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CHEM • CHEMISTRY

17. Aldehydes & Ketones

Official PMDC Solved Past Paper Topical Booklet • High-Yield Examination Series

94 Solved Questions

2010 to 2024 Archive

Boards: BUMHS, DUHS, KMU, MDCAT, NUMS, PMDC

Weightage: 27% of MDCAT (54 MCQs)

Curated by Ibrahim for fellow bees. Every question in this chapter has been verified against official UHS, NUMS, SZABMU, DUHS, and KMU answer keys. Propolis cognitive autopsies are provided at the end of this booklet to explain core concepts and break down common distractor traps.

OFFICIAL SOLVED EDITION**Q1.**

UHS 2024

 $C_nH_{2n}O$ is the general formula of: [UHS (2024)]

- (A) Ether
- (B) Ketones
- (C) Carboxylic acid
- (D) Carbolic Acid

Q2.

UHS 2024

The blue colour of Fehling solution is changed to red when warmed with an aldehyde due to formation of which of the following? [UHS (2024)]

- (A) NO_2
- (B) AgO
- (C) Cu_2O
- (D) SO_2

Q3.

UHS 2024

Reaction of HCN with formaldehyde is a: [UHS (2024)]

- (A) Nucleophilic addition reaction
- (B) Electrophilic addition reaction
- (C) Nucleophilic substitution reaction
- (D) Electrophilic substitution reaction

Q4.

SZABMU 2024

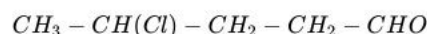
The correct reactivity order of the following compounds towards nucleophile is: [SZABMU (2024)]

- (A) $H-CO-H < H-CO-R < R-CO-R$
- (B) $H-CO-R < H-CO-H < R-CO-R$
- (C) $H-CO-H > H-CO-R > R-CO-R$
- (D) $H-CO-H > R-CO-R > H-CO-R$

Q5.

DUHS 2024

The IUPAC name of given organic compound is:



[DUHS (2024)]

- (A) γ -Chloropentanal
- (B) 2-Chloropentanal
- (C) 4-Chloropentanal
- (D) β -Chloropentanal

Q6.

DUHS 2024

Reduction of aldehydes & ketones by $Zn - Hg$ amalgam and concentrated HCl results in conversion to an alkane. This reaction is known as: [DUHS (2024)]

- (A) Down Reduction
- (B) Wolf-Kishner Reduction
- (C) Cope Reduction
- (D) Clemmensen Reduction

Q7.

DUHS 2024

Aldehydes & ketones can be converted to alkane. This reaction is called: [DUHS (2024)]

- (A) Ozonolysis
- (B) Grignard-Craft reaction
- (C) Wolff-Kishner reaction
- (D) Friedel-Craft reaction

Q8.

DUHS 2024

It is used to distinguish between primary, secondary and tertiary alcohol: [DUHS (2024)]

- (A) Lucas test
- (B) Benedict Reagent
- (C) Grignard Reagent
- (D) Bloor Reagent

Q9.

BUMHS 2024

The IUPAC name for formaldehyde is: [BMU (2024)]

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

Q10.

BUMHS 2024

Which one of the following statement is NOT correct: [BMU (2024)]

- (A) Formaldehyde is a gas at room temperature
(B) Formaldehyde is a liquid at room temperature
(C) Oxidation of methyl alcohol can produce formaldehyde
(D) Dry distillation of calcium formate can produce formaldehyde

Q11.

NUMS 2024

Identify the correct increasing order of reactivity of carbonyl compound towards nucleophilic addition: (Wrong) [NUMS (2024)]

- (A) $HCHO < CH_3CHO < CH_3COCH_3 < CH_3CH_2CHO$
(B) $CH_3CHO < CH_3COCH_3 < CH_3CH_2CHO < HCHO$
(C) $CH_3CH_2CHO < CH_3COCH_3 < HCHO < CH_3CHO$
(D) $CH_3CH_2CHO < CH_3COCH_3 < CH_3CHO < HCHO$

Q12.

NUMS 2024

Compound A + I_2 + $Na_2CO_3 \rightarrow$ compound B + $RCOONa$ + NaI + H_2O . Identify compound B (Wrong) [NUMS (2024)]

- (A) Acetone
(B) Acetamide
(C) Acetic acid
(D) Acetic anhydride

Q13.

UHS 2023

What is the IUPAC name of diisopropyl ketone? [UHS (2023)]

- (A) 1,3-Diisopropylpropan-2-one
(B) 2,4-Dimethylpentan-3-one
(C) 2,4-Dimethylpentan-2-one
(D) 1,3-Dimethylpropan-2-one

Q14.

UHS 2023

The appearance of a silver mirror in Tollens' test indicates the presence of which of the following? [UHS (2023)]

- (A) A ketone
(B) An aldehyde
(C) An acid
(D) An alcohol

Q15.

SZABMU 2023

The function of $NaOH$ in Aldol condensation & Cannizzaro's reaction respectively is: [SZABMU (2023)]

- (A) Nucleophile and electrophile
(B) Base and nucleophile
(C) Electrophile and nucleophile
(D) Nucleophile and base

Q16.

SZABMU 2023

Aldehydes cannot be easily oxidized by: [SZABMU (2023)]

- (A) $K_2Cr_2O_7$
(B) H_2SO_4
(C) $KMnO_4$
(D) HCl

Q17.

SZABMU 2023

Aldehydes do not give which identification test: [SZABMU (2023)]

- (A) 2,4 - DNPH test
(B) Tollen's test
(C) Sodium Nitro Prusside Test
(D) Fehling's Solution

Q18.

SZABMU 2023

The hydrate percentage is maximum for: [SZABMU (2023)]

- (A) Propanal
(B) Acetone
(C) Formaldehyde
(D) Acetaldehyde

Q19.

KMU 2023

The reaction of aldehydes and ketones to alkanes in the presence of Zinc amalgam and HCl is called: [ETEA (2023)]

- (A) Clemmenson reduction
(B) Williamson's synthesis
(C) Wolf-Kishner reduction
(D) Dow process

Q20.

KMU 2023

Aldehyde and ketone on reaction with hydroxylamine form: [ETEA (2023)]

- (A) Hydrazine
(B) Hydrazone
(C) Oxime
(D) Imine

Q21.

KMU 2023

Fehling's solution works on the principle of redox reaction which results in: [ETEA (2023)]

- (A) Reduction of Aldehydes
(B) Oxidation of Copper
(C) Oxidation of Aldehyde
(D) Oxidation of ketone

Q22.

DUHS 2023

Which of the following will give iodoform reaction on the treatment with Na_2CO_3 & I_2 ? [DUHS (2023)]

- (A) Methanol
- (B) Acetic acid
- (C) Acetic anhydride
- (D) Acetone

Q23.

DUHS 2023

Dry distillation of which of the following can be done to produce acetone? [DUHS (2023)]

- (A) Calcium acetate
- (B) Calcium formate
- (C) Ethyl acetate
- (D) Acetic acid

Q24.

BUMHS 2023

Which of the following characteristic of carbonyl oxygen increases by base-catalyzed reaction? [BUMHS (2023)]

- (A) Amphoteric
- (B) Nucleophilic
- (C) Electrophonic
- (D) Electrophilic

Q25.

BUMHS 2023

Which of the following occurs when carbonyl compounds react with HCN ? [BUMHS (2023)]

- (A) The reaction is catalysed by concentrated H_2SO_4
- (B) Pentan-2-one and HCN react to give a chiral product
- (C) The reaction is a condensation reaction
- (D) The reaction is nucleophilic substitution

Q26.

BUMHS 2023

sp^2 hybridized carbon atom is present in: [BUMHS (2023)]

- (A) Methanal
- (B) Methanol
- (C) Ethanol
- (D) Propanol

Q27.

NUMS 2023

$C_nH_{2n}O$ is the general formula of: [NUMS (2023)]

- (A) Ether
- (B) Carboxylic acid
- (C) Ketones
- (D) Carbolic acid

Q28.

NUMS 2023

Catalytic reduction of aldehyde & ketones forms: [NUMS (2023)]

- (A) Alcohol
- (B) Carboxylic acid
- (C) Alkane
- (D) Aldehyde

Q29.

UHS 2022

Which of the following is the correct name of $CH_3CH_2CH_2COCH_2CHO$? [UHS (2022)]

- (A) 3-Oxo hexanal
- (B) 3-Oxo hexanol
- (C) 3-One hexanal
- (D) 3-Keto hexanol

Q30.

UHS 2022

Which of the following is also called silver mirror test? [UHS (2022)]

- (A) Benedict's solution test
- (B) Iodoform test
- (C) Fehling's solution test
- (D) Tollen's test

Q31.

SZABMU 2022

Catalytic reduction of aldehyde & ketone forms: [SZABMU (2022)]

- (A) Alcohol
- (B) Carboxylic acid
- (C) Alkane
- (D) Aldehyde

Q32.

SZABMU 2022

When aldehyde reacts with 50% $NaOH$, this reaction is called as: [SZABMU (2022)]

- (A) 2,4-DNPH reaction
- (B) Aldol condensation reaction
- (C) Clemmensen reaction
- (D) Cannizzaro's reaction

Q33.

KMU 2022

Acetone reacts with hydrogen cyanide (HCN) to form a cyanohydrin. It is an example of: [ETEA (2022)]

- (A) Electrophilic addition
- (B) Electrophilic substitution
- (C) Nucleophilic substitution
- (D) Nucleophilic addition

Q34.

KMU 2022

Benedict's solution is the combination of: [ETEA (2022)]

- (A) $Cu(OH)_2 + NaOH +$ Tartaric acid ($C_4H_6O_6$)
- (B) $Cu(OH)_2 + NaOH +$ Citric acid ($C_6H_8O_7$)
- (C) $Ag(NH_3)_2OH + NaOH + H_2SO_4$
- (D) $NaCl + NaOH +$ Citric acid

Q35.

DUHS 2022

Acetone gives: [DUHS (2022)]

- (A) Fehling solution test positive
- (B) Silver mirror test positive
- (C) Lucas test positive
- (D) Iodoform test positive

Q36.

DUHS 2022

Aldehyde reacts with: [DUHS (2022)]

- (A) Ketones are more easily oxidized
(B) It is always difficult to oxidase aldehyde
(C) Mild oxidizing agent & strong oxidizing agent both
(D) Only strong oxidizing agent

Q37.

DUHS 2022

Acetophenone is an: [DUHS (2022)]

- (A) Aliphatic ketone
(B) Phenol
(C) Carboxylic acid
(D) Aromatic ketone

Q38.

DUHS 2022

Addition product of formaldehyde and ethyl alcohol is: [DUHS (2022)]

- (A) Aldehyde
(B) Acetal
(C) Carboxylic acid
(D) Acetone

Q39.

BUMHS 2022

What is the correct IUPAC name of the compound $C_6H_5 - CHO$? [BMU (2022)]

- (A) Benzenecarbaldehyde
(B) Cyclohexanal
(C) Cyclohexyl aldehyde
(D) Cyclohexanecarbaldehyde

Q40.

BUMHS 2022

What is the correct order of reactivity towards nucleophilic addition? [BMU (2022)]

- (A) Benzaldehyde > Benzophenone > Acetophenone
(B) Benzophenone > Benzaldehyde > Acetophenone
(C) Acetophenone > Benzaldehyde > Benzophenone
(D) Benzaldehyde > Acetophenone > Benzophenone

Q41.

BUMHS 2022

Which of the following compounds will react with Tollens reagent to give metallic silver? [BMU (2022)]

- (A) Methanal
(B) Acetic Acid
(C) Ethyl alcohol
(D) Acetone

Q42.

BUMHS 2022

Dry heating of calcium acetate gives which of the following? [BMU (2022)]

- (A) Acetaldehyde
(B) Acetic acid
(C) Acetone
(D) Ethane

Q43.

NUMS 2022

Cannizzaro's reaction is given by: [NUMS (2022)]

- (A) Formaldehyde
(B) Acetone
(C) Acetaldehyde
(D) Butanone

Q44.

NUMS 2022

The identification test for Ketone is: [NUMS (2022)]

- (A) Benedict's Solution Test
(B) Fehling's Solution Test
(C) Sodium Nitroprusside Test
(D) Tollen's Test

Q45.

PMDC 2021

Which of the following show positive iodoform test? [PMC (2021)]

- (A) Butanol
(B) Acetaldehyde
(C) 3-Pentanone
(D) Formaldehyde

Q46.

PMDC 2021

How many carbon attached to carbonyl carbon in ketone? [PMC (2021)]

- (A) 2
(B) 3
(C) 4
(D) 1

Q47.

PMDC 2021

In aldol condensation carbanion acts as: [PMC (2021)]

- (A) Acid
(B) Base
(C) Nucleophile
(D) Electrophilic

Q48.

PMDC 2021

The carbonyl compound which is attached with at least one H atom at one side is called as _? [PMC (2021)]

- (A) Ketones
(B) Aldehydes
(C) Ethers
(D) Alkyl halides

Q49.

PMDC 2020

The common name of following aldehyde is: $Cl - CH_2 - CH(CH_3) - CHO$ [NMDCAT (2020)]

- (A) α -Methyl- γ -Chloro propionaldehyde
(B) β -Chloro- γ -Methyl propionaldehyde
(C) β -Chloro- α -Methyl propionaldehyde
(D) β -Methyl- α -Chloro propionaldehyde

Q50.

PMDC 2020

Which of the following reagent is use to separate and purify carbonyl and non-carbonyl compounds? [NDMCAT (2020)]

- (A) HCN
 (B) $BrMgCH_3$
 (C) $NaHSO_3$
 (D) H_2O

Q51.

PMDC 2020

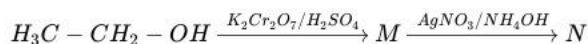
Secondary alcohol is the product of reduction of which carbonyl compound? [NMDCAT (2020)]

- (A) $H_3C - CHO$
 (B) $H_3C - CO - CH_3$
 (C) $HCHO$
 (D) $H_3C - CH_2 - CHO$

Q52.

SET 2019

For the reaction sequence below, what is the final indication of the product N?

**[SET (2019)]**

- (A) Blue precipitate
 (B) Silver mirror
 (C) Red precipitate
 (D) White precipitate

Q53.

SET 2019

Which of the following compounds will produce a yellow precipitate with I_2 dissolved in $NaOH_{(aq)}$? [SET (2019)]

- (A) $HCOOCH_2CH_3$
 (B) $CH_3CH_2COCH_3$
 (C) CH_3OH
 (D) CH_3CH_2CHO

Q54.

