PRACTICE PAPER

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

General Instructions: Same as Practice Paper–1.

Choose the correct option.

1. **Which of the following is true in respect of adsorption?**
   (a) $\Delta G < 0$, $\Delta S < 0$, $\Delta H > 0$
   (b) $\Delta G < 0$, $\Delta S > 0$, $\Delta H < 0$
   (c) $\Delta G < 0$, $\Delta S < 0$, $\Delta H < 0$
   (d) $\Delta G > 0$, $\Delta S > 0$, $\Delta H < 0$

2. **Charge carried by 1 mole of electrons is**
   (a) 6.023×10^{23} coulomb
   (b) 9.65×10^{4} coulomb
   (c) 1.6×10^{-19} coulomb
   (d) 6.28×10^{19} coulomb

3. **Crystalloids and colloids differ in**
   (a) particle size
   (b) chemical composition
   (c) ionic character
   (d) none of these

4. **A student made the following observations in the laboratory**
   1. **Clean copper metal did not react with 1 molar $Pb(NO_3)_2$ solution.**
   2. **Clean lead metal dissolved in a 1 molar $AgNO_3$ solution and crystals of silver metal appeared.**
   3. **Clean silver metal did not react with 1 molar $Cu(NO_3)_2$ solution.**

   The order of decreasing reducing agent strength of the three metal is
   (a) Cu, Ag, Pb
   (b) Pb, Ag, Cu
   (c) Cu, Pb, Ag
   (d) Pb, Cu, Ag

5. **Arrhenius equation may not be represented as**
   (a) $\ln\dfrac{k}{A} = \dfrac{-E_a}{RT}$
   (b) $\dfrac{d\ln k}{dt} = \dfrac{E_a}{RT^2}$
   (c) $\log A = \log k + \dfrac{E_a}{2.303RT}$
   (d) $\log_{10}\left(-\dfrac{E_a}{RT}\right) = \dfrac{k}{A}$

6. **The e.m.f. of the given cell will be**
   Pt | $H_1(P_1)$ || $H^+(aq)$ | $H_2(P_2)$ | Pt
   (a) $\dfrac{RT}{F}\ln\dfrac{P_1}{P_2}$
   (b) $\dfrac{RT}{2F}\ln\dfrac{P_1}{P_2}$
   (c) $\dfrac{RT}{F}\ln\dfrac{P_2}{P_1}$
   (d) None of the above

7. **For a given reaction $t_{1/2} = \dfrac{1}{ka}$, The order of reaction is**
   (a) 1
   (b) 0
   (c) 3
   (d) 2

8. **The fraction of the total volume occupied by the atoms present in a simple cube is**
   (a) $\pi/4$
   (b) $\pi/6$
   (c) $\pi/(3\sqrt{2})$
   (d) $\pi/(4\sqrt{2})$

9. **The half life of first order reaction is 10 min. If initial amount is 0.08 mol/L and concentration at some instant is 0.01 mol/L, then the time required is**
   (a) 10 min   (b) 30 min   (c) 20 min   (d) 40 min

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

   Assertion (A) : Semiconductors are solids with conductivities in the intermediate range from $10^{-6} - 10^{4}$ ohm^{-1} m^{-1}.

   Reason (R) : Intermediate conductivity in semiconductor is due to partially filled valence band.
   (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.

11. **Which of the following crystals does not exhibit Frenkel defect?**
   (a) AgBr   (b) AgCl   (c) KBr   (d) ZnS

12. **Which of the following statement is wrong for Galvanic cell ?**
   (a) Its electrodes are known as half cells.
   (b) Cathode is the positive electrode in it.
   (c) Anode is the positive electrode in it.
   (d) The process of oxidation takes place at anode and reduction takes place at cathode.

