1.   Which of the following compounds is formed by ammonolysis of ethyl chloride and reacts with tosyl-chloride but remains insoluble in KOH?

        A) $Ph - NH - PH$ b) $Et - NH_2$ c) $Ph - NH - Pr$ *d) $Et - NH - Et$

Sol: Sulphonamides of secondary amine will be insoluble in KOH.

2.   Statement-I: Orthonitrophenol has intra molecular H-bonding

        Statement-II: Orthonitrophenol has high melting point due to H-bonding.

        *a) Statement I is true, Statement II is false

        b) Statement I is false, Statement II is true

        c) Statement I, II both are true

        d) Statement I, II both are false

3.   Give the major product (P) of the following reaction

        $$CH_3 - CH = CH - Br \xrightarrow[\text{(ii) Red hot Fe tube}]{\text{(i) NaNH}_2/\Delta} (P)$$

        a)   *b)
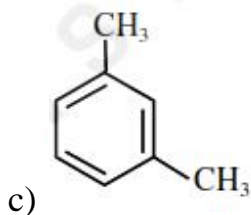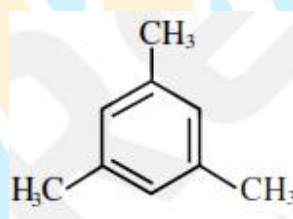
        c)   d)

4.   Which is used in the coagulation of blood?

        *a) Vitamin K   b) Vitamin C   c) Vitamin A   d) Vitamin E

Sol: Vitamin K is used by the body to help blood clot. Warfarin (Coumadin) is used to show blood clotting. By helping the blood clot, vitamin K might decrease the effectiveness of warfarin.

5.   What is the major product of the following reaction

a)   *b)

c)   d)
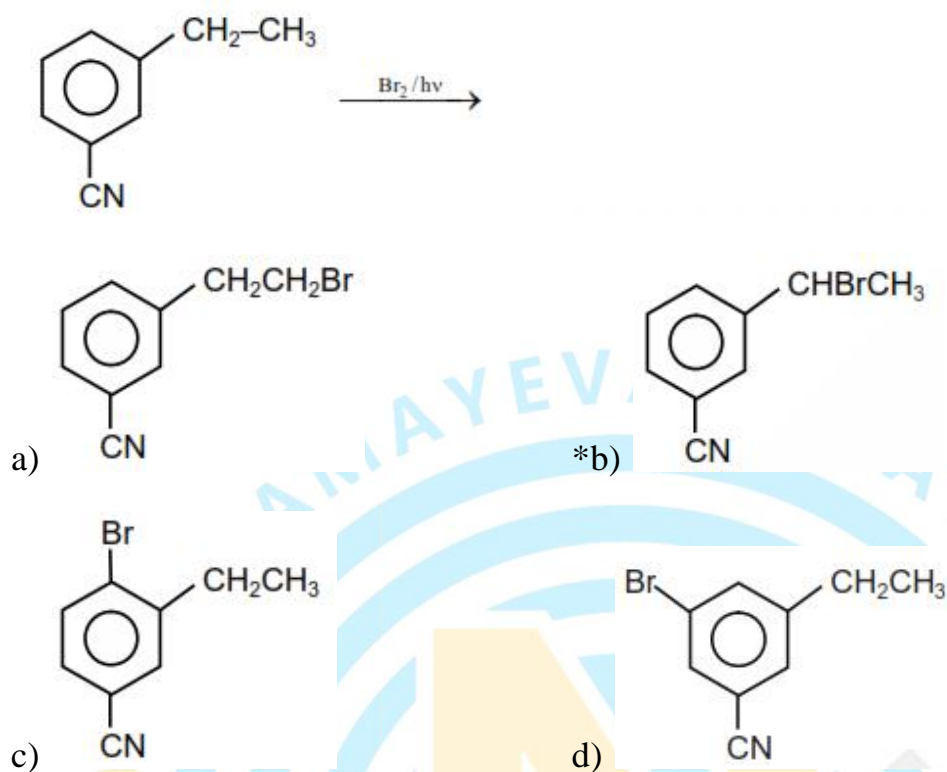
sol:
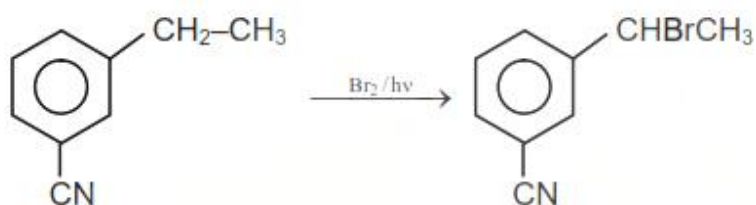
It is free-radical substitution reaction of alkanes, so bromination takes place at benzylic carbon.

