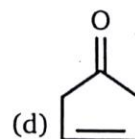
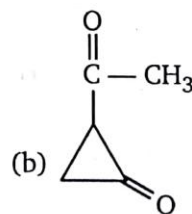
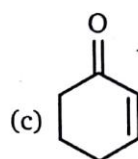
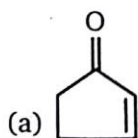
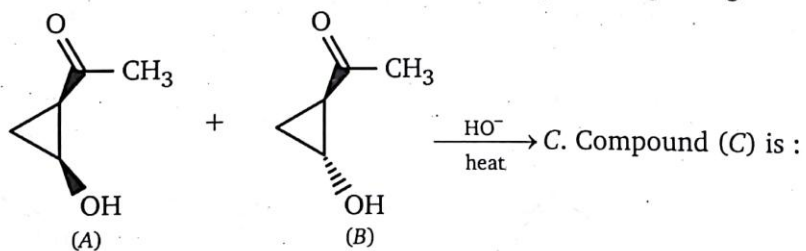


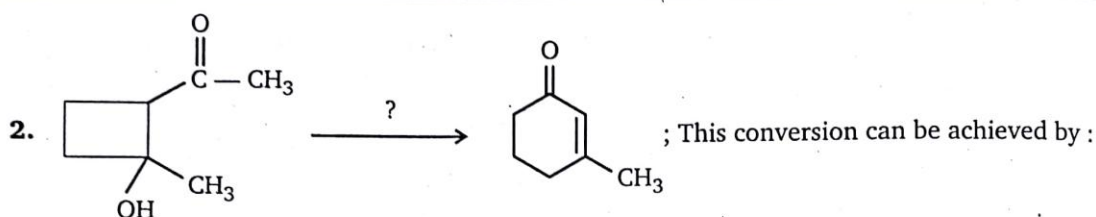
## 8

## ALDOL AND CANNIZARO REACTION

## LEVEL-1

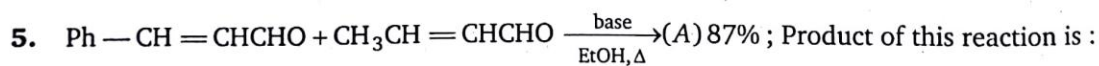
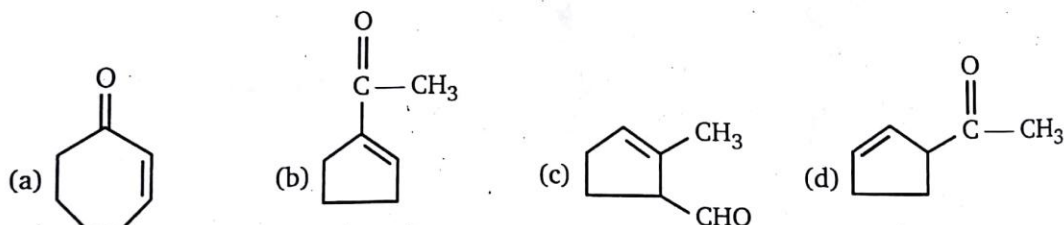
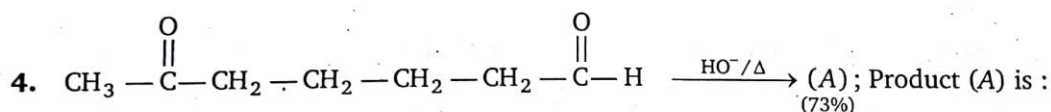
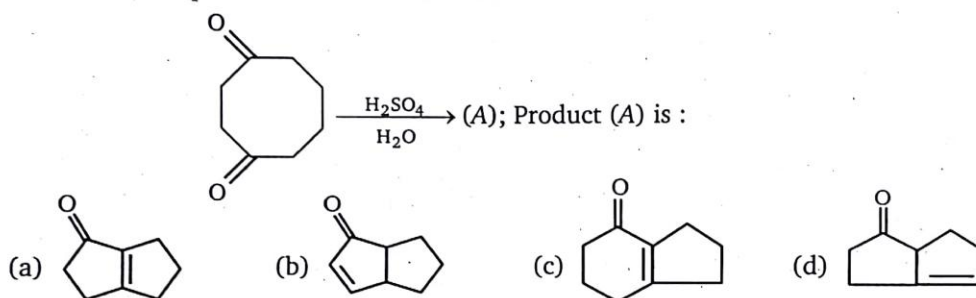
1. Compound A and B, both were treated with NaOH, producing a single compound C.



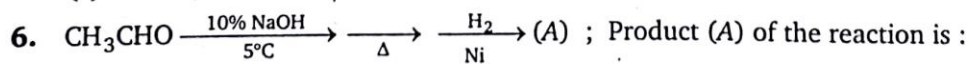


- (a) Dehydration, Hydrolysis  
 (b) Retro aldol and further condensation  
 (c) Perkin condensation & Clemmensen reduction  
 (d) Clemmensen and Perkin condensation

