CUET Chemistry Solved Paper-2023

Held on 25 May 2023

1. Number of coulombs required for the reduction of 1 mol of MnO_4^- to Mn^{2+} is
   - (a) $1.93 \times 10^5 C$
   - (b) $4.825 \times 10^5 C$
   - (c) $5.79 \times 10^5 C$
   - (d) $2.89 \times 10^5 C$

2. Match **List I** with **List II**.

List I		List II	
A.	Zone refining	I.	Titanium
B.	Mond's process	II.	Zinc
C.	Electrolytic refining	III.	Nickel
D.	van-Arkel method	IV.	Germanium

   - (a) A-III, B-I, C-IV, D-II
   - (b) A-IV, B-II, C-III, D-I
   - (c) A-IV, B-III, C-II, D-I
   - (d) A-II, B-IV, C-I, D-III

3. The IUPAC name of the compound

   $$CH_3 - \underset{\underset{C_2H_5}{|}}{C} = \underset{\underset{Br}{|}}{C} - CH_2OH \text{ is}$$

   - (a) 2-Bromo-3-methyl pent-2-en-1-ol
   - (b) 2-Bromo-3-ethyl but-2-en-1-ol
   - (c) 2-Bromo-3-methyl but-2-en-1-ol
   - (d) 2-Ethyl-3-bromo but-2-en-1-ol

4. According to Arrhenius rate equation, rate constant k is equal to $A.e^{-E_a/RT}$. Which of the following options represents the graph of $\ln k$ vs $\frac{1}{T}$?

5. Since physisorption arises mainly because of van der Waals forces, it means adsorption is : (pick the incorrect option)
   - (a) Non-specific in nature
   - (b) Reversible in nature
   - (c) Multimolecular in layer
   - (d) Enthalpy dependent

6. A solution of copper sulphate cannot be stored in zinc vessel because
   - (a) Copper is more reactive than zinc
   - (b) Reduction potential of copper is less than zinc
   - (c) Oxidation potential of copper is higher than zinc
   - (d) Reduction potential of copper is higher than zinc

7. Which of the following are the characteristics of chemisorption?
   - A. Highly specific in nature
   - B. Low activation energy
   - C. High heat of adsorption
   - D. Reversible in nature

   Choose the correct answer from the options given below:
   - (a) A and D only
   - (b) A and C only
   - (c) B and D only
   - (d) B and C only

8. The molecular formula of dodecacarbonyltrimanganese(0)
   - (a) $[Mn_2(CO)_{11}]$
   - (b) $[Mn_3(CO)_{12}]$
   - (c) $[Mn_3(CO)_{10}]$
   - (b) $[Mn_2(CO)_{12}]$

9. In the given equations (Note: equations are not balanced)

   $$Zn + Conc. \ HNO_3 \rightarrow Zn(NO_3)_2 + \boxed{x} + H_2O \quad ...(1)$$

   $$Zn + Dil. \ HNO_3 \rightarrow Zn(NO_3)_2 + \boxed{y} + H_2O \quad ...(2)$$

   the compounds x and y respectively are:
   - (a) NO_2 and NO
   - (b) NO_2 and NO_2
   - (c) N_2O and NO_2
   - (d) NO_2 and N_2O

10. The most effective electrolyte for the coagulation $Fe_2O_3 \cdot H_2O/Fe^{3+}$ is
    - A. $AgCl$
    - B. $FeCl_3$
    - C. $MgCl_2$
    - D. $K_4[Fe(CN)_6]$
    - E. KCl

    Choose the correct answer from the options given below:
    - (a) A and B only
    - (b) D only
    - (c) E only
    - (d) C only

11. Which among the following are correctly matched?
    - A. $C_6H_5OCH_2CH_3$ – Phenetole
    - B. $C_6H_5O(CH_2)_6CH_3$ – Heptyl phenyl ether
    - C. $C_6H_5OCH_3$ – Dimethyl ether
    - D. $C_2H_5OCH_2CH_3$ – Methyl ethyl ether

    Choose the correct answer from the options given below:
    - (a) A and B only
    - (b) C and D only
    - (c) A and C only
    - (d) B and D only

12. When Br_2 is treated with aqueous solution of NaF, NaCl, NaI separately
    - (a) F_2, Cl_2, I_2 are liberated
    - (b) Only F_2 and Cl_2 are liberated
    - (c) Only Cl_2 is liberated
    - (d) Only I_2 is liberated

13. In a pure crystal, the lattice point cannot be occupied by_____
    - (a) an atom
    - (b) a molecule
    - (c) an ion
    - (d) an electron