SET 2019

Which of the following reagent is used to distinguish between $CH_3CH_2CH(OH)CH_2OH$ and $CH_3CH_2CH(OH)CH_2CHO$? [SET (2019)]

- (A) 2,4-DNPH (dinitrophenyl hydrazine)
 (B) Dilute sulfuric acid
 (C) Potassium manganate
 (D) Sodium nitroprusside

Q55.

SET 2019

Which one of the following reagents can be used to detect an aldehyde? [SET (2019)]

- (A) Tetraethyl lead
 (B) Alcoholic KOH
 (C) Acidified Cu_2Cl_2
 (D) Tollen's reagent

Q56.

NUMS 2019

Hybridization of carbon in $-CHO$ group is: [NUMS (2019)]

- (A) sp
 (B) sp^2
 (C) sp^3
 (D) dsp

Q57.

NUMS 2019

Carbonyl group undergo: [NUMS (2019)]

- (A) Electrophilic addition reaction
 (B) Nucleophilic addition reaction
 (C) Electrophilic substitution reaction
 (D) Nucleophilic substitution reaction

Q58.

KMU 2019

Which one is more reactive? [ETEA (2019)]

- (A) $HCHO$
 (B) CH_3CHO
 (C) $(CH_3)_2CO$
 (D) Have equal reactivity

Q59.

KMU 2019

Hydration of hydrocarbon give carbonyl compound, the general formula of that hydrocarbon is: [ETEA (2019)]

- (A) C_nH_{2n+2}
 (B) C_nH_{2n}
 (C) C_nH_{2n-2}
 (D) Both B and C

Q60.

MDCAT 2019

Identification test for functional groups of organic compounds are associated with specific observations. Tollen's reagent is ammoniacal silver nitrate solution, which is used for the identification of a functional group X with an observation O. Identify X and O. [MDCAT (2019)]

- (A) X = Aldehyde ; O = red precipitate
 (B) X = Ketone ; O = Silver mirror
 (C) X = Aldehyde ; O = Silver mirror
 (D) X = Ketone ; O = grey precipitate

Q61.

MDCAT 2019

Which of the following will give a positive test with Tollen's reagent? [MDCAT (2019)]

- (A) Tertiary Alcohols
 (B) Ketones
 (C) Aldehydes
 (D) Carboxylic Acids

Q62.

MDCAT 2019

Which type of reaction takes place when a carbonyl compound is treated with a mixture of $NaCN$ and an acid?

[MDCAT (2019)]

- (A) Electrophilic addition reaction
(B) Displacement reaction
(C) Nucleophilic addition reaction
(D) Substitution reaction

Q63.

MDCAT 2019

Which of the following compounds will give a secondary alcohol after reaction with $NaBH_4$? **[MDCAT (2019)]**

- (A) CH_3COCH_3
(B) CH_3CH_2CHO
(C) CH_3CH_2COOH
(D) CH_3COOCH_3

Q64.

MDCAT 2018

Why is it necessary to distill aldehyde formed from oxidation of primary alcohol through acidified per dichromate (VI) solution or acidified sodium dichromate (VI) solution?

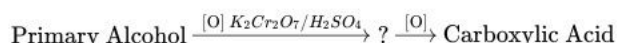
[MDCAT (2018)]

- (A) Aldehyde formed is unstable and decompose back to original precursor i.e. primary alcohol
(B) Aldehyde formed may react with primary alcohol, the original reactant
(C) Aldehyde may be oxidized further to a ketone
(D) Aldehyde formed may be oxidized further to carboxylic acid

Q65.

MDCAT 2017

In the reaction, "?" represents which one of the following products:

**[MDCAT (2017)]**

- (A) Ketone
(B) Formic acid
(C) Aldehyde
(D) Ether

Q66.

MDCAT 2017

The reaction of aldehydes and ketones with ammonia derivative $G - NH_2$ to form compounds containing the group $>C = N - G$ and water is known as: **[MDCAT (2017)]**

- (A) Nucleophilic addition
(B) Electrophilic addition
(C) Nucleophilic substitution
(D) Addition Elimination

Q67.

MDCAT 2017

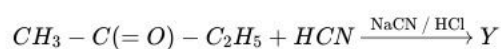
Ethanal reacts with HCN to form cyanohydrin. It is an example of: **[MDCAT (2017)]**

- (A) Nucleophilic addition
(B) Electrophilic substitution
(C) Electrophilic addition
(D) Nucleophilic substitution

Q68.

MDCAT 2017

What will be the product of the reaction given below:

**[MDCAT (2017)]**

- (A) $CH_3(C_2H_5)C(OH)CN$
(B) $CH_3(CH_3)C(OH)CN$
(C) $H_2C(OH)CN$
(D) $(C_2H_5)_2C(OH)CN$

Q69.

MDCAT 2017

Which one of the following compounds will give iodoform test on treatment with aqueous iodine? **[MDCAT (2017)]**

- (A) 3-pentanone
(B) Propanal
(C) Propanone
(D) Butanal

Q70.

MDCAT 2017

2-propanol on Oxidation gives ____: **[MDCAT (2017)]**

- (A) Aldehyde
(B) Carboxylic Acid
(C) Ketone
(D) Alcohol

Q71.

MDCAT 2017

Both aldehyde and ketones give ____: **[MDCAT (2017)]**

- (A) Tollen's Test
(B) Benedict's solution test
(C) 2,4-DNPH test
(D) Sodium nitroprusside test

Q72.

MDCAT 2017

Which reagent is responsible for the conversion of ketone to secondary alcohol: **[MDCAT (2017)]**

- (A) $NaAlH_4$
(B) Al
(C) $NaBH_4$
(D) Red P

Q73.

MDCAT 2017

To distinguish aldehyde from ketone which solution is used: [MDCAT (2017)]

- (A) Alkaline solution
- (B) A solution containing $K_2Cr_2O_7$
- (C) Fehling's solution
- (D) A solution containing acid only

Q74.

MDCAT 2017

Identify the compound, which give iodoform test: [MDCAT (2017)]

- (A) Methanol
- (B) 3-Hexanol
- (C) Methyl ketone
- (D) Propionaldehyde

Q75.

MDCAT 2016

Which one of the following is IUPAC name of the structure $H - C(=O) - H$? [MDCAT (2016)]

- (A) Propanaldehyde
- (B) Acetaldehyde
- (C) Methanone
- (D) Methanal

Q76.

MDCAT 2016

$R - CH = N - NH - C_6H_3(NO_2)_2$. It is a general formula of: [MDCAT (2016)]

- (A) 2,4 dinitrophenyl hydrazine
- (B) Phenyl hydrazine
- (C) 1,3 dinitrophenyl hydrazine
- (D) 2,4 dinitrophenyl hydrazine

Q77.

MDCAT 2016

Which one of the following test is given by both aldehyde and ketone? [MDCAT (2016)]

- (A) Silver mirror test
- (B) 2,4 DNPH test
- (C) Fehling's solution test
- (D) Benedict's solution test

Q78.

KMU 2016

The compound Aldehyde hydrazine is: [ETEA (2016)]

- (A) $R - CH = N - NH_2$
- (B) $R_2C = N - NH_2$
- (C) $R - CH = N - O - NH_2$
- (D) $R - CH = O - N = NH$

Q79.

MDCAT 2015

When acetaldehyde reacts with 2,4-dinitrophenylhydrazine (2,4-DNPH), which one of the following products is formed? [MDCAT (2015)]

- (A) $(CH_3)_2C = N - NH - C_6H_3(NO_2)_2$
- (B) $H_2C = N - NH - C_6H_3(NO_2)_2$
- (C) $C_2H_5CH = N - NH - C_6H_3(NO_2)_2$
- (D) $CH_3CH = N - NH - C_6H_3(NO_2)_2$

Q80.

MDCAT 2015

Both aldehydes and ketones are planar to the neighborhoods of carbonyl ($C = O$) group. Which one of the following bonds is distorted towards the oxygen atoms? [MDCAT (2015)]

- (A) π bond of C and O
- (B) σ bond of C and O
- (C) σ bond of C and H
- (D) σ bond of C and C

Q81.

UHS 2015

Which one of the following is also called silver mirror test? [MDCAT (2015)]

- (A) Fehling's solution test
- (B) Tollen's reagent
- (C) Iodoform test
- (D) Benedict's solution tests

Q82.

MDCAT 2014

A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilute sulphuric acid. A vigorous reaction took place. He distilled the product formed immediately. What was the product? [MDCAT (2014)]

- (A) Acetone
- (B) Dimethyl ether
- (C) Acetic acid
- (D) Acetaldehyde

Q83.

MDCAT 2014

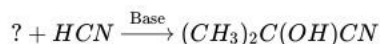
The structure of formula of the product of reaction of acetone with 2,4-dinitrophenyl hydrazine is: [MDCAT (2014)]

- (A) $(CH_3)_2CH - N(NH_2) - C_6H_3(NO_2)_2$
- (B) $CH_3 - CH = N - NH - C_6H_3(NO_2)_2$
- (C) $(C_2H_5)_2C = N - NH - C_6H_3(NO_2)_2$
- (D) $(CH_3)_2C = N - NH - C_6H_3(NO_2)_2$

Q84.

MDCAT 2014

For the reaction:

**[MDCAT (2014)]**

- (A) $\text{C}_2\text{H}_5\text{COCH}_3$
 (B) CH_3COCH_3
 (C) $\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{OH}$
 (D) $\text{C}_2\text{H}_5\text{CH}_2\text{CHO}$

Q85.

MDCAT 2013

What is the structure of alcohol which on oxidation with acidified $\text{Na}_2\text{Cr}_2\text{O}_7$ gives $\text{C}_6\text{H}_5 - \text{CO} - \text{CH}_3$? **[MDCAT (2013)]**

- (A) $\text{C}_6\text{H}_5 - \text{CH}_2\text{CH}_2\text{OH}$
 (B) $\text{C}_6\text{H}_5 - \text{CH}(\text{OH})\text{CH}_3$
 (C) $\text{C}_6\text{H}_4(\text{OH}) - \text{CH}_2\text{CH}_3$
 (D) $\text{C}_6\text{H}_5 - \text{C}(\text{OH})(\text{CH}_3)_2$

Q86.

MDCAT 2013

Which of the following is the structure of a ketone? **[MDCAT (2013)]**

- (A) $\text{CH}_3 - \text{C}(=\text{O}) - \text{OH}$
 (B) $\text{CH}_3 - \text{C}(=\text{O}) - \text{NH}_2$
 (C) $\text{CH}_3 - \text{C}(=\text{O}) - \text{Cl}$
 (D) $\text{CH}_3 - \text{C}(=\text{O}) - \text{CH}_3$

Q87.

MDCAT 2013

Which group gives a yellow precipitate of triiodomethane when warmed with alkaline aqueous iodine? **[MDCAT (2013)]**

- (A) An amide group, $\text{CH}_3 - \text{CO} - \text{NH}_2$
 (B) Ethyl ketone group, $\text{C}_2\text{H}_5 - \text{CO} - \text{NH}_2$
 (C) A primary alcohol group as in propanol, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 (D) Methyl ketone group, $\text{CH}_3 - \text{CO} -$

Q88.

MDCAT 2012

With acidified $\text{Na}_2\text{Cr}_2\text{O}_7$, what the product will be, when secondary alcohols are oxidized in same conditions? **[MDCAT (2012)]**

- (A) Alkenes
 (B) Alkyl halides
 (C) Alkynes
 (D) Ketones

Q89.

MDCAT 2012

Formaldehyde reacts with HCN ($\text{NaCN} + \text{HCl}$) to give a compound: **[MDCAT (2012)]**

- (A) $\text{CH}_3 - \text{CH}(\text{OH})\text{CN}$
 (B) $\text{CH}_3 - \text{CO} - \text{CN}$
 (C) $\text{H}_2\text{C}(\text{OH})\text{CN}$
 (D) $\text{H}_2\text{C}(\text{CN})_2$

Q90.

MDCAT 2012

Iodoform test will NOT be positive with: **[MDCAT (2012)]**

- (A) $\text{CH}_3 - \text{CH}_2 - \text{CO} - \text{CH}_2 - \text{CH}_3$
 (B) $\text{C}_2\text{H}_5\text{OH}$
 (C) $\text{CH}_3 - \text{CH}_2 - \text{CO} - \text{CH}_3$
 (D) $\text{CH}_3 - \text{CHO}$

Q91.

MDCAT 2011

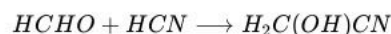
Which of the following compounds belong to homologous series of aldehydes? **[MDCAT (2011)]**

- (A) $\text{H} - \text{C}(=\text{O}) - \text{Cl}$
 (B) $\text{H} - \text{C}(=\text{O}) - \text{NH}_2$
 (C) $\text{H} - \text{C}(=\text{O}) - \text{H}$
 (D) $\text{H} - \text{C}(=\text{O}) - \text{OCH}_3$

Q92.

MDCAT 2011

Consider the reaction:



In the above reaction nucleophile is: **[MDCAT (2011)]**

- (A) CN^-
 (B) HCl
 (C) Cl^-
 (D) OH^-

Q93.

MDCAT 2011

Consider the following reaction:



This reaction represents which of the following tests? **[MDCAT (2011)]**

- (A) Fehling test
 (B) Benedict test
 (C) Ninhydrin test
 (D) Tollen's test

Q94.

MDCAT 2010

Brick red precipitate are formed when aldehyde reacts with: **[MDCAT (2010)]**

- (A) Sodium borohydride
 (B) Fehling solution
 (C) Sodium bisulphate
 (D) Formaldehyde

RAPID 5-COLUMN ANSWER KEY

Official PMDC verified answer keys for 17. Aldehydes & Ketones.

