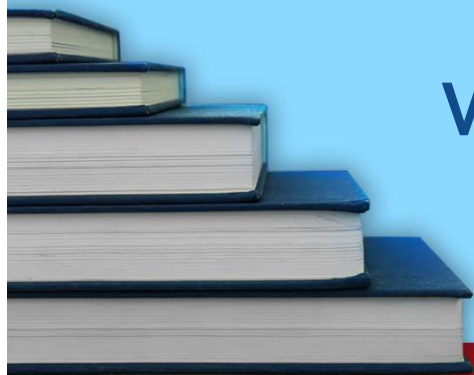


CHEMISTRY



WORKSHEET-4



STP

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Worksheet-04
(C. Organic Chemistry)
Aldehydes and Ketones

Q.1 Mark the incorrect statement about aldehydes and ketones:

- A) They have higher boiling points than that of alkanes
- B) They have lower boiling points than that of alcohols
- C) Aldehydes are present in essential oils and ketonic group is present in camphor
- D) Aldehydes have H-bonding but ketones do not have

Q.2 All of the following statements are correct about aldehydes and ketones EXCEPT:

- A) Aldehydes are easily oxidized while ketones do not
- B) Aldehydes show position isomerism while ketones do not
- C) Aldehydes can be oxidized easily by Fehling's solution while ketones do not
- D) Aldehydes react with alcohols to form acetal while ketones do not

Q.3 Which of the following reactions is not given by ketones?

- A) Grignard reagent
- B) 2,4-DNPH
- C) Polymerization
- D) HCN

Q.4 Which of the following tests is shown by ketones only?

- A) Sod. nitroprusside test
- B) Tollen's reagent test
- C) Fehling solution test
- D) Benedict reagent test

Q.5 Which one of the following organic compounds does not give iodoform test?

- A) Ethanal
- B) Ethanol
- C) Methyl ketones
- D) Methanal

Q.6 All of the following reagents reduce aldehydes and ketones to their respective alcohols EXCEPT:

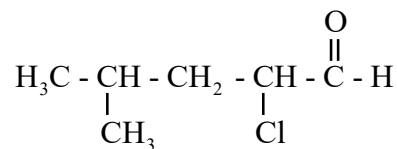
- A) H_2/Ni
- B) $LiAlH_4$
- C) N_2H_2/KOH
- D) $NaBH_4$

Q.7 Which of the following aldehydes is the most reactive?

- A) Methanal
- B) Ethanal
- C) Butanal
- D) Propanal

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Q.14 Consider the following structure of aldehyde:



The correct name according to IUPAC is:

- A) 2-Chloro-4-methylpentanal
- B) 2-Methyl-4-chloropentanal
- C) 2-Chloro-3-methylbutanol
- D) 3-Methyl-2-chloropentanal

Q.15 Aldehydes can occur:

- A) Anywhere in the carbon chain
- B) In the middle of carbon chain
- C) Only at the second carbon atom of the carbon chain
- D) Only at the terminal carbon atom of the carbon chain

Q.16 Aldehyde acts as _____ when treated with Fehling's solution.

- A) Reducing agent only
- B) Oxidizing agent only
- C) Both A and B
- D) Neither A nor B

Q.17 Aldehydes and ketones react with ammonia derivatives G-NH_2 to form condensation product containing the group $\text{C} = \text{N} - \text{G}$ and water. The reaction is:

- A) Base catalyzed only
- B) Acid catalyzed only
- C) Both A and B
- D) Neither A nor B

Q.18 Which of the following is not easily oxidized?

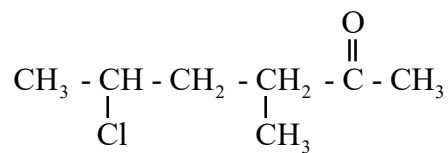
- A) Aldehyde
- B) 1° alcohol
- C) Ketone
- D) 2° alcohol

Q.19 Ketones are generally resistant to oxidation. But they can be oxidized by strong oxidizing agent such as ($\text{K}_2\text{Cr}_2\text{O}_7 + \text{conc. H}_2\text{SO}_4$). On oxidation of 2-pentanone, which of the following products are possible?

