CBSE Class 12 - Chemistry

Sample Paper 09 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

a. There are 33 questions in this question paper. All questions are compulsory.
b. Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
c. Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
d. Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
e. Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
f. There is no overall choice. However, internal choices have been provided.
g. Use of calculators and log tables is not permitted.

Section A

1. **Read the following and answer any four out of the following questions:**

   The f-block consists of elements in which 4f and 5f orbitals are progressively filled. They are placed in a separate panel at the bottom of the periodic table. The names transition metals and inner transition metals are often used to refer to the elements of d-and f-blocks respectively. The d–block occupies the large middle section of the periodic table flanked between s and p blocks in the periodic table. In general, the electronic configuration of the outer orbitals of these elements is $(n-1)d^{1-10}ns^{1-2}$. The electronic configurations of outer orbitals of Zn, Cd, Hg and Cn are represented by the general formula $(n-1)d^{10}ns^{2}$. The transition metals and their compounds also exhibit catalytic property and paramagnetic behaviour. Transition metal also forms an alloy. An alloy is a blend of metals prepared by mixing the components. Alloys may be homogeneous solid solutions in which the atoms of one metal are distributed randomly among the atoms of the other.

   The following questions are multiple-choice questions. Choose the most appropriate

answer.

i. Which of the following has a magnetic moment value of 5.9?
   a. Fe^{2+}
   b. Fe^{3+}
   c. Ni^{2+}
   d. Cu^{2+}

ii. Which of the following are d-block elements but not regarded as transition elements?
   a. Cu, Ag, Au
   b. Zn, Cd, Hg
   c. Fe, Co, Ni
   d. Ru, Rh, Pd

iii. Transition elements form alloys easily because they have
   a. Same atomic number
   b. Same electronic configuration
   c. Nearly same atomic size
   d. None of the above

iv. Which one of the following characteristics of the transition metals is associated with higher catalytic activity?
   a. High enthalpy of atomisation
   b. Paramagnetic behaviour
   c. Colour of hydrate ions
   d. Variable oxidation states

v. Which of the following has the maximum number of unpaired electrons?
   a. Mg^{2+}
   b. Ti^{3+}
   c. V^{3+}
   d. Fe^{2+}

2. **Read the passage and answer any four out of the following question**

Alfred Werner (1866-1919), a Swiss chemist was the first to formulate his ideas about the structures of coordination compounds. Werner proposed the concept of a primary valence and a secondary valence for a metal. The coordination entity constitutes a central metal atom or ion bonded to a fixed number of ions or molecules. In a coordination

entity, the atom/ion to which a fixed number of ions/groups are bound in a definite geometrical arrangement around it is called the central atom or ion. The ions or molecules bound to the central atom/ion in the coordination entity are called ligands. Ligands may be simple ions such as Cl^-, small molecules such as H_2O or NH_3, larger molecules such as $H_2NCH_2CH_2NH_2$ or $N(CH_2CH_2NH_2)_3$ or even macromolecules, such as protein. Ligands are unidentate, bidentate and polydentate. The coordination number (CN) of a metal ion in a complex is the number of ligand donor atoms to which the metal is directly bonded.

In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

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

i. **Assertion:** Binary compounds such as $CrCl_3$, have a primary valence of 3.

Reason: Coordinate compound metals show only one type of linkage that is primary linkage.

ii. **Assertion:** $CoCl_3(NH_3)_3$ is a coordination entity in which the cobalt ion is surrounded by three ammonia molecules and three chloride ion.

Reason: The central atom/ion in the coordination entities: $[NiCl_2(H_2O)_4]$ is Ni^{2+}.

iii. **Assertion:** $H_2NCH_2CH_2NH_2$ (ethane-1,2-diamine) ligand is said to be didentate.

Reason: Didentate ligands are bind through two donor atoms.

iv. **Assertion:** The complex ions, $[PtCl_6]^{2-}$ the coordination number of Pt is 4.

Reason: Ligand which can ligate through two different atoms is called ambidentate ligand.

v. **Assertion:** EDTA can bind through two nitrogen and four oxygen atoms to a central metal ion.

Reason: The number of ligating groups attach to an atom is called the denticity of the ligand.