6.   What is the structure of neoprene?

a)   b)

*c)   d)

Sol:

nCH$_2$=C–CH=CH$_2$ $\xrightarrow[\text{Catalyst}]{\text{Zieglar-Natta}}$

2-chloro-1,3 butadiene
or
chloroprene

(Trans polymer
Trans polychloroprene or Neoprene)
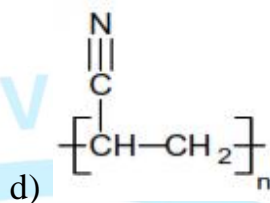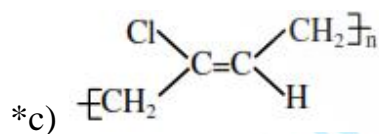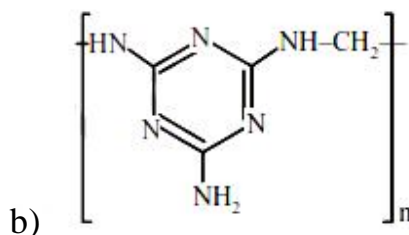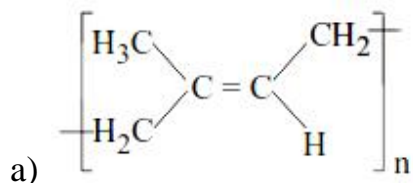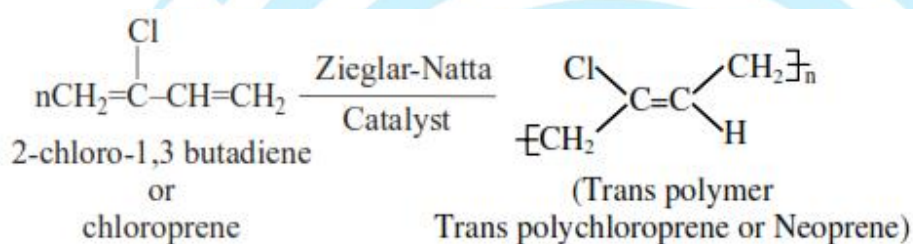
7.   What will be major product [A] and [B] in the given sequence of reactions?

a)   *b)

c)   d)

sol:

It is Reimer–Tiemann reaction

It is monobromination of phenol in non polar solvent

8. $C_4H_8Cl_2(A) \xrightarrow{\text{Hydrolysis}} C_4H_8O(B)$
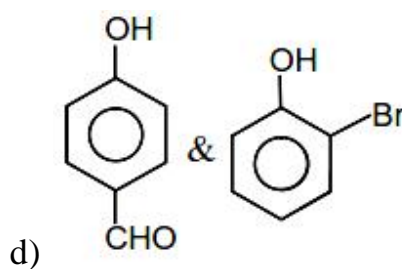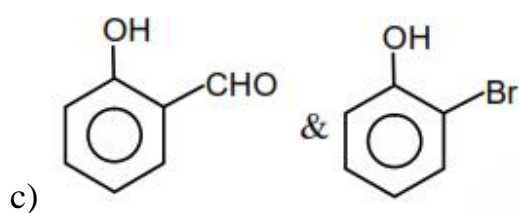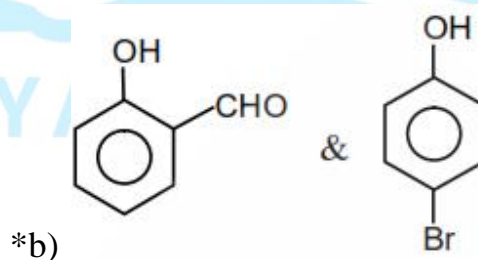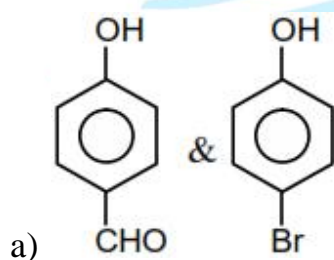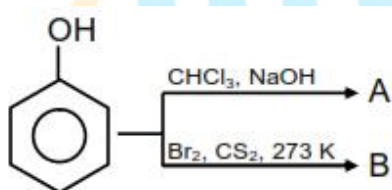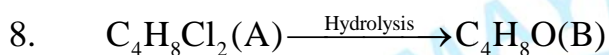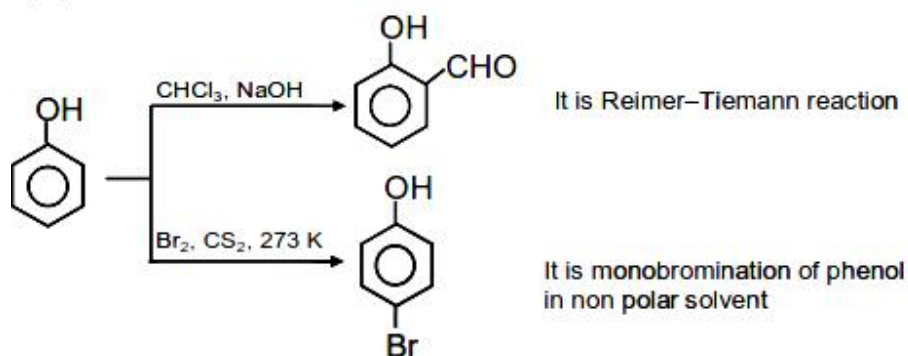
B forms oxime with NH_2OH but does not give Tollen's test.

Compound (A) and (B) are respectively:

*a) 2,2-Dichlorobutane & 2-Butanone

b) 2,2-Dichlorobutane & 2-Butanal

c) 1,1- Dichlorobutane & 2-Butanal

d) 1,2- Dichlorobutane & 2-Butanone
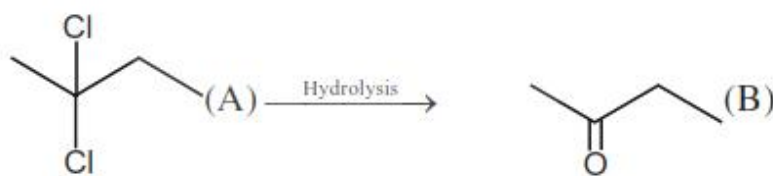
Sol:

9.   Statement-I: Chloroform and aniline is separated by simple distillation.

Statement-II: When we separate water and aniline by steam distillation aniline boils below its boiling point.

a) Statement I is true, Statement II is false

b) Statement I is false, Statement II is true

*c) Statement I, II both are true

d) Statement I, II both are false

10. Which statement is false?

    a) Kjeldal method is used for estimation of nitrogen.

    b) Carius tube is used for estimation of sulphur

    *c) Carius tube is used for estimation of Nitrogen

    d) Phosphoric acid is precipitated by adding magnesia mixture yields $Mg_2P_2O_7$ on heating.