14. Out of the following compounds, which will give iodoform test.
    - A. Isopropyl alcohol
    - B. Isobutyl alcohol
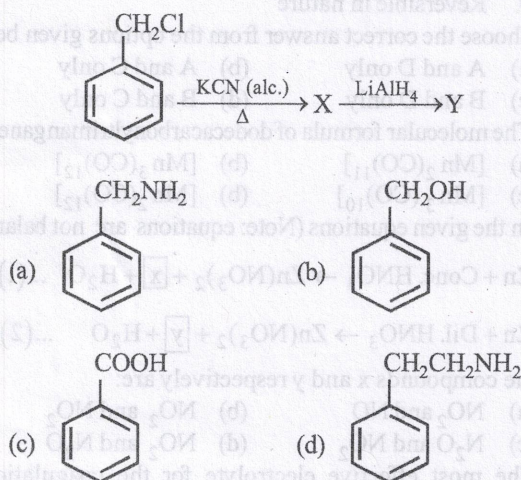   - C. Secondary butyl alcohol
    - D. Ethyl alcohol
    - E. Acetic Acid

    Choose the correct answer from the options given below:
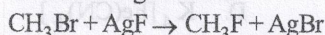   - (a) A, B, D
    - (b) A, C, D
    - (c) A, D
    - (d) A, D, E

15. Oxidation of acetaldehyde with SeO_2 forms:
    - (a) Ethanoic acid
    - (b) Methanolic acid
    - (c) Glyoxal
    - (d) Oxalic acid

16. The product 'Y' in the following reaction sequence is

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

17. The synthesis of alkyl fluoride is best accomplished by the following reaction
    $$CH_3Br + AgF \rightarrow CH_3F + AgBr$$
    The reaction is termed as:
    - (a) Swarts reaction
    - (b) Finkelstein reaction
    - (c) Wurtz reaction
    - (d) Fittig reaction

18. What is/are true regarding most of the medicines
    - A. They are colloidal in nature
    - B. Their particle size range from 1-1000 nm
    - C. They have large surface area
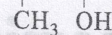   - D. They are easily assimilated

    Choose the correct answer from the options given below:
    - (a) A, B only
    - (b) B, C only
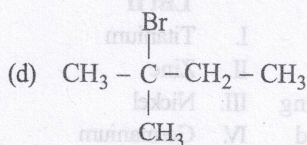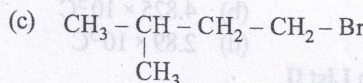   - (c) A, B, C only
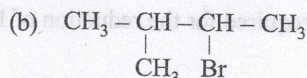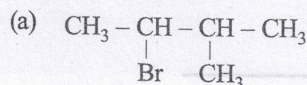   - (d) A, B, C, D only

19. Mn_2O_7, CrO and V_2O_5 respectively are:
    - (a) Acidic, amphoteric and basic
    - (b) Basic, acidic and amphoteric
    - (c) Amphoteric, basic and acidic
    - (d) Acidic, basic and amphoteric

20. $$H_3C - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{OH}{|}}{CH} - CH_3 + HBr \rightarrow A$$

    A (predominantly) is

    - (a) $CH_3 - \underset{\underset{Br}{|}}{CH} - \underset{\underset{CH_3}{|}}{CH} - CH_3$
    - (b) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{Br}{|}}{CH} - CH_3$
    - (c) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_2 - Br$
    - (d) $CH_3 - \underset{\underset{CH_3}{|}}{\underset{|}{C}} - CH_2 - CH_3$ (with Br on central C)

21. Match List I with List II

List I		List II (van't Hoff factor)
A.	$K_4[Fe(CN)_6]$	I. 3
B.	K_2SO_4	II. 0.5
C.	CH_3COOH in benzene	III. 5
D.	KCl	IV. 2

    Choose the correct answer from the options given below:
    - (a) A-III, B-I, C-II, D-IV
    - (b) A-III, B-I, C-IV, D-II
    - (c) A-II, B-I, C-III, D-IV
    - (d) A-II, B-III, C-I, D-IV

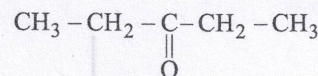22. Chlorine is extracted from brine by
    - (a) Oxidation
    - (b) Leaching
    - (c) Distillation
    - (d) Reduction

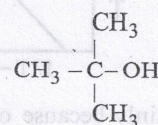23. Match List I with List II: Match the test use for distinguishing the organic compounds

List I	List II
A. $(CH_3)_3N$, $CH_3CH_2CH_2NH_2$	I. Tollen's test
B. $HCOOH$, CH_3COOH	II. Lucas test
C. $CH_3 - \underset{\underset{O}{\|}}{C} - CH_2 - CH_2CH_3$, $CH_3 - CH_2 - \underset{\underset{O}{\|}}{C} - CH_2 - CH_3$	III. Carbylamine test
D. $CH - CH_2 - CH_2 - CH_2 - OH$ (with CH_3), $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH$	IV. Iodoform test

    Choose the correct answer from the options given below:
    - (a) A-I, B-II, C-III, D-IV
    - (b) A-III, B-II, C-I, D-IV
    - (c) A-III, B-I, C-IV, D-II
    - (d) A-III, B-IV, C-II, D-I

24. Match List I with List II

List-I		List-II	
A.	Mathematical expression for rate of reaction	I.	rate constant
B.	Rate of reaction for zero order reaction is equal to	II.	rate law
C.	Unit of rate constant for zero order reaction is same as that of	III.	order of slowest step
D.	Order of a complex reaction is determined by	IV.	rate of reaction

Choose the correct answer from the options given below:

(a) A-III, B-IV, C-II, D-I   (b) A-I, B-II, C-III, D-IV
(c) A-II, B-I, C-IV, D-III   (d) A-IV, B-III, C-I, D-II

25. Aryl halides do not undergo nucleophilic substitution reactions under ordinary conditions because
A. approach of nucleophile is retarded
B. carbon carrying halogen atom is sp^3 hybridised
C. the substrate molecule is destabilised due to resonance
D. of partial double bond character between carbon and halogen.