3. The following reaction takes place in the presence of:

   a. None of these
   b. H_2/Pd
   c. NaOH/Pd
   d. HCl/Pd

4. Addison's disease is characterised by
   a. increased susceptibility to stress
   b. All of these
   c. hypoglycemia
   d. weakness

OR

Which one of the following is not a globular protein?

   a. Insulin
   b. Enzyme
   c. Haemoglobin
   d. Myosin

5. Which among the following is an example of liquid in solid?
   a. Aerated drinks
   b. Hydrated salts
   c. Sugar solution
   d. Alloys

6. Finkelstein reaction is:
   a. $CH_3CH_2CH_2Cl + NaI \rightarrow CH_3CH_2CH_2I + NaCl$
   b. $CH_3CH_2CH_2Cl + NaBr \rightarrow CH_3CH_2CH_2Br + NaCl$
   c. $CH_3CH_2CH_2I + NaCl \rightarrow CH_3CH_2CH_2 - Cl + NaI$
   d. $CH_3 = CH_2 + H - I \rightarrow CH_3CH_2CH_2I + CH_3CHICH_3$

OR

Carbon – halogen bond of alkyl halides is responsible for their nucleophilic substitution,

elimination, and their reaction with metal atoms to form organometallic compounds because of its:

a. Polarity
b. Kinetic properties
c. Chirality
d. Racemisation

7. The correct decreasing order of basic strength of the following species is _____.

H_2O, NH_3, OH^-, NH_2^-

a. $H_2O > NH_3 > OH^- > NH_2^-$
b. $OH^- > NH_2^- > H_2O > NH_3$
c. $NH_2^- > OH^- > NH_3 > H_2O$
d. $NH_3 > H_2O > NH_2^- > OH^-$

OR

If the starting amide has got four carbon atoms and the amine that is formed has got only 3 carbon atoms, then the reaction is called _____.

a. Gabriel synthesis
b. Carbylamines reaction
c. Hoffmann bromamide reaction
d. Clemmensen reduction

8. Liquid – liquid sols are known as

a. Emulsions
b. Foam
c. Aerosols
d. Gels

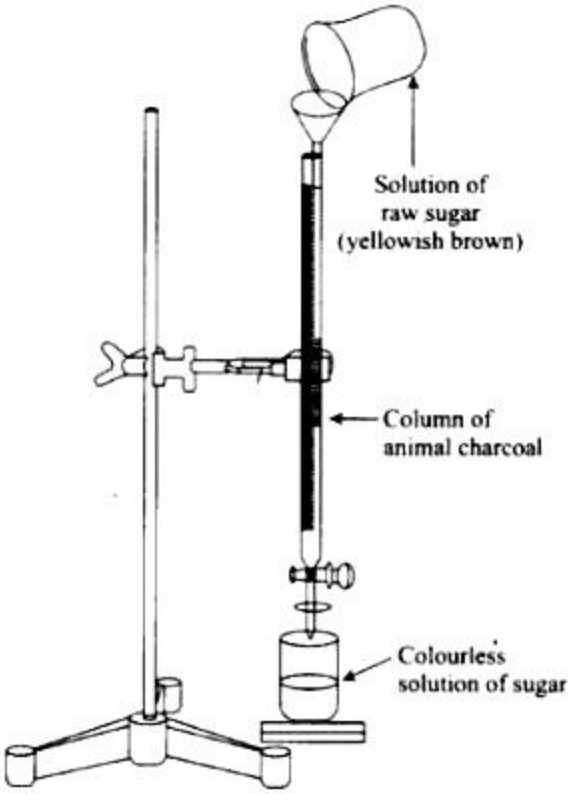
OR

Micelles are:

a. Ideal solution
b. Associated colloids
c. Adsorbed solution

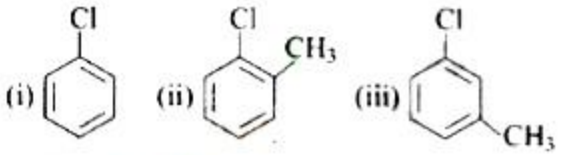
d. Emulsion cum gel

9. Which of the following phenomenon is applicable to the process shown in the Fig.?



a. Emulsification
b. Absorption
c. Adsorption
d. Coagulation

10. Arrange the following compounds in increasing order of rate of reaction towards nucleophilic substitution.



a. (i) < (ii) < (iii)
b. (ii) < (iii) < (i)
c. (iii) < (ii) < (i)
d. (i) < (iii) < (ii)

11. The structure of CsCl crystal is:

a. Octahedral
b. None of these
c. Body centred cubic lattice

d. Face centred cubic lattice

12. **Assertion:** Tetrahedral complexes do not show geometrical isomerism.
Reason: Bond angle in tetrahedral geometry is 109.5°.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.
13. **Assertion:** Except glycine, all naturally occurring α-amino acids are optically active.
Reason: All α-amino acids occurring naturally except glycine has at least one asymmetric carbon.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.
14. **Assertion:** A solution having greater vapour pressure has a higher boiling point.
Reason: Elevation in boiling point is directly proportional to the lowering of vapour pressure.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT

OR

Assertion: 1 M solution of Glauber's salt is isotonic with 1 M solution of KNO_3.

Reason: Solutions having same molar concentrations of solute may or may not have same osmotic pressure.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of

the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
c. Assertion is CORRECT but, reason is INCORRECT.
d. Assertion is INCORRECT but, reason is CORRECT.