- A) $\text{CH}_3\text{CH}_2\text{COOH}$ only
- B) $\text{CH}_3\text{-CH}_2\text{-COOH}$ and CH_3COOH
- C) CH_3COOH only
- D) CH_3COOH and HCOOH

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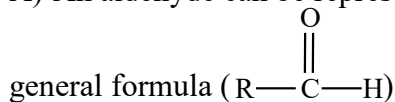
Q.20 Consider the following structure:



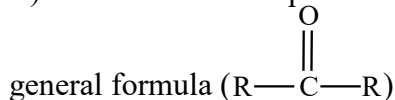
- A) 5-Chloro-3-methyl-2-hexanone
 B) 2-Chloro-3-methyl-5-hexanone
 C) 4-Methyl-5-chloro-2-hexanone
 D) 3-Methyl-2-chloro-2-hexanone

Q.21 Identify the incorrect statement about aldehydes and ketones:

A) An aldehyde can be represented by

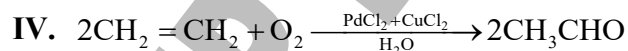
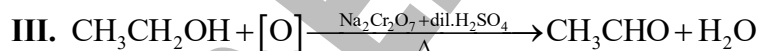
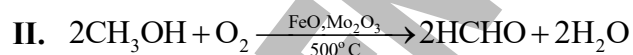
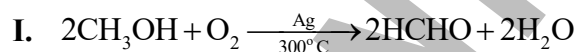


B) A ketone can be represented by



- C) Ketone group is present in maltose, camphor and menthone
 D) The homologous series of both aldehydes and ketones have general formula $\text{C}_n\text{H}_{2n}\text{O}$

Q.22 Preparatory methods of methanal, ethanal are given below:



Which of the following above methods is/are used for the preparation of methanal and ethanal respectively on the industrial scale?

- A) I and III
 B) II and IV
 C) I and IV
 D) III and IV

Q.23 Aldehydes and ketones show which of the following type of structural isomerism:

- A) Position isomerism
 B) Functional group isomerism
 C) Metamerism

USE THIS SPACE FOR
SCRATCH WORK

D) Tautomerism

Q.24 Which of the following tests is used for the identification of aldehydes only?

Options	Tests	Applications
A)	2,4-DNPH	Aldehydes and ketones form a yellow or red precipitate with 2,4-DNPH solution
B)	Addition of HCN	Aldehyde and ketone react with HCN to give cyanohydrins
C)	Benedict's solution test	Aliphatic aldehydes form a brick-red precipitate with Benedict's solution
D)	Reduction with NaBH_4	Aldehydes and ketones are reduced to alcohols with NaBH_4

Q.25 Which of the following instruments is used in infrared spectroscopic technique?

- A) Photometer
B) Spectrophotometer
C) Polarimeter
D) Refractometer

Q.26 The infrared spectrum is divided into how many regions:

- A) 2
B) 4
C) 3
D) 5

Q.27 Which of the following techniques is used to identify functional groups of various classes of organic compounds?

- A) IR
B) UV
C) NMR
D) X-rays

Q.28 In which of the following wave number range (cm^{-1}) the C = O (carbonyl group) is identified by using IR technique?

- A) $3230 - 3550 \text{ cm}^{-1}$
B) $2500 - 3300 \text{ cm}^{-1}$
C) $3100 - 3500 \text{ cm}^{-1}$
D) $1680 - 1750 \text{ cm}^{-1}$

Q.29 All of the following are applications of IR technique EXCEPT:

- A) It is widely used in inorganic and organic chemistry
B) It is used in forensic analysis in criminal
C) It is used to identify unsaturation in organic compounds
D) It is used in measuring the degree of polymerization in polymer manufacture

Q.30 IR spectroscopy can be applied to study and identify a substance if the sample of the substance is in the _____ state.