Choose the correct answer from the options given below:

(a) A and D only   (b) B and C only
(c) A and C only   (d) B and D only

26. Arrange the given compounds in order of decreasing oxidation state of nitrogen
A. N$_2$ B. NO   C. HNO$_3$ D. NH$_4$Cl

Choose the correct answer from the options given below

(a) HNO$_3$ > NO > NH$_4$Cl > N$_2$
(b) HNO$_3$ > NO > N$_2$ > NH$_4$Cl
(c) HNO$_3$ > NH$_4$Cl > NO > N$_2$
(d) NO > HNO$_3$ > NH$_4$Cl > N$_2$

27. For a substance at a given temperature, the osmotic pressure of its concentrated solution
(a) Is same as that of dilute solution
(b) Is lower than that of dilute solution
(c) Is higher than that of dilute solution
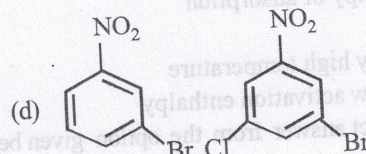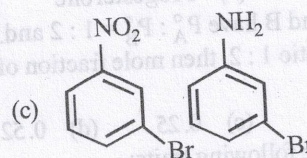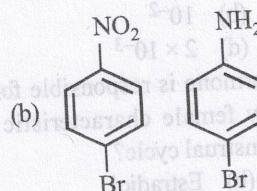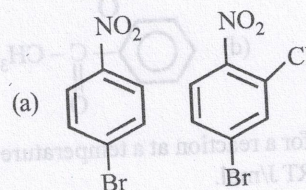(d) Cannot be compared with osmotic pressure of dilute solution

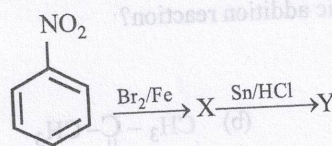**28.** Match List I with List II

| List I		List II	
A.	Cubic cell	I.	$\alpha = \beta = \gamma = 90°$
B.	Monoclinic cell	II.	$\alpha = \beta = 90°, \gamma = 120°$
C.	Triclinic cell	III.	$\alpha = \gamma = 90°, \beta \neq 90°$
D.	Hexagonal cell	IV.	$\alpha \neq \beta \neq \gamma \neq 90°$

Choose the correct answer from the options given below:

(a) A-I, B-III, C-II, D-IV   (b) A-III, B-I, C-II, D-IV
(c) A-III, B-I, C-IV, D-II   (d) A-I, B-III, C-IV, D-II

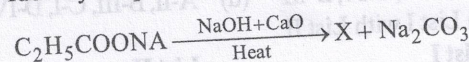**29.** The products X and Y for the below reaction are:

30. Isomerism shown by $[Co(NH_3)_3 (NO_2)_3]$ is
(a) Cis and trans   (b) Facial and meridional
(c) Optical   (d) Solvate

31. On the basis of the information available from the reaction

$$\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3}Al_2O_3, \Delta G = -827\ kJ/mol^{-1}$$
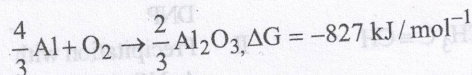
The minimum e.m.f. required to carry the electrolysis of Al$_2$O$_3$ is (F = 96500 C mol^{-1})

(a) 2.14 V   (b) 4.29 V
(c) 6.42 V   (d) 8.56 V

32. Identify the product 'X' in the following reaction:

$$C_2H_5COONA \xrightarrow[\text{Heat}]{\text{NaOH+CaO}} X + Na_2CO_3$$

(a) C$_2$H$_4$ (b) C$_2$H$_6$
(c) C$_3$H$_8$ (d) C$_3$H$_6$

33. Which of the following compound is most reactive towards nucleophilic addition reaction?

(a) $CH_3 - \overset{\overset{\displaystyle O}{\parallel}}{C} - H$

(b) $CH_3 - \overset{\overset{\displaystyle O}{\parallel}}{C} - CH_3$

(c) [benzene ring] $- \overset{\underset{\displaystyle O}{\parallel}}{C} - H$

(d) [benzene ring] $- \overset{\underset{\displaystyle O}{\parallel}}{C} - CH_3$
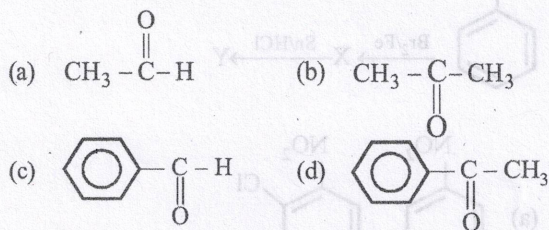
34. The activation energy for a reaction at a temperature T K was found to be 2.303 RT J/mol.
The ratio of the rate constant to Arrhenius factor is

(a) 10^{-1} (b) 10^{-2}

(c) 2×10^{-2} (d) 2×10^{-3}

35. Which of the following hormone is responsible for the development of secondary female characteristic and participate in control of menstrual cycle?