15. **Assertion:** Ether behaves as bases in the presence of mineral acids.
Reason: Due to the presence of lone pairs of electron on oxygen.
a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
c. Assertion is CORRECT but, reason is INCORRECT.
d. Assertion is INCORRECT but, reason is CORRECT.
16. **Assertion:** Addition of HBr to 1 - butene in the presence of peroxide gives 1-bromobutane.
Reason: It involves the formation of primary radical.
a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
c. Assertion is CORRECT but, reason is INCORRECT.
d. Assertion is INCORRECT but, reason is CORRECT.

Section B

17. How will you bring this conversion?
Bromomethane to propanone

OR

How will you bring about the following conversion?
Toluene to benzyl alcohol

18. Based on solute-solvent interactions, arrange the following in order of increasing solubility in n-octane and explain. Cyclohexane, KCl, CH_3OH, CH_3CN.
19. Explain the mechanism of adsorption.

OR

Why is adsorption always exothermic?

20. A reaction is second order with respect to a reactant. How will be the rate of reaction get affected if the concentration of the reactant is:
    i. doubled
    ii. reduced to half.
21. Define the terms -
    i. Order of a reaction
    ii. Molecularity of a reaction.
22. What happens when phenol is treated with H_2 in presence of nickel?
23. While filling up of electrons in the atomic orbitals, the 4s orbital is filled before the 3d orbital but the reverse happens during the ionization of the atom. Explain why?
24. Give the structure of 2 - chloro - 1 - phenylpropane
25. Mention one property which is caused due to the presence of F-centres in a solid.

Section C

26. Explain why NH_3 is basic while BiH_3 is only feebly basic.

OR

Oxygen molecule has the formula O_2 while sulphur is S_8. (Give reason)

27. Write an equation of the reaction of aniline with benzoyl chloride and write the name of the product obtained.

OR

Why is NH_2 group of aniline acetylated before carrying out nitration?

28. Copper crystallises into a fcc lattice with edge length 3.61×10^{-8} cm. Show that the calculated density is in agreement with its measured value of 8.92 g cm^{-3}.
29. Differentiate between globular and fibrous proteins.
30. How may the following conversion be carried out:
    i. Propene to propan-2-ol
    ii. Anisole to phenol.

Section D

31. Complete and balance:-

i. $PbS\ (s)\ +\ 4O_3\ (g) \rightarrow$

ii. $NO\,(g)\ +\ O_3\,(g) \rightarrow$

iii. $4FeS_2\,(s)\ +\ 11O_2\,(g) \rightarrow$

iv. $2NaOH\ +\ SO_2 \rightarrow$

v. $2Fe^{3+} +\ SO_2\ +\ 2H_2O \rightarrow$

OR

Give reasons for the following:

i. $(CH_3)_3P{=}O$ exists but $(CH_3)_3\ N{=}O$ does not.

ii. Oxygen has less electron gain enthalpy with negative sign than sulphur.

iii. H_3PO_2 is a stronger reducing agent than H_3PO_3.

32. i. How would you account for the following?
    a. Aldehydes are more reactive than ketones toward nucleophiles.
    b. The boiling points of aldehydes and ketones are lower than that of the corresponding acids.
    c. The aldehydes and ketones undergo a number of addition reactions.

    ii. Give chemical tests to distinguish between
    a. acetaldehyde and benzaldehyde.
    b. propanone and propanol

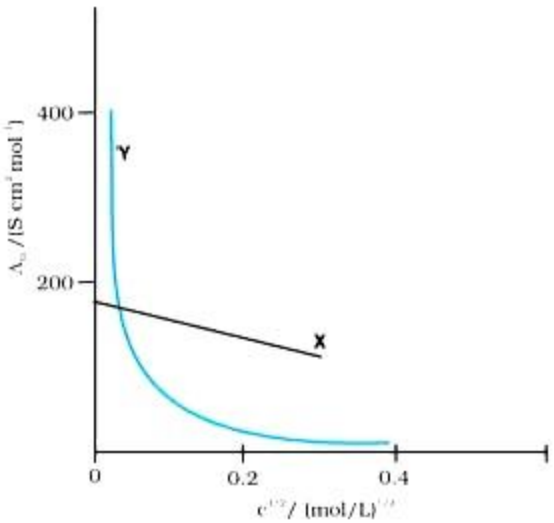
OR

Write structural formulas and names of four possible aldol condensation products from propanal and butanal. In each case, indicate which aldehyde acts as nucleophile and which as electrophile.

33. Write Nernst equation for a Daniel cell?

OR

The following curve is obtained when molar conductivity, Λ_m is plotted against the square root of concentration, $C^{1/2}$ along y and x-axis respectively for the two electrolytes X and Y.



i. What can you say about the nature of these two electrolytes?

ii. How do you account for the increase in Λ_m for the electrolytes X and Y with dilution?

iii. How can you determine Λ_m^∞ for these electrolytes?