13. **In an electrical connection between cathode and anode of a voltaic cell, the electrons will flow from**
   (a) Cathode to anode   (b) Anode to cathode
   (c) Both (a) and (b)   (d) None of these

14. **The mixture that forms minimum boiling azeotrope is**
   (a) Methanol-acetic acid   (b) Chloroform-benzene
   (c) Water-nitric acid   (d) Ethyl alcohol-water

15. **In cold countries, glycol is added to water in car radiators during winter. It results in**
   (a) lowering in boiling point.   (b) reducing the viscosity.
   (c) reducing the specific heat.   (d) lowering in freezing point.

16. **A 5.2 molal aqueous solution of methyl alcohol, CH_3OH, is supplied. The mole fraction of methyl alcohol in the solution will be**
   (a) 0.100   (b) 0.190   (c) 0.086   (d) 0.050

17. **Match the items given in Column I with the items given in Column II.**

Column I	Column II
A. Coloured bands	(i) Zone refining
B. Impure metal to volatile complex	(ii) Fractional distillation
C. Purification of Ge and Si	(iii) Mond Process
D. Purification of mercury	(iv) Chromatography
	(v) Liquation

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

18. **Identify the set of reagent/reaction conditions 'X' and 'Y' in the following set of transformations:**

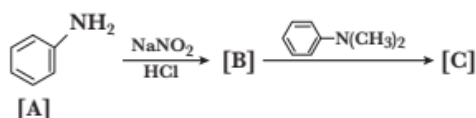$$CH_3CH_2CH_2Br \xrightarrow{X} \text{Product} \xrightarrow{Y} CH_3-\underset{\underset{Br}{|}}{CH}-CH_3$$

   (a) X = dil. aq. NaOH, 20°C; Y = HBr/acetic acid, 20°C
   (b) X = conc. alc. NaOH, 80°C; Y = HBr/acetic acid, 20°C
   (c) X = dil. aq. NaOH, 20°C; Y = Br_2/CHCl$_3$, 0°C
   (d) X = conc. alc. NaOH, 80°C; Y = Br_2/CHCl$_3$, 0°C

19. An atom with atomic number 21 belongs to the category of
    (a) s-block elements
    (b) p-block elements
    (c) d-block elements
    (d) f-block elements

20. Manganese achieves its highest oxidation state in its compound
    (a) MnO_2
    (b) Mn_2O_4
    (c) $KMnO_4$
    (d) K_2MnO_4

21. The EAN of cobalt in the complex ion $[Co(en)_2 Cl_2]^+$ is
    (a) 27
    (b) 36
    (c) 33
    (d) 35

22. $CH_3CH_2CHClCH_3$ obtained by chlorination of n-butane will be
    (a) meso form
    (b) racemic form
    (c) d-form
    (d) l-form

23. Nitrogen is chemically less reactive because of its
    (a) small atomic energy
    (b) stable electronic configuration
    (c) high electronegativity
    (d) high bond enthalpy

24. A one litre flask is full of bromine vapours. The intensity of brown colour of vapours will not decrease appreciably on adding to the flask some
    (a) pieces of marble
    (b) carbon tetrachloride
    (c) animal charcoal powder
    (d) carbon disulphide

25. Froth floatation process is used for the concentration of
    (a) Al_2O_3
    (b) Fe_3O_4
    (c) ZnS
    (d) $Fe_2O_3.3H_2O$

26. Which one of the following has the least magnetic moment?
    (a) Cu^{2+}
    (b) Ni^{2+}
    (c) Co^{2+}
    (d) Fe^{2+}

27. What kind of isomerisms are exhibited by octahedral $[Co(NH_3)_4Br_2]Cl$?
    (a) Geometrical and ionization
    (b) Geometrical and optical
    (c) Optical and ionization
    (d) Geometrical only

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

    Statement P : The degree of complex formation in actinides decreases in the order $M^{4+} > MO_2^{2+} > M^{3+} > MO_2^+$.

