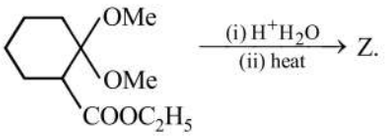
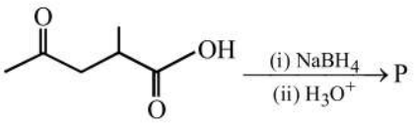
Aldehydes, Ketones and Carboxylic Acids

1. Acetic acid is dissolved in water having oxygen as ^{18}O. How many ^{18}O atom will be present in the product molecule?

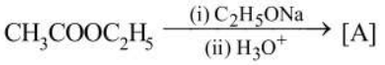
2. 

How many number of sp^2 hybridised carbon atoms are there in the product Z.

3. How many membered ring will be formed in the product P of the following reaction.



4. Compound A is obtained by following reaction.



How many following statement(s) is(are) true about A ?

(i) It gives red colour with blue litmus solution.

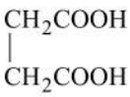
(ii) It decomposes $NaHCO_3$ solution and evolves CO_2 gas.

(iii) It decolourises bromine water colour.

(iv) It reacts with 2,4-dinitrophenyl-hydrazine

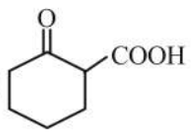
(v) Product A will undergo acid catalysed halogenation.

5. How many of the following compound is decarboxylated on heating ?

(I) 

(II) $C_2H_5CH(COOH)_2$

(III) CH_3COCH_2COOH

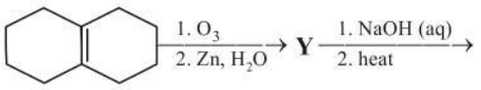
(IV) 

6. How many of the following compounds can be used as an acylating agent ?

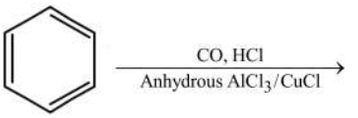
(I) CH_3COCl (II) $(CH_3CO)_2O$

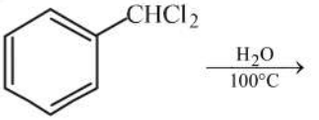
(III) CH_3COOH (IV) CH_3CH_2COCl.

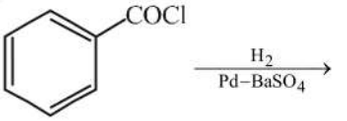
7. In the scheme given below, how many number of intramolecular aldol condensation products formed from '**Y**'?

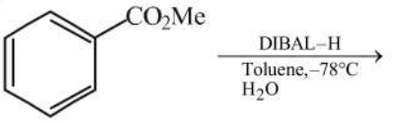


8. Among the following, how many number of reaction(s) produce(s) benzaldehyde?

I. 

II. 

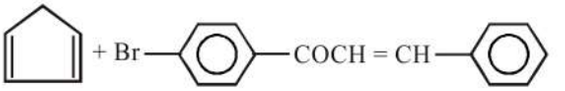
III. 

IV. 

9. Find the number of reactants among the given options which does not undergo Michael addition?

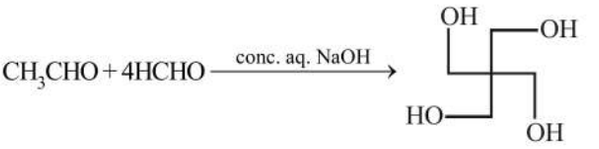
(I) $C_6H_5CH = CHCOCH_3 + C_6H_5COCH_3$

(II) $C_6H_5CH = CHCH_2COC_6H_5 + CH_2(COOC_2H_5)_2$

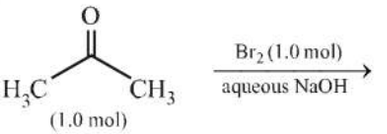
(III) 