- A) Solid only
B) Liquid only
C) Solid, Liquid, Gas
D) Both gas, Liquid

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ANSWER KEY (Worksheet-04)

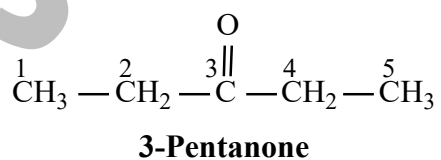
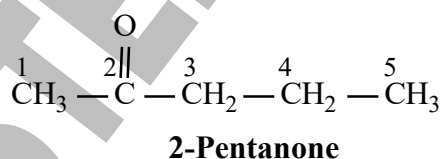
1	D	11	C	21	C
2	B	12	D	22	B
3	C	13	C	23	B
4	A	14	A	24	C
5	D	15	D	25	B
6	C	16	A	26	C
7	A	17	B	27	A
8	D	18	C	28	D
9	C	19	B	29	B
10	A	20	A	30	C

ANSWERS EXPLAINED

Q.1 (D) In fact, aldehydes and ketones do not show **hydrogen bonding**. They show dipole-dipole intermolecular forces.

Q.2 (B) It is incorrect statement. In fact, aldehydes **do not** show position isomerism because CHO group is always present at the terminal carbon atom of the carbon chain. However, ketones show position isomerism. It has been explained by examples:

- **Position isomerism.** The isomers having carbonyl group at different locations in the chain are called position isomers. e.g. pentanone can have carbonyl group at two different locations as shown below:



Q.3 (C) Ketones do not give polymerization whereas aldehydes such as methanal forms metaformaldehyde and ethanal form paraldehyde polymer.

Q.4 (A) Ketones produce a wine red or orange red colour on adding alkaline sodium nitroprusside solution dropwise.

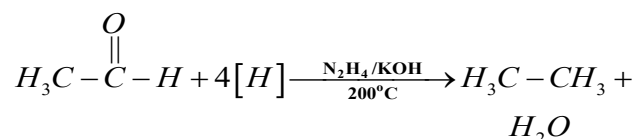
- While aldehydes do not give this test.

ADDITIONAL INFORMATIONS

Alkaline sodium nitroprusside (SNP) ($\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$) is used as a medicine to lower blood pressure. This may be done if the blood pressure is very high and resulting in symptoms, in certain types of heart failure, and during surgery to decrease bleeding. It is used by continuous injection into a vein.

Q.5 (D) Methanal does not give iodoform test while all others A, B and C give iodoform test.

Q.6 (C) The **Wolff-Kishner reduction** reaction is a reaction used in organic chemistry to convert **carbonyl functionalities** into **methylene** groups as shown in the reaction. In this reaction **aldehyde** is reduced to **alkane** with **hydrazine** in the presence of **KOH**.



Q.7 (A) Methanal is the most reactive aldehyde because it has no alkyl group. Since alkyl group is electron donating thus with the increase of alkyl groups, polarity of carbonyl group of carbonyl compounds decreases and

thus reactivity decreases. **Order of the reactivity of aldehyde is as shown:**

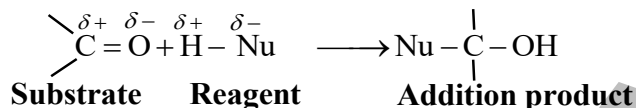
Methanal > Ethanal > Propanal > Butanal.

Q.8 (D) 3-Pentanone



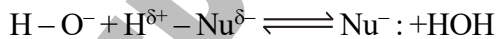
does not give iodoform test because **methyl ketones** can only give **iodoform test**. Other **A, B and C** give **iodoform test** they are **treated as methyl ketone**.