(a) Adrenal cortex   (b) Estradiol

(c) Androgens   (d) Progesterone

36. If two substances A and B have $P_A^\circ : P_B^\circ = 1 : 2$ and have mole fraction in the ratio 1 : 2, then mole fraction of A in vapours is

(a) 0.33   (b) 0.2   (c) 0.25   (d) 0.52

37. Chemisorption has the following traits:
A. High enthalpy of adsorption
B. Reversible
C. Favoured by high temperature
D. Requires low activation enthalpy
Choose the correct answer from the option given below:

(a) A, B only   (b) A, C only

(c) A, B, C only   (d) A, B, D only

38. Match **List I** with **List II**

List I		List II
A.	C_6H_5CHO	I.	Precipitation with 2, 4 DNP
B.	$CH_3C \equiv CH$	II.	Precipitation with $AgNO_3$(ammoniacal)
C.	HCN	III.	Nucleophile
D.	I^-	IV.	Cyanohydrin formation

Choose the correct answer from the options given below:

(a) A-I, B-II, C-III, D-IV   (b) A-IV, B-III, C-II, D-I

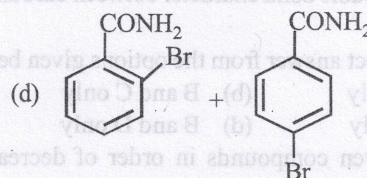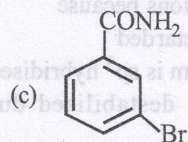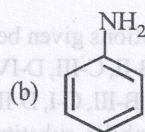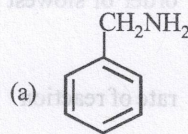(c) A-I, B-II, C-IV, D-III   (d) A-II, B-III, C-I, D-IV
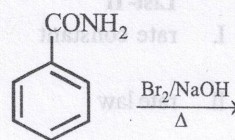
39. Match List I with List II

List I		List II
A.	XeF_6	I.	sp^3d^3 distorted octahedral
B.	XeO_3	II.	$sp^3 d^2$ square planar
C.	$XeOF_4$	III.	sp^3 pyramidal
D.	XeF_4	IV	sp^3d^2 square pyramidal

Choose the correct answer from the options given below:

(a) A-I, B-III, C-IV, D-II   (b) A-I, B-II, C-III, D-IV

(c) A-IV, B-III, C-I, D-II   (d) A-II, B-III, C-IV, D-I

40. Predict the product for the following reaction :

[benzene ring with $CONH_2$] $\xrightarrow[\Delta]{Br_2/NaOH}$

(a) [benzene ring with CH_2NH_2]

(b) [benzene ring with NH_2]

(c) [benzene ring with $CONH_2$ and Br at meta position]

(d) [benzene ring with $CONH_2$ and Br] + [benzene ring with $CONH_2$ and Br para]

DIRECTIONS : (Qs. 41 - 45) : Answer the following questions on the basis of passage given below :

In the periodic table, the d-block contains the elements of group 3 to 12. The d-orbitals are progressively filled in each of the four long periods. The elements of d-block referred as transition metals have partly filled d-orbitals and exhibit certain characteristic properties such as variety of oxidation states. states, formation of coloured ions, act as catalyst and show paramagnetic behaviour. The two inner transition metal series 4f and 5f are known as Lanthanoids and Actinoids respectively. The lanthanoids resemble one another more closely as compared to ordinary transition elements in any series.

41. The catalytic activity of transition metals and their compounds is ascribed mainly to

(a) Their ability to adopt variable oxidation states

(b) Their chemical reactivity

(c) Their magnetic behaviour

(d) Their outer most orbital which has two electrons

42. In context of the Lanthanoids, which of the following statements is/are **NOT** correct?

A. There is a gradual decrease in the radii of the members with increasing atomic number in the series

B. Availability of 4f electrons results in the formation of compounds in +4 oxidation state for all the members of the series.