    Statement Q : Actinides form complexes with π-bonding ligands such as alkyl phosphines and thioethers.
    (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

29. Oxygen does not show – 2 oxidation state in the case of
    (a) OH_2
    (b) CO_2
    (c) OF_2
    (d) OCl_2

30. The addition of propene with HOCl proceeds via the addition of
    (a) H^+ in the first step
    (b) Cl^+ in the first step
    (c) OH^- in the first step
    (d) Cl^+ and OH^- in a single step

31. Which of the following is most powerful oxidising agent?
    (a) H_2SO_4
    (b) H_3BO_3
    (c) HPO_3
    (d) H_3PO_4

32. Which substance is not present in nucleic acid?
    (a) Cytosine
    (b) Adenine
    (c) Thymine
    (d) Insulin

33. An organic compound 'X' having molecular formula $C_5H_{10}O$ yield phenyl hydrazone and gives negative response to Iodoform test and Tollen's reagent. It produces n-pentane on reduction. 'X' could be
    (a) Pentan-3-one
    (b) n–amyl alcohol
    (c) pentanol
    (d) Pentan-2-one

34. _____ is called as carbolic acid.
    (a) $C_6H_5—COOH$
    (b) $C_6H_5—CHO$
    (c) $C_6H_5—OH$
    (d) H_2CO_3

35. Synthetic polymer prepared by using caprolactam is known as:
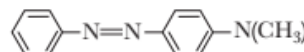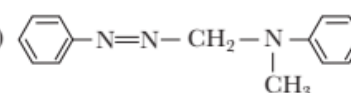   (a) Terylene
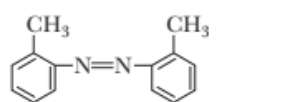   (b) Teflon
    (c) Nylon-6
    (d) Neoprene

36. The characteristic group of secondary alcohol is

(a) $-CH_2OH$ (b) $>CHOH$ (c) $-\overset{|}{\underset{|}{C}}-OH$ (d) $>C<\overset{OH}{\underset{OH}{}}$

37. In the following reactions of aniline, a coloured product C was obtained.

The structure of [C] would be:

(a) ⬡-NH-NH-⬡-N(CH₃)₂
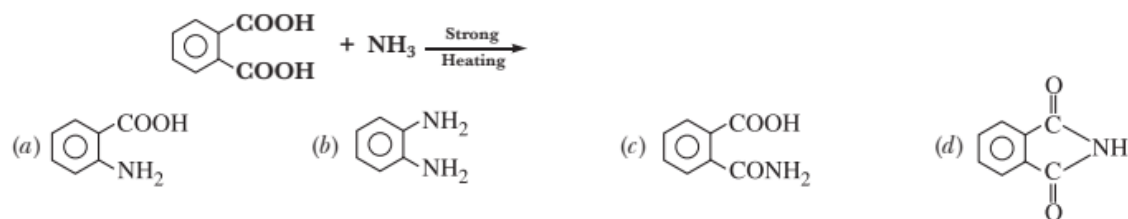
(b) ⬡-N=N-⬡-N(CH₃)₂

(c) ⬡-N=N-CH₂-N(CH₃)-⬡

(d) structure with CH₃ groups and N=N

38. Which one of the following reactions is a method for the conversion of a ketone into hydrocarbon?
(a) Aldol condensation
(b) Reimer-Tiemann reaction
(c) Cannizzaro reaction
(d) Wolff-Kishner reaction

39. A reaction in which a primary amine is formed from primary amide is called
(a) Hoffmann bromamide reaction
(b) Gabriel phthalimide reaction
(c) Carbylamine reaction
(d) Libermann's nitrosoamine reaction

40. The major product of the following reaction is

41. Identify the product C in the series of reaction:

$CH_3CN \xrightarrow{Na/C_2H_5OH} A \xrightarrow{HNO_2} B \xrightarrow{K_2Cr_2O_7/H_2SO_4} C$