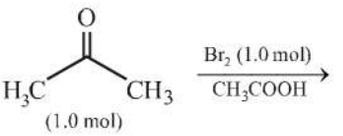
(IV) $CH_2 = CHCOCH_3 + CH_3COCH_3$

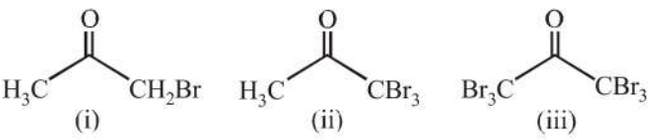
10. How many number of aldol reaction(s) occurs in the given transformation?

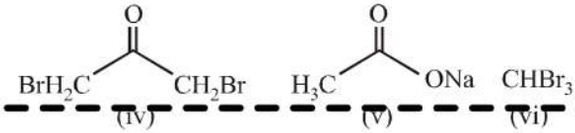


11. How many number of organic compounds among the following compounds are present in the reaction mixture after the completion of reactions I and II?

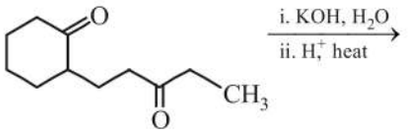
Reaction I : 

Reaction II : 

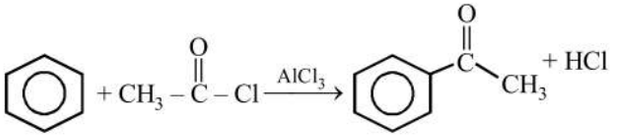




12. Find the total number of product in the given reaction.

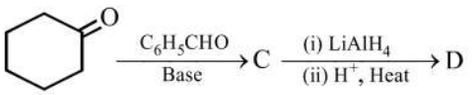


13. How many steps are there in the mechanism of the following reaction?



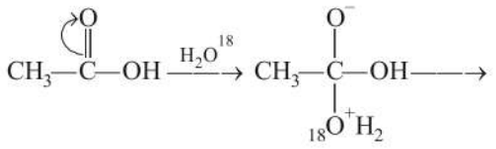
14. An unknown compound of carbon, hydrogen and oxygen contains 69.77% carbon and 11.63% hydrogen and has a molecular weight of 86. It does not reduce Fehling solution, but forms a bisulphite addition compound and gives a positive iodoform test. How many possible structures can be drawn for the unknown compound?

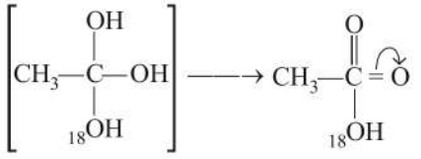
15. How many total number of ketonic groups are present in compound C and D in the given reaction sequence?

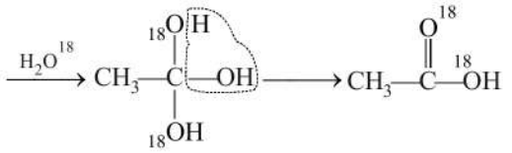


SOLUTIONS

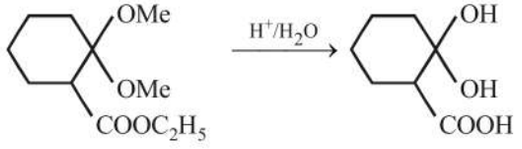
1. **(2)**

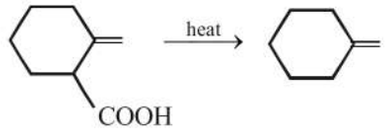






2. **(1)**

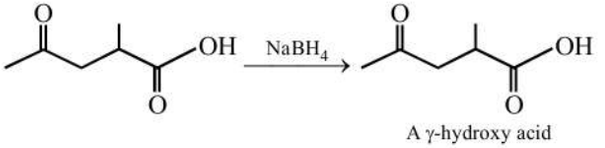




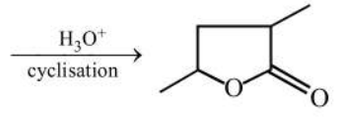
β-Keto acid

Remember that β-keto acids undergo decarboxylation on heating.

