PRACTICE PAPER

14

**Time allowed: 45 minutes**   **Maximum Marks: 200**

General Instructions: Same as Practice Paper–1.

Choose the correct option.

1. **Partial pressure of a solution component is directly proportional to its mole fraction. This statement is known as**
   (a) Henry's law   (b) Raoult's law   (c) Distribution law   (d) Ostwald's dilution law

2. **The electrode potential is dependent upon**
   (a) concentration of ions   (b) nature of electrode
   (c) temperature   (d) all of these

3. **Equimolar solutions in the same solvent will have**
   (a) different boiling and different freezing points.
   (b) same boiling and same freezing points.
   (c) same freezing point but different boiling point.
   (d) same boiling point but different freezing point.

4. **The best way of preventing rusting of iron is by**
   (a) putting it in saline water   (b) barrier protection
   (c) both of these   (d) none of these

5. **The boiling point of water (100°C) becomes 100.52°C, if 3 g of a non-volatile solute is dissolved in 200 g of water. The molecular weight of solute is (K_b for water = 0.6 K/m)**
   (a) 17.31 g mol^{-1} (b) 15.42 g mol^{-1} (c) 12.20 g mol^{-1} (d) 20.46 g mol^{-1}

6. **Which of the following expression is correct for the cell potential?**
   (a) $E = E^\circ - \dfrac{RT}{nF} \ln \dfrac{\text{(Products)}}{\text{(Reactants)}}$ (b) $E = E^\circ - \dfrac{RT}{nF} \ln \dfrac{\text{(Reactants)}}{\text{(Products)}}$
   (c) $E = E^\circ + \dfrac{RT}{nF} \ln \dfrac{\text{(Products)}}{\text{(Reactants)}}$ (d) $E = E^\circ - \dfrac{RT}{nF} \log \dfrac{\text{(Products)}}{\text{(Reactants)}}$

7. **When NaCl crystal is doped with $MgCl_2$, the nature of defect produced is**
   (a) Interstitial   (b) Schottky   (c) Frenkel   (d) Impurity

8. **The rate of a first order reaction is 0.04 mol L^{-1} s^{-1} at 10 seconds and 0.03 mol L^{-1} s^{-1} at 20 seconds after initiation of the reaction. The half-life period of the reaction is**
   (a) 34.1 s   (b) 44.1 s   (c) 54.1 s   (d) 24.1 s

9. **The total number of atoms per unit cell of a face centred cubic crystal is**
   (a) 1   (b) 2   (c) 3   (d) 4

10. **The specific rate constant of a first order reaction depends upon**
   (a) concentration of the reactant
   (b) concentration of the product
   (c) time
   (d) temperature

11. **The ionic radii of A^+ and B^- ions are 0.98×10^{-10} m and 1.81×10^{-10} m. The coordination number of each ion in AB is**
   (a) 8
   (b) 2
   (c) 6
   (d) 4

12. **When initial concentration of a reactant is doubled in a reaction its half-life period is not affected. The order of the reaction is**
   (a) zero
   (b) first
   (c) second
   (d) more than zero but less than one

13. **An example of auto-catalytic reaction is**
   (a) the decomposition of nitroglycerin.
   (b) thermal decomposition of $KClO_3$, MnO_2 mixture.
   (c) breakdown of $^{14}C_6$.
   (d) hydrogenation of vegetable oil using nickel catalyst.

14. **Tyndall effect is due to**
   (a) absorption of light.
   (b) scattering of light.
   (c) reflection of light.
   (d) presence of positivly charged particles.