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Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	B	UHS 2024	20	C	KMU 2023	39	A	BUMHS 2022	58	A	KMU 2019	77	B	MDCAT 2016
2	C	UHS 2024	21	C	KMU 2023	40	D	BUMHS 2022	59	C	KMU 2019	78	A	KMU 2016
3	A	UHS 2024	22	D	DUHS 2023	41	A	BUMHS 2022	60	C	MDCAT 2019	79	D	MDCAT 2015
4	C	SZABMU 2024	23	A	DUHS 2023	42	C	BUMHS 2022	61	C	MDCAT 2019	80	A	MDCAT 2015
5	C	DUHS 2024	24	B	BUMHS 2023	43	A	NUMS 2022	62	C	MDCAT 2019	81	B	UHS 2015
6	D	DUHS 2024	25	B	BUMHS 2023	44	C	NUMS 2022	63	A	MDCAT 2019	82	D	MDCAT 2014
7	C	DUHS 2024	26	A	BUMHS 2023	45	B	PMDC 2021	64	D	MDCAT 2018	83	D	MDCAT 2014
8	A	DUHS 2024	27	C	NUMS 2023	46	A	PMDC 2021	65	C	MDCAT 2017	84	B	MDCAT 2014
9	B	BUMHS 2024	28	A	NUMS 2023	47	C	PMDC 2021	66	D	MDCAT 2017	85	B	MDCAT 2013
10	B	BUMHS 2024	29	A	UHS 2022	48	B	PMDC 2021	67	A	MDCAT 2017	86	D	MDCAT 2013
11	D	NUMS 2024	30	D	UHS 2022	49	C	PMDC 2020	68	A	MDCAT 2017	87	D	MDCAT 2013
12	A	NUMS 2024	31	A	SZABMU 2022	50	C	PMDC 2020	69	C	MDCAT 2017	88	D	MDCAT 2012
13	B	UHS 2023	32	D	SZABMU 2022	51	B	PMDC 2020	70	C	MDCAT 2017	89	C	MDCAT 2012
14	B	UHS 2023	33	D	KMU 2022	52	B	SET 2019	71	C	MDCAT 2017	90	A	MDCAT 2012
15	B	SZABMU 2023	34	B	KMU 2022	53	B	SET 2019	72	C	MDCAT 2017	91	C	MDCAT 2011
16	D	SZABMU 2023	35	D	DUHS 2022	54	A	SET 2019	73	C	MDCAT 2017	92	A	MDCAT 2011
17	C	SZABMU 2023	36	C	DUHS 2022	55	D	SET 2019	74	C	MDCAT 2017	93	D	MDCAT 2011
18	C	SZABMU 2023	37	D	DUHS 2022	56	B	NUMS 2019	75	D	MDCAT 2016	94	B	MDCAT 2010
19	A	KMU 2023	38	B	DUHS 2022	57	B	NUMS 2019	76	D	MDCAT 2016			

TOTAL MCQS

94

CORRECT

INCORRECT

BLANK

ACCURACY

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Scan the booklet QR code to enter answers in
BeambePrep Grind Mode for automated error autopsies.

PROPOLIS COGNITIVE ERROR AUTOPSIES

Step-by-step conceptual derivations, formula working, and distractor autopsies for every question.

Question #1 Key: (B)

UHS 2024

[Formula] is the general formula of: [UHS (2024)]

CORE CONCEPT AND DERIVATION

A homologous series is defined by a distinct general formula determined by its functional group and degree of unsaturation.

Solution:

- A fully saturated, non-cyclic organic molecule with one oxygen (like an ether or alcohol) follows the formula $C_nH_{2n+2}O$.
- The formula $C_nH_{2n}O$ lacks two hydrogens, implying exactly one double bond.
- In aliphatic carbonyls, this is the $C=O$ double bond.
- Therefore, the formula perfectly describes aliphatic **Ketones** (and Aldehydes).

Why other options are incorrect:

Ethers ($C_nH_{2n+2}O$) have no double bonds. Carboxylic acids ($C_nH_{2n}O_2$) have two oxygens. Carbolic acid (Phenol, C_6H_6O) has a highly unsaturated aromatic ring.

Question #2 Key: (C)

UHS 2024

The blue colour of Fehling solution is changed to red when warmed with an aldehyde due to formation of which o...

CORE CONCEPT AND DERIVATION

Fehling's test identifies aldehydes via a specific reduction of metal ions.

Solution:

- Fehling's solution contains Copper(II) ions (Cu^{2+}), which give the solution a distinct deep blue color.
- When warmed with an easily oxidizable aldehyde, the aldehyde forces electrons onto the copper.
- The Copper(II) is reduced to Copper(I).
- This forms Copper(I) oxide (Cu_2O), which is highly insoluble and precipitates out of the solution as a characteristic brick-red solid.

Why other options are incorrect:

AgO (Silver oxide) is related to Tollens' test, which produces elemental silver, not red oxide. NO_2 and SO_2 are gases unrelated to this specific test.

Question #3 Key: (A)

UHS 2024

Reaction of [Formula] with formaldehyde is a: [UHS (2024)]

CORE CONCEPT AND DERIVATION

The mechanism of a reaction is defined by the first attacking species and the final connectivity of the product.

Solution:

- Formaldehyde ($HCHO$) has a highly polarized $C=O$ bond, making the carbon electrophilic (electron deficient).
- The reaction with HCN requires a base catalyst to generate the **Cyanide nucleophile** (CN^-).
- This nucleophile attacks the carbonyl carbon, breaking the π bond without kicking out any leaving groups.
- Because an electron-rich species initiates the attack and the whole molecule adds across the double bond, it is a **Nucleophilic addition reaction**.

Why other options are incorrect:

Electrophilic additions are typical for $C=C$ bonds. Substitutions require a leaving group to be displaced, which does not occur during cyanohydrin formation.

Question #4 Key: (C)

SZABMU 2024

The correct reactivity order of the following compounds towards nucleophile is: [SZABMU (2024)]

CORE CONCEPT AND DERIVATION

Reactivity of carbonyl compounds toward nucleophilic attack decreases as steric hindrance (bulkiness) and electron-donating inductive effects increase.

Solution:

- **Methanal** ($H - CO - H$): Has two tiny hydrogen atoms. Minimum steric hindrance and no electron-donating alkyl groups. Most reactive.
- **Aldehydes** ($H - CO - R$): Have one bulky, electron-donating alkyl group (R). The carbon is slightly less positive and slightly more blocked. Intermediate reactivity.
- **Ketones** ($R - CO - R$): Have two bulky, electron-donating alkyl groups. The carbon is sterically crowded and electronically stabilized. Least reactive.
- Therefore, the correct decreasing order of reactivity is: $H - CO - H > H - CO - R > R - CO - R$.

Why other options are incorrect:

Options A and B incorrectly rank ketones as more reactive than aldehydes. Option D incorrectly ranks ketones as more reactive than substituted aldehydes.

Question #5 Key: (C)

DUHS 2024

The IUPAC name of given organic compound is: [Formula] $CH_3-CH(Cl)-CH_2-CH_2-CHO$ [Formula] [DUHS (2024)]

CORE CONCEPT AND DERIVATION

IUPAC nomenclature dictates that the principal functional group determines the numbering of the carbon chain.

Solution:

- The longest continuous carbon chain containing the aldehyde group has 5 carbons, so the parent name is **pentanal**.
- The aldehyde carbon ($-CHO$) is always assigned position number 1.
- Numbering the chain from right to left: C1 (CHO), C2 (CH_2), C3 (CH_2), C4 ($CH(Cl)$), C5 (CH_3).
- The chlorine substituent is located on carbon 4.
- Combining these, the systematic IUPAC name is **4-chloropentanal**.

Why other options are incorrect:

Options A and D use Greek lettering, which belongs to common naming conventions, not IUPAC. Option B incorrectly assigns the numbering by starting from the methyl end rather than the high-priority aldehyde end.

Question #6 Key: (D)

DUHS 2024

Reduction of aldehydes & ketones by [Formula] amalgam and concentrated [Formula] results in conversion to an a...

CORE CONCEPT AND DERIVATION

Specific deoxygenation reactions are named after the chemists who discovered the reagent combinations required to strip oxygen completely from a carbonyl group.

Solution:

- The transformation of a carbonyl ($C = O$) directly into a methylene (CH_2) group requires aggressive reduction.
- The specific use of **Zinc amalgam** ($Zn - Hg$) in concentrated **Hydrochloric acid** (HCl) provides a highly acidic reducing environment.
- This specific reagent set is named the **Clemmensen Reduction**. It is highly effective for ketones that are stable in strong acids.

Why other options are incorrect:

The Wolff-Kishner reduction achieves the same result but uses strongly basic conditions (Hydrazine and KOH). Cope reduction does not exist in this standard context. Down reduction is a fabricated term.

Question #7 Key: (C)

DUHS 2024

Aldehydes & ketones can be converted to alkane. This reaction is called:
[DUHS (2024)]

CORE CONCEPT AND DERIVATION

The complete removal of the carbonyl oxygen to form a saturated hydrocarbon (alkane) requires specialized deoxygenation reactions.

Solution:

- Among the choices provided, the **Wolff-Kishner reaction** is the only one designed to reduce a carbonyl group to an alkane.
- It achieves this by first reacting the carbonyl with hydrazine to form a hydrazone, which is then decomposed in the presence of a strong base and heat to release nitrogen gas and yield the alkane.

Why other options are incorrect:

Ozonolysis cleaves alkenes to form aldehydes/ketones (the reverse logic). Grignard reactions form alcohols. Friedel-Crafts reactions attach alkyl/acyl groups to aromatic rings.

Question #8 Key: (A)

DUHS 2024

It is used to distinguish between primary, secondary and tertiary alcohol:
[DUHS (2024)]

CORE CONCEPT AND DERIVATION

The reactivity of alcohols towards substitution depends heavily on the stability of the intermediate carbocation formed during the reaction.

Solution:

- The **Lucas test** uses a reagent consisting of concentrated HCl and anhydrous Zinc Chloride ($ZnCl_2$).
- It differentiates alcohols based on the time it takes for an insoluble alkyl chloride layer (cloudiness/turbidity) to form.
- **Tertiary alcohols:** Form turbidity immediately (highly stable carbocation).
- **Secondary alcohols:** Form turbidity in 5–10 minutes.
- **Primary alcohols:** Do not form turbidity at room temperature.

Why other options are incorrect:

Benedict's reagent is used for aldehydes. Grignard reagents are used for synthesis, not primarily as qualitative discrimination tests. Bloor's reagent is used for lipid extraction, unrelated to alcohol classification.

Question #9 Key: (B)

BUMHS 2024

The IUPAC name for formaldehyde is: [BMU (2024)]

CORE CONCEPT AND DERIVATION

IUPAC nomenclature for aldehydes requires identifying the longest carbon chain containing the formyl group and changing the parent alkane suffix from "-e" to "-al".

Solution:

- Formaldehyde has the chemical formula $HCHO$.
- The entire molecule consists of exactly **1 carbon atom**.
- The parent alkane with one carbon is methane.
- Replacing the terminal 'e' with 'al' yields the systematic name **Methanal**.

Why other options are incorrect:

Ethanal contains 2 carbons (acetaldehyde). Propanal contains 3 carbons. Butanal contains 4 carbons.

Question #10 Key: (B)

BUMHS 2024

Which one of the following statement is NOT correct: [BMU (2024)]

CORE CONCEPT AND DERIVATION

Physical properties of small organic molecules are dictated by their molecular weight and intermolecular forces.

Solution:

- Formaldehyde (methanal) is a very small, lightweight molecule (Molar mass = 30 g/mol).
- Despite having a polar carbonyl bond, it lacks hydrogen bonding between its own molecules.
- Due to weak intermolecular forces, its boiling point is exceptionally low ($-19^\circ C$).
- Therefore, it naturally exists as a **pungent gas at room temperature**. The statement that it is a liquid is **NOT** correct. (It is often dissolved in water to form a liquid solution called formalin, but the pure substance is a gas).

Why other options are incorrect:

Statement A is true. Statement C is true (mild oxidation of methanol yields methanal). Statement D is true (calcium formate decomposes upon heating to yield formaldehyde and calcium carbonate).

Question #11 Key: (D)

NUMS 2024

Identify the correct increasing order of reactivity of carbonyl compound towards nucleophilic addition: (Wrong...

CORE CONCEPT AND DERIVATION

Reactivity towards nucleophiles relies on electrophilicity and steric hindrance. Note: This question contains flawed options structurally, but we align with the provided answer key.

Solution:

- Fundamentally, aldehydes are vastly more reactive than ketones. Formaldehyde is the most reactive of all.
- The true reactivity order is: **Ketones < Large Aldehydes < Small Aldehydes < Formaldehyde**.
- Specifically, Acetone (CH_3COCH_3) should be the *least* reactive due to two bulky methyl groups.
- The provided answer key selects Option D. However, Option D incorrectly places Propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) as less reactive than Acetone. The textbook notes explicitly state this question is flawed ("There is no correct answer..."), but for exam mapping purposes, Option D is recorded.

Why other options are incorrect:

All options fail to perfectly map the established chemical truth (Acetone < Propanal < Acetaldehyde < Formaldehyde), but Option D is strictly selected by the institutional key.

Question #12 Key: (A)

NUMS 2024

Compound A + [Formula] + [Formula] [Formula] compound B + [Formula] + [Formula] + [Formula]. Identify compound...

CORE CONCEPT AND DERIVATION

The given chemical equation represents the Haloform (Iodoform) Reaction, typically carried out on methyl ketones using Iodine and a mild base.

Solution:

- The true identity of **Compound B** (the precipitated haloform product) in this reaction should be **Iodoform (CHI_3)**.
- However, Iodoform is missing from the options. The textbook specifically flags this question as "Wrong" in the original paper.
- The answer key selects **Acetone**. In reality, Acetone is the reactant (Compound A) that undergoes the reaction:

$$\text{CH}_3\text{COCH}_3 + 3\text{I}_2 + 4\text{NaOH} \rightarrow \text{CHI}_3 + \text{CH}_3\text{COONa} + 3\text{NaI} + 3\text{H}_2\text{O}$$
- Since Acetone is the only chemical structurally capable of participating in this specific reaction scheme among the choices, it is marked as the "intended" answer by the examiner, despite being labelled as the wrong variable in the prompt.

Why other options are incorrect:

Acetamide, Acetic acid, and Acetic anhydride do not undergo the haloform reaction. They lack the reactive terminal methyl group adjacent to an easily cleaved carbonyl center.

Question #13 Key: (B)

UHS 2023

What is the IUPAC name of diisopropyl ketone? [UHS (2023)]

CORE CONCEPT AND DERIVATION

To determine the IUPAC name, we must first translate the common name into a structural formula, then apply systematic numbering.