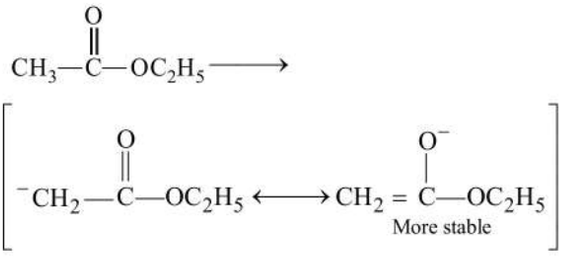
3. **(5)**

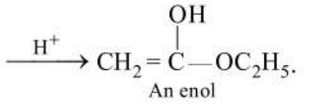


A γ-hydroxy acid



4. **(4)** (I), (III), (IV), (V)



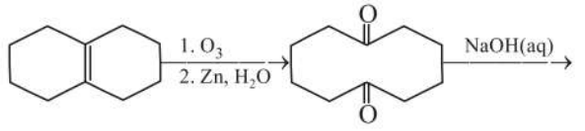


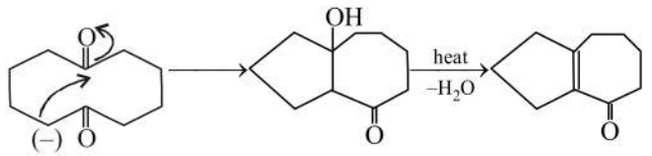
An enol

5. **(3)** Dicarboxylic acids having two —COOH groups on the same carbon atom ; and β-keto acids are easily decarboxylated on heating.

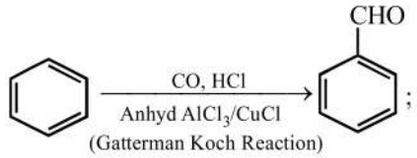
6. **(3)** Stronger the basic nature of the leaving group, weaker will be its leavability. In CH_3COOH, OH^- is a strong base so it can't be removed easily to form $CH_3\overset{+}{C}O$ required for acetylation (acylation).

7. **(1)**

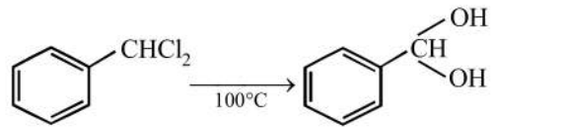


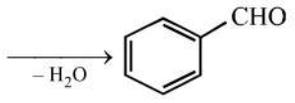


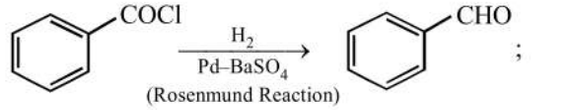
8. **(4)**



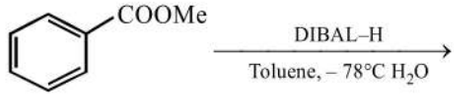
(Gatterman Koch Reaction)

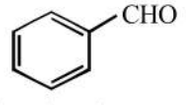






(Rosenmund Reaction)





9. **(2)** (II) does not have α, β-unsaturated carbonyl group, while (IV) can't form stable carbanion (from acetone). Remember that cyclopentadiene is quite acidic in nature, because its carbanion is stable due to presence

of conjugated system; hence it functions as the nucleophile required in Michael reaction.