15. **A dilute aqueous solution of Na_2SO_4 is electrolysed using platinum electrodes. The products at the anode and cathode are**
   (a) O_2, H_2
   (b) $S_2O_8^{2-}$, Na
   (c) O_2, Na
   (d) $S_2O_8^{2-}$, H_2

16. **The standard electrode potential of Cu^{2+}/Cu and Cu^{2+}/Cu^+ are 0.337 and 0.153 V respectively. The standard electrode potential for Cu^+/Cu half cell will be**
   (a) 0.184 V
   (b) 0.827 V
   (c) 0.521 V
   (d) 0.490 V

17. **The number of unpaired electrons in the complexes $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ is**
   (a) 1, 2
   (b) 4, 5
   (c) 0, 1
   (d) 5, 4

18. **Which of the following elements does not show variable oxidation states?**
   (a) Copper
   (b) Iron
   (c) Zinc
   (d) Titanium

19. **The metal which is used for making wires, water and steam pipes is**
   (a) copper
   (b) tungsten
   (c) zinc
   (d) silicon

20. **The correct increasing order of ionic radii is**
   (a) Po < Se < Te < S < O
   (b) O < S < Se < Te < Po
   (c) S < O < Te < Se < Po
   (d) none of these

21. **The hybridisation of Xe in XeF_6 is**
   (a) sp^3d^2
   (b) sp^3
   (c) sp^3d^3
   (d) dsp^3

22. **The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as**
   (a) A dehydrohalogenation reaction
   (b) A substitution reaction
   (c) An addition reaction
   (d) A dehydration reaction

23. **Chromatographic method is based on the principle that**
   (a) same components of a mixture are adsorbed on an adsorbent.
   (b) different components of a mixture are differently adsorbed on an adsorbent.
   (c) same components of a mixture are absorbed on an absorbent.
   (d) different components of a mixture are differently absorbed on an absorbent.

24. **The solution of the complex $[Cu(NH_3)_4]SO_4$ in water will give**
   (a) the tests for Cu^{2+} ion
   (b) the tests for NH_3
   (c) the tests for SO_4^{2-} ions
   (d) does not give test

25. Arrange the following in increasing order of rate of reaction towards nucleophilic substitution reaction.
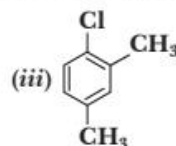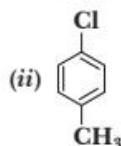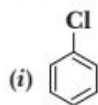
(a) (i) < (ii) < (iii) (b) (ii) < (i) < (iii) (c) (iii) < (ii) < (i) (d) (i) < (iii) < (ii)

26. Arrange the following compounds in order of increasing dipole moment :

Toluene (I); m-Dichlorobenzene (II); o-Dichlorobenzene (III); p-dichlorobenzene (IV).

(a) I < IV < II < III (b) IV < I < II < III
(c) IV < I < III < II (d) IV < II < I < III

27. A gas 'Z' is used in voltage regulators. It is also used in discharge tubes and fluorescent bulbs. Identify 'Z'.

(a) He (b) Ar (c) Ne (d) Rn

28. Arrange Ce^{3+}, La^{3+}, Pm^{3+} and Yb^{3+} in increasing order of their ionic radii

(a) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$ (b) $Ce^{3+} < Yb^{3+} < Pm^{3+} < La^{3+}$
(c) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$ (d) $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

29. The lanthanoid contraction is responsible for the fact that

(a) Zr and Y have almost same atomic size. (b) Zr and Nb have similar oxidation state.
(c) Zr and Hf have almost same atomic size. (d) Zr and Zn have the same oxidation state.

30. Identify the correct order of decreasing acid strength in the following acids:

ClOH(I) ; BrOH(II) ; IOH(III)

(a) I > II > III (b) II > I > III (c) III > II > I (d) I > III > II

31. The effective atomic number of Fe in the complex $K_3[Fe(CN)_6]$ is

(a) 18 (b) 12 (c) 24 (d) 35

32. Which of the following is not a condensation polymer?

(a) Bakelite (b) Nylon (c) Dacron (d) Teflon

33. A nucleoside consists of :

(a) base and sugar (b) base and phosphate
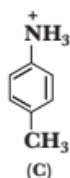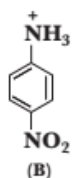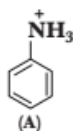(c) sugar and phosphate (d) base, sugar and phosphate