C. Because of similar properties, the separation of lanthanoids is not easy.

D. $La(OH)_3$ is least basic among hydroxides of lanthanoids.

E. Ce^{2+} can act as an oxidising agent.

Choose the correct answer from the options given below:

(a) A and E only   (b) B and D only

(c) C and D only   (d) B and E only

43. The bonds present in the structure of dichromate ion are

(a) Six equivalent Cr-O bonds and one O-O bond

(b) Six equivalent Cr-O bonds and one Cr-Cr bond

(c) Eight equivalent Cr-O bods

(d) Six equivalent Cr-O bonds and one Cr-O-Cr bond

44. For the four successive transition elements given below, the stability of +2 oxidation state will be

A. Cr (Atomic number, Z = 24)

B. Mn (Z = 25)

C. Fe (Z = 26)

D. Co (Z = 27)

Choose the correct answer from the options given below:

(a) Cr > Mn > Co > Fe   (b) Mn > Fe > Cr > Co

(c) Fe > Mn > Co > Cr   (d) Co > Mn > Fe > Cr

45. Highest oxidations state of manganese in fluoride is +4 (MnF_4) but highest oxidation state in oxides is $+7(Mn_2O_7)$ because

(a) Fluorine is more electronegative than oxygen.

(b) Fluorine does not possess d-orbitals.

(c) Fluorine stabilises lower oxidation state.

(d) Fluorine can form single bond only while oxygen forms double in covalent compounds.

**DIRECTIONS : (Qs. 46 - 50) :** Answer the following questions on the basis of passage given below :

Proteins are the polymers of about twenty different α-amino acids which are linked by peptide bonds. Proteins performs various structural and dynamic functions in the organisms. Proteins which contain only α-amino acids are called simple proteins. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their function. This is called denature of proteins. Enzymes are biocatalysts which speed up the reaction in biosystems. Vitamins are accessory food factors required in the diet. They are classified as fat soluble (A, D, E and K) and water soluble (B group and C). Deficiency of vitamin leads to many diseases. Nucleic acids are the polymers of nucleotides which in turn consist of a base, a pentose sugar and phosphate moiety. Nucleic acids are responsible for the transfer of characters from parents of offsprings. There are two types of nucleic acids-DNA and RNA. DNA contains a five carbon sugar molecule called 2-deoxyribose whereas RNA contains ribose.

46. During denaturation of proteins.

(a) Biological activity remains unaltered

(b) 3° Structure remains unaltered

(c) 2° Structure remains unaltered

(d) 1° Structure remain unaltered

47. RNA and DNA differ due to presence/absence of oxygen at which carbon of sugar moiety?

(a) 4th (b) 3rd (c) 2nd (d) 1st

48. Deficiency of which of following vitamins can cause scurvy (loosening and bleeding of gum)?

(a) Vitamin A   (b) Vitamin C

(c) Vitamin D   (d) Vitamin K

49. Which of the following is an essential amino acids?

(a) Leucine   (b) Glycine

(c) Alanine   (d) Aspartic acid

50. Which of the following vitamin cannot be stored in our body?

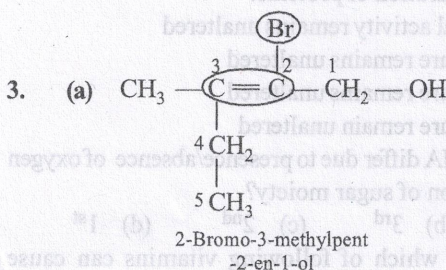(a) Vitamin D   (b) Vitamin B_{12}

(c) Vitamin K   (d) Vitamin B_2
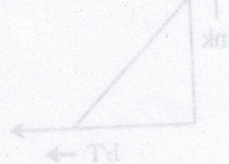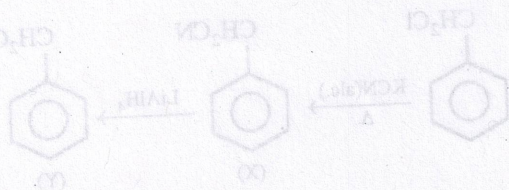
Hints & Explanations

1. (b) $\overset{+7}{MnO_4^-} + 5e^- \longrightarrow \overset{+2}{Mn^{2+}}$
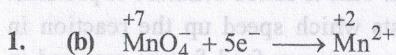
Thus, for 1 mole of MnO_4^-, 5 moles of electrons are required.
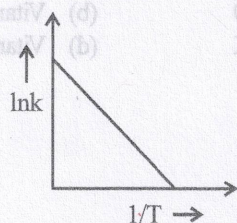
$\Rightarrow$ Charge = $5F = 5 \times 96500 = 4.825 \times 10^5$ C

2. (c) Zone refining (for semiconductors) = Ge

Mond's process (for volatile compounds with metals) = Ni

Electrolytic refining (for reactive metals) = Zn

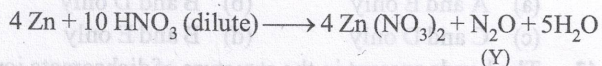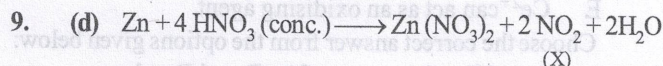Van-Arkel process (vapour-phase refining) = Ti

3. (a)

$$CH_3 \overset{\overset{\displaystyle Br}{|}}{\underset{3}{C}} = \underset{2}{C} \overset{1}{-} CH_2 - OH$$
$$\overset{|}{\underset{4}{CH_2}}$$
$$\overset{|}{\underset{5}{CH_3}}$$