CBSE Class 12 - Chemistry

Sample Paper 09 (2020-21)

Solution

Section A

1. i. (b) Fe^{3+}
   ii. (b) Zn, Cd, Hg
   iii. (c) Nearly same atomic size
   iv. (d) Variable oxidation state
   v. (d) Fe^{2+}
2. i. (c) Assertion is correct statement but reason is wrong statement
   ii. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion
   iii. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion
   iv. (d) Assertion is wrong statement but reason is correct statement
   v. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion
3. (b) H_2/Pd

   Explanation: -NO_2 group is reduced to -NH_2 using H_2/Pd.
4. (b) All of these

   Explanation: If adrenal cortex does not function properly then one of the results may be Addison's disease characterised by hypoglycemia, weakness and increased susceptibility to stress.

OR

(d) Myosin

Explanation: Globular proteins are formed when the chains of polypeptides coil around to give a spherical shape. These are usually soluble in water. When the polypeptide chains run parallel and are held together by hydrogen and disulphide bonds, then fibre–like structure is formed. Such proteins called fibrous proteins are generally insoluble in water. Myosin (present in muscles), is a fibrous protein and not a globular protein.

5. (b) Hydrated salts

   Explanation: Hydrated salts have water molecule of hydration as solute.

6. (a) $CH_3CH_2CH_2Cl + NaI \rightarrow CH_3CH_2CH_2I + NaCl$

   Explanation: Halide exchange reaction is Finkelstein reaction in which alkyl chloride is converted to alkyl iodide.

   The classic Finkelstein reaction entails the conversion of an alkyl chloride or an alkyl bromide to an alkyl iodide by treatment with a solution of sodium iodide in dry acetone. Sodium iodide is soluble in acetone and sodium chloride and sodium bromide are not. The reaction is driven toward products according to Le chatelier's principle due to the precipitation of the salt insoluble in acetone. For example, in this case, chloropropane can be converted to iodopropane:

   $CH_3CH_2CH_2Cl_{(acetone)} + NaI_{(acetone)} \rightarrow CH_3CH_2CH_2I_{(acetone)} + NaCl_{(s)}$

   OR

   (a) Polarity

   Explanation: Since halogen atoms are more electronegative than carbon, the carbon-halogen bond of alkyl halide is polarised; the carbon atom bears a partial positive charge whereas the halogen atom bears a partial negative charge. This is responsible for nucleophilic substitution reactions, elimination reactions, and the reaction of alkyl halides with a metal to form organometallic compounds.

7. (c) $\mathbf{NH_2^-} > OH^- > NH_3 > H_2O$

   Explanation: $\mathbf{NH_2^-} > OH > NH_3 > H_2O$. Due to higher electronegativity of O than N atom, the O-H bond is more polar than the N-H bond. Hence, O-H is more acidic in nature than the N-H bond. Now, NH_2 and OH have a negative charge due to which they are more basic than NH_3 and H_2O.

   OR

   (c) Hoffmann bromamide reaction

   Explanation: In Hoffmann bromamide degradation reaction, the amine formed has one carbon less than the amide.

   $RCONH_2 + Br_2 + 4NaOH \rightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$

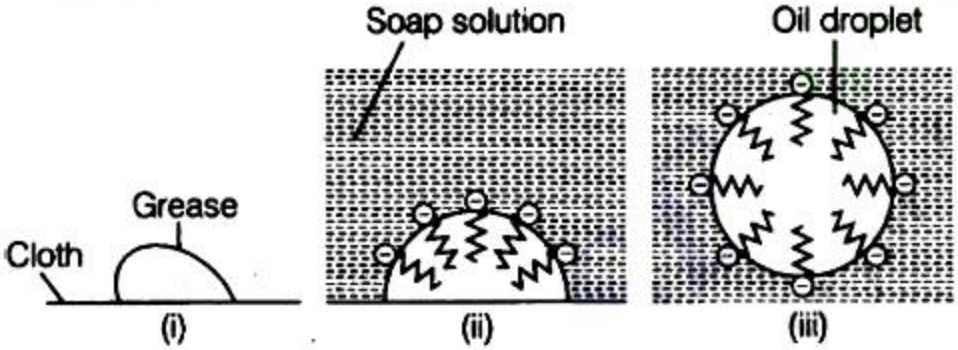
8. (a) Emulsions

   Explanation: Liquid in liquid sols are emulsions. Examples are milk, hair cream.

   OR

   (b) Associated colloids

   Explanation: Micelles are chemical structures formed with both hydrophilic (they'll mix into water) and hydrophobic (they don't mix into water). Also called as Associated colloids. In the general case, micelles are formed when there is an ideal temperature in the medium (called the Kraft temperature) and a certain concentration of electrolytes (called the CMC: Critical Micelle Concentration) in the medium.



   i. Grease or oil on surface of cloth.
   ii. Stearate ions arranged around the grease or oil droplet.
   iii. Grease or oil droplet surrounded by stearate ions (ionic micelle formed).