34. Which of the following species can act as the strongest base?

(a) $^{\ominus}OH$ (b) $^{\ominus}OR$ (c) $^{\ominus}OC_6H_5$ (d)

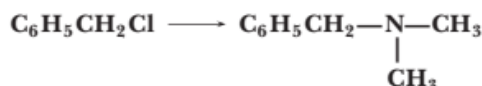35. Which of the following is an anionic detergent?

(a) Sodium lauryl sulphate (b) Cetyltrimethyl ammonium bromide
(c) Glyceryl oleate (d) Sodium stearate

36. Rank the following three compounds in order of decreasing acidity.

(a) B > A > C (b) B > C > A (c) C > B > A (d) C > A > B

37. The reagent required for the following conversion is

$$C_6H_5CH_2Cl \longrightarrow C_6H_5CH_2{-}N(CH_3){-}CH_3$$

(a) CH_3NH_2, CH_3Cl (b) NH_3, CH_3Cl (c) $CH_3CH_2NH_2$ (d) CH_3Cl, RNH_2

38. **The interparticle forces between linear chains in Nylon-66 are:**
    (a) Hydrogen-bonds (b) Covalent bonds (c) Ionic bonds (d) None of these

39. **Match the reactions given in Column I with the suitable reagents given in Column II.**

Column I (Reactions)		Column I (Reagents)	
A.	Benzophenone → Diphenylmethane	(i)	LiAlH$_4$
B.	Benzaldehyde → 1-Phenylethanol	(ii)	DIBAL—H
C.	Cyclohexanone → Cyclohexanol	(iii)	Zn(Hg)/Conc. HCl
D.	Phenyl benzoate → Benzaldehyde	(iv)	CH$_3$MgBr

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

40. **Given below are two statements labelled as Statement P and Statement Q:**

   Statement P : Penicillin (G) is an antibiotic.

   Statement Q : Penicillin (G) is effective against gram positive as well as gram negative bacteria.
   (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

41. **Which reaction is suitable for the preparation of α-chloroacetic acid?**
    (a) Hell-Volhard Zelinsky reaction (b) Nef reaction
    (c) Stephen's reaction (d) Perkins condensation

42. **The carbohydrate which give blue-black colour with iodine is :**
    (a) glucose (b) sucrose (c) cellulose (d) starch

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

   Assertion (A) : Compounds containing —CHO group are easily oxidised to corresponding carboxylic acid.

   Reason (R) : Carboxylic acids can be reduced to alcohols by treatment with LiAlH$_4$.
   (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.

44. **Phenol is less acidic than _____.**
    (a) ethanol (b) o-nitrophenol (c) o-methylphenol (d) o-methoxyphenol

45. **The reagent used for preparing benzene from benzenediazonium chloride is**
    (a) KI (b) HBF$_4$ (c) H$_2$O (d) CH$_3$CH$_2$OH

46. **The conversion of m-nitrophenol to resorcinol involves respectively**
    (a) diazotization, reduction and hydrolysis (b) hydrolysis, diazotization and reduction
    (c) reduction, diazotization and hydrolysis (d) hydrolysis, reduction and diazotization

47. **Formaldehyde when reacted with methyl magnesium bromide gives**
    (a) C$_2$H$_5$OH (b) CH$_3$COOH (c) CH$_3$CHO (d) HCHO

48. **Cellulose is not digestible by human beings due to absence of cellulose hydrolysing enzyme called**
    (a) cellulase (b) invertase (c) zymase (d) urease

49. **When acetylene is passed through dilute H$_2$SO$_4$ in the presence of HgSO$_4$, the compound formed is:**
    (a) C$_2$H$_5$OH (b) acetone (c) carbide of Hg (d) CH$_3$CHO

50. **Kolbe's electrolysis of aqueous potassium ethanoate leads to the formation of**
    (a) Ethene (b) Ethylene (c) Ethane (d) Ethyne

Answers

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

Solutions

2. *(d)* Electrode potential is defined as the tendency of either lose or gain electrons when it is in contact with its own ions in solution.