Q.9 (C) In carbonyl compounds carbon atom is electrophilic in nature. Therefore, most of the reactions of the carbonyl group will be considered to be nucleophilic addition reactions as shown below.



In these reactions of aldehydes and ketones, the negative part of the reagent combines with electrophilic carbon of the carbonyl group, whereas the positive part, which is usually hydrogen goes to the oxygen.

Q.10 (A) A base catalyzed reaction increases **nucleophilic character** of **attacking reagent** as shown in the reaction.

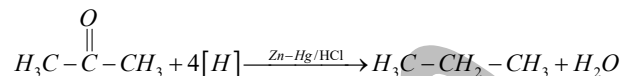


It is clear the Nu^- has more **nucleophilic character** than that of $H^{\delta+} - Nu^{\delta-}$ because Nu^- has **more ionic character**.

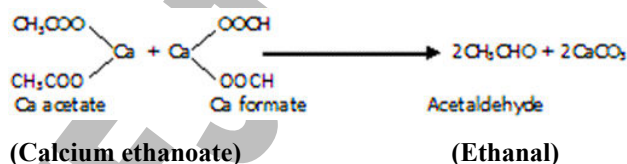
Q.11 (C) Aldehydes do not give β -elimination reaction.

Q.12 (D) Ketone is less reactive than aldehyde. So strong reducing agent is required for the complete reduction

of **ketone** into **alkane** as shown in the reaction

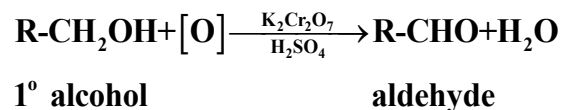


Q.13 (C) It is incorrect statement. In fact, on dry distillation cal.methanoate ethanal cannot be prepared. So in order to prepare ethanal dry distillation of both cal.methanoate and cal.ethanoate is done simultaneously as shown in reaction.

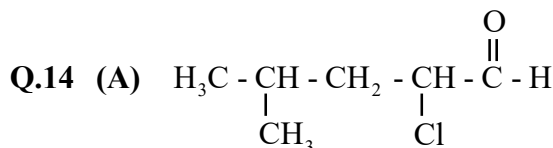
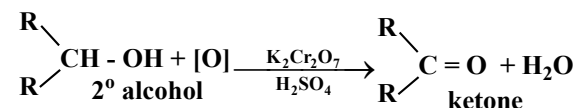


Detail of the other reactions are given below

A) On oxidation of 1° alcohol aldehyde is obtained



B) On oxidation of 2° alcohol ketone is obtained



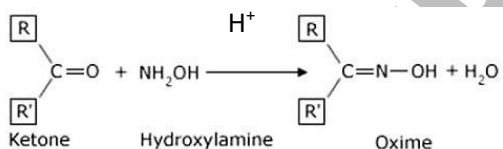
According to IUPAC the correct name of the given structure is **2-Chloro-4-methylpentanal**

Q.15 (D) Carbon is tetravalent. It can form **four covalent bonds**. Since in aldehyde group carbon atom forms

double bond with oxygen and **single bond** with hydrogen. So there is **one vacancy available** for making bond. That is why **aldehydes group** present at the **terminal carbon atom of carbon chain**. It cannot be placed in the **middle** of the carbon chain because in such condition carbon atom should **have two vacancies available** which is **not possible in this case**. Similarly **carboxylic acid group (-COOH)** is always present at the **terminal carbon of the carbon chain**.

Q.16 (A) Aldehyde only acts as **reducing agent** when treated with **mild oxidizing agents** such as **Fehling's solution, Benedict reagent and Tollen's reagent**.

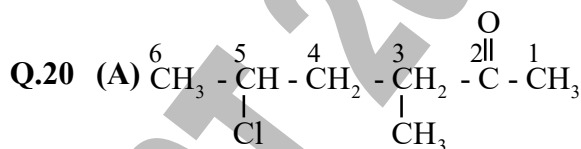
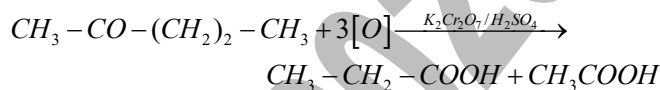
Q.17 (B) Aldehydes and ketones react with **ammonia derivative** in acidic medium as shown in the reaction e.g.



