	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**DEPARTMENT: SCIENCE (2026-27)** **SUBJECT: CHEMISTRY**	**Date: 07/08/2026**
Worksheet: 05	**TOPIC: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS**	**Note:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS (1M)

1. Arrange the following in increasing order of their reactivity towards nucleophilic addition reaction.

(A) $HCHO < CH_3CHO < CH_3COCH_3 < C_6H_5COCH_3$
(B) $CH_3COCH_3 < C_6H_5COCH_3 < HCHO < CH_3CHO$
(C) $C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO < HCHO$
(D) $CH_3COCH_3 < CH_3CHO < C_6H_5COCH_3 < HCHO$

2. Identify the product obtained when ethanal is treated with dilute NaOH.

(A) $CH_3\text{-}\underset{\displaystyle OH}{\underset{|}{CH}}\text{-}CH_2\text{-}CHO$ (B) $CH_3\text{-}CH{=}CH\text{-}CHO$

(C) $CH_3\text{-}\underset{\displaystyle OH}{\underset{|}{CH}}\text{-}CH_2\text{-}CH_2OH$ (D) $CH_3\text{-}CH{=}CH\text{-}CH_2OH$

3. Which of the following does not undergo Aldol condensation?
(A) CH_3CHO (B) CH_3COCH_3 (C) CH_3CH_2CHO (D) C_6H_5CHO

4. Acetic acid reacts with PCl_5 to give _____
(A) $Cl\text{-}CH_2\text{-}COCl$ (B) $Cl\text{-}CH_2\text{-}COOH$
(C) $CH_3\text{-}COCl$ (D) $CCl_3\text{-}COOH$

5. Consider the following reaction:

$$\underset{H}{\overset{H}{\diagdown\!\diagup}}C=O + \underset{H}{\overset{H}{\diagdown\!\diagup}}C=O + Conc\cdot KOH \xrightarrow{\Delta} A + B$$

(A) A- Methanol, B- Potassium formate
(B) A- Ethanol, B- Potassium formate
(C) A- Methanal, B- Ethanol
(D) A- Methanol, B- Potassium acetate

6. Rosenmund reduction is used for the preparation of aldehydes. The catalyst used in the reaction is:

(A) Pd-$BaSO_4$ (B) Anhydrous $AlCl_3$ (C) Iron(III)oxide (D) $HgSO_4$

7. Electron-withdrawing groups increase the acidity of carboxylic acids because they:
   (A) Destabilise the conjugate base
   (B) Stabilise the conjugate base
   (C) Increase electron density on oxygen
   (D) Donate electrons to -COOH

8. Which among the following statements is correct?
   (A) Butanal and butan-2-one both give Tollens' test
   (B) Ethanal and benzaldehyde give Fehling's test
   (C) Aldehydes are more easily oxidised than ketones.
   (D) Ketones react more readily than aldehydes in oxidation tests.

9. Ethanal reacts with excess ethanol in the presence of dry HCl to form: (2025)
   (A) Acetal (B) Ketone (C) Ester (D) Carboxylic acid

10. Which of the following reactions gives a ketone as the final product?
   (A) Propanenitrile + Phenyl magnesium bromide + hydrolysis
   (B) Phthalic acid + NH_3 + heat
   (C) p-Fluorotoluene + CrO_3 + hydrolysis
   (D) None of these

ASSERTION REASON TYPE QUESTIONS (1M)

(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).

(B) Both (A) and (R) are true, and (R) is not the correct explanation of (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

11. **Assertion (A):** Aromatic aldehydes and formaldehyde undergo Cannizzaro reaction.
Reason (R): Aromatic aldehydes are almost as reactive as formaldehyde towards nucleophilic addition.

12. **Assertion(A):** Semicarbazide contains two amino groups, but only one forms semicarbazones.
Reason(R): The amino group attached to the carbonyl group is less available for nucleophilic attack because of electron delocalisation.

13. **Assertion (A):** Sodium hydrogen sulphite is used for the separation and purification of aldehydes.
Reason (R): Aldehydes form crystalline addition compounds with sodium hydrogen sulphite, which can later be decomposed to regenerate the pure aldehyde. (2025)

14. **Assertion (A):** Benzoic acid is less soluble in water than acetic acid.
Reason (R): The benzene ring increases the hydrophobic character of benzoic acid.