10. (3) $\overset{\alpha}{CH_3}-CHO + HCHO \xrightarrow[\text{1st aldol condensation}]{OH^-}$

$\overset{\alpha}{CH_2}(-CHO)(-CH_2OH) \xrightarrow[\text{2nd aldol condensation}]{OH^-/HCHO} \overset{\alpha}{CH}(-CHO)(-CH_2OH)_2$

$\xrightarrow[\text{3rd aldol condensation}]{OH^-/HCHO} HOCH_2-C(-CHO)(-CH_2OH)_2$

$HOCH_2-C(-CH_2OH)_2-CH_2OH \xleftarrow[\text{Cannizzaro reaction}]{OH^-/HCHO}$ (same as above)

11. (3) Reaction I : $CH_3-CO-CH_3 \xrightarrow[Na^+OH^-]{Br_2(1.0\ mol)}$

1.0 mol

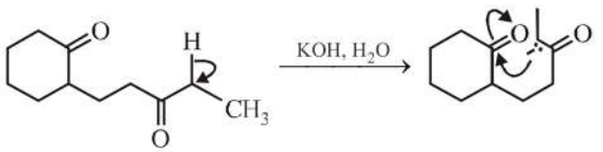
$CH_3COONa + CHBr_3 +$ (unreacted)

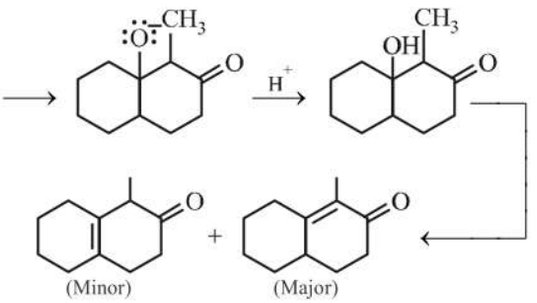
(v) (U)

Reaction II : $CH_3-CO-CH_3 \xrightarrow[CH_3COOH]{Br_2(1.0\ mol)} CH_3-CO-CH_2Br$

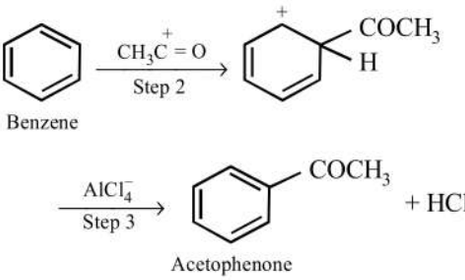
1.0 mol (i)

12. (2)





13. (3) $CH_3COCl + AlCl_3 \xrightarrow[\text{step1}]{} CH_3C^+=O + AlCl_4^-$



14. (2) Empirical formula can be calculated as

Element	Percentage	Relative no. of atoms	Simplest ratio
C	69.77	5.81	5
H	11.63	11.63	10
O	18.60	1.16	1

$\therefore$ Empirical formula of compound is $C_5H_{10}O$ and empirical formula wt. = 86.

Also molecular wt. = 86.

$\therefore$ Molecular formula of compound is $C_5H_{10}O$.

(ii) Compound forms bisulphite addition compound and thus has carbonyl gp, *i.e.* aldehyde or ketone.

(iii) It does not reduce Fehling solution and thus it is not an aldehyde but a ketone.

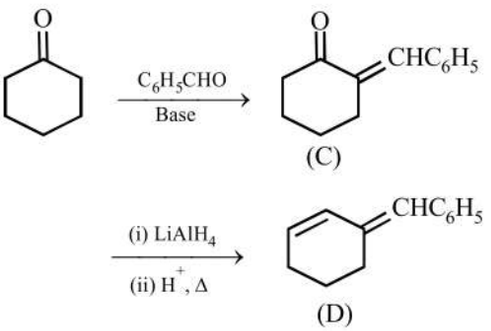
(iv) It gives positive iodoform test and thus it has unit, $CH_3-\overset{\overset{O}{\|}}{C}-$

(v) Above facts reveal that the compound is

$CH_3CH_2CH_2COCH_3$ or $(CH_3)_2CHCOCH_3$

pentan-2-one 3-methylbutan-2-one

15. (1)



There is only one ketonic group in C and zero ketonic group in D.