2-Bromo-3-methylpent
-2-en-1-ol

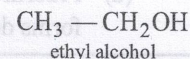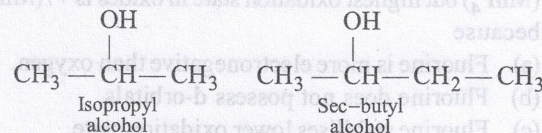**4. (a)** $k = Ae^{-E_a/RT} \Rightarrow \ln k = \ln A - \dfrac{E_a}{RT}$

$(y = C + mx)$

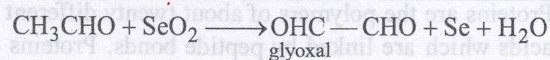Thus, $y = \ln k$, $m = -\dfrac{E_a}{R}$, $C = \ln A$, $x = \dfrac{1}{T}$

5. (d) Physisorption is enthalpy independent due to very low requirement of heat.

6. (d) Due to higher reduction potential of Cu, Cu^{2+} is reduced to Cu and Zn is oxidized to Zn^{2+}.

7. (b) Chemisorption is the adsorption of a substance over a surface due to chemical bonds between the adsorbate and adsorbent.

It has high activation and heat of adsorption and is highly specific and irreversible in nature.

8. (b) Dodeca = 12, tri = 3 $\Rightarrow$ formula = $[Mn_3(CO)_{12}]$.

9. (d) $\underset{(X)}{Zn + 4HNO_3 \text{ (conc.)} \longrightarrow Zn(NO_3)_2 + 2NO_2 + 2H_2O}$

$\underset{(Y)}{4Zn + 10HNO_3 \text{ (dilute)} \longrightarrow 4Zn(NO_3)_2 + N_2O + 5H_2O}$

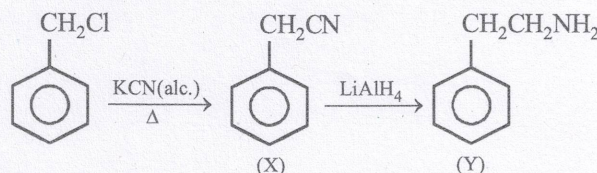**10. (b)** According to Hardy-Schulze rule, an ion with greater charge is able to coagulate the sol more effectively. $[Fe(CN)_6]^{4-}$ has the greatest charge among the given options, so it is most effective coagulating agent.

11. (a) $C_6H_5OCH_3$ = Methyl phenyl ether

$C_2H_5OCH_2CH_3$ = Diethyl ether

12. (d) Oxidizing power of halogens = $F_2 > Cl_2 > Br_2 > I_2$.

$\Rightarrow Br_2$ will be able to oxidize only I^- to I_2.

13. (d) A lattice point is occupied by a constituent particle like an atom, molecule or ion.
Electrons move around in the crystals if they are free.

14. (b) Iodoform test is given by methyl ketones and alcohols. Such compounds are –

$$\underset{\text{Isopropyl alcohol}}{CH_3 - \overset{\overset{\displaystyle OH}{|}}{CH} - CH_3} \quad \underset{\text{Sec–butyl alcohol}}{CH_3 - \overset{\overset{\displaystyle OH}{|}}{CH} - CH_2 - CH_3}$$

$$\underset{\text{ethyl alcohol}}{CH_3 - CH_2OH}$$

15. (c) Riley oxidation :

$$CH_3CHO + SeO_2 \longrightarrow \underset{\text{glyoxal}}{OHC - CHO} + Se + H_2O$$
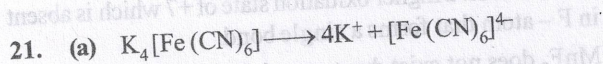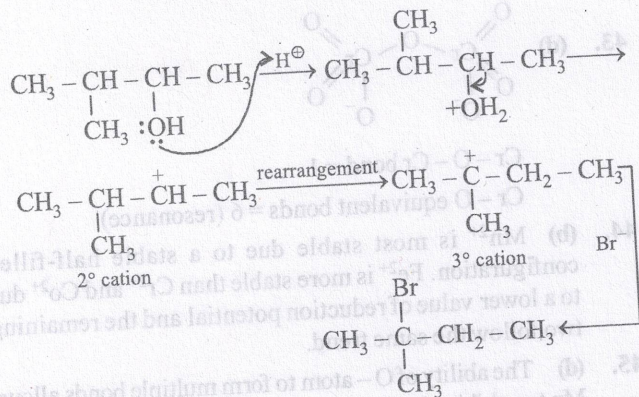
16. (d)

17. (a) Swarts reaction = Halide to fluoride

Finkelstein reaction = Halide to iodide

Wurtz reaction = Halide to alkane

Fittig reaction = aryl halide to biphenyls

18. (d) Medicines are colloids or colloidal suspensions so they have large particle size (1 – 1000 nm) and surface area because of which they are assimilated easily.
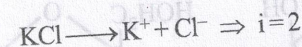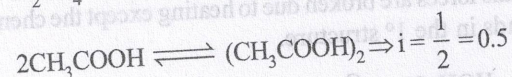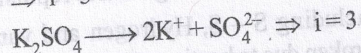
19. **(d)** Mn_2O_7 = Acidic (due to +7 state which is highest)

CrO = Basic (due to +2 state which is lowest)

V_2O_5 = amphoteric (due to its ability to react with both, acids and bases and by gaining or losing electrons).