9. (c) Adsorption

   Explanation: In this figure, impurities present in raw sugar indicating yellowish-brown colour get adsorbed by animal charcoal. So this clearly indicates an adsorption process.

10. (b) (ii) < (iii) < (i)

    Explanation: Due to the presence of an electron releasing group at ortho or para positions, decreases the rate of nucleophilic substitution.

11. (c) Body centred cubic lattice

    Explanation: A body-centred cubic (bcc) unit cell has an atom at each of its corners and also one atom at its body centre as in CsCl.

12. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

    Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

13. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the

assertion.

Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

14. (d) Assertion is INCORRECT but, reason is CORRECT

    Explanation: Assertion is INCORRECT but, reason is CORRECT

OR

(d) Assertion is INCORRECT but, reason is CORRECT.

Explanation: Assertion is INCORRECT but, reason is CORRECT.

15. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

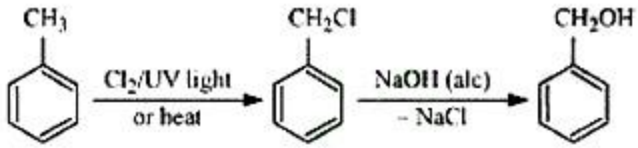
16. (c) Assertion is CORRECT but, reason is INCORRECT.

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

Section B

17. $CH_3Br \xrightarrow{KCN} CH_3CN \xrightarrow{CH_3MgBr} CH_3C(CH_3) = NMgBr \xrightarrow{H^+, H_2O} CH_3COCH_3$

OR



18. n-octane is a non-polar solvent. Therefore, the solubility of a non-polar solute is more than that of a polar solute in the n-octane.

    The order of increasing polarity is:

    Cyclohexane < CH_3CN < CH_3OH < KCl

    Therefore, the order of increasing solubility is:

    KCl < CH_3OH < CH_3CN < Cyclohexane

19. Adsorption arises due to presence of unbalanced forces or residual attractive forces on the surface of the particles. These forces are responsible for attracting the adsorbate particles on its surface and they cause the adsorption.

OR

Adsorption is always exothermic. This statement can be explained in two ways:

i. Adsorption leads to a decrease in the residual forces on the surface of the adsorbent. This causes a decrease in the surface energy of the adsorbent. Therefore, adsorption is always exothermic.

ii. ΔH of adsorption is always negative. When a gas is adsorbed on a solid surface, its movement is restricted leading to a decrease in the entropy of the gas i.e., ΔS is negative. Now for a process to be spontaneous, ΔG should be negative. Therefore, $\Delta G = \Delta H - T\Delta S$. Since ΔS negative, ΔH has to be negative to make ΔG negative. Hence, adsorption is always exothermic.

20. For the reaction, A $\rightarrow$ Product

$Rate = k[A]^2 \ldots\ldots\ldots (i)$

Let the concentration of the reactant be [A] = a

Rate of reaction, $Rate = k[A]^2 = ka^2 \implies R = ka^2$

i. If the concentration of the reactant is doubled, i.e. [A] = 2a, then the rate of the reaction (i) would be

$R' = k(2a)^2 = 4ka^2 = 4R \ [\because R = ka^2]$

Therefore, the rate of the reaction would become 4 times the original rate.

ii. If the concentration of the reactant is reduced to half, i.e. [A] $= \frac{1}{2}$ a, then the rate of the reaction would be

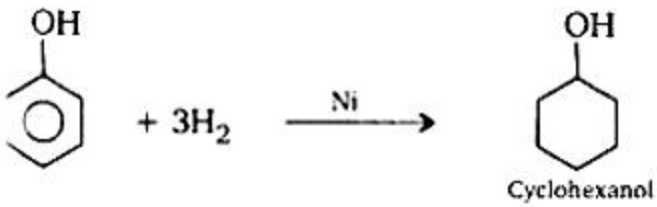
$R" = \frac{1}{2}a^2 = \frac{1}{4}Ka^2 = \frac{1}{4}R$

Therefore, the rate of the reaction would be reduced to ¼th the original rate of reaction.

21. i. Order of a reaction: the sum of powers of the concentration of the reactants in the rate law expression is called order of that reaction. It can be zero, fraction or integer. For example:

Rate = k $[A]^x$ $[B]^y$, then order of reaction = x+y

ii. Molecularity of a reaction: The number of reacting species which must collide simultaneously in order to bring about a chemical reaction is called molecularity of a reaction. It is always an integer.

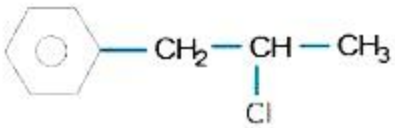
22. 