11. A compound on reaction with hot dilute H_2SO_4 liberates a gas 'X' which when brought in contact with $K_2Cr_2O_7$ paper dipped in dil. H_2SO_4 gives a green compound 'Y'.

    'X' and 'Y' respectively are

    a) $SO_3, Cr_2(SO_4)_3$ b) SO_2, Cr_2O_3 c) SO_3, Cr_2O_3 *d) $SO_2, Cr_2(SO_4)_3$

sol: $\underset{(Sulphite)}{Compound} + \underset{Hot\ dil}{H_2SO_4} \longrightarrow SO_{2(g)} \xrightarrow{k_2Cr_2O_7} Cr_2(SO_4)_3$

12. Which of the following combination is correct?

Ore	Elements
A) Kernite	(P) Zn
B) Calamine	(Q) F
C) Cassiterite	(R) B
D) Cryolite	(S) Sn

    *a) A-R; B-P; C-S; D-Q   B) A-R; B-Q; C-P; D-S

    C) A-P; B-R; C-S; D-Q   D) A-Q; B-S; C-P; D-R

13. A compound which is used in lead storage battery, having amphoteric nature & is a strong oxidising agent is?

    *a) PbO_2 b) Pb_3O_4 c) $PbSO_4$ d) PbO

14.   Which does not form MO_2?

        a) Nd   *b) Yb   c) Dy   d) Pr

sol: Yb shows +2 & +3 only.

15.   Match the following electronic configuration with ΔH_{IE} values:

        (i) $1s^2 2s^2$ (p) 810

        (ii) $1s^2 2s^2 2p^1$ (q) 899

        (iii) $1s^2 2s^2 2p^3$ (r) 1300

        (iv) $1s^2 2s^2 2p^4$ (s) 1400

        *a) i-q; ii-p; iii-s; iv-r   b) i-q; ii-s; iii-p; iv-r

        c) i-s; ii-q; iii-p; iv-r   d) i-s; ii-p; iii-q; iv-r

sol: Order: $B < Be < O < N$

16.   Select the correct statement

        a) Heavy water is used to determine reaction mechanism

        b) Viscosity of heavy water is less than that of water

        c) D_2O can be prepared by exhaustive electrolysis of H_2O

        d) Boiling point of heavy water is more than that of normal water.

        *a) a, c, d   b) a, b, d   c) a, c   d) a, b, c

Sol: Since extent of intermolecular forces are more in D_2O as compared to H_2O, therefore
        D_2O has more viscosity as well as Boiling point as compared to H_2O.

17. Statement-I: Dipole-dipole interaction is the only non-covalent interaction force responsible for H-Bonding.

    Statement-II: F is the most EN element & HF forms symmetrical H-bond.

    a) Statement I is true, Statement II is true and Statement-II is correct explanation of Statement-I

    *b) Statement I is false, Statement II is true

    c) Statement I, II both are true

    d) Statement I, II both are false

18. For which of the following orbital, number of angular node and radial node are each 2.

    *a) 5d   b) 4f   c) 3p   d) 2s

Sol:

Orbital	Angular Node	Radial Node
5d	2	2
4f	3	0
3p	1	1
2s	0	1

19. O_3 is troposphere

    *a) Form photochemical smog   b) Protect us from UV light

    c) Protect from Smog X-rays   d) Protect from Green house effect

20. When dichromate reacts with base. What is the oxidation number of Cr in the product?

Ans: 6

Sol: $Cr_2O_7^{2-} + 2OH^- \rightleftharpoons 2CrO_4^{2-} + H_2O$

CrO_4^{2-}

$x + (-2 \times 4) = -2$

$x = 6$

21.   3.12 g of O_2 is adsorbed in 1.2 g Pt. determine volume of O_2 (in L) adsorbed per gm of Pt at 1 atm and 300 K

$$R = 0.082 \frac{atm - L}{Mol - K}$$

Ans: 2

Sol: Moles of $O_2 = \frac{3.12}{32} = 0.0975$

Volume of $O_2 = \frac{nRT}{P} = \frac{0.0975 \times 0.082 \times 300}{1} = 2.3985 \, litres \simeq 2.4 \, litres$

Volume of O_2 adsorbed per gm of $Pt = \frac{2.4}{1.2} = 2$

22. $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

Determine the amount of current in faraday for conversion of 5 moles of MnO_4^- to Mn^{2+}.