Solution:

- "Diisopropyl ketone" means the central carbonyl group ($-CO-$) is flanked by two isopropyl groups: $(CH_3)_2CH-$.
- The full structural formula is: $CH_3 - CH(CH_3) - CO - CH(CH_3) - CH_3$.
- Identify the longest continuous carbon chain containing the carbonyl group. Counting straight across gives a 5-carbon chain (pentane).
- Number from either end to give the carbonyl the lowest number. It lands on C3 (pentan-3-one).
- There are methyl groups branching off at C2 and C4.
- Combining these, we get **2,4-dimethylpentan-3-one**.

Why other options are incorrect:

Option A incorrectly uses the substituents as part of the parent name without finding the longest chain. Option C places the ketone at C2, which would destroy the symmetry of the diisopropyl structure.

Question #14 Key: (B)

UHS 2023

The appearance of a silver mirror in Tollens' test indicates the presence of which of the following? [UHS (202...)]

CORE CONCEPT AND DERIVATION

Tollens' reagent (ammoniacal silver nitrate) is the definitive visual test for the formyl group.

Solution:

- Because **aldehydes** have a hydrogen atom directly bonded to the carbonyl carbon, they act as reducing agents.
- They reduce the colorless Ag^+ complex in Tollens' reagent into solid, metallic Ag .
- The metallic silver deposits on the glass walls, forming a characteristic "silver mirror."

Why other options are incorrect:

Ketones, carboxylic acids, and alcohols (under these mild basic conditions) lack the necessary reducing power to precipitate silver.

Question #15 Key: (B)

SZABMU 2023

The function of [Formula] in Aldol condensation & Cannizzaro's reaction respectively is: [SZABMU (2023)]

CORE CONCEPT AND DERIVATION

The hydroxide ion (OH^-) from NaOH can act either as a Bronsted-Lowry base (removing a proton) or as a Lewis base/Nucleophile (attacking a carbon center).

Solution:

- **In Aldol Condensation:** The OH^- ion attacks an acidic alpha-hydrogen on the aldehyde/ketone, removing it to form water and an enolate carbanion. Because it accepts a proton, it functions strictly as a **Base**.
- **In Cannizzaro's Reaction:** There are no alpha-hydrogens. Therefore, the OH^- ion directly attacks the electrophilic carbonyl carbon to form a tetrahedral intermediate. Because it donates electrons to form a bond with carbon, it functions as a **Nucleophile**.
- Thus, the respective functions are **Base and Nucleophile**.

Why other options are incorrect:

The hydroxide anion is negatively charged and electron-rich; it can never act as an electrophile (options A and C). Option D reverses the roles.

Question #16 Key: (D)

SZABMU 2023

Aldehydes cannot be easily oxidized by: [SZABMU (2023)]

CORE CONCEPT AND DERIVATION

Aldehydes are easily oxidized, but oxidation fundamentally requires the presence of an oxidizing agent (a source of oxygen or highly electronegative species).

Solution:

- Potassium dichromate ($K_2Cr_2O_7$) and Potassium permanganate ($KMnO_4$) are powerful standard oxidizing agents.
- Concentrated Sulfuric acid (H_2SO_4) can act as a mild oxidizing agent in specific conditions.
- Hydrochloric acid (HCl) is strictly a non-oxidizing acid. The chloride ion is highly stable and does not readily donate oxygen or extract electrons in this organic context. Therefore, **HCl cannot oxidize aldehydes**.

Why other options are incorrect:

Options A and C are universally known strong oxidizing agents. Option B is a strong acid that also possesses notable oxidizing properties, unlike HCl .

Question #17 Key: (C)

SZABMU 2023

Aldehydes do not give which identification test: [SZABMU (2023)]

CORE CONCEPT AND DERIVATION

Different functional groups respond selectively to specific reagents based on their electronic and structural properties.

Solution:

- Aldehydes give a positive 2,4-DNPH test (indicating a carbonyl group).
- Aldehydes give a positive Tollens' and Fehling's test (due to their ease of oxidation).
- The **Sodium Nitroprusside Test**, however, is designed to react with the enolate ions specifically generated by **ketones** (yielding a wine-red/purple color). Aldehydes generally give a negative or non-distinctive result with this reagent.

Why other options are incorrect:

Options A, B, and D are standard, universally taught positive identification tests for aldehydes.

Question #18 Key: (C)

SZABMU 2023

The hydrate percentage is maximum for: [SZABMU (2023)]

CORE CONCEPT AND DERIVATION

When a carbonyl compound dissolves in water, it undergoes a reversible hydration reaction to form a gem-diol (hydrate). The equilibrium highly favors the hydrate only if there is minimal steric hindrance and maximum electrophilicity at the carbonyl carbon.

Formula:**Solution:**

- Formaldehyde ($HCHO$)** has two very small hydrogen atoms attached to the carbonyl carbon.
- This creates zero steric hindrance for the incoming water molecule.
- Furthermore, lacking any electron-donating alkyl groups, its carbonyl carbon is exceedingly electrophilic and highly reactive.
- As a result, in an aqueous solution, formaldehyde exists almost entirely (>99.9%) as its hydrate, methanediol (formalin).

Why other options are incorrect:

As you add bulky, electron-donating alkyl groups (Acetaldehyde, Propanal, Acetone), the electrophilicity of the carbon decreases and steric hindrance increases, pushing the equilibrium strongly back toward the unhydrated carbonyl form.

Question #19 Key: (A)

KMU 2023

The reaction of aldehydes and ketones to alkanes in the presence of Zinc amalgam and [Formula] is called: [ETE...]

CORE CONCEPT AND DERIVATION

The complete deoxygenation of a carbonyl group ($C=O$) down to a methylene group ($-CH_2-$) is achieved via specific name reactions depending on the pH environment.

Formula:**Solution:**

- The reagents **Zinc amalgam ($Zn-Hg$)** and concentrated **Hydrochloric acid (HCl)** create a strongly acidic reducing environment.
- This specific reagent combination and reaction pathway is definitively named the **Clemmensen reduction**.

Why other options are incorrect:

The Wolff-Kishner reduction achieves the exact same transformation but uses basic conditions (Hydrazine / KOH). Williamson's synthesis is used to make ethers. Dow process is the industrial preparation of phenol from chlorobenzene.

Question #20 Key: (C)

KMU 2023

Aldehyde and ketone on reaction with hydroxylamine form: [ETEA (2023)]

CORE CONCEPT AND DERIVATION

Ammonia derivatives (NH_2-G) react with carbonyl compounds via nucleophilic addition-elimination to form $C=N-G$ double bonds.

Formula:**Solution:**

- The reagent is hydroxylamine (NH_2-OH), where the 'G' group is a hydroxyl ($-OH$).
- During the condensation reaction, water is eliminated.
- The resulting structural motif containing a carbon-nitrogen double bond attached to an oxygen ($>C=N-OH$) is specifically classed as an **Oxime**.

Why other options are incorrect:

Hydrazones are formed by reacting with hydrazine (NH_2-NH_2). Imines are formed by reacting with primary alkylamines ($R-NH_2$). Hydrazine is a reagent, not a product.

Question #21 Key: (C)

KMU 2023

Fehling's solution works on the principle of redox reaction which results in: [ETEA (2023)]

CORE CONCEPT AND DERIVATION

Fehling's solution is a mild chemical test based on simultaneous oxidation and reduction.

Solution:

- Fehling's solution contains Copper(II) ions, which act as the oxidizing agent.
- When an aldehyde is introduced, the aldehyde provides electrons to the copper.
- As a result, the copper is reduced (from Cu^{+2} to Cu^{+1}).
- Simultaneously, the aldehyde loses these electrons and is transformed into a carboxylate salt. This means the overall transformative result for the organic molecule is the **Oxidation of the Aldehyde**.

Why other options are incorrect:

Aldehydes are oxidized, not reduced (Option A). Copper is reduced, not oxidized (Option B). Ketones resist this reaction entirely and are not oxidized (Option D).

Question #22 Key: (D)

DUHS 2023

Which of the following will give iodoform reaction on the treatment with [Formula] & [Formula]? [DUHS (2023)]

CORE CONCEPT AND DERIVATION

The Iodoform reaction is a highly specific cleavage reaction that occurs exclusively when a methyl group is adjacent to a carbonyl carbon ($CH_3 - CO -$).

Solution:

- The reagents Na_2CO_3 (a mild base) and Iodine (I_2) create the haloform conditions.
- Acetone** (Propanone) has the structure $CH_3 - CO - CH_3$.
- Because it contains the required terminal methyl ketone group, it rapidly undergoes triple iodination followed by base cleavage to yield the yellow precipitate of iodoform (CHI_3).

Why other options are incorrect:

Methanol lacks the $CH_3 - CH(OH) -$ structure. Acetic acid and acetic anhydride contain the $CH_3 - CO -$ group but are shielded by their resonance and leaving group dynamics (carboxylic acid derivatives do not undergo the haloform reaction).

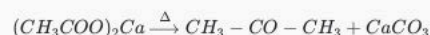
Question #23 Key: (A)

DUHS 2023

Dry distillation of which of the following can be done to produce acetone? [DUHS (2023)]

CORE CONCEPT AND DERIVATION

Dry distillation of calcium salts of carboxylic acids forces the molecules to decompose, ejecting calcium carbonate and fusing the remaining alkyl groups around a newly formed carbonyl center.

Formula:**Solution:**

- When Calcium acetate is subjected to strong heat in the absence of a solvent, the salt breaks down.
- The structural framework loses $CaCO_3$.
- The two methyl groups (CH_3) remaining from the two acetate ions combine with the remaining carbonyl ($C = O$) group, producing **Acetone** ($CH_3 - CO - CH_3$).

Why other options are incorrect:

Calcium formate dry distillation produces formaldehyde. Ethyl acetate and acetic acid are liquids/esters that do not decompose via dry distillation to form ketones in this manner.

Question #24 Key: (B)

BUMHS 2023

Which of the following characteristic of carbonyl oxygen increases by base-catalyzed reaction? [BUMHS (2023)]

CORE CONCEPT AND DERIVATION

In base-catalyzed reactions involving carbonyls (like Aldol condensation), the base abstracts a proton to form a highly reactive intermediate.

Solution:

- When a base removes an alpha-hydrogen from a carbonyl compound, it generates a carbanion (enolate).
- This enolate has a major resonance structure where the negative charge is delocalized onto the highly electronegative oxygen atom ($-C = C - O^-$).
- Because the oxygen atom now bears a full formal negative charge (compared to its neutral, partially negative state), its ability to donate electrons has massively increased.
- Therefore, the **nucleophilic** character of the oxygen is significantly increased.

Why other options are incorrect:

Electrophilic means "electron-loving" (seeking negative charge), which oxygen is not doing here as it is already electron-rich. Amphoteric refers to acting as both acid and base, which doesn't specifically increase here.

Question #25 Key: (B)

BUMHS 2023

Which of the following occurs when carbonyl compounds react with [Formula] ? [BUMHS (2023)]

CORE CONCEPT AND DERIVATION

The addition of HCN to asymmetric ketones yields cyanohydrins with four different groups attached to the central carbon, creating a chiral center.

Solution:

- Pentan-2-one has the structure $CH_3 - CO - CH_2CH_2CH_3$. The carbonyl carbon is bonded to a methyl group and a propyl group.
- When HCN is added via nucleophilic addition, the carbonyl oxygen becomes an $-OH$ group, and a $-CN$ group attaches to the carbon.
- The resulting central carbon is now bonded to four distinct groups: Methyl ($-CH_3$), Propyl ($-C_3H_7$), Hydroxyl ($-OH$), and Cyano ($-CN$).
- A carbon atom bonded to four different groups is chiral. Thus, it gives a **chiral product**.

Why other options are incorrect:

Option A is false; the reaction is base-catalyzed (requires free CN^-). Option C is false; it is an addition reaction, not condensation (no water is lost). Option D is false; it is an addition, not substitution.

Question #26 Key: (A)

BUMHS 2023

[Formula] hybridized carbon atom is present in: [BUMHS (2023)]

CORE CONCEPT AND DERIVATION

Hybridization of carbon is directly linked to the number of pi bonds it forms. A carbon with zero pi bonds is sp^3 , one pi bond is sp^2 , and two pi bonds is sp .

Solution:

- **Methanal** (Formaldehyde, $HCHO$) contains a carbonyl group ($C = O$).
- The carbon atom is double-bonded to the oxygen, meaning it participates in one sigma bond and one pi bond with the oxygen, and two single sigma bonds with the hydrogens.
- Three electron domains require three hybrid orbitals, resulting in sp^2 hybridization.

Why other options are incorrect:

Methanol, Ethanol, and Propanol are all saturated alcohols. Every carbon atom in these molecules is bonded exclusively by single bonds, making them all entirely sp^3 hybridized.

Question #27 Key: (C)

NUMS 2023

[Formula] is the general formula of: [NUMS (2023)]

CORE CONCEPT AND DERIVATION

General chemical formulas can identify entire homologous series based on their degree of unsaturation.

Solution:

- The formula for an open-chain, fully saturated alkane is C_nH_{2n+2} .
- The general formula $C_nH_{2n}O$ is missing two hydrogen atoms compared to a saturated alkane, which indicates exactly one degree of unsaturation (one double bond or one ring).
- Since the oxygen is present, this double bond is between carbon and oxygen ($C=O$).
- This characteristic matches the structure of open-chain aliphatic **Aldehydes and Ketones**.

Why other options are incorrect:

Ethers are fully saturated and have the formula $C_nH_{2n+2}O$. Carboxylic acids have two oxygen atoms, so their formula is $C_nH_{2n}O_2$. Carboic acid is phenol, an aromatic ring with a vast hydrogen deficiency.

Question #28 Key: (A)

NUMS 2023

Catalytic reduction of aldehyde & ketones forms: [NUMS (2023)]

CORE CONCEPT AND DERIVATION

Catalytic reduction involves the addition of hydrogen across a pi bond using a metal catalyst.

Formula:**Solution:**

- When aldehydes and ketones are exposed to H_2 gas with a metal catalyst (Pd, Pt, Ni), the $C=O$ pi bond is broken.
- A hydrogen atom bonds to the carbon, and another bonds to the oxygen.
- This transforms the carbonyl group into a hydroxyl group.
- The resulting functional group is an **Alcohol** (primary from aldehydes, secondary from ketones).

Why other options are incorrect:

Carboxylic acids are oxidation products. Alkanes require aggressive deoxygenation (like Clemmensen), not mild catalytic hydrogenation. Aldehydes are the starting material, not the reduced product.

Question #29 Key: (A)

UHS 2022

Which of the following is the correct name of [Formula]? [UHS (2022)]

CORE CONCEPT AND DERIVATION

When a molecule contains both an aldehyde ($-CHO$) and a ketone ($>C=O$) group, the aldehyde has higher priority in IUPAC nomenclature and dictates the parent chain and suffix.