15. **Assertion (A):** The α-hydrogens of aldehydes and ketones are acidic in nature. (2024)
Reason (R): Removal of an α-hydrogen gives an enolate ion stabilised by resonance.

16. **Assertion(A):** The solubility of aldehydes and ketones in water decreases with an increase in the size of the alkyl group.
Reason(R): Aldehydes and ketones have dipole-dipole interaction (2026)

SHORT ANSWER TYPE QUESTIONS (2M)

17. How will you bring about the following conversions: (2026)
    (A) Bromobenzene to 1-Phenylethanol
    (B) Benzene to m-Nitroacetophenone

18. Give a plausible explanation for the following.
    (A) Benzoic acid does not undergo Friedel-Crafts reaction.
    (B) Carboxylic acids have a higher boiling point than alcohols of comparable molecular mass. (2026)

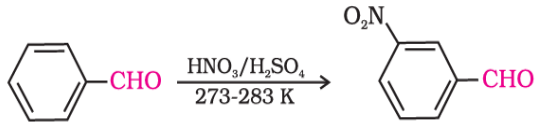
19. Arrange the following in
    (A) Decreasing reactivity towards nucleophilic addition reaction
        Propanal, Acetone, Benzaldehyde
    (B) Increasing order of boiling point
        Propane, Ethanol, Dimethyl Ether, Propanal (2024)

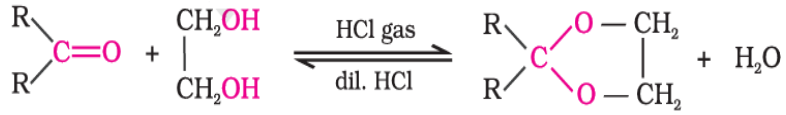
20. Give a simple chemical test to distinguish between:
    (A) $C_6H_5COCH_3$ and C_6H_5CHO
    (B) CH_3CHO and CH_3CH_2CHO (2025)

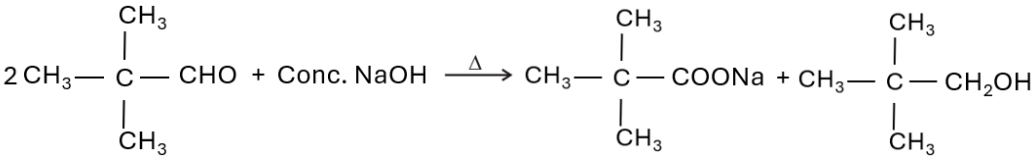
21. Write short notes on:
    (A) Etard reaction of p-Nitrotoluene
    (B) Wolff-Kishner reduction of Propanone

SHORT ANSWER TYPE QUESTIONS (3M)

22. Identify the type of reaction in the following. (Disproportionation/Electrophilic substitution/Nucleophilic addition reactions)

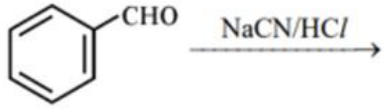
(A) 

(B) 

(C) 

23. (A), (B) and (C) are three non-cyclic functional isomers of a carbonyl compound with the molecular formula C_4H_8O. Isomers (A) and (C) give positive Tollens' test, whereas isomer (B) does not give Tollens' test, but gives a positive iodoform test. Isomers (A) and (B) on reduction with Zn(Hg)/conc. HCl give the same product (D).
    (a) Write the structures of (A), (B), (C) and (D).
    (b) Out of (A), (B) and (C) isomers, which one is least reactive towards the addition of HCN? (2020)

24. Complete the reaction.

(A) 

(B) $(C_6H_5CH_2)_2Cd + 2CH_3COCl \longrightarrow$

(C) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH \xrightarrow[(ii)\ H_2O]{(i)\ Br_2\ /\ Red\ P_4}$

25. Explain the following reactions with a suitable example:
    (A) Rosenmund reduction
    (B) Etard reaction
    (C) Clemmensen reduction

26. An organic compound with molecular formula $C_5H_{10}O$ does not reduce Tollens' reagent but forms an addition compound with sodium hydrogen sulphite and gives a positive iodoform test. On vigorous oxidation, it gives ethanoic acid and propanoic acid. Identify the compound and justify your answer.