Q.18 (C) **Ketones** are **not easily oxidized** because the **carbonyl group** in ketones is **less polar** in nature. They show oxidative cleavage phenomenon rather than simple oxidation like aldehyde. That is why it **does not** react with mild **oxidizing agents** such as **Fehling's solution, Benedict reagent and Tollen's reagent**. It can only be oxidized in the presence of strong oxidizing agent such as **K₂Cr₂O₇/H₂SO₄, KMnO₄/H₂SO₄ and conc. HNO₃**.

Q.19 (B) **2-Pentanone** on oxidation in the presence of **strong oxidizing agent** is converted into **propanoic acid** and

ethanoic acid as shown in the reaction. The oxidation of such ketone is in accordance to **Popoff's rule**. **This rule states that in the case of ketones, the carbonyl group remains with the smaller alkyl group during oxidation.**

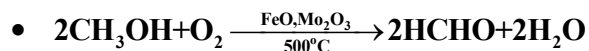


According to IUPAC the correct name of the given structure is **5-chloro-3-methyl-2-hexanone**.

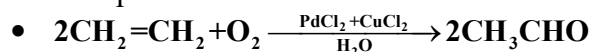
Q.21 (C) It is incorrect answer. In fact, ketone group is present only in camphor and menthone but not in maltose.

Q.22 (B) Following methods are used to prepare methanal and ethanal on the industrial scale as show by the reaction:

Methanal is manufactured on the industrial scale by passing mixture of methanol vapours and air over iron oxide-molybdenum oxide at **500°C**.



Ethanal is manufactured on the industrial scale by air oxidation of ethene using **PdCl₂ with CuCl₂** promoter.



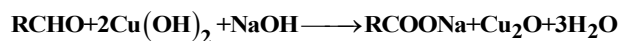
Ethene

Ethanal

Q.23 (B) Aldehydes and ketones show functional group isomerism e.g.

Propanal ($\text{CH}_3\text{-CH}_2\text{-CHO}$) and propanone ($\text{CH}_3\text{-CO-CH}_3$) show functional group isomerism.

- Q.24 (C) Benedict's solution test:** (An alkaline solution containing a cupric citrate complex ion) aliphatic aldehydes form a brick-red precipitate with Benedict's solution. To an aldehyde solution, add Benedict's solution and boil, a brick-red precipitate of cuprous oxide are formed.



- Q.25 (B) Spectrophotometry** is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength.

A spectrophotometer measures either the amount of light reflected from a sample object or the amount of light that is absorbed by the sample object.

- Q.26 (C)** The infrared portion of the electromagnetic spectrum is usually divided into three regions the near,

mid – and far – infrared named for their relation to the visible spectrum.

- Q.27 (A) Infrared Spectroscopy** is the analysis of infrared light interacting with a molecule. This can be analyzed in three ways by measuring absorption, emission and reflection. The main use of this technique is in organic and inorganic chemistry. It is used by chemists to determine functional groups in molecules.

- Q.28 (D)**

Bond	Functional Alcohols	Wave number / cm^{-1}
O – H	Alcohols	3230 – 3550
N – H	Amines	3100 – 3500
O – H	H – bonded in carboxylic acid	2500 – 3300
>C=O	Aldehydes ketone	1680 – 1750

- Q.29 (B) IR-spectroscopy** has been successfully used in analysis and identification of pigments in paintings and other art objects such as illuminated manuscripts except it is used in forensic analysis in criminal.

- Q.30 (C) IR spectroscopy** can be used to identify and study a substance. Sample of the substance can be in the solid, liquid or in the gaseous state.

STOP

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