(a) CH_3COOH
(b) CH_3CH_2NHOH
(c) CH_3CONH_2
(d) CH_3CHO
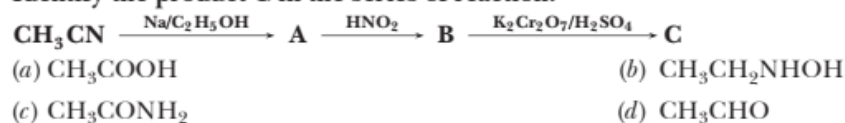
42. Which of the following is used as an antacid?
(a) Iproniazid
(b) Salvarsan
(c) Zantac
(d) Chloramphenicol

43. Which one of the following is a cross-linked polymer?
(a) Bakelite
(b) Glycogen
(c) Nylon
(d) Polythene

44. The function of enzyme in the living system is to :
(a) transport oxygen
(b) provide immunity
(c) catalyse biochemical reactions
(d) provide energy

45. Chloroquine is an effective drug for:
(a) pain   (b) fever
(c) malaria   (d) pneumonia

46. Which one is the general formula of monohydric alcohol?
(a) $C_nH_{2n}OH$ (b) $C_{n+1}H_{2n}OH$ (c) $C_nH_{2n+2}OH$ (d) $C_nH_{2n+1}OH$

47. The presence or absence of hydroxyl group on which carbon atom of sugar differentiate RNA and DNA
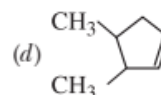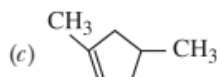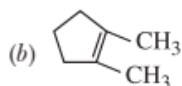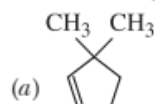(a) 2nd   (b) 4th   (c) 3rd   (d) 1st

48. Treatment of phenol with Br_2/H_2O yields
(a) o–bromophenol   (b) m–bromophenol
(c) 2, 4, 6–tribromophenol   (d) p–bromophenol

49. $CH_3-C\equiv C-H \xrightarrow[HgSO_4]{H_2O,H_2SO_4}$ Intermediate (A) $\longrightarrow$ product (B)

(a) A : $CH_3-C(OH)=CH_2$; B : $CH_3-C(SO_4)=CH_2$
(b) A : $CH_3-C(OH)=CH_2$; B : $CH_3-C\equiv CH$
(c) A : $CH_3-C(OH)=CH_2$; B : $CH_3-C(O)-CH_3$
(d) A : $CH_3-C(SO_4)=CH_2$; B : $CH_3-C(=O)-CH_3$

50. A single compound of the structure $CHO-CH_2-CH(CH_3)-CH_2-C(CH_3)=O$ is obtainable from ozonolysis of which of the following cyclic compounds?

(a) (b) (c) (d)

Answers

Solutions

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1. (c) Adsorption process is feasible only when $\Delta G = \Delta H - T$ is negative. For adsorption, ΔH is negative and ΔS is also negative. So, for ΔG = negative, $\Delta H > T \cdot \Delta S$ in magnitude.

2. (b) 1 mole of electrons carries 96500 coulomb charge or 9.65×10^4 coulomb charge.

3. (a) In colloids, the size of dispersed particles range between 1 nm and 1000 nm. Crystalloid is a substance which when dissolved in solvent forms a true solution and exhibits the particle size of molecular dimensions less than 1 nm.

4. (d) The order of decrease in reducing character of three metals is Pb > Cu > Ag.
   Pb has maximum reducing power. Hence, Pb can reduce both copper ions and silver ions.
   Ag has a minimum reducing power. Hence, it can neither reduce copper ions nor reduce lead ions.
   The reducing power of Cu is higher than that of Ag but lower than that of Pb. Hence, Cu can reduce silver ions but cannot reduce lead ions.