PASSAGE-BASED QUESTIONS (4M)

27. Read the passage and answer the following questions.
A chemistry student is studying the reactions and properties of aromatic compounds and carbonyl compounds. During an experiment, the student is asked to prepare benzoic acid from different starting materials such as bromobenzene, ethylbenzene, and acetophenone. The student also investigates how the presence of electron-withdrawing groups affects the acidity of carboxylic acids. For this purpose, the acids, fluoroacetic acid ($F–CH_2–COOH$), acetic acid (CH_3COOH), and nitroacetic acid ($O_2N–CH_2–COOH$) are compared.
In another set of experiments, the student studies nucleophilic addition reactions of carbonyl compounds. It is observed that methanal, ethanal, and propanone react with nucleophiles at different rates. The differences in their reactivity are explained based on electronic and steric effects.

(a) Arrange the following acids in increasing order of acid strength:
C_6H_5COOH, $O_2N–CH_2–COOH$, $CF_3–COOH$, $HCOOH$

(b) Name suitable reagents and write the reaction sequence for converting: (2025)
    (i) Bromobenzene to benzoic acid
    (ii) Ethylbenzene to benzoic acid

(c) Why does ethylbenzene readily yield benzoic acid on oxidation, whereas bromobenzene does not directly undergo such oxidation?

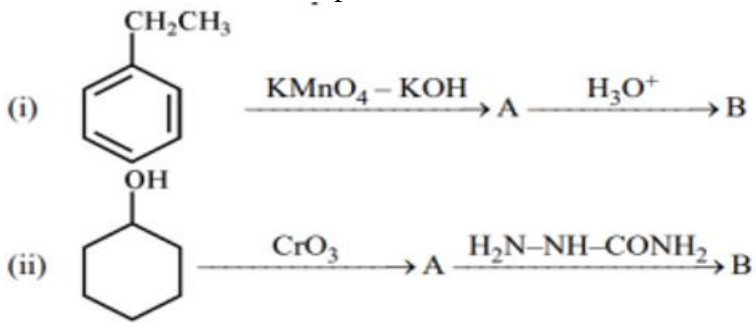
LONG ANSWER TYPE QUESTIONS (5M)

28. An organic compound (A) with the molecular formula $C_9H_{10}O$ forms a 2,4-DNP derivative, reduces Fehling's solution and undergoes Cannizzaro reaction. On vigorous oxidation, it gives Benzene-1,2-dicarboxylic acid.
    (i) Identify the compound (A) and write its IUPAC name.
    (ii) Write the reaction of compound (A) with
        (a) 2,4-Dinitrophenylhydrazine
        (b) Fehling's solution
    (iii) Write the equation of compound (A) when it undergoes Cannizzaro reaction. (2024)

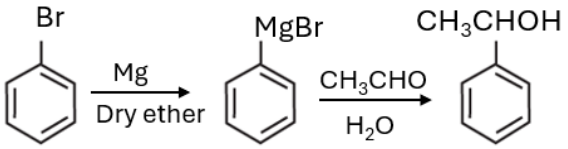
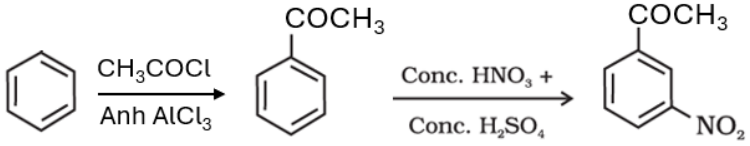
29. (a) An organic compound 'A' having the molecular formula C_3H_8O, on treatment with Cu at 573 K,