23. According to n + 1 rule: For 3d = n + 1 = 5

    4s = n + 1 = 4

    Therefore, the electron will enter in 4s orbital first and then in 3d orbitals. ionization enthalpy is responsible for the ionization of atom. The electron present in 4s orbital are loosely held by the nucleus. So electrons are removed from 4s orbital prior to 3d orbital.

24. As we can figure out the parent chain contains 3 C as it is a propane. Also at position 2, - Cl is attached and at position 1 - C_6H_5 (phenyl) is attached. So the structure of the compound must be

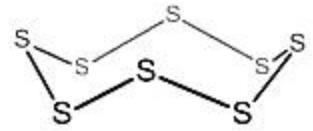
25. F-centre is responsible for the colour and paramagnetic behaviour of the solid.

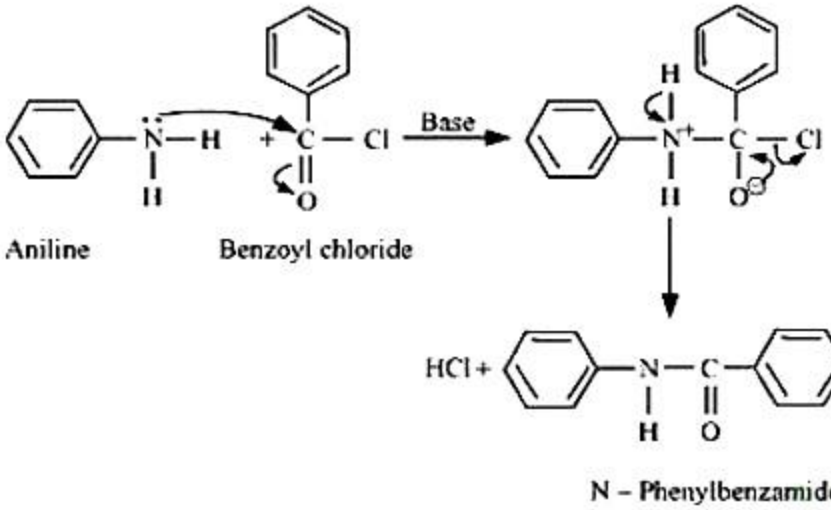
Section C

26. NH_3 is distinctly basic while BiH_3 is feebly basic. Nitrogen has a small size due to which the lone pair of electrons is concentrated in a small region. This means that the charge density per unit volume is high. On moving down a group, the size of the central atom increases and the charge gets distributed over a large area decreasing the electron density. Hence, the electron donating capacity of group 15 element hydrides decreases on moving down the group.

OR

Due to the small size and high electronegativity oxygen forms $p\pi - p\pi$ multiple bonds. As a result, oxygen exists as diatomic (O_2) molecule. Due to its bigger size and lower electronegativity sulphur does not form $p\pi - p\pi$ multiple bonds. Consequently, sulphur because of its high tendency of catenation and a lower tendency of $p\pi - p\pi$ multiple bonds forms octa atomic (S8) molecules having an eight-membered puckered ring structure.

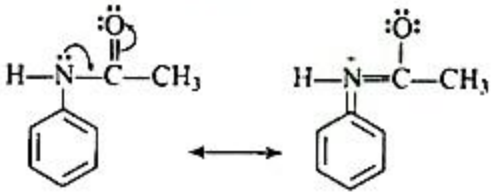




27. Aniline Benzoyl chloride

OR

Direct nitration of aniline is not possible on account of oxidation of the NH_2 group to yeild tarry oxidation products in addition to nitro derivatives. However, nitration can be carried after protecting the -NH_2 group by acetylation to give acetanilide which is then nitrated and finally hydrolyzed to give o- and p-nitroanilines. The acetyl group being electron-withdrawing attracts the lone pair of electrons of the N-atom towards the carbonyl group.



As a result, the activating effect -NH_2 group is reduced i.e., the lone pair of electrons on nitrogen is less available for donation to the benzene ring by resonance. Therefore, the activating effect of -$NHCOCH_3$ group is less than that of -NH_2 group.

28. Edge length, a = 3.61×10^{-8} cm

As the lattice is fcc type, the number of atoms per unit cell, Z= 4

Atomic mass, M = 63.5 g mol^{-1}

We also know that, NA = 6.022×10^{23} mol^{-1}

Applying the relation:

$$d = \frac{ZM}{a^3 N_a} = \frac{4 \times 63.5 g\ mol^{-1}}{(3.61 \times 10^{-8}\ cm)^3 \times 6.022 \times 10^{23} mol^{-1}} = 8.97\ g\ cm^{-3}$$

The measured value of density is given as 8.92 g cm^{-3} . Hence, the calculated density 8.97 g cm^{-3} is in agreement with its measured value.

29.