5. (d) Arrhenius equation is represented as
   $$k = Ae^{-E_a/RT}$$
   On taking natural log on both sides, we get
   $$\ln k = \ln A - \frac{E_a}{RT}$$
   or, $\ln \frac{k}{A} = -\frac{E_a}{RT}$

or, $\log k = \log A - \dfrac{E_a}{2.303RT}$
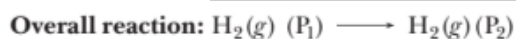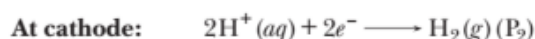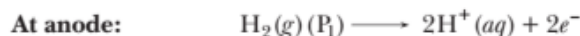
$\Rightarrow \log A = \log k + \dfrac{E_a}{2.303RT}$

It can also be represented as

$$\frac{d\ln k}{dT} = \frac{E_a}{RT^2}$$

6. (b) Pt | $H_2(g)$,(P_1) | $H^+(aq)$ || $H_2(g)$,(P_2) | Pt

   Cell reaction:

   At anode: $H_2(g)(P_1) \longrightarrow 2H^+(aq) + 2e^-$

   At cathode: $2H^+(aq) + 2e^- \longrightarrow H_2(g)(P_2)$

   Overall reaction: $H_2(g)(P_1) \longrightarrow H_2(g)(P_2)$

   $$E_{cell} = E^\circ_{cell} - \frac{RT}{nF}\ln\frac{[\text{Oxidised state}]}{[\text{Reduced state}]}$$

   $$= 0 - \frac{RT}{2F}\ln\frac{P_2}{P_1}$$

   or, $E_{cell} = \dfrac{RT}{2F}\ln\dfrac{P_1}{P_2}$

7. (d) For second order reaction, $t_{1/2} = \dfrac{1}{ka}$
   Where, a = initial concentration of reactant.

8. (b) For simple cubic unit cell.
   Number of atoms = $8 \times \dfrac{1}{8} = 1$
   Volume occupied by atom in unit cell = $\dfrac{4}{3}\pi r^3$
   Now, we know for simple cubic unit cell

$a = 2r, r = \dfrac{a}{2}$

Packing efficiency

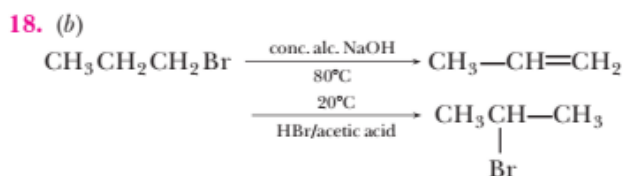$= \dfrac{\text{Volume occupied by one atom}}{\text{Volume of cube}}$

$= \dfrac{4/3\pi r^3}{a^3} = \dfrac{4/3\pi \times \left(\dfrac{a}{2}\right)^3}{a^3}$

$= \dfrac{4}{3} \times \pi \times \dfrac{1}{8} = \dfrac{\pi}{6}$

9. (*b*) Given, $t_{1/2} = 10$ mins

$[A]_0 = 0.08$ mol/L

$[A] = 0.01$ mol/L

$t_{1/2} = \dfrac{0.693}{k} \implies k = \dfrac{0.693}{10}$

$\therefore \quad t = \dfrac{2.303 \times 10}{0.693} \log \dfrac{[0.08]}{[0.01]} = 30$ min

10. (*c*) The intermediate conductivity of a semiconductor is due to the small energy gap between filled valence band and the empty conduction band.

11. (*c*) This is due to absence of large size difference between K^+ and Br^-.

12. (*c*) In a galvanic cell there are two half-cells, *i.e.*, oxidation half cell and reduction half-cell. Each half-cell contains an electrode in an electrolyte. The electrolytes of the two half-cells are connected internally through a salt bridge. Anode is the negative electrode where oxidation takes place, and cathode is the positive electrode where reduction takes place.

13. (*b*) In the galvanic or voltaic cells, the electrons flow from anode to cathode while current flows from cathode to anode, *i.e.*, in the opposite direction to the flow of electrons.

14. (*d*) Ethanol boils at 78.4°C and water boils at 100°C, but azeotropic mixture of ethanol and water boils at 78.2°C, which is lower than either of its constituents. Hence, it is minimum boiling azeotropic.