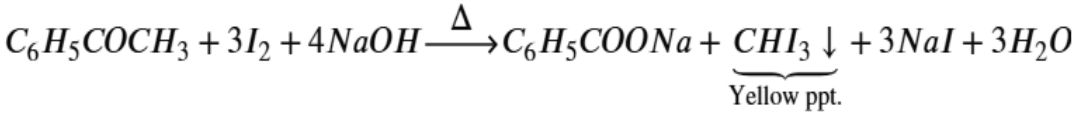
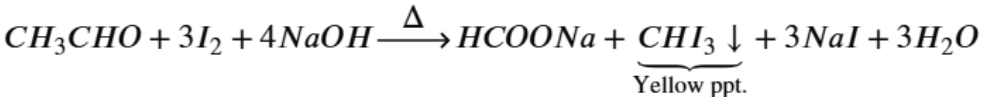
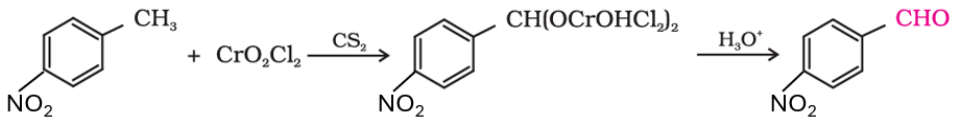
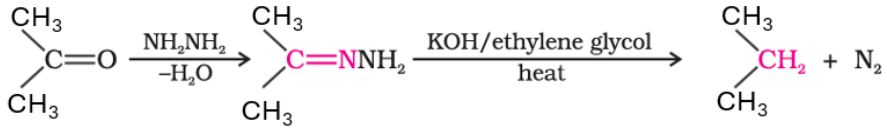
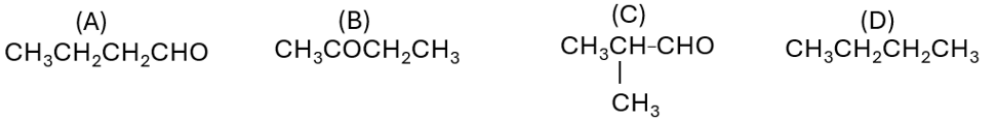
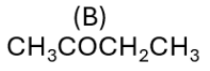
gives ‘B’. ‘B’ does not reduce Fehling’s solution but gives a yellow precipitate of the compound ‘C’ with I_2/NaOH. Deduce the structures of A, B, and C.

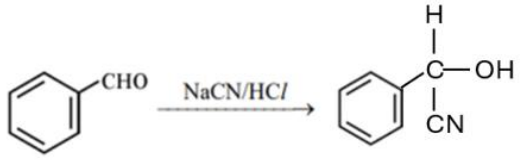
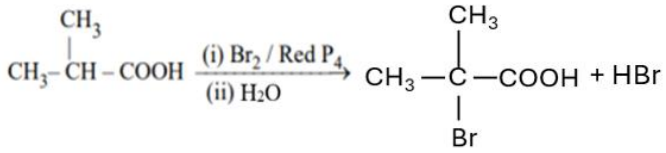
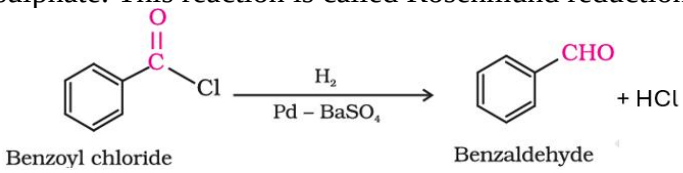
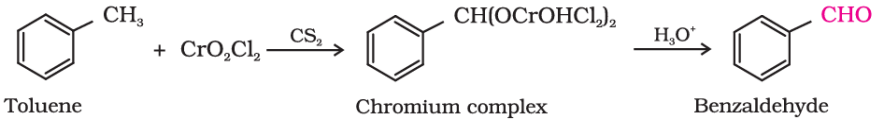
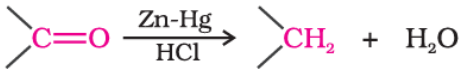
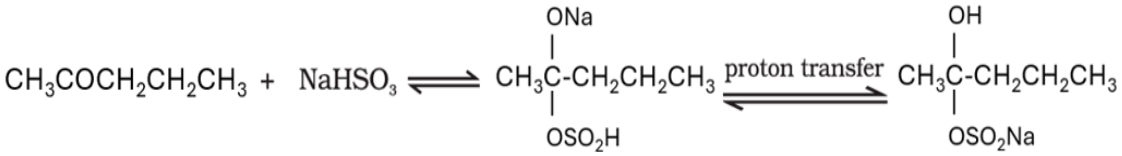
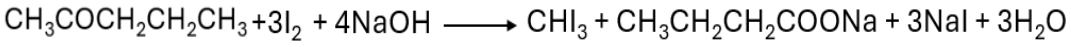
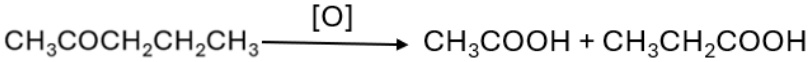
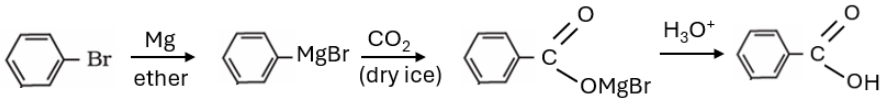
(b) Write the structures of the compounds A and B in each of the following reactions.