20. **(d)**

$$CH_3-CH-CH-CH_3 \xrightarrow{H^{\oplus}} CH_3-CH-CH-CH_3 \longrightarrow$$
with substituents CH_3, $:OH$ below first; CH_3 and $+OH_2$ below second

$$CH_3-CH-\overset{+}{CH}-CH_3 \xrightarrow{rearrangement} CH_3-\overset{+}{C}-CH_2-CH_3$$
CH_3 below; 2° cation ; CH_3 below; 3° cation

$$CH_3-\overset{Br}{\underset{CH_3}{C}}-CH_2-CH_3 \longleftarrow$$

with Br

21. **(a)** $K_4[Fe(CN)_6] \longrightarrow 4K^+ + [Fe(CN)_6]^{4-}$

$\Rightarrow i = 5$

$K_2SO_4 \longrightarrow 2K^+ + SO_4^{2-} \Rightarrow i = 3$

$2CH_3COOH \rightleftharpoons (CH_3COOH)_2 \Rightarrow i = \dfrac{1}{2} = 0.5$

$KCl \longrightarrow K^+ + Cl^- \Rightarrow i = 2$

22. **(a)** Brine = NaCl solution in water.

Thus, to get Cl_2 from NaCl, we need to oxidize Cl^- to Cl_2.

23. **(c)** Tollen's test = for –CHO group in $H-\overset{O}{\overset{\|}{C}}-OH$.

Lucas test = for 1° *vs* 3° alcohols.

Carbylamine test = for detection of 1° amines.

Iodoform test = For methyl ketones and alcohols.

24. **(c)** Rate Law : Rate = k[Concentration]$^\alpha$

Zero order reaction = Rate $K[A]^\circ$ = k.

Since rate = k $\Rightarrow$ units of k = mol $L^{-1} s^{-1}$.

For a multistep complex reaction, the order is determined from the order of the slowest step.

25. **(a)** Ar – X do not undergo nucleophilic substitution reactions because of steric hindrance due to bulky benzene ring and interelectronic repulsion, and C – X partial double bond characters.

The resonance stabilizes the Ar – X molecule.
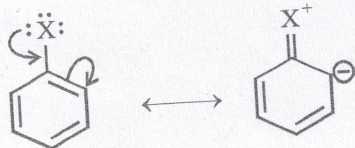
26. **(b)** $\overset{+5}{H}NO_3 > \overset{+2}{NO} > \overset{0}{N_2} > \overset{-3}{N}H_4Cl$
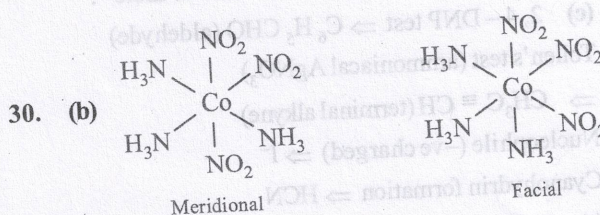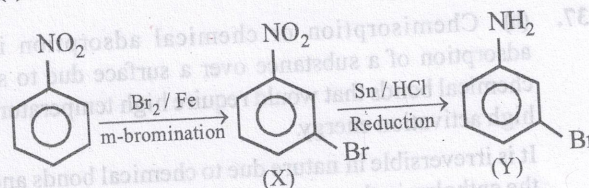
27. **(c)** $\pi = CRT \Rightarrow \pi \propto C$

28. **(d)** Cubic cell (most symmetric); $\alpha = \beta = \gamma = 90°$

Triclinic cell (least symmetric); $\alpha \neq \beta \neq \gamma \neq 90°$

Monoclinic cell; $\alpha = \gamma = 90°$, $\beta \neq 90°$

Hexagonal cell; $\alpha = \beta = 90°$, $\gamma = 120°$

29. **(c)**

benzene with NO_2 $\xrightarrow[\text{m-bromination}]{Br_2/Fe}$ NO_2, Br (X) $\xrightarrow[\text{Reduction}]{Sn/HCl}$ NH_2, Br (Y)

30. **(b)**

Meridional : Co complex with NO_2, H_3N, NO_2, H_3N, NH_3, NO_2

Facial : Co complex with NO_2, H_3N, NO_2, H_3N, NO_2, NH_3

31. **(a)** $\Delta G = -nFE \Rightarrow E = \dfrac{-\Delta G}{nF}$

$n = 4$ according to the balanced equation.

$\Rightarrow E = \dfrac{-(-827 \times 10^3)}{4 \times 96500} = 2.14$ V.

32. **(b)** $C_2H_5COON_a \xrightarrow[\Delta]{NaOH + CaO} C_2H_6 + Na_2CO_3$

33. **(a)** The reactivity of carbonyl compounds towards nucleophilic addition reactions is :–

Aliphatic aldehyde > aromatic aldehyde > aliphatic ketone > aromatic ketone.