15. (*d*) Addition of glycol lowers the freezing point of water in the radiator so that the cold winter temperatures wouldn't burst the lines and therefore, glycol-water mixture is used as antifreeze in radiators of cars.

16. (*c*) A 5.2 molal aqueous solution of methyl alcohol means 5.2 moles of methyl alcohol is present in 1000 g of water.
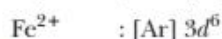
$\therefore$ Mole fraction $= \dfrac{n}{n + N}$ (n = moles of methyl alcohol, N = moles of water)

$= \dfrac{5.2}{5.2 + \dfrac{1000}{18}} = 0.086$

18. (*b*)

$CH_3CH_2CH_2Br \xrightarrow[80°C]{\text{conc. alc. NaOH}} CH_3{-}CH{=}CH_2$

$\xrightarrow[\text{HBr/acetic acid}]{20°C} CH_3CH{-}CH_3$ | Br

19. (*c*) $Z = 21 : 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^2\,3d^1\,4s^2$

$\therefore$ The element belongs to d-block of the long form of the periodic table.

20. (*c*) The oxidation state of Mn in MnO_2, Mn_2O_4, $KMnO_4$ and K_2MnO_4 is +4, +4, +7 and +6 respectively. Thus, the highest oxidation state of Mn is achieved in $KMnO_4$.

21. (*b*) Atomic number of cobalt is 27.

$Co_{27} = 3d^7 4s^2$

$Co(III) = 3d^6 4s^0$

Hence, EAN $= 27 - 3 + (4 \times 2) + (2 \times 2) = 36$

22. (*b*) 2-chlorobutane obtained by chlorination of butane, will be racemic form

d-form(50%)   *l*-form(50%)
Recemic mixture

23. (*d*) N_2 has very little reactivity at ordinary temperature. The chemical inertness of dinitrogen is attributed to high bond enthalpy of $N \equiv N$ bond(946 kcal/mol).

24. (*a*) As marble does not react with Br_2 and therefore the intensity of brown colour of vapours will not decrease appreciably on adding to the flask some pieces of marble. Br_2 is soluble in CCl_4 and CS_2.

25. (*c*) Froth floatation method is based on preferential wetting of ore particles by pine oil and gangue particles with water. The sulphide ores of zinc, copper and lead are usually concentrated by this method.

**26. (a)** The electronic configuration of the given ions are as follows:

$Cu(Z = 29)$: $[Ar] 3d^{10} 4s^1$

Cu^{2+} : $[Ar] 3d^9$

$Ni(Z = 28)$: $[Ar] 3d^8 4s^2$

Ni^{2+} : $[Ar] 3d^8$

$Co(Z = 27)$: $[Ar] 3d^7 4s^2$

Co^{2+} : $[Ar] 3d^7$

$Fe(Z = 26)$: $[Ar] 3d^6 4s^2$

Fe^{2+} : $[Ar] 3d^6$

Transition metal ion	Cu^{2+}	Ni^{2+}	Co^{2+}	Fe^{2+}
d-subshell configuration	$3d^9$	$3d^8$	$3d^7$	$3d^6$
Number of unpaired electrons	1	2	3	4

Thus, Cu^{2+} with least number of unpaired electrons will have least magnetic moment.

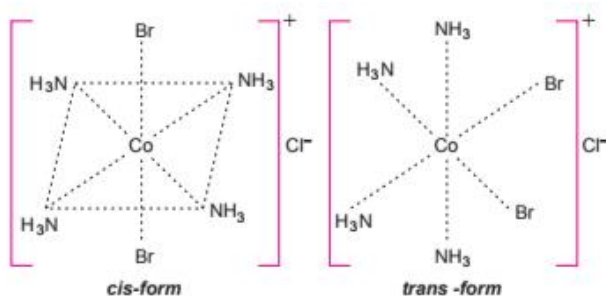**27. (a)** Goemetrical and ionisation isomerism is exhibited by the octahedral complex