Fibrous protein	Globular protein
1. It is a fibre-like structure formed by the polypeptide chain. These proteins are held together by strong hydrogen and disulphide bonds.	1. The polypeptide chain in this protein is folded around itself, giving rise to a spherical structure.
2. It is usually insoluble in water.	2. It is usually soluble in water.
3. Fibrous proteins are usually used for structural purposes. For example, keratin is present in nails and hair; collagen in tendons; and myosin in muscles.	3. All enzymes are globular proteins. Some hormones such as insulin are also globular proteins.

30. i. $\underset{Propene}{CH_3 - CH = CH_2} + H_2O \xrightarrow{H_2SO_4} CH_3 - \underset{\underset{\text{Propan-2-ol}}{OH}}{\overset{|}{C}}H - CH_3$

ii. 

Section D

31. i. $PbS\ (s)\ +\ 4O_3\ (g) \rightarrow PbSO_4\ (s)\ +\ 4O_2\ (g)$

ii. $NO\ (g)\ +\ O_3\ (g)\ \rightarrow NO_2\ (g)\ +\ O_2\ (g)$

iii. $4FeS_2\ (s) + 11O_2\ (g) \rightarrow 2Fe_2O_3\ (s) + 8SO_2\ (g)$

iv. $2NaOH\ +\ SO_2 \rightarrow Na_2SO_3 + H_2O$

v. $2Fe^{3+} + SO_2\ + 2H_2O\ \rightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$

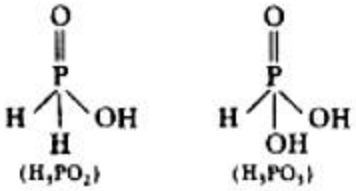
OR

i. Due to the absence of d-orbitals, N cannot form $p\pi - d\pi$ multiple bonds. As a result, N cannot expand its covalency more than four, therefore, the compound $R_3N{=}O$ does

not exist. On the other hand, due to the presence of d-orbitals in P, it forms $p\pi - d\pi$ multiple bonds, therefore can expand its covalency beyond 4. As a result, P can form $R_3P{=}O$. In this compound, the covalency of P is 5.

ii. Because of the compact nature (small size) of oxygen atom, it has less negative electron gain enthalpy than sulphur.

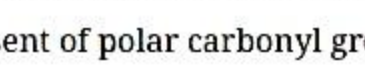
iii. The structures of H_3PO_2 and H_3PO_3 are as follows:



The acids which contain P-H bond, have strong reducing properties. Hypophosphorous acid (H_3PO_2) contains two P-H bonds, whereas orthophosphorous acid (H_3PO_3) has one P-H bond. Hence, H_3PO_2 is a stronger reducing agent than H_3PO_3.

32. i. a. Aldehydes are more reactive than ketones toward nucleophiles due to steric and electronic reasons. Sterically, the presence of two relatively large substituents in ketones hinders the approach of nucleophile to carbonyl carbon than in aldehyde having only one such substituent.

b. This is because of the presence of intermolecular hydrogen bonding in carboxylic acids as they have polar-OH group due to which carboxylic acids exist as associated molecules and hence, high temperature is required to break H-bond, which leads to their high boiling points.

c. Due to the present of polar carbonyl group  the carbonyl carbon bears partial positive charge, and thus undergo nucleophilic addition reaction.

ii. a. Due to the presence of $CH_3 - \overset{O}{\overset{\|}{C}}-$ group in acetaldehyde it undergoes iodoform reaction by giving yellow ppt. with $NaOH/I_2$, while benzaldehyde does not show this (iodoform) test due to the absence of $CH_3 - \overset{O}{\overset{\|}{C}}-$ group.

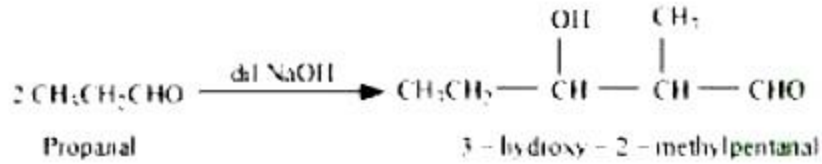
$$CH_3 - C - H + 2NaOI \rightarrow \underset{Yellow\ ppt}{HCOONa + CHI_3\downarrow} + 2NaOH$$

$$C_6H_5 - \overset{O}{\overset{\|}{C}} - H \xrightarrow{NaOI} \text{No yellow ppt. of } CHI_3$$

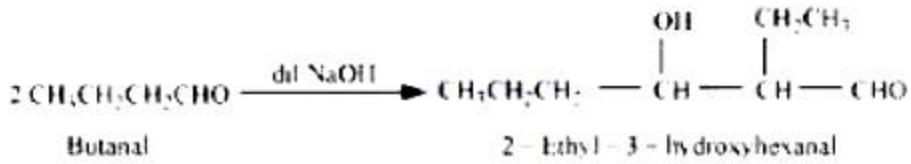
b. Propanone gives iodoform test with $NaOHI/I_2$ and gives yellow ppt. of CHI_3 while propanol does not give this test.