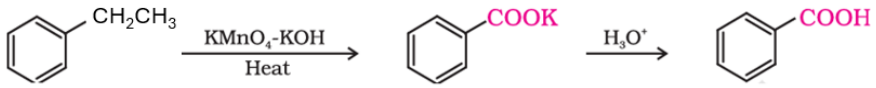
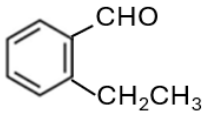
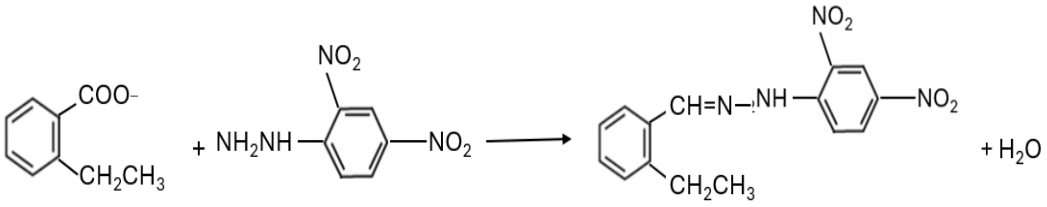
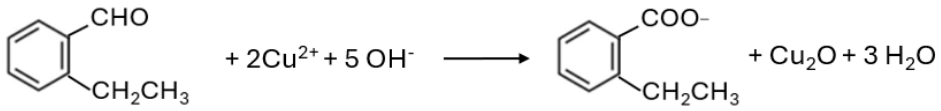
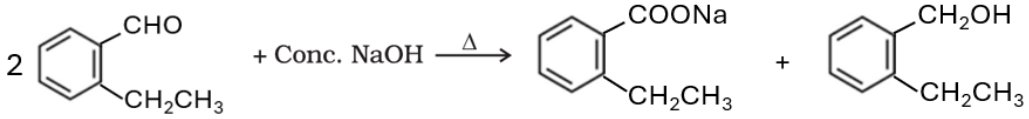
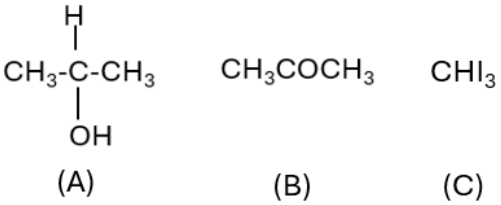
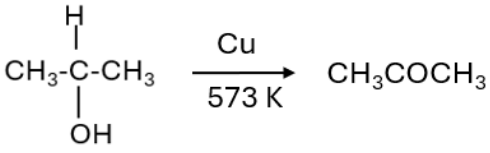