$[Co(NH_3)_4Br_2]Cl$

Geometrical and ionisation isomerism is exhibited by the octahedral complex $[Co(NH_3)_4Br_2]Cl$

Ionisation isomers

$[Co(NH_3)_4Br_2]Cl$ and $[Co(NH_3)ClBr]Br$
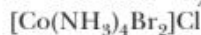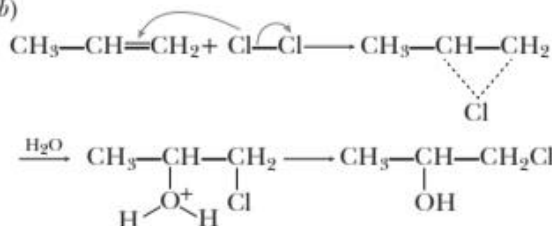
Geometrical isomers

cis-form   trans -form

29. (c) In case of OF_2, the oxidation state of oxygen is $+2$.
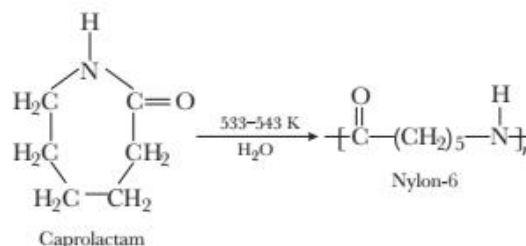
30. (b)

32. (d) Insulin is a protein while rest are the purines and pyrimidine bases present in nucleic acids.

33. (a) Since 'X' yields phenyl hydrazone. This indicates presence of carbonyl group. Further, since it does not give iodoform test and tollen's test. Therefore, it must be Pentan-3-one.
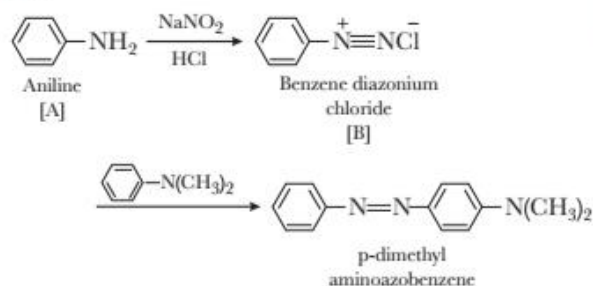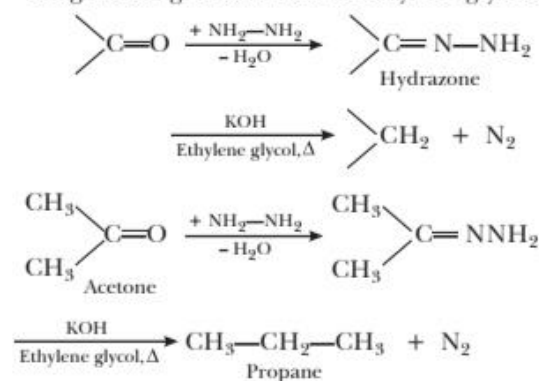
34. (c) Phenol is also known as carbolic acid.

35. (c)

Caprolactam → Nylon-6

36. (b) Secondary alcohols are those alcohols in which the —OH group is attached to a secondary carbon atom.

37. (b)