The electrode potential depends on nature of the metal or electrode, temperature and the concentration of metal ions in solution.

3. *(b)* Boiling point and freezing point depends upon K_b (molal elevation constant) and K_f (molal depression constant) of the solvent. Thus, equimolar solution (of the non-electrolyte) will have same boiling point and also same freezing point.

$$\Delta T_f = K_f \times \text{molality}$$
$$\Delta T_b = K_b \times \text{molality}$$

5. *(a)*
$$\Delta T_b = K_b\, m$$
$$T_b - T_b^\circ = K_b \times m$$
$$100.52 - 100.00 = \frac{0.6 \times 3 \times 1000}{M \times 200}$$
$$= \frac{1800}{104} = 17.31 \text{ g mol}^{-1}$$

6. *(a)* The nernst equation for a cell is expressed as
$$E_{cell} = E^\circ_{cell} - \frac{RT}{nF} \ln \frac{[\text{Products}]}{[\text{Reactants}]}$$

7. *(d)* When NaCl is doped with $MgCl_2$, two Na^+ are replaced by one Mg^{2+} ion to maintain electrical neutrality. Thus, the cationic vacancies thus produced are equal in number to that of Mg^{2+} ions. Hence, this type of defect is called impurity defect.

8. *(d)* The rate constant k for the first order reaction is expressed as
$$k = \frac{2.303}{t_2 - t_1} \log_{10} \frac{a_1}{a_2}$$
$$\therefore \quad k = \frac{2.303}{20 - 10} \log_{10} \left(\frac{0.04}{0.03}\right)$$
$$\text{or, } k = \frac{2.303}{10} \log_{10} \left(\frac{4}{3}\right) = 0.0288 \text{ s}^{-1}$$

Now, $t_{1/2} = \dfrac{0.693}{k} = \dfrac{0.693}{0.0288} = 24.1 \text{ s}$

10. *(d)* The specific rate constant of a reaction depends upon temperature as $k = Ae^{-E_a/RT}$.

11. *(c)* Radius ratio $\dfrac{r^+}{r^-} = \dfrac{0.98 \times 10^{-10}}{1.81 \times 10^{-10}} = 0.541$

It lies in the range of 0.414 to 0.732 hence, coordination number of each ion will be 6 as the compound will have NaCl type structure, *i.e.*, octahedral arrangement.

12. *(b)* For any order of reaction, the relationship between $t_{1/2}$ and initial concentration is
$$t_{1/2} \propto \frac{1}{a^{n-1}}$$

For a 1st order reaction, $n = 1$, so '$t_{1/2}$' becomes independent of 'a'.

13. *(a)* A chemical reaction is said to be auto-catalytic if one of the reaction product is also a catalyst for the same or a coupled reaction.
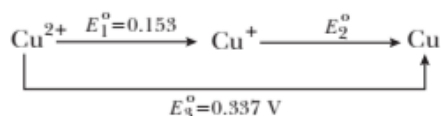
The decomposition of nitroglycerin is an autocatalytic reaction.

$$4C_3H_5N_3O_9 \longrightarrow 6N_2 + 12CO_2 + 10H_2O + O_2$$

15. *(a)* **At cathode:**
$$2H_2O(l) + 2e^- \longrightarrow H_2(g) + 2OH^-(aq)$$

At anode: $2H_2O(l) \longrightarrow O_2(g) + 4H^+(aq)$

16. *(c)*

$$Cu^{2+} \xrightarrow{E^\circ_1 = 0.153} Cu^+ \xrightarrow{E^\circ_2} Cu$$
$$E^\circ_3 = 0.337 \text{ V}$$

