The reaction of benzenediazonium chloride with CuCN/KCN is known as Sandmeyer's reaction.
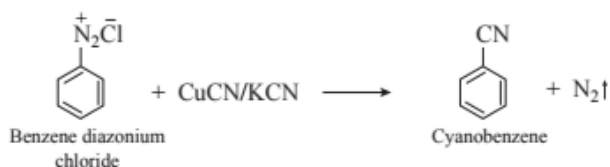
35. (*c*) Since, $BrCH_2CH_2COOH$ is the weakest acid among the given compounds and therefore it has the smallest dissociation constant.

36. (*d*) The balanced chemical equation for the reaction of benzene sulphonic acid with sodium bicarbonate is
$$C_6H_5SO_3H + NaHCO_3$$
$$\longrightarrow C_6H_5SO_3^-Na^+ + CO_2\uparrow + H_2O$$

The balanced chemical equation for the reaction of *p*-nitrophenol with $NaHCO_3$ is
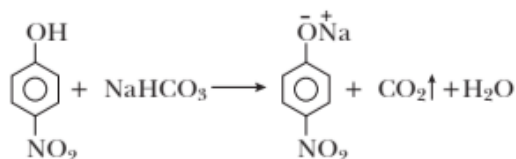

37. (*a*) **Lucas test:** In this test, the alcohol is treated with Lucas reagent which is an equimolar mixture of conc. HCl and $ZnCl_2$. Alcohols are soluble in Lucas reagent and form a clear solution. On reaction, alkyl chlorides are formed which being insoluble result in turbidity in the solution.

$$\text{Alcohol} \xrightarrow[ZnCl_2]{conc.\ HCl} \text{Alkyl chloride} + H_2O$$
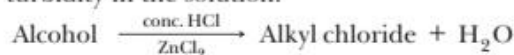
If turbidity appears immediately, tertiary alcohol is indicated.
If turbidity appears within five minutes, secondary alcohol is indicated.
If turbidity appears only upon heating, primary alcohol is indicated.

38. (*a*)
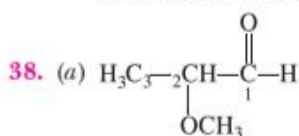
IUPAC name : 2-methoxy propanal

39. (*a*) *o*-, *m*- and *p*- cresol, all contains phenolic group, thus they give violet colouration with $FeCl_3$ whereas benzyl alcohol and methyl phenyl ether do not contain phenolic group, hence give no colouration with $FeCl_3$. Hence the pair of compounds which are identifiable by $FeCl_3$ is o-cresol and benzyl alcohol.

40. (*b*) When aldehydes are heated with Tollens' reagent (ammoniacal silver nitrate solution), they form silver mirror on the inner side of the test tube. Ketones, carboxylic acid(except formic acid) and alcohols do not respond to this test.
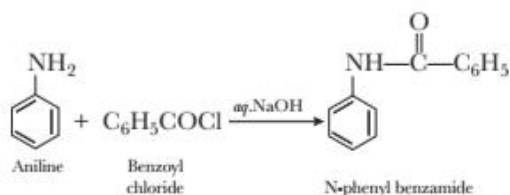
41. (*b*)
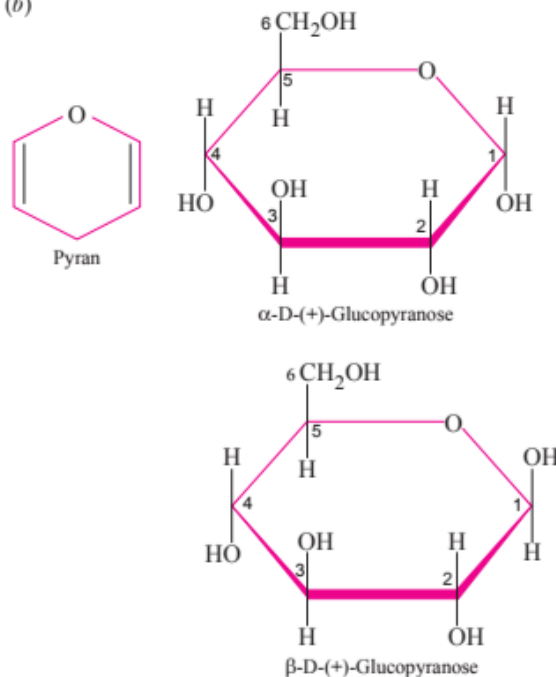
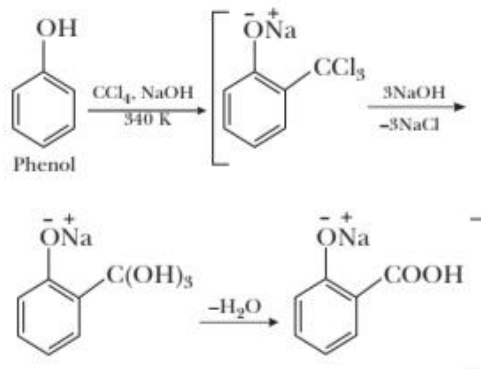**42.** (*b*) Dilute solutions of boric acid and hydrogen peroxide are weak antiseptics.

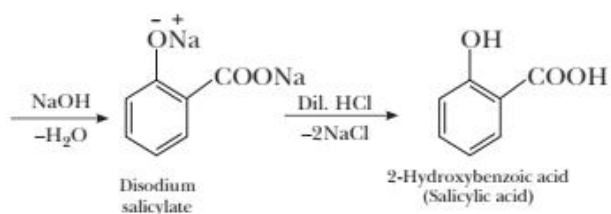**43.** (*c*) Cellulose is a polymer of β-glucose.

44. (*a*) Anomers differ from each other in the configuration of C-1 and the carbon is known as anomeric carbon

45. (*a*)

46. (*a*)

$$\xrightarrow[-H_2O]{NaOH}$$ Disodium salicylate $$\xrightarrow[-2NaCl]{Dil.\ HCl}$$ 2-Hydroxybenzoic acid (Salicylic acid)

48. (b) α-Helix is one of the most common ways in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed screw (helix) with the –NH group of each amino acid residue hydrogen bonded to the CO of an adjacent turn of the helix.

49. (b) Polystyrene a polymer of styrene is an example of addition polymer and formed by addition polymerisation or chain growth polymerisation.

50. (b) Salvarsan was a first effective medicine for syphilis, a sexually transmitted disease that was exacting a toll on public health similar to that of HIV in recent decades.

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