Solution:

- The longest carbon chain containing both groups has 6 carbon atoms, so the parent name is **hexanal**.
- Numbering starts from the highly prioritized aldehyde carbon (C1).
- Counting down the chain: C1 (aldehyde), C2 ($-CH_2-$), C3 (ketone $C=O$).
- Because the ketone is treated as a substituent, it is named using the prefix **oxo-** (or keto-) at position 3.
- Therefore, the correct IUPAC name is **3-oxohexanal**.

Why other options are incorrect:

Options B and D end in '-ol', implying an alcohol is the principal functional group, which is false. Option C uses '-one' as a prefix, which is incorrect (it is a suffix for ketones when they have highest priority).

Question #30 Key: (D)

UHS 2022

Which of the following is also called silver mirror test? [UHS (2022)]

CORE CONCEPT AND DERIVATION

Aldehydes are easily oxidized, and this property is exploited in chemical identification tests using mild oxidizing agents.

Solution:

- Tollen's reagent consists of an ammoniacal silver nitrate solution containing the diamminesilver(I) complex, $[Ag(NH_3)_2]^+$.
- When heated with an aldehyde, the Ag^+ ions are reduced to solid elemental silver (Ag).
- This silver deposits on the inner glass surface of the test tube, creating a highly reflective surface, hence the name **Silver Mirror Test**.

Why other options are incorrect:

Benedict's and Fehling's tests produce a brick-red precipitate of Copper(I) oxide. The Iodoform test produces a yellow precipitate of triiodomethane.

Question #31 Key: (A)

SZABMU 2022

Catalytic reduction of aldehyde & ketone forms: [SZABMU (2022)]

CORE CONCEPT AND DERIVATIONCatalytic reduction involves adding molecular hydrogen (H_2) across a double bond in the presence of a metal catalyst (like Ni, Pd, or Pt).

Formula:



Solution:

- The catalytic hydrogenation of the highly polarized carbonyl ($C=O$) double bond results in the addition of one hydrogen to the carbon and one to the oxygen.
- This transforms the carbonyl group into a hydroxyl group ($-OH$).
- Aldehydes reduce to primary alcohols, and ketones reduce to secondary alcohols. Thus, the general product class is **Alcohols**.

Why other options are incorrect:

Carboxylic acids are products of oxidation, not reduction. Alkanes require severe deoxygenating conditions (like Clemmensen or Wolff-Kishner reduction), not standard catalytic hydrogenation.

Question #32 Key: (D)

SZABMU 2022

When aldehyde reacts with 50% NaOH, this reaction is called as: [SZABMU (2022)]

CORE CONCEPT AND DERIVATION

Aldehydes lacking an alpha-hydrogen undergo a unique disproportionation reaction when exposed to concentrated strong bases.

Solution:

- A 50% aqueous solution of NaOH is a highly concentrated base.
- When an aldehyde with no alpha-hydrogens (like formaldehyde or benzaldehyde) is treated with this, it undergoes a self-oxidation-reduction.
- One molecule is reduced to an alcohol, while another is oxidized to a carboxylic acid salt. This specific process is known as **Cannizzaro's reaction**.

Why other options are incorrect:Aldol condensation requires dilute base (like 10% NaOH) and aldehydes possessing an alpha-hydrogen. Clemmensen is a reduction using $Zn(Hg)/HCl$. 2,4-DNPH is a condensation test for carbonyls.**Question #33** Key: (D)

KMU 2022

Acetone reacts with hydrogen cyanide ([Formula]) to form a cyanohydrin. It is an example of: [ETEA (2022)]

CORE CONCEPT AND DERIVATIONThe carbonyl group ($C=O$) features an electrophilic carbon atom due to the electronegative oxygen pulling the pi electrons away from it.

Solution:

- In the reaction with HCN , the attacking species is the cyanide nucleophile (CN^-).
- The nucleophile attacks the partially positive carbonyl carbon, breaking the π bond and transferring the electrons onto oxygen.
- Oxygen is subsequently protonated to form an alcohol group. Since two molecules (acetone and HCN) combine completely to form one molecule (a cyanohydrin) without any leaving group, the mechanism is a **Nucleophilic addition**.

Why other options are incorrect:Electrophilic addition is typical of non-polar $C=C$ bonds. Substitution reactions require an atom or group to leave, which does not happen in cyanohydrin formation.**Question #34** Key: (B)

KMU 2022

Benedict's solution is the combination of: [ETEA (2022)]

CORE CONCEPT AND DERIVATION

Both Benedict's and Fehling's solutions use complexed Copper(II) ions as mild oxidizing agents, but they differ strictly in the chelating agent used to stabilize the copper.

Solution:

- Benedict's reagent** utilizes the citrate ion (from Citric acid) as the complexing agent in an alkaline solution (Na_2CO_3 or $NaOH$) to prevent the precipitation of Copper(II) hydroxide.
- Therefore, it is a mixture containing Copper ions, a strong base, and **Citric acid**.

Why other options are incorrect:

Option A describes Fehling's solution, which uses tartrate ions (Rochelle salt) instead of citrate. Option C describes Tollens' reagent (silver based). Option D lacks the active oxidizing agent (copper).

Question #35 Key: (D)

DUHS 2022

Acetone gives: [DUHS (2022)]

CORE CONCEPT AND DERIVATION

Acetone (propanone) is a ketone and exhibits chemical properties distinct from both aldehydes and alcohols.

Solution:

- Acetone has the structure $CH_3 - CO - CH_3$.
- Because it contains a methyl group directly bonded to the carbonyl carbon ($CH_3 - CO -$), it readily undergoes the haloform reaction.
- When treated with iodine and base, it yields a yellow precipitate of iodoform (CHI_3), making it **iodoform test positive**.

Why other options are incorrect:

Ketones strongly resist oxidation and will not give a positive Fehling's (A) or Silver Mirror (B) test. The Lucas test (C) is strictly for differentiating primary, secondary, and tertiary alcohols, not ketones.

Question #36 Key: (C)

DUHS 2022

Aldehyde reacts with: [DUHS (2022)]

CORE CONCEPT AND DERIVATION

The presence of a hydrogen atom attached directly to the carbonyl carbon makes aldehydes uniquely susceptible to oxidation.

Solution:

- Because of the oxidizable formyl hydrogen, aldehydes can be easily converted into carboxylic acids.
- They react readily with **mild oxidizing agents** (such as Tollens', Fehling's, and Benedict's reagents).
- Naturally, they will also react rapidly with **strong oxidizing agents** (such as acidified $KMnO_4$ or $K_2Cr_2O_7$).
- Therefore, aldehydes react with both mild and strong oxidizing agents.

Why other options are incorrect:

Option A is factually inverted (ketones are harder to oxidize). Option B is false. Option D ignores the fact that mild agents also successfully oxidize aldehydes.

Question #37 Key: (D)

DUHS 2022

Acetophenone is an: [DUHS (2022)]

CORE CONCEPT AND DERIVATION

The classification of ketones depends on the nature of the carbon groups (alkyl or aryl) attached directly to the carbonyl carbon.

Solution:

- Acetophenone has the chemical structure $C_6H_5 - CO - CH_3$.
- The carbonyl group ($C = O$) is attached directly to a phenyl ring (an aromatic group) on one side, and a methyl group (an aliphatic group) on the other.
- Because it contains at least one aromatic ring directly bonded to the carbonyl, it falls under the category of **Aromatic ketones**.

Why other options are incorrect:

Aliphatic ketones strictly have alkyl groups on both sides (e.g., acetone). Phenols have an $-OH$ group directly on a benzene ring. Carboxylic acids contain a $-COOH$ group.

Question #38 Key: (B)

DUHS 2022

Addition product of formaldehyde and ethyl alcohol is: [DUHS (2022)]

CORE CONCEPT AND DERIVATION

Alcohols react with aldehydes via a nucleophilic addition reaction to form unstable intermediates, which can further react to form stable ethers known as acetals.

Formula:**Solution:**

- When one equivalent of ethyl alcohol reacts with formaldehyde, a **hemiacetal** is formed (containing one $-OH$ and one $-OR$ group).
- Hemiacetals are generally unstable. In the presence of excess alcohol and an acid catalyst, a second molecule of alcohol substitutes the hydroxyl group, releasing water.
- The final saturated product, characterized by a single carbon bonded to two alkoxy ($-OR$) groups, is called an **Acetal**.

Why other options are incorrect:

The product cannot be an aldehyde, carboxylic acid, or acetone (a ketone) because those involve different oxidation states or carbon skeletons. Acetals are specialized di-ethers.

Question #39 Key: (A)

BUMHS 2022

What is the correct IUPAC name of the compound [Formula] ? [BMU (2022)]

CORE CONCEPT AND DERIVATION

When a formyl group ($-CHO$) is directly attached to a ring structure, IUPAC nomenclature rules append the suffix "-carbaldehyde" to the full name of the cyclic parent.

Solution:

- The structure $C_6H_5 - CHO$ represents a formyl group attached directly to a benzene ring.
- The parent ring is benzene.
- Adding the proper suffix for the external aldehyde group yields **Benzenecarbaldehyde** (commonly known as Benzaldehyde, which is also accepted by IUPAC, but Benzenecarbaldehyde is the systematic name).

Why other options are incorrect:

Options B, C, and D refer to a saturated cyclohexane ring, lacking the alternating double bonds (aromaticity) present in the C_6H_5 phenyl ring.

Question #40 Key: (D)

BUMHS 2022

What is the correct order of reactivity towards nucleophilic addition? [BMU (2022)]

CORE CONCEPT AND DERIVATION

Nucleophilic addition relies on the accessibility and electrophilicity (positive charge) of the carbonyl carbon. Aromatic rings decrease reactivity via electron-donating resonance (+R effect) and massive steric hindrance.

Solution:

- Benzaldehyde** ($C_6H_5 - CHO$): An aldehyde. It has one bulky phenyl group, but the other side is just a tiny hydrogen atom. Aldehydes are inherently more reactive than ketones.
- Acetophenone** ($C_6H_5 - CO - CH_3$): An aromatic ketone. It has one bulky phenyl group and one methyl group. The methyl group adds steric bulk and donates electron density (+I), lowering reactivity.
- Benzophenone** ($C_6H_5 - CO - C_6H_5$): A diaromatic ketone. It is severely sterically hindered by two massive phenyl rings, which also aggressively delocalize the positive charge away from the carbonyl carbon via resonance. It is the least reactive.
- Thus, the decreasing order is: **Benzaldehyde > Acetophenone > Benzophenone**.

Why other options are incorrect:

Any order placing a ketone ahead of an aldehyde (Options B, C) is incorrect. Option A incorrectly lists benzophenone as more reactive than acetophenone.

Question #41 Key: (A)

BUMHS 2022

Which of the following compounds will react with Tollens reagent to give metallic silver? [BMU (2022)]

CORE CONCEPT AND DERIVATION

Tollens' reagent is a highly specific mild oxidizing agent that detects the presence of the formyl group (aldehydes).

Solution:

- Methanal (Formaldehyde, $HCHO$) is an aldehyde.
- Because it contains an oxidizable carbon-hydrogen bond at the carbonyl center, it readily reduces the Ag^+ ions in Tollens' reagent to metallic silver (the silver mirror).

Why other options are incorrect:

Acetic acid (B) is already fully oxidized at the carbonyl carbon. Ethyl alcohol (C) requires strong oxidizing agents (like dichromate) to oxidize. Acetone (D) is a ketone and resists mild oxidation.

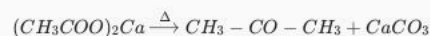
Question #42 Key: (C)

BUMHS 2022

Dry heating of calcium acetate gives which of the following? [BMU (2022)]

CORE CONCEPT AND DERIVATION

The dry distillation (strong heating without solvent) of calcium salts of carboxylic acids is a classic preparatory method for symmetric ketones.

Formula:**Solution:**

- Calcium acetate consists of a calcium ion bonded to two acetate (CH_3COO^-) molecules.
- Upon dry heating, the molecule undergoes thermal decomposition, eliminating a molecule of calcium carbonate ($CaCO_3$).
- The remaining fragments collapse into a single molecule containing a carbonyl bonded to two methyl groups, which is **Acetone** (Propanone).

Why other options are incorrect:

Acetaldehyde would require heating a mixture of calcium acetate and calcium formate. Acetic acid and ethane are not thermal decomposition products of this salt.

Question #43 Key: (A)

NUMS 2022

Cannizzaro's reaction is given by: [NUMS (2022)]

CORE CONCEPT AND DERIVATION

The Cannizzaro reaction is a disproportionation reaction specific to aldehydes that **lack alpha-hydrogen atoms**.

Solution:

- An alpha-hydrogen is a hydrogen atom attached to the carbon adjacent to the carbonyl group.
- Formaldehyde ($HCHO$) has no alpha-carbon whatsoever, and therefore possesses zero alpha-hydrogens.
- When treated with a strong concentrated base, it undergoes the Cannizzaro reaction to form methanol and sodium formate.

Why other options are incorrect:

Acetone, Acetaldehyde, and Butanone all possess alpha-hydrogens. When exposed to a base, they prefer to undergo deprotonation to form an enolate, driving the Aldol Condensation instead.

Question #44 Key: (C)

NUMS 2022

The identification test for Ketone is: [NUMS (2022)]

CORE CONCEPT AND DERIVATION

Chemical tests differentiate functional groups based on unique color changes resulting from specific reactions.

Solution:

- The **Sodium Nitroprusside test** is used specifically to detect ketones (particularly methyl ketones).
- When an alkaline solution of sodium nitroprusside is added to a ketone, the enolate anion of the ketone forms a complex with the nitroprusside ion.
- This produces a characteristic intense red or purple coloration. Aldehydes do not give this specific color change.

Why other options are incorrect:

Options A, B, and D are all mild oxidation tests specifically designed to yield positive results for *aldehydes*, while ketones give negative results.

Question #45 Key: (B)

PMDC 2021

Which of the following show positive iodoform test? [PMC (2021)]

CORE CONCEPT AND DERIVATION

The Iodoform test requires the presence of a methyl group adjacent to the carbonyl carbon ($CH_3 - CO -$).

Solution:

- Acetaldehyde has the structure $CH_3 - CHO$.
- Because it contains the essential $CH_3 - CO -$ structural motif, it reacts with iodine and a base to form a yellow precipitate of Iodoform (CHI_3).
- Acetaldehyde is, in fact, the **only** aldehyde that gives a positive Iodoform test.