We know that
$$\Delta G = -nFE^\circ_{cell}$$
$$-2 \times F \times 0.337 = -(1 \times F \times 0.153) - (1 \times F \times E^\circ_2)$$
$$\Rightarrow \quad 2 \times 0.337 = 0.153 + E^\circ_2$$
$$\Rightarrow \quad E^\circ_2 = 0.521 \text{ V}$$

17. *(c)* The electronic configuration of
Fe_{26} is $[Ar]\, 3d^6\, 4s^2$

In the complex, $[Fe(CN)_6]^{4-}$, the electronic configuration of $Fe^{2+} = [Ar]\, 3d^6$

Due to presence of strong field ligand, all the electrons are paired up.

In the complex, $[Fe(CN)_6]^{3-}$, the electronic configuration of $Fe^{3+} = [Ar]\, 3d^5$
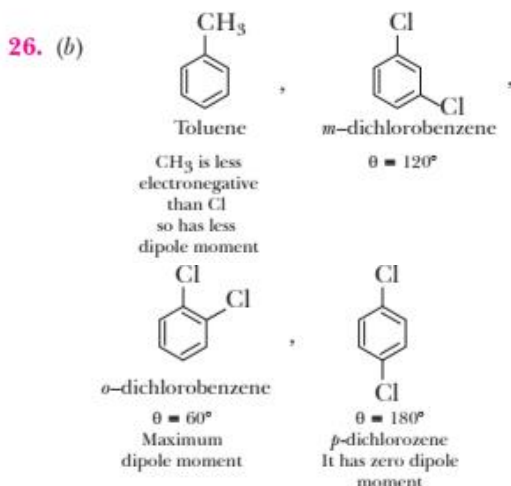
Due to presence of strong field ligand, all the electrons get paired up and only one electron is left unpaired.

18. *(c)* Zinc shows only one oxidation state of +2 while Fe and Ti shows +2, +3 and +4 and Cu shows +1 and +2 oxidation states.

19. *(a)* Copper being a good conductor of heat and electricity is used for making electrical wires, water and steam pipes.

20. *(b)* Down the group, the ionic radii increases mainly due to addition of a new shell. Therefore, the correct order is O < S < Se < Te < Po

21. *(c)* The hybridisation of Xe in XeF_6 is sp^3d^3 and the shape is distorted octahedral.

23. *(b)* Chromatographic method is based on the principle that different components of a mixture are differently adsorbed on an adsorbent.

24. *(c)* The solution of the complex $[Cu(NH_3)_4]$ SO_4 in water will give the tests of SO_4^{2-} ions because the ionisation of this complex is

$$[Cu(NH_3)_4]SO_4 \rightleftharpoons [Cu(NH_3)_4]^{2+} + SO_4^{2-}$$
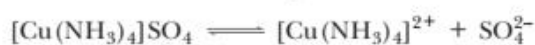
25. *(c)* Presence of electron donating group ($-CH_3$) decreases the reactivity towards nucleophilic substitution. Thus, the increasing order of rate of reaction towards nucleophilic substitution is $(iii) < (ii) < (i)$

26. *(b)*

Toluene
CH_3 is less electronegative than Cl so has less dipole moment

m–dichlorobenzene
$\theta = 120°$

o–dichlorobenzene
$\theta = 60°$
Maximum dipole moment

p–dichlorozene
$\theta = 180°$
It has zero dipole moment

28. *(a)* Ionic radii decreases as we move across lanthanide series due to lanthanoid contraction. Thus, the correct increasing order of ionic radii Ln^{3+} ions is:

$$Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$$

[At. no. La = 57, Ce = 58, Pm = 61, Yb = 70]

29. *(c)* Due to lanthanoid contraction the pairs of elements such as Zr/Hf, Nb/Ta and Mo/W have almost same atomic size.