(Given $E^o_{MnO_4^-/Mn^{2+}} = 1.51V$

Ans: 25

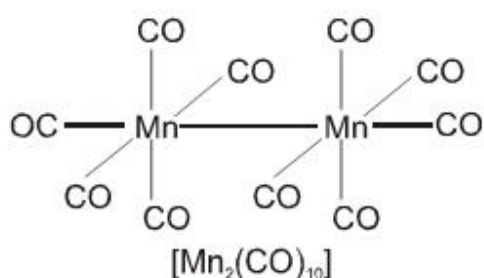Sol: $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

1 mole of MnO_4^- require 5 Faraday charge

5 moles of MnO_4^- will require 25 Faraday

23.   No of Bridging CO ligands in $Mn_2(CO)_{10}$ is

Ans: 0

Sol:

$[Mn_2(CO)_{10}]$

24. $\Delta H = -20 \, kJ / mole$ E_a for forward $= 30 \, kJ / mole$

Determine E_a for backward $= ?$

Ans: 50 kJ/mole

Sol: $\Delta H = E_a, f - E_{a,b}$

$-20 = 30 - E_{a,b}$

$E_{a,b} = 50 \, kJ / mole$

25.   For a reaction $\Delta H = 80 \, kJ$, $\Delta S = 2T \, J / mol - K$

Calculate the minimum temperature at which the reaction will be spontaneous.

Ans: 200 K

Sol: For spontaneous reaction $\Delta G < 0$

$\Delta G - T\Delta S < 0$

$80,000 - (T)(2T) < 0$

$2T^2 > 80,000$

$T^2 > 40,000$

$T > 200 \, K$

$\therefore$ Ans. 200 K

26.   For a gas $P(V_m - b) = RT$

If $\left(\dfrac{dz}{dp} \right)_T = \dfrac{xb}{RT}$ find x?

Ans: 1

Sol: $P(V - b) - RT$

$PV - Pb - RT$
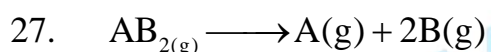
$\dfrac{PV}{RT} - \dfrac{Pb}{RT} = 1$

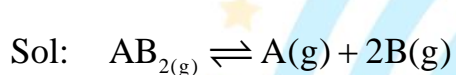$$z = 1 + \frac{Pb}{RT}$$

$$\frac{dz}{dp} = 0 + \frac{b}{RT}$$

$$= \frac{b}{RT} = \frac{xb}{RT}$$

$$x = 1$$

27. $AB_{2(g)} \longrightarrow A(g) + 2B(g)$

Starting with 1 mole of AB_2 in 25L container, pressure at equilibrium is found to be 1.9 atm at 300 K. If K_P is $x \times 10^{-1}$, determine x.

Ans: 7

Sol: $AB_{2(g)} \rightleftharpoons A(g) + 2B(g)$ $P_i = \dfrac{1 \times 1}{12} \times \dfrac{300}{25}$

      1   –   – $= 1$

      1-x   x   2x

      $1 + 2x = 1.9$ $K_P = \dfrac{P_A \times \left(P_B\right)^2}{P_{AB_2}}$

      $2x = 0.9$

      $x = 0.45$ $K_P = \dfrac{9 \times 9 \times 9 \times 20}{20 \times 100 \times 11}$

$$K_P = \frac{9 \times 9 \times 9}{100 \times 11} = 0.6627 = 6.627 \times 10^{-1}$$