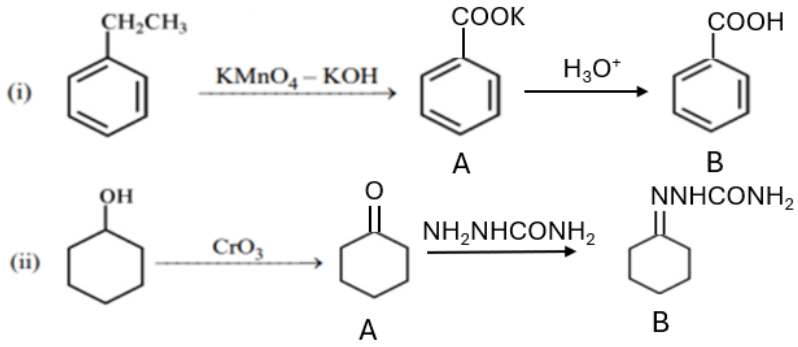
ANSWERS

Q.NO	ANSWERS	MARKS
1	(C) $C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO < HCHO$	1
2	(A) $CH_3\text{-}\underset{\underset{OH}{|}}{CH}\text{-}CH_2\text{-}CHO$	1
3	(D) C_6H_5CHO	1
4	(C) CH_3-COCl	1
5	(A) A- Methanol, B- Potassium formate	1
6	(A) Pd-$BaSO_4$	1
7	(B) Stabilise the conjugate base	1
8	(C) Aldehydes are more easily oxidised than ketones.	1
9	(A) Acetal	1
10	(A) Propanenitrile + Phenyl magnesium bromide + hydrolysis	1
11	(C) Assertion (A) is true, but Reason (R) is false.	1
12	(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).	1
13	(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).	1
14	(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).	1
15	(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).	1
16	(B) Both (A) and (R) are true, and (R) is not the correct explanation of (A).	1
17	(A)  (B) 	1 1

18	(A) Benzoic acid does not undergo Friedel-Crafts reaction because the carboxyl group is deactivating, and the catalyst, aluminium chloride (Lewis acid) gets bonded to the carboxyl group. (B) This is due to the more extensive association of carboxylic acid molecules through intermolecular hydrogen bonding. The hydrogen bonds are not broken completely, even in the vapour phase. Carboxylic acids exist as dimers in the vapour phase or in aprotic solvents.	1 1
19	(A) Propanal > Acetone > Benzaldehyde (B) Propane < Dimethyl Ether < Propanal < Ethanol	1 1
20	(A) $C_6H_5COCH_3$ with I_2/NaOH forms a yellow ppt of CHI_3, whereas C_6H_5CHO does not.  (B) CH_3CHO with I_2/NaOH forms a yellow ppt of CHI_3, whereas CH_3CH_2CHO does not. 	1 1
21	(A)  (B) 	1 1
22	(A) Electrophilic substitution reaction (B) Nucleophilic addition reaction (C) Disproportionation reaction	1 1 1
23	(a)  Butanal Butan-2-one 2-Methylpropanal Butane (b) 	½ ×2 1

24	(A)  (B) $(C_6H_5CH_2)_2Cd + 2CH_3COCl \longrightarrow 2\,C_6H_5CH_2COCH_3 + CdCl_2$ (C) 	1 1 1
25	(A) Rosenmund reduction Acyl chloride (acid chloride) is hydrogenated over a catalyst, palladium on barium sulphate. This reaction is called Rosenmund reduction.  Benzoyl chloride Benzaldehyde (B) Etard reaction Chromyl chloride oxidises the methyl group to a chromium complex, which on hydrolysis gives the corresponding benzaldehyde.  Toluene Chromium complex Benzaldehyde (C) Clemmensen reduction The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc amalgam and concentrated hydrochloric acid. 	1 1 1
26	Pentan-2-one – $CH_3COCH_2CH_2CH_3$ **Reaction with $NaHSO_3$**  **Reaction with I_2/NaOH**  **Strong oxidation** 	1 ½ ½ 1
27	(a) $HCOOH < C_6H_5COOH < O_2N–CH_2–COOH < CF_3–COOH$ (b) (i) 	1 1

	(ii)  (c) Ethylbenzene readily oxidises to benzoic acid because it possesses benzylic hydrogens (hydrogens on the carbon directly attached to the benzene ring). Strong oxidising agents, such as alkaline $KMnO_4$, selectively target these hydrogens, cleaving the side chain. Conversely, bromobenzene lacks any alkyl side chain and has no benzylic hydrogens available for this attack.	1 1
28	(i)  (A) 2-Ethylbenzaldehyde (ii) (a)  (b)  (iii)  	1+1 1 1 1
29	(a)  (A) (B) (C)  (A) (B)	½ ×3 ½

	$CH_3COCH_3 + 3I_2 + 4NaOH \xrightarrow{\Delta} CHI_3 + CH_3COONa + 3\,NaI + H_2O$ (B) (C) (b)  	1 ½ ×2 ½ ×2

Prepared by:
Ms Jasmin Joseph