30. *(a)* Due to decrease in electronegativity, the correct order is
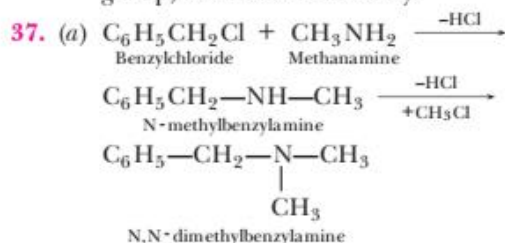
ClOH(I) > BrOH(II) > IOH(III)

31. *(d)* The EAN of Fe in the complex $K_3[Fe(CN)_6]$ is calculated as

EAN = $Z - x + 2$ C.N

where Z = atomic number of central atom

x = oxidation number

EAN = $26 - 3 + 2(6) = 35$

32. *(d)* Teflon is an addition polymer.

34. *(b)* Weakest acid has the strongest conjugate base. ROH is the acid of RO^- conjugate base, HOH is the acid of ^-OH, C_6H_5OH is the acid of $C_6H_5O^-$ and HO–⟨O⟩–NO_2 is the acid of
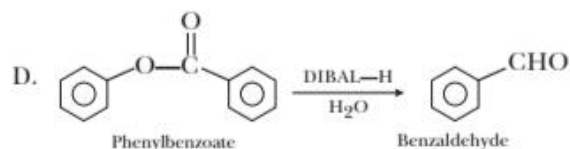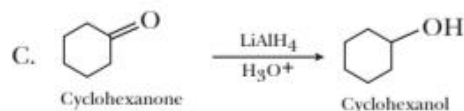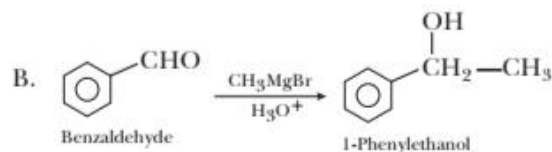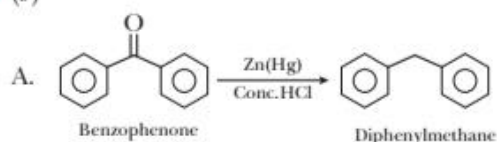
^-O–⟨O⟩–NO_2.

Among all these acids, ROH is the weakest acid and hence $^{\ominus}OR$ act as the strongest base.

36. *(a)* $-NO_2$ (electron withdrawing group) increases the acidity while $-CH_3$ (electron releasing group) decreases the acidity.

37. *(a)*

$\underset{\text{Benzylchloride}}{C_6H_5CH_2Cl} + \underset{\text{Methanamine}}{CH_3NH_2} \xrightarrow{-HCl}$

$\underset{\text{N-methylbenzylamine}}{C_6H_5CH_2-NH-CH_3} \xrightarrow[+CH_3Cl]{-HCl}$

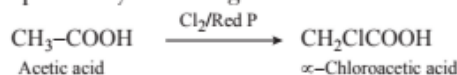$C_6H_5-CH_2-\underset{\underset{\text{N,N-dimethylbenzylamine}}{CH_3}}{\overset{|}{N}}-CH_3$

38. *(a)* Nylon 6,6 has strong intermolecular forces like hydrogen bonding. These strong forces also lead to close packing of chains and thus impart crystalline nature.

39. *(b)*

A. Benzophenone $\xrightarrow[\text{Conc.HCl}]{Zn(Hg)}$ Diphenylmethane

B. Benzaldehyde (CHO) $\xrightarrow[H_3O^+]{CH_3MgBr}$ 1-Phenylethanol (CH_2-CH_3, OH)

C. Cyclohexanone $\xrightarrow[H_3O^+]{LiAlH_4}$ Cyclohexanol (OH)

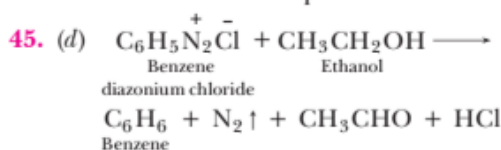D. Phenylbenzoate $\xrightarrow[H_2O]{DIBAL-H}$ Benzaldehyde (CHO)

40. (*a*) Statement P is true, but statement Q is false. The correct form is "Penicillin G is a narrow-spectrum antibiotic, it is reliably active against many gram-positive pathogens."