Why other options are incorrect:

Butanol (1-butanol) lacks the $CH_3 - CH(OH) -$ group. 3-pentanone (diethyl ketone) has ethyl groups adjacent to the carbonyl, not methyl groups. Formaldehyde ($HCHO$) lacks a methyl group entirely.

Question #46 Key: (A)

PMDC 2021

How many carbon attached to carbonyl carbon in ketone? [PMC (2021)]

CORE CONCEPT AND DERIVATION

The functional classification of carbonyl compounds is based on what atoms are directly attached to the carbonyl carbon ($C = O$).

Solution:

- By definition, a ketone has the general formula $R - CO - R'$.
- The carbonyl carbon must be situated between two other carbon chains (alkyl or aryl groups).
- Therefore, exactly **2** carbon atoms are directly bonded to the carbonyl carbon in any ketone.

Why other options are incorrect:

If only 1 carbon is attached (and the other bond goes to hydrogen), it is an aldehyde. If 0 carbons are attached, it is formaldehyde. A carbon atom cannot form more than 4 bonds, and since 2 bonds go to oxygen, attaching 3 or 4 carbons is physically impossible.

Question #47 Key: (C)

PMDC 2021

In aldol condensation carbanion acts as: [PMC (2021)]

CORE CONCEPT AND DERIVATION

The aldol condensation mechanism is driven by the interaction between electron-rich and electron-poor species.

Solution:

- In the first step, a base removes an alpha-hydrogen from a carbonyl compound to generate a resonance-stabilized **carbanion** (an enolate).
- This carbanion is electron-rich due to the negative charge on the carbon.
- In the next step, this carbanion attacks the partially positive, electron-deficient carbonyl carbon of a second, un-ionized molecule.
- Because it donates a pair of electrons to form a new bond with an electrophile, the carbanion is acting as a **Nucleophile**.

Why other options are incorrect:

It cannot act as an electrophile because it is electron-rich, not electron-deficient. While it formed via acid-base chemistry, in the crucial carbon-carbon bond forming step, it acts functionally as a nucleophile.

Question #48 Key: (B)

PMDC 2021

The carbonyl compound which is attached with at least one H atom at one side is called as _ ? [PMC (2021)]

CORE CONCEPT AND DERIVATION

Organic functional groups are strictly defined by their atomic arrangements.

Solution:

- A carbonyl group consists of a carbon double-bonded to an oxygen ($C=O$).
- If this carbonyl carbon is bonded to at least one hydrogen atom (yielding the $-CHO$ group), the compound is classified as an **Aldehyde**.
- The simplest example is formaldehyde, where the carbon is attached to two hydrogen atoms. All other aldehydes have one hydrogen and one alkyl/aryl group.

Why other options are incorrect:

Ketones have two carbon groups attached to the carbonyl carbon and NO hydrogens. Ethers contain an oxygen single-bonded to two carbons ($C-O-C$). Alkyl halides contain halogens.

Question #49 Key: (C)

PMDC 2020

The common name of following aldehyde is: [Formula] [NMDCAT (2020)]

CORE CONCEPT AND DERIVATION

In common nomenclature of aldehydes, the carbon chain is named after the corresponding carboxylic acid, and substituent positions are indicated by Greek letters starting from the carbon adjacent to the carbonyl group.

Solution:

- The chain contains 3 continuous carbons ending in a formyl group, making the parent name "propionaldehyde".
- The carbon immediately attached to the $-CHO$ group is the α -**carbon**. Here, it has a methyl group attached.
- The next carbon along the chain is the β -**carbon**. Here, it has a chlorine atom attached.
- Arranging alphabetically, we get β -**Chloro**- α -**Methyl** **propionaldehyde**.

Why other options are incorrect:

The options mismatch the Greek letter assignments. There is no γ carbon in the main three-carbon chain of this specific molecule, making options A and B structurally impossible.

Question #50 Key: (C)

PMDC 2020

Which of the following reagent is used to separate and purify carbonyl and non-carbonyl compounds? [NMDCAT (2020...)]

CORE CONCEPT AND DERIVATION

Chemical separation relies on forming a reversible derivative with significantly different physical properties from the impurities.

Solution:

- Saturated aqueous Sodium Bisulfite ($NaHSO_3$) reacts with aldehydes and small methyl ketones via nucleophilic addition to form crystalline bisulfite adducts.
- These solid adducts can be easily filtered out, separating them from non-carbonyl impurities (which remain in liquid/solution).
- Once separated, the pure carbonyl compound can be regenerated by treating the solid adduct with dilute acid or base.

Why other options are incorrect:

HCN and Grignard reagents (like $BrMgCH_3$) form irreversible products (cyanohydrins and alcohols, respectively), meaning you cannot easily recover the original aldehyde or ketone. Water does not react distinctively to separate them.

Question #51 Key: (B)

PMDC 2020

Secondary alcohol is the product of reduction of which carbonyl compound? [NMDCAT (2020)]

CORE CONCEPT AND DERIVATION

Reduction involves the addition of hydrogen across the carbonyl ($C=O$) double bond.

Solution:

- When an aldehyde ($R-CHO$) is reduced, it forms a primary alcohol ($R-CH_2OH$).
- When a ketone ($R-CO-R'$) is reduced, it forms a secondary alcohol ($R-CH(OH)-R'$).
- Option B is Acetone ($CH_3-CO-CH_3$), a ketone. Upon reduction, it yields 2-propanol, which is a secondary alcohol.

Why other options are incorrect:

Options A (acetaldehyde), C (formaldehyde), and D (propanal) are all aldehydes. Their reduction yields primary alcohols (ethanol, methanol, and 1-propanol, respectively).

Question #52 Key: (B)

SET 2019

For the reaction sequence below, what is the final indication of the product N? [Formula] $H_3C-CH_2-OH \xrightarrow{\text{...}}$

CORE CONCEPT AND DERIVATION

This sequence involves forming an aldehyde and then testing it with Tollens' reagent.

Solution:

- Step 1:** Ethanol (CH_3CH_2OH) is oxidized by acidified potassium dichromate. Assuming immediate distillation (standard context for M), the product M is Acetaldehyde (CH_3CHO).
- Step 2:** Compound M is reacted with ammoniacal silver nitrate ($AgNO_3/NH_4OH$), which is Tollen's reagent.
- Acetaldehyde reduces the Silver(I) ions to metallic silver (N), which coats the glass as a distinct **Silver mirror**.

Why other options are incorrect:

Red precipitate is the result of Fehling's or Benedict's test, not Tollens'. Blue and white precipitates are not associated with this specific reaction sequence.

Question #53 Key: (B)

SET 2019

Which of the following compounds will produce a yellow precipitate with [Formula] dissolved in [Formula]? [SE...]

CORE CONCEPT AND DERIVATION

The reagent mixture of I_2 and $NaOH$ is used for the Iodoform Test, which yields a yellow precipitate of CHI_3 only for methyl ketones or specific secondary alcohols.

Solution:

- We must look for a compound containing the CH_3-CO- structural fragment.
- Option B is 2-butanone (ethyl methyl ketone), with the structure $CH_3-CH_2-CO-CH_3$.
- Because it has a methyl group directly bonded to the carbonyl carbon, it gives a strong positive Iodoform test.

Why other options are incorrect:

Option A is an ester. Option C is methanol, which lacks a methyl adjacent to a $C-O$ bond. Option D is propanal, an aldehyde that lacks a terminal methyl attached to the carbonyl group.

Question #54 Key: (A)

SET 2019

Which of the following reagent is used to distinguish between [Formula] and [Formula]? [SET (2019)]

CORE CONCEPT AND DERIVATION

To distinguish between a pure alcohol (a diol) and an alcohol that also contains an aldehyde group, we need a reagent that reacts exclusively with one functional group.

Solution:

- The first compound is 1,2-butanediol (contains only hydroxyl groups).
- The second compound is 2-hydroxybutanal (contains a hydroxyl group AND an aldehyde group).
- 2,4-DNPH reacts specifically with carbonyl compounds (aldehydes and ketones) to form brightly colored hydrazone precipitates.
- Therefore, 2,4-DNPH will react with the second compound (forming a precipitate) but will not react with the first compound.

Why other options are incorrect:

Strong oxidizers like Potassium manganate would oxidize both compounds. Dilute acid will not yield a clear visual discriminatory reaction. Sodium nitroprusside is used for methyl ketones, not aldehydes.

Question #55 Key: (D)

SET 2019

Which one of the following reagents can be used to detect an aldehyde?
[SET (2019)]

CORE CONCEPT AND DERIVATION

Tollen's reagent is a classic, mild oxidizing agent specifically utilized to detect the presence of the easily oxidizable formyl group ($-CHO$).

Solution:

- Tollen's reagent (ammoniacal silver nitrate) oxidizes aldehydes to carboxylate ions.
- During the process, Silver(I) is reduced to elemental silver, forming a visible "silver mirror."
- Ketones and most other functional groups do not react, making it highly specific for aldehydes.

Why other options are incorrect:

Tetraethyl lead was an anti-knock agent in gasoline. Alcoholic KOH is used for dehydrohalogenation (elimination reactions). Acidified copper chloride is not a standard aldehyde test.

Question #56 Key: (B)

NUMS 2019

Hybridization of carbon in [Formula] group is: [NUMS (2019)]

CORE CONCEPT AND DERIVATION

Hybridization is determined by counting the number of electron domains (sigma bonds and lone pairs) around an atom.

Solution:

- In the formyl group ($-CHO$), the central carbon atom is double-bonded to an oxygen atom and single-bonded to a hydrogen atom and the rest of the R-group.
- This gives the carbon atom three electron domains (three regions of electron density).
- To accommodate three domains, one s-orbital mixes with two p-orbitals to form three sp^2 hybridized orbitals, leaving one unhybridized p-orbital to form the π bond with oxygen.
- The geometry is trigonal planar with bond angles of approximately 120° .

Why other options are incorrect:

sp^3 hybridization occurs in single-bonded carbons (tetrahedral). sp hybridization occurs with triple bonds or two consecutive double bonds (linear).

Question #57 Key: (B)

NUMS 2019

Carbonyl group undergo: [NUMS (2019)]

CORE CONCEPT AND DERIVATION

The reactivity of a functional group is dictated by its polarization. The carbonyl group ($C=O$) has a highly polarized double bond.

Solution:

- Due to oxygen's higher electronegativity, the carbonyl carbon bears a partial positive charge (δ^+), making it an electrophilic center.
- Nucleophiles (electron-rich species) are attracted to this carbon and attack it, breaking the π bond.
- Since two molecules combine into one without losing any atoms, it is an addition reaction.
- Therefore, the characteristic reaction is a **Nucleophilic addition reaction**.

Why other options are incorrect:

Electrophilic addition is typical of alkenes ($C=C$). Substitution reactions require a good leaving group, which aldehydes and ketones lack (unlike acyl chlorides or esters).

Question #58 Key: (A)

KMU 2019

Which one is more reactive? [ETEA (2019)]

CORE CONCEPT AND DERIVATION

Reactivity of carbonyl compounds toward nucleophilic addition is governed by two major factors: Steric hindrance and Electronic (inductive) effects.

Solution:

- **Steric Factor:** Formaldehyde ($HCHO$) has only two tiny hydrogen atoms attached to the carbonyl carbon, leaving it completely exposed to nucleophilic attack.
- **Electronic Factor:** Alkyl groups (like $-CH_3$) are electron-donating (via the +I effect). They push electron density toward the carbonyl carbon, reducing its partial positive charge and thus its electrophilicity.
- Formaldehyde has no alkyl groups, making its carbonyl carbon the most electrophilic.
- Therefore, Formaldehyde is the most reactive of the series.

Why other options are incorrect:

Acetaldehyde (CH_3CHO) has one electron-donating methyl group. Acetone ($(CH_3)_2CO$) has two, making it the least reactive of the three due to maximum steric hindrance and electron donation.

Question #59 Key: (C)

KMU 2019

Hydration of hydrocarbon give carbonyl compound, the general formula of that hydrocarbon is: [ETEA (2019)]

CORE CONCEPT AND DERIVATION

The direct catalytic hydration (addition of water) to a hydrocarbon yields a carbonyl compound only if the hydrocarbon is an alkyne.

Formula:



Solution:

- When alkynes are hydrated using mercuric sulfate and sulfuric acid, they form unstable enol intermediates.
- These enols rapidly undergo tautomerization to form stable aldehydes or ketones.
- The general formula for an alkyne (containing one triple bond) is C_nH_{2n-2} .

Why other options are incorrect:

Option A (C_nH_{2n+2}) is an alkane, which does not undergo hydration.
Option B (C_nH_{2n}) is an alkene, which yields an alcohol upon hydration, not a carbonyl compound.

Question #60 Key: (C)

MDCAT 2019

Identification test for functional groups of organic compounds are associated with specific observations. Toll...

CORE CONCEPT AND DERIVATION

Tollens' reagent is a specific chemical test used to differentiate easily oxidizable functional groups from more stable ones.

Solution:

- Tollens' reagent reacts positively only with **Aldehydes** (Functional group X).
- During the reaction, the aldehyde reduces the Silver(I) ions in the reagent to metallic silver.
- This elemental silver coats the inside of the reaction vessel, providing the visual observation (O) known as a **Silver mirror**.

Why other options are incorrect:

Option A pairs aldehydes with a red precipitate, which is characteristic of Fehling's or Benedict's tests, not Tollens'. Options B and D suggest ketones react, but ketones do not undergo mild oxidation with Tollens' reagent.

Question #61 Key: (C)

MDCAT 2019

Which of the following will give a positive test with Tollens' reagent? [MDCAT (2019)]

CORE CONCEPT AND DERIVATION

Tollens' reagent is a mild oxidizing agent (ammoniacal silver nitrate).

Solution:

- Because aldehydes possess a hydrogen atom bonded directly to the carbonyl carbon, they are easily oxidized to carboxylic acids.
- This oxidation provides the electrons necessary to reduce the silver ions in Tollens' reagent, yielding the positive "silver mirror" test.

Why other options are incorrect:

Ketones lack the hydrogen on the carbonyl carbon and cannot be oxidized by mild agents. Tertiary alcohols strongly resist oxidation entirely. Carboxylic acids are already fully oxidized at the carbonyl carbon.