Aniline [A] → Benzene diazonium chloride [B] → p-dimethyl aminoazobenzene

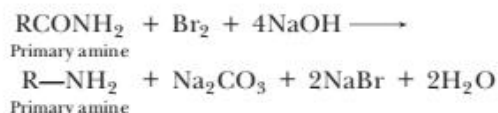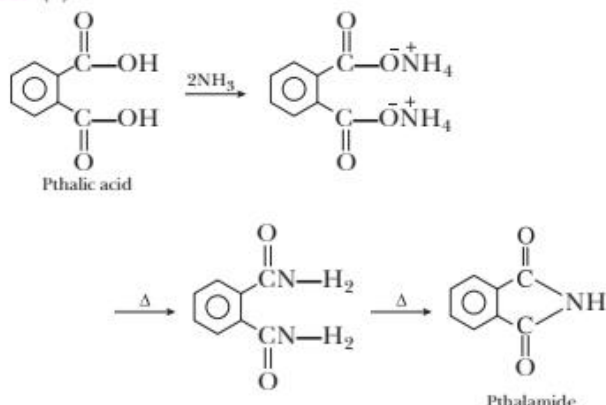**38. (d)** In Wolff–Kishner reaction, the carbonyl group of aldehydes and ketones is reduced to —CH_2 group on treatment with hydrazine followed by heating with potassium or sodium hydroxide in a high boiling solvent such as ethylene glycol.
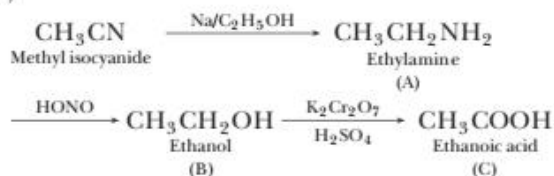
39. (a) **Hoffmann Bromamide Reaction:**

$$RCONH_2 + Br_2 + 4NaOH \longrightarrow$$
Primary amine

$$R{-}NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$$
Primary amine

40. (d)

Pthalic acid

Pthalamide

41. (a)

$$CH_3CN \xrightarrow{\text{Na/C}_2\text{H}_5\text{OH}} CH_3CH_2NH_2$$
Methyl isocyanide   Ethylamine (A)

$$\xrightarrow{\text{HONO}} CH_3CH_2OH \xrightarrow[\text{H}_2\text{SO}_4]{\text{K}_2\text{Cr}_2\text{O}_7} CH_3COOH$$
Ethanol (B)   Ethanoic acid (C)

42. (c) Zantac is an antacid. Iproniazid is a tranquilizer, salvarsan is used for treatment of syphilis and chloramphenicol is a broad spectrum antibiotic.
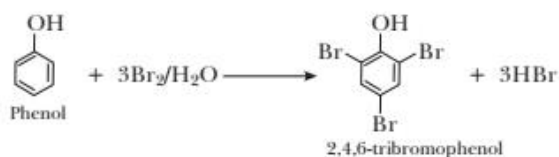
43. (a) Bakelite is formed by cross linking of linear chains of the polymer novolac.

45. (c) Chloroquine is a medication primarily used to prevent and treat malaria in areas where malaria remains sensitive to its effects.
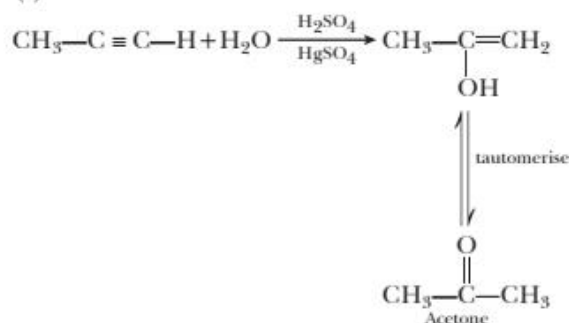
46. (d) The general formula of monohydric alcohol is $C_nH_{2n+1}OH$ where $n = 1, 2, 3....$etc.

47. (a) RNA has a hydroxy group on the second carbon which is not present in DNA.

48. (c)

49. (c)

$$CH_3{-}C \equiv C{-}H + H_2O \xrightarrow[\text{HgSO}_4]{\text{H}_2\text{SO}_4} CH_3{-}\overset{\overset{\text{OH}}{|}}{C}{=}CH_2$$

tautomerise

$$CH_3{-}\overset{\overset{O}{||}}{C}{-}CH_3$$
Acetone

50. (c) During ozonolysis the $>C=C<$ is converted to $>C=O$ group.