41. (*a*) In HVZ reaction, carboxylic acid containing alkyl group reacts with Cl_2 and Br_2 in the presence of red phosphorus, the hydrogen atom of the α-carbon atom are successively replaced by the halogen atom.

$$CH_3-COOH \xrightarrow{\text{Cl}_2/\text{Red P}} CH_2ClCOOH$$
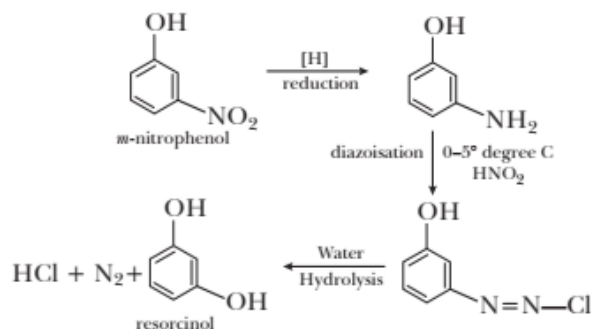$$\underset{\text{Acetic acid}}{} \qquad\qquad \underset{\propto-\text{Chloroacetic acid}}{}$$

43. (*b*) The correct explanation is"Aldehydes get easily oxidised even with mild oxidising agents as the H atom(which is more acidic) on carboxyl carbon(—CHO) changes easily to hydroxyl group (—OH) without any cleavage of any other bond."
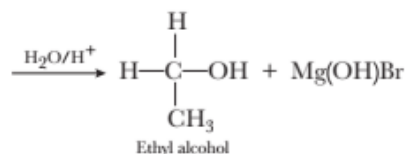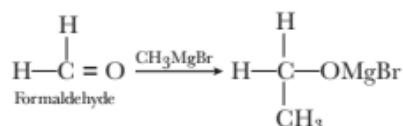
44. (*b*) Presence of electron withdrawing group (—NO_2) at ortho position increases the acidic strength. On the other hand, in *o*-methylphenol and in *o*-methoxyphenol, electron releasing group are present. Presence of these groups at ortho or para positions of phenol decreases the acidic strength of phenols. So, phenol is less acidic than *o*-nitrophenol.

45. (*d*)
$$\underset{\substack{\text{Benzene}\\\text{diazonium chloride}}}{C_6H_5\overset{+}{N_2}\overset{-}{Cl}} + \underset{\text{Ethanol}}{CH_3CH_2OH} \longrightarrow$$
$$\underset{\text{Benzene}}{C_6H_6} + N_2\uparrow + CH_3CHO + HCl$$

46. (*c*)

47. (*a*)

48. (*a*) Cellulose occurs exclusively in plants. Human beings do not able to digest it due to absence of cellulose hydrolysing enzyme called cellulase.

49. (*d*)
$$\underset{\text{Acetylene}}{HC\equiv CH} + H_2O \xrightarrow[\substack{1\% \text{ HgSO}_4,\\343K}]{\text{dil. }H_2SO_4} \underset{\text{Acetaldehyde}}{CH_3CHO}$$

50. (*c*)
$$\underset{\substack{\text{Potassium}\\\text{ethanoate}}}{2CH_3COOK} + 2H_2O \xrightarrow{\text{Electrolysis}}$$
$$\underset{\substack{\text{Ethane}\\\text{At anode}}}{CH_3-CH_3} + 2CO_2 + \underset{\substack{\\\text{At cathode}}}{H_2}$$