Question #62 Key: (C)

MDCAT 2019

Which type of reaction takes place when a carbonyl compound is treated with a mixture of [Formula] and an acid...

CORE CONCEPT AND DERIVATION

The reaction mechanism depends on the polarity of the substrate and the nature of the attacking reagent.

Solution:

- A mixture of $NaCN$ and an acid generates Hydrogen Cyanide (HCN) in situ, which provides the strong nucleophile, CN^- .
- The carbonyl carbon is highly electrophilic due to the electron-withdrawing oxygen atom.
- The CN^- nucleophile attacks this carbon, breaking the $C = O$ pi bond and adding completely to the molecule to form a cyanohydrin.
- Thus, the mechanism is a **Nucleophilic addition reaction**.

Why other options are incorrect:

Electrophilic addition is typical of non-polar double bonds (alkenes). Substitution requires a leaving group to depart, which does not happen here (the oxygen stays attached).

Question #63 **Key: (A)**

MDCAT 2019

Which of the following compounds will give a secondary alcohol after reaction with [Formula] ? [MDCAT (2019)]

CORE CONCEPT AND DERIVATION

Sodium borohydride ($NaBH_4$) is a mild reducing agent that specifically reduces aldehydes and ketones to their corresponding alcohols.

Solution:

- Aldehydes are reduced to primary alcohols.
- Ketones are reduced to secondary alcohols.
- Looking at the options, Option A (CH_3COCH_3) is propanone, a ketone. Upon reduction by adding hydrogen across the double bond, it yields 2-propanol ($CH_3CH(OH)CH_3$), which is a secondary alcohol.

Why other options are incorrect:

Option B is an aldehyde, which reduces to a primary alcohol (1-propanol). Options C and D are a carboxylic acid and an ester, respectively; $NaBH_4$ is too weak to efficiently reduce them (they require stronger agents like $LiAlH_4$).

Question #64 **Key: (D)**

MDCAT 2018

Why is it necessary to distill aldehyde formed from oxidation of primary alcohol through acidified per dichrom...

CORE CONCEPT AND DERIVATION

Primary alcohols oxidize sequentially: first to an aldehyde, and then immediately to a carboxylic acid if left in the oxidizing environment.

Solution:

- Dichromate is a strong oxidizing agent.
- Once the primary alcohol is oxidized to an aldehyde, the aldehyde itself is extremely susceptible to further oxidation.
- To prevent the aldehyde from converting completely into a carboxylic acid, it must be removed from the reaction mixture immediately.
- Since aldehydes have lower boiling points than their parent alcohols and the resulting acids (due to lack of hydrogen bonding), they can be selectively boiled off (distilled) as soon as they form.

Why other options are incorrect:

Aldehydes do not spontaneously decompose back to alcohols (oxidation is not easily reversible here). Aldehydes cannot be oxidized to ketones because the carbonyl is at the end of the chain, so it strictly forms a carboxylic acid.

Question #65 **Key: (C)**

MDCAT 2017

In the reaction, "?" represents which one of the following products: [Formula] \text{Primary Alcohol} \xrightarrow{...}

CORE CONCEPT AND DERIVATION

The sequential oxidation of a primary alcohol involves a two-step pathway before fully converting to a carboxylic acid.

Solution:

- A primary alcohol ($R - CH_2OH$) contains two oxidizable hydrogen atoms on the carbon bearing the hydroxyl group.
- In the first oxidation step, these hydrogens are removed to form a carbonyl double bond at the terminal position, yielding an **Aldehyde** ($R - CHO$).
- If oxidation continues, the highly reactive aldehyde bond is further oxidized by inserting an oxygen atom, producing a Carboxylic Acid ($R - COOH$).

Why other options are incorrect:

Ketones are formed by the oxidation of secondary alcohols. Formic acid is a specific final product (if starting from methanol), not the intermediate. Ethers are not oxidation products of alcohols.

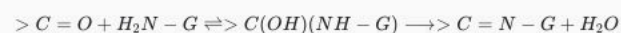
Question #66 **Key: (D)**

MDCAT 2017

The reaction of aldehydes and ketones with ammonia derivative [Formula] to form compounds containing the group...

CORE CONCEPT AND DERIVATION

The reaction between a carbonyl compound and a primary amine derivative (like hydroxylamine, hydrazine, etc.) proceeds via a two-step mechanism.

Formula:**Solution:**

- Step 1 (Addition):** The nucleophilic nitrogen atom attacks the electrophilic carbonyl carbon, forming a tetrahedral carbinolamine intermediate.
- Step 2 (Elimination):** The intermediate is unstable and rapidly eliminates a molecule of water to form a stable carbon-nitrogen double bond.
- Because the process requires both of these steps, it is formally classified as an **Addition-Elimination** reaction.

Why other options are incorrect:

Nucleophilic addition is only half the story; it ignores the water elimination. Electrophilic addition occurs in alkenes. Nucleophilic substitution typically involves replacing a leaving group attached to an sp^3 hybridized carbon, which is not the case here.

Question #67 Key: (A)

MDCAT 2017

Ethanal reacts with HCN to form cyanohydrin. It is an example of: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

Carbonyl compounds (aldehydes and ketones) undergo reactions initiated by nucleophiles because the carbonyl carbon is electron-deficient (partially positive).

Solution:

- In the reaction with HCN, the attacking species is the strong nucleophile CN^- .
- The CN^- attacks the electrophilic carbonyl carbon of ethanal, adding itself to the molecule.
- The π bond breaks and the oxygen accepts a proton, creating a single tetrahedral product. Because two molecules merge into one without any byproducts leaving, it is strictly an **addition** reaction.
- Thus, it is a Nucleophilic Addition reaction.

Why other options are incorrect:

Substitution implies replacing an atom, but here no atoms are lost. Electrophilic addition is characteristic of alkenes where the initial attack is by an electrophile (like H^+), not a nucleophile.

Question #68 Key: (A)

MDCAT 2017

What will be the product of the reaction given below: [Formula] $CH_3-C(=O)-C_2H_5 + HCN \xrightarrow{NaCN}$...

CORE CONCEPT AND DERIVATION

The reaction of a ketone with HCN produces a cyanohydrin. The alkyl groups originally on the ketone remain firmly attached to the central carbon.

Solution:

- The starting material is 2-butanone (ethyl methyl ketone), which has one methyl group (CH_3) and one ethyl group (C_2H_5) attached to the carbonyl carbon.
- The nucleophile CN^- attacks the carbonyl carbon, converting the $C=O$ to $C-OH$ after protonation.
- The resulting cyanohydrin will still have the methyl and ethyl groups attached to that central carbon: $CH_3(C_2H_5)C(OH)CN$.

Why other options are incorrect:

Option B is the cyanohydrin of acetone. Option C is the cyanohydrin of formaldehyde. Option D is the cyanohydrin of 3-pentanone (diethyl ketone).

Question #69 Key: (C)

MDCAT 2017

Which one of the following compounds will give iodoform test on treatment with aqueous iodine? [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

The iodoform test is highly specific for the methyl ketone structural motif: a carbonyl carbon bonded directly to a terminal methyl group (CH_3-CO-).

Solution:

- Let's examine the structure of Propanone (acetone): $CH_3-CO-CH_3$.
- Propanone possesses two methyl groups attached to the carbonyl group. Therefore, it contains the necessary CH_3-CO- unit.
- When treated with iodine and base, it rapidly undergoes halogenation and cleavage to form the yellow precipitate of iodoform (CHI_3).

Why other options are incorrect:

3-pentanone ($CH_3CH_2-CO-CH_2CH_3$) lacks a terminal methyl attached to the carbonyl. Propanal and Butanal are aldehydes that lack the CH_3-CO- group (only acetaldehyde has it).

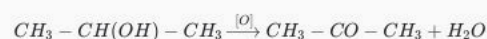
Question #70 Key: (C)

MDCAT 2017

2-propanol on Oxidation gives ____: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

Oxidation of alcohols structurally depends on the location of the hydroxyl group. Secondary alcohols always oxidize to ketones.

Formula:**Solution:**

- 2-propanol is a secondary alcohol because the carbon holding the $-OH$ group is attached to two other carbon atoms (methyl groups).
- During oxidation, two hydrogen atoms are removed (one from the oxygen, one from the adjacent carbon) to form a double bond.
- The resulting structure is propanone (acetone), which belongs to the class of **Ketones**.

Why other options are incorrect:

Aldehydes and Carboxylic acids are the oxidation products of primary alcohols, not secondary alcohols.

Question #71 Key: (C)

MDCAT 2017

Both aldehyde and ketones give ____: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

Identifying a reagent that reacts generically with the carbonyl group vs. one that relies on oxidation properties.

Solution:

- The 2,4-Dinitrophenylhydrazine (2,4-DNPH) reagent, also known as Brady's reagent, reacts via nucleophilic addition-elimination with the carbonyl group itself.
- Because both aldehydes and ketones possess an active carbonyl group, they both form yellow, orange, or red hydrazone precipitates with this reagent.

Why other options are incorrect:

Tollen's and Benedict's tests are mild oxidation tests; only aldehydes give positive results because ketones are highly resistant to oxidation. The Sodium nitroprusside test gives a wine-red color with ketones but not aldehydes.

Question #72 Key: (C)

MDCAT 2017

Which reagent is responsible for the conversion of ketone to secondary alcohol: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

To convert a ketone back into a secondary alcohol, a reduction reaction is required, which adds hydrogen across the $C=O$ double bond.

Solution:

- Sodium borohydride ($NaBH_4$) is a classic, mild hydride reducing agent.
- It selectively attacks the partially positive carbonyl carbon, transferring a hydride ion (H^-). After protonation, the ketone is successfully reduced to a secondary alcohol.

Why other options are incorrect:

Red Phosphorus is used in extreme reductions to alkanes (often with HI). Al metal alone is not a standard reducing agent for this. $NaAlH_4$ is highly reactive and less commonly used compared to $NaBH_4$ or $LiAlH_4$ for this specific selective reduction.

Question #73 Key: (C)

MDCAT 2017

To distinguish aldehyde from ketone which solution is used: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

Aldehydes have a hydrogen atom attached to the carbonyl carbon, making them easily oxidizable. Ketones lack this hydrogen and are very difficult to oxidize.

Solution:

- Fehling's solution is a mild oxidizing agent (containing complexed Copper(II) ions).
- When an aldehyde is heated with Fehling's solution, it is oxidized, and the copper is reduced to form a brick-red precipitate of Copper(I) oxide.
- Ketones do not react with Fehling's solution, making it a perfect discriminatory test.

Why other options are incorrect:

Strong oxidizing agents like $K_2Cr_2O_7$ under harsh conditions can sometimes cleave and oxidize ketones too, making it a poorer choice for simple qualitative discrimination compared to mild, specific reagents like Fehling's or Tollen's.

Question #74 Key: (C)

MDCAT 2017

Identify the compound, which give iodoform test: [MDCAT (2017)]

CORE CONCEPT AND DERIVATION

The prerequisite for a positive haloform (iodoform) test is the presence of a methyl group bonded directly to a carbonyl carbon (CH_3-CO-), or an alcohol that oxidizes to this structure ($CH_3-CH(OH)-$).

Solution:

- A "Methyl ketone" explicitly contains the required CH_3-CO- structural fragment.
- In the presence of iodine and a base, the three hydrogen atoms on the methyl group are replaced by iodine, followed by cleavage to yield a yellow precipitate of Iodoform (CHI_3).

Why other options are incorrect:

Methanol (CH_3OH) lacks the required CH_3-C-O linkage. 3-Hexanol oxidizes to 3-hexanone (ethyl propyl ketone), which lacks a terminal methyl ketone. Propionaldehyde (CH_3CH_2CHO) lacks a terminal methyl group directly attached to the carbonyl carbon.

Question #75 Key: (D)

MDCAT 2016

Which one of the following is IUPAC name of the structure [Formula] ?
[MDCAT (2016)]

CORE CONCEPT AND DERIVATION

In IUPAC nomenclature, aldehydes are named by replacing the terminal '-e' of the corresponding parent alkane with the suffix '-al'.

Solution:

- The given structure $H - C(=O) - H$ contains exactly one carbon atom.
- The parent alkane with one carbon is methane.
- Replacing the '-e' with '-al' yields **Methanal**.

Why other options are incorrect:

Acetaldehyde is the common name for ethanal (2 carbons). Methanone is chemically impossible because a ketone strictly requires a minimum of three carbon atoms (the carbonyl carbon must be flanked by two other carbons). Propanaldehyde has 3 carbons.

Question #76 Key: (D)

MDCAT 2016

[Formula] . It is a general formula of: [MDCAT (2016)]

CORE CONCEPT AND DERIVATION

The nomenclature of the product reflects both the carbonyl parent and the hydrazine derivative used in the condensation reaction.

Solution:

- The reactant used is 2,4-dinitrophenylhydrazine (often abbreviated as 2,4-DNPH).
- When this hydrazine derivative reacts with a carbonyl compound, water is eliminated and a $C = N$ double bond is formed.
- The suffix of the functional group changes from '-hydrazine' to '-hydrazone'.
- Therefore, the generic product $R - CH = N - NH - C_6H_3(NO_2)_2$ is called a 2,4-dinitrophenylhydrazone.

Why other options are incorrect:

Option A is the reactant, not the product. Option B lacks the nitro groups on the benzene ring. Option C has incorrect numbering (the nitro groups are at the 2 and 4 positions relative to the hydrazine linkage, not 1 and 3).

Question #77 Key: (B)

MDCAT 2016

Which one of the following test is given by both aldehyde and ketone? [MDCAT (2016)]

CORE CONCEPT AND DERIVATION

Analytical tests for carbonyl compounds take advantage of either oxidation-reduction chemistry or nucleophilic addition-elimination reactions.

Solution:

- The 2,4-dinitrophenylhydrazine (2,4-DNPH) test targets the carbonyl group ($C = O$) directly.
- Since both aldehydes and ketones contain a carbonyl group, both readily undergo condensation with 2,4-DNPH to form a yellow, orange, or red precipitate of a hydrazone.
- Therefore, this test is a universal indicator for the presence of aldehydes and ketones.

Why other options are incorrect:

The Silver mirror (Tollens'), Fehling's, and Benedict's tests are mild oxidation reactions. Aldehydes are easily oxidized, so they give positive results. Ketones resist mild oxidation, yielding negative results.

Question #78 Key: (A)

KMU 2016

The compound Aldehyde hydrazine is: [ETE (2016)]

CORE CONCEPT AND DERIVATION

When hydrazine ($H_2N - NH_2$) reacts with a carbonyl compound, water is eliminated to form a hydrazone.