OR

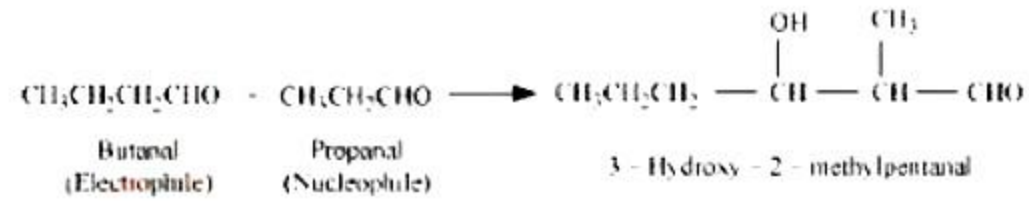
i. Taking two molecules of <u>propanal CH_3CH_2CHO</u>, one which acts as a <u>nucleophile</u> and the other as an <u>electrophile</u>.



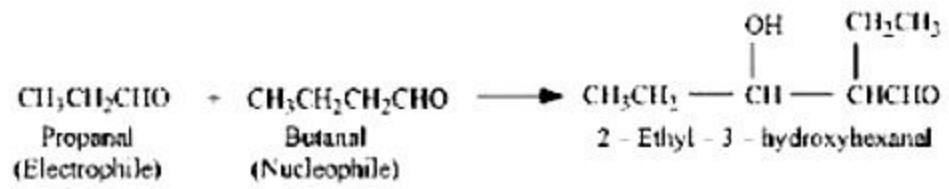
ii. Taking two molecules of <u>butanal</u> $CH_3CH_2CH_2CHO$, one which acts as a <u>nucleophile</u> and the other as an <u>electrophile</u>.



iii. Taking one molecule each of propanal CH_3CH_2CHO and butanal$CH_3CH_2CH_2CHO$ in which propanal acts as a nucleophile and butanal acts as an electrophile.



iv. Taking one molecule each of propanal CH_3CH_2CHO and butanal $CH_3CH_2CH_2CHO$ in which propanal acts as an electrophile and butanal act as a nucleophile.



33. **Nernst Equation for Daniel cell:**

In Daniel cell, following redox reaction occurs:

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

This reaction is a combination of two half reactions whose addition gives the overall cell reaction:

i. $Cu^{2+} + 2e^- \rightarrow Cu(s)$ (reduction half reaction)

ii. $Zn(s) \rightarrow Zn^{2+} + 2e^-$ (oxidation half reaction)

The cell is represented as:

$Zn(s)|Zn^{2+}(aq)||Cu^{2+}(aq)|Cu(s)$

Nernst showed that for the electrode reaction:

$$M^{n+}(aq) + ne^- \rightarrow M(s)$$

the electrode potential at any concentration measured with respect to standard hydrogen electrode can be represented by:

$$E_{(M^{n+}/M)} = E^{\ominus}_{(M^{n+}/M)} - \frac{RT}{nF}\ln\frac{[M]}{[M^{n+}]}$$

but concentration of solid M is unity, therefore we have

$$E_{(M^{n+}/M)} = E^{\ominus}_{(M^{n+}/M)} - \frac{RT}{nF}\ln\frac{1}{[M^{n+}]}$$

For Daniell cell, **n=2 moles of electrons**. With this information, we can proceed now.

In Daniell cell, the electrode potential for any given concentration of Cu^{2+} and Zn^{2+} ions are given by

For Cathode:

$$E_{(Cu^{2+}/Cu)} = E^{\ominus}_{(Cu^{2+}/Cu)} - \frac{RT}{2F}\ln\frac{1}{[Cu^{2+}(aq)]} \text{ (A)}$$

For Anode:

$$E_{(Zn^{2+}/Zn)} = E^{\ominus}_{(Zn^{2+}/Zn)} - \frac{RT}{2F}\ln\frac{1}{[Zn^{2+}(aq)]} \text{ (B)}$$

The cell potential is given by

$$E_{(cell)} = E_{(Cu^{2+}/Cu)} - E_{(Zn^{2+}/Zn)} \text{ (C)}$$

Using (A), (B) and (C), we get the Nernst Equation for Daniell cell.

$$E_{(cell)} = E^{\ominus}_{(cell)} - \frac{RT}{2F}\ln\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

OR

i. Electrolyte X is a strong electrolyte and Y is a weak electrolyte.

ii. Molar conductivity, Λ_m of X (strong electrolysis) increases slowly with dilution. This is

because interionic forces of attraction decreases on dilution, although the number of ions remain the same. As a result ions move freely and hence Λ_m increases with dilution. On the other hand, for Y (weak electrolyte) Λ_m increases sharply with dilution.This is because degree of dissociation increases on dilution resulting in greater number of ions on dilution. Hence Λ_m increases.

iii. For X, Λ_m^∞ can be obtained by extrapolation to zero concentration.