Thus, CH_3CHO is most reactive.

34. **(a)** $k = Ae^{-E_a/RT} \Rightarrow \dfrac{k}{A} = e^{-E_a/RT}$

$\Rightarrow \log\left(\dfrac{k}{A}\right) = \dfrac{-E_a}{2.303\,RT} = \dfrac{-2.303\,RT}{2.303\,RT} = -1$

$\Rightarrow \dfrac{k}{A} = 10^{-1}$

35. **(b)** Estradiol (oestradiol) is an estrogen steroid hormone and a secondary female hormone regulating the control of menstrual cycle.

36. **(b)** From Raoult's Law amd Dalton's Law:–

$P_A^\circ X_A = P_{solution}\, Y_A$

$P_B^o X_B = P_{solution} Y_B$

(Where X_A / X_B = mole fractions in solution, Y_A / Y_B = mole fractions in vapours)

Dividing the two equations:–

$$\frac{Y_A}{Y_B} = \frac{P_A^o X_A}{P_B^o X_B} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$Y_A = \frac{1}{4+1} = \frac{1}{5} = 0.2$$

37. **(b)** Chemisorption or chemical adsorption is the adsorption of a substance over a surface due to strong chemical bonds that would require high temperature and high activation energy.

It is irreversible in nature due to chemical bonds and has the enthalpy in the range of $200 - 300$ kJ mole^{-1}.

38. **(c)** $2, 4 - $DNP test $\Rightarrow C_6 H_5 CHO$ (aldehyde)

Tollen's test (ammoniacal $AgNO_3$)

$\Rightarrow CH_3 C \equiv CH$ (terminal alkyne)

Nucleophile ($-$ve charged) $\Rightarrow I^-$

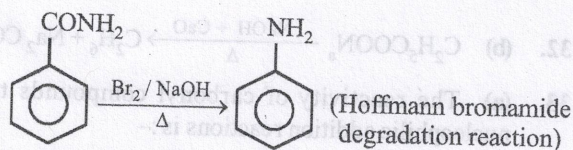Cyanohydrin formation $\Rightarrow HCN$

39. **(a)** $XeF_6 \Rightarrow$ 6 b.p. $+ 1$ l.p. $= sp^3 d^3$ hybridization, distorted octahedral

$XeO_3 \Rightarrow$ 3 b.p. $+ 1$ l.p. $= sp^3$, pyramidal shape

$XeOF_4 \Rightarrow$ 5 b.p. $+ 1$ l.p $= sp^3 d^2$, square pyramidal shape

$XeF_4 \Rightarrow$ 4 b.p. $+ 2$ l.p. $= sp^3 d^2$, square planar

40. **(b)**

(Hoffmann bromamide degradation reaction)

41. **(a)** The ability of transition metals to exhibit variable oxidation states gives them the ability to form complexes and hence catalytic activity.
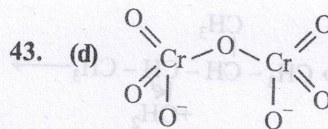
42. **(b)** Due to high electrode potential, Ce^{4+} reduces back to Ce^{3+}.

Thus, (B) is incorrect.

The metallic character decreases from left to right in a period due to which the hydroxides become less ionic.

Thus, La $(OH)_3$ is most ionic and thus most basic.

Thus, statement (D) is incorrect.

43. **(d)**

$Cr - O - Cr$ bond $= 1$

$Cr - O$ equivalent bonds $= 6$ (resonance)

44. **(b)** Mn^{2+} is most stable due to a stable half-filled configuration. Fe^{2+} is more stable than Cr^{2+} and Co^{2+} due to a lower value of reduction potential and the remaining two follow the same trend.

45. **(d)** The ability of O – atom to form multiple bonds allows Mn to exhibit a higher oxidation state of +7 which is absent in F – atom that forms a single bond.

MnF_7 does not exist due to much high steric repulsion.

46. **(d)** All bonds including S – S, Hydrogen and van der Waals forces are broken due to heating except the chemical bonds in the 1° structure.

47. **(c)**

ribose   deoxyribose
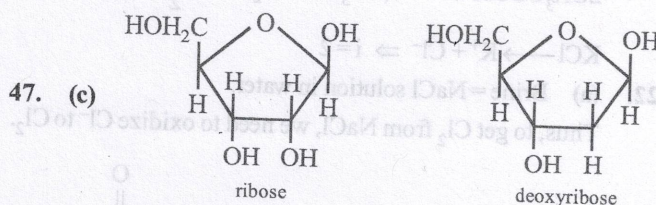
48. **(b)** Scurvy (bleeding gum) is caused by the deficiency of vitamin C.

49. **(a)** Essential amino acid = Leucine.

Non – essential amino acids = Glycine, alanine, aspartic acid

50. **(d)** Water soluble vitamins are excreted out of our body.

Such vitamins are vitamin B and vitamin C.

Vitamin B_{12} is stored in the liver in the excess.