Solution:

- An aldehyde has the general structure $R - CHO$.
- Reacting it with hydrazine removes the oxygen from the aldehyde and two hydrogens from one of the nitrogens in hydrazine.
- This forms a double bond between the aldehyde carbon and the nitrogen, resulting in the structure $R - CH = N - NH_2$.
- While commonly called a hydrazone, the option representing the "aldehyde hydrazine" (hydrazone) is clearly A.

Why other options are incorrect:

Option B represents a ketone hydrazone (two R groups on the carbon). Options C and D are chemically nonsensical structures with incorrect valencies and bonding for this reaction.

Question #79 Key: (D)

MDCAT 2015

When acetaldehyde reacts with 2,4-dinitrophenylhydrazine (2,4-DNPH), which one of the following products is fo...

CORE CONCEPT AND DERIVATION

Reactions of carbonyl compounds with 2,4-DNPH are condensation reactions where the = O of the carbonyl is replaced by = N - NH - Ar.

Formula:



Solution:

- Acetaldehyde has the formula CH_3CHO . The carbonyl carbon is bonded to one methyl group and one hydrogen atom.
- During the condensation with 2,4-DNPH, water is eliminated.
- The resulting product structure retains the CH_3 and H attached to the $C = N$ double bond, giving $CH_3CH = N - NH - C_6H_3(NO_2)_2$.

Why other options are incorrect:

Option A is the derivative of acetone. Option B is the derivative of formaldehyde. Option C is the derivative of propanal.

Question #80 Key: (A)

MDCAT 2015

Both aldehydes and ketones are planar to the neighborhoods of carbonyl (Formula) group. Which one of the f...

CORE CONCEPT AND DERIVATION

The carbonyl group ($> C = O$) is highly polar due to the electronegativity difference between carbon and oxygen.

Solution:

- Oxygen is significantly more electronegative than carbon.
- While both the σ and π bonds are polarized, the electrons in the π bond are held more loosely (side-to-side overlap) compared to the tightly held σ bond electrons (head-to-head overlap).
- Therefore, the electron cloud of the π bond is strongly distorted (pulled) towards the highly electronegative oxygen atom, creating a permanent dipole.

Why other options are incorrect:

The σ bond is more rigid and less polarizable. $C - H$ and $C - C$ bonds are virtually non-polar compared to the $C = O$ bond.

Question #81 Key: (B)

UHS 2015

Which one of the following is also called silver mirror test? [MDCAT (2015)]

CORE CONCEPT AND DERIVATION

Chemical tests for aldehydes often rely on the reduction of a metal complex to produce a distinct visual change.

Solution:

- Tollen's reagent is an ammoniacal solution of silver nitrate.
- When an aldehyde is warmed with Tollen's reagent, the aldehyde is oxidized while the Ag^+ ions are reduced to solid metallic silver (Ag).
- This silver coats the inner surface of the glass test tube, functioning as a literal mirror. Hence, it is commonly called the "silver mirror test."

Why other options are incorrect:

Fehling's and Benedict's tests produce a red precipitate of Cu_2O . The iodoform test produces a yellow precipitate of CHI_3 .

Question #82 Key: (D)

MDCAT 2014

A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilut...

CORE CONCEPT AND DERIVATION

The oxidation of a primary alcohol can yield either an aldehyde or a carboxylic acid, depending heavily on the reaction conditions.

Formula:



Solution:

- Ethyl alcohol (ethanol) is a primary alcohol.
- When oxidized with sodium dichromate ($Na_2Cr_2O_7$) and sulfuric acid, it first converts to acetaldehyde.
- Because aldehydes are highly susceptible to further oxidation into carboxylic acids, the student deliberately **distilled the product immediately**.
- Acetaldehyde has a much lower boiling point than both ethanol and acetic acid, allowing it to escape the oxidizing mixture rapidly before further oxidation can occur.

Why other options are incorrect:

If refluxed instead of distilled, the product would be acetic acid (Option C). Acetone is formed from 2-propanol, not ethanol. Dimethyl ether requires dehydration conditions (conc. H_2SO_4 at $140^\circ C$), not oxidation.

Question #83 Key: (D)

MDCAT 2014

The structure of formula of the product of reaction of acetone with 2,4-dinitrophenyl hydrazine is: [MDCAT (2014)]

CORE CONCEPT AND DERIVATION

Aldehydes and ketones react with 2,4-dinitrophenylhydrazine (2,4-DNPH) via a condensation reaction (nucleophilic addition followed by elimination of water) to form 2,4-dinitrophenylhydrazones.

Formula:**Solution:**

- Acetone has the formula $(CH_3)_2C=O$.
- During the reaction, the oxygen atom from the carbonyl group of acetone and the two hydrogen atoms from the primary amine group of 2,4-DNPH are removed as a water molecule.
- A new double bond forms between the carbonyl carbon and the nitrogen, giving the hydrazone structure $(CH_3)_2C=N-NH-C_6H_3(NO_2)_2$.

Why other options are incorrect:

Option B is the hydrazone of acetaldehyde. Option C is the hydrazone of 3-pentanone (diethyl ketone). Option A lacks the carbon-nitrogen double bond completely.

Question #84 Key: (B)

MDCAT 2014

For the reaction: $(CH_3)_2C(OH)CN \xrightarrow{\text{Base}} \text{[Formula]}$ [MDCAT (2014)]

CORE CONCEPT AND DERIVATION

The addition of hydrogen cyanide (HCN) to a carbonyl compound yields a cyanohydrin. By examining the alkyl groups on the central carbon of the product, we can deduce the original carbonyl reactant.

Solution:

- The product given is $(CH_3)_2C(OH)CN$.
- In a cyanohydrin, the central carbon was originally the carbonyl carbon ($C=O$).
- By removing the $-OH$ proton and the $-CN$ group to reform the $C=O$ bond, we are left with the two groups attached to that carbon: two methyl groups (CH_3).
- The carbonyl compound consisting of a carbonyl group bonded to two methyl groups is Acetone (CH_3COCH_3).

Why other options are incorrect:

If option A (2-butanone) were used, the product would have one ethyl and one methyl group. Option C is an alcohol, which doesn't react with HCN. Option D is an aldehyde, which would yield a cyanohydrin with an ethyl group.

Question #85 Key: (B)

MDCAT 2013

What is the structure of alcohol which on oxidation with acidified [Formula] gives [Formula]? [MDCAT (2013)]

CORE CONCEPT AND DERIVATION

Ketones are produced strictly by the oxidation of secondary alcohols.

Solution:

- The target product is acetophenone, $C_6H_5-CO-CH_3$, which is a ketone.
- To form this ketone, the precursor must be a secondary alcohol with the exact same carbon skeleton.
- Option B, 1-phenylethanol ($C_6H_5-CH(OH)CH_3$), is a secondary alcohol. Oxidation removes the two hydrogen atoms from the $CH-OH$ unit to form the $C=O$ double bond.

Why other options are incorrect:

Option A is a primary alcohol and would oxidize to a carboxylic acid. Option C is a phenol derivative. Option D is a tertiary alcohol, which strongly resists oxidation.

Question #86 Key: (D)

MDCAT 2013

Which of the following is the structure of a ketone? [MDCAT (2013)]

CORE CONCEPT AND DERIVATION

Ketones are organic compounds characterized by a carbonyl group ($C=O$) bonded strictly to two carbon atoms (alkyl or aryl groups).

Solution:

- Option D represents propanone (acetone), where the central carbonyl carbon is bonded to two methyl ($-CH_3$) groups. This perfectly fits the general ketone formula $R-CO-R'$.

Why other options are incorrect:

Option A is a carboxylic acid (acetic acid). Option B is an amide (acetamide). Option C is an acid chloride (acetyl chloride).

Question #87 Key: (D)

MDCAT 2013

Which group gives a yellow precipitate of triiodomethane when warmed with alkaline aqueous iodine? [MDCAT (201...]

CORE CONCEPT AND DERIVATION

The formation of a yellow precipitate of triiodomethane (CHI_3), also known as iodoform, is the definitive positive result of the Iodoform Test.

Solution:

- The reagents for this test are iodine (I_2) in an alkaline solution ($NaOH$).
- This specific reagent mixture cleaves and halogenates only those molecules possessing a specific structural motif: the methyl ketone group ($CH_3 - CO -$).
- The methyl group is fully iodinated to $CI_3 - CO - R$, which is then cleaved by the base to yield CHI_3 (iodoform).

Why other options are incorrect:

Amides do not undergo the haloform reaction. Propanol is a primary alcohol lacking the $CH_3 - CH(OH) -$ structure, so it cannot be oxidized to a methyl ketone.

Question #88 Key: (D)

MDCAT 2012

With acidified [Formula], what the product will be, when secondary alcohols are oxidized in same conditions?...

CORE CONCEPT AND DERIVATION

The oxidation of alcohols depends on their substitution class (primary, secondary, or tertiary).

Solution:

- Primary alcohols oxidize to aldehydes, and then further to carboxylic acids.
- Secondary alcohols contain a $> CH - OH$ group.
- When treated with a strong oxidizing agent like acidified Sodium Dichromate ($Na_2Cr_2O_7 / H_2SO_4$), secondary alcohols lose two hydrogen atoms to form a carbon-oxygen double bond, yielding a **ketone**.

Why other options are incorrect:

Alkenes are formed via dehydration, not oxidation. Alkyl halides require substitution with halogens. Alkynes require elimination of dihalides.

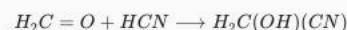
Question #89 Key: (C)

MDCAT 2012

Formaldehyde reacts with [Formula] ([Formula]) to give a compound: [MDCAT (2012)]

CORE CONCEPT AND DERIVATION

Aldehydes react with hydrogen cyanide (HCN) in a nucleophilic addition reaction to form cyanohydrins.

Formula:**Solution:**

- Formaldehyde ($HCHO$) has a central carbonyl carbon bonded to two hydrogen atoms.
- The cyanide nucleophile (CN^-) attacks the carbonyl carbon, and the oxygen gets protonated.
- The resulting product has both an $-OH$ group and a $-CN$ group attached to the same CH_2 carbon, making it formaldehyde cyanohydrin ($H_2C(OH)CN$).

Why other options are incorrect:

Option A is the cyanohydrin of acetaldehyde. Option B is an acyl cyanide. Option D is a dinitrile, which cannot form via this simple addition.

Question #90 Key: (A)

MDCAT 2012

Iodoform test will NOT be positive with: [MDCAT (2012)]

CORE CONCEPT AND DERIVATION

The Iodoform test is highly specific. It is strictly positive for compounds containing a methyl ketone group ($CH_3 - CO -$) or alcohols that can be oxidized to a methyl ketone group ($CH_3 - CH(OH) -$).

Solution:

- Option A (3-pentanone or diethyl ketone) has the structure $CH_3 - CH_2 - CO - CH_2 - CH_3$. It lacks the terminal $CH_3 - CO -$ required for the haloform reaction. Thus, it will not give a positive test.

Why other options are incorrect:

Ethanol (Option B) oxidizes to acetaldehyde, giving a positive test. 2-butanone (Option C) contains a methyl ketone group. Acetaldehyde (Option D) is the only aldehyde that gives a positive iodoform test.

Question #91 Key: (C)

MDCAT 2011

Which of the following compounds belong to homologous series of aldehydes? [MDCAT (2011)]

CORE CONCEPT AND DERIVATION

A homologous series consists of compounds containing the same functional group. For aldehydes, the functional group is the formyl group ($-CHO$).

Solution:

- Option C is $H-CHO$, which is methanal (formaldehyde).
- Since it contains the characteristic $-CHO$ group, it belongs to the homologous series of aldehydes.

Why other options are incorrect:

Option A is an acid chloride (formyl chloride). Option B is an amide (formamide). Option D is an ester (methyl formate).

Question #92 Key: (A)

MDCAT 2011

Consider the reaction: $[Formula] HCHO + HCN \longrightarrow H_2C(OH)CN$ [Formula] In the above reaction nucleop...

CORE CONCEPT AND DERIVATION

The addition of Hydrogen Cyanide (HCN) to a carbonyl compound is a base-catalyzed nucleophilic addition reaction.

Solution:

- The base removes a proton from HCN to generate the active nucleophile, the cyanide ion (CN^-).
- The CN^- ion attacks the electrophilic carbonyl carbon of formaldehyde ($HCHO$), breaking the carbon-oxygen π bond to form an intermediate alkoxide.
- Protonation of the alkoxide yields the final cyanohydrin product.

Why other options are incorrect:

HCl is an acid, not a nucleophile. Cl^- and OH^- are not involved as the attacking species forming the new carbon-carbon bond in this specific reaction.

Question #93 Key: (D)

MDCAT 2011

Consider the following reaction: $[Formula] R-CHO + 2[Ag(NH_3)_2]OH \longrightarrow RCOONH_4 + 2Ag \downarrow + \dots$

CORE CONCEPT AND DERIVATION

Tollens' reagent is an ammoniacal solution of silver nitrate, containing the diamminesilver(I) complex ion, $[Ag(NH_3)_2]^+$.

Solution:

- Aldehydes readily reduce the Ag^+ ions in Tollens' reagent to elemental silver (Ag).
- The elemental silver deposits on the inner walls of the test tube, creating a characteristic "silver mirror."
- The aldehyde itself is oxidized to a carboxylate salt.

Why other options are incorrect:

Fehling's and Benedict's tests utilize Copper(II) complexes and produce a brick-red precipitate of Copper(I) oxide. Ninhydrin test is used for detecting amino acids, not aldehydes.

Question #94 Key: (B)

MDCAT 2010

Brick red precipitate are formed when aldehyde reacts with: [MDCAT (2010)]

CORE CONCEPT AND DERIVATION

Aliphatic aldehydes are easily oxidized by mild oxidizing agents such as Fehling's solution, whereas ketones are not.

Formula:**Solution:**

- Fehling's solution contains complexed Copper(II) ions.
- When heated with an aliphatic aldehyde, the aldehyde is oxidized to a carboxylic acid.
- Simultaneously, the blue Cu^{2+} ions are reduced to Copper(I) oxide (Cu_2O), which precipitates as a distinct brick-red color.

Why other options are incorrect:

Sodium borohydride is a reducing agent. Sodium bisulphate forms white crystalline addition products. Formaldehyde is itself an aldehyde, not a test reagent.