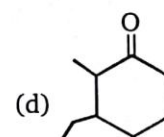
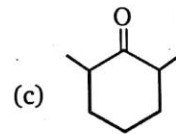
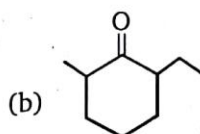
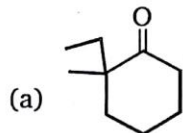
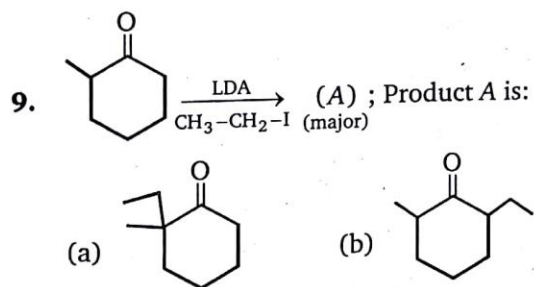
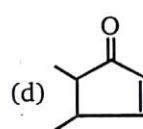
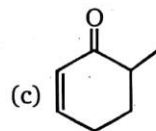
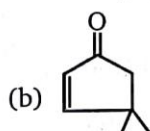
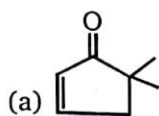
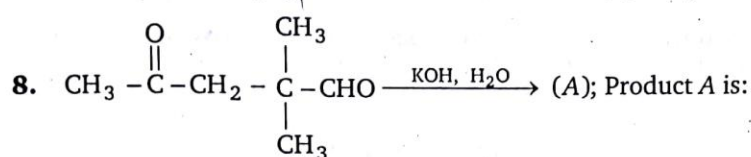
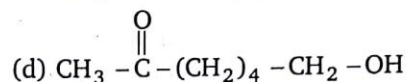
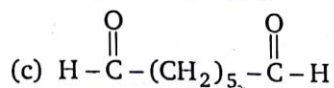
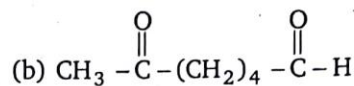
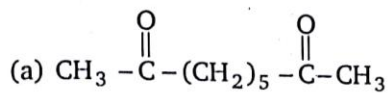
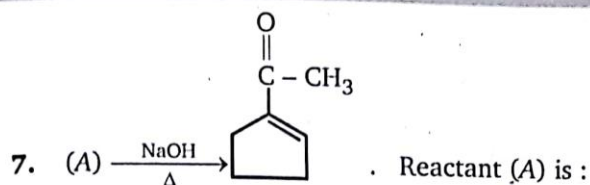
3. This is an example of an intramolecular aldol reaction :



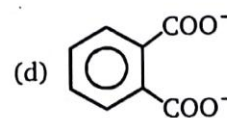
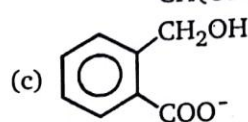
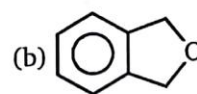
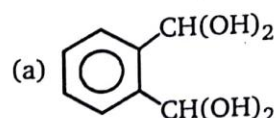
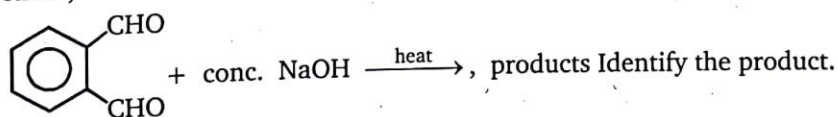
- (a)  $\text{Ph} - (\text{CH} = \text{CH})_2 - \text{CHO}$  (b)  $\text{Ph} - (\text{CH} = \text{CH})_3\text{CHO}$   
 (c)  $\text{Ph} - (\text{CH} = \text{CH})_4\text{CHO}$  (d)  $\text{Ph} - \text{CH} = \text{CH} - \text{CH} = \text{CH} - \text{CH}_3$



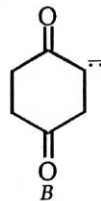
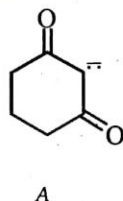
- (a) propanol (b) ethanol (c) butanol (d) pentanol



10. The reaction ,

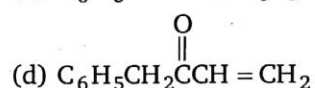
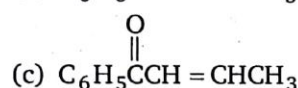
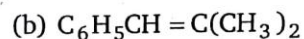
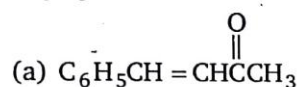


11. Compare enolate A with enolate B.

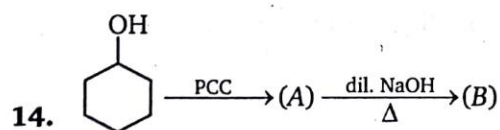
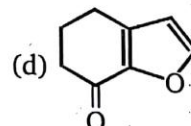
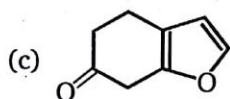
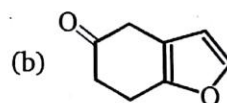
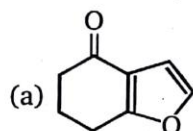
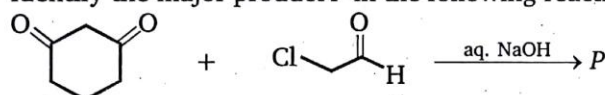


Which of the following statements is true ?

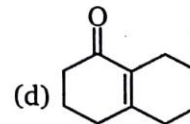
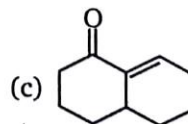
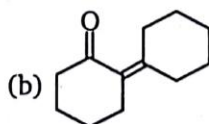
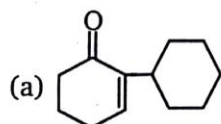
- (a) A is more stable than B  
(b) A and B have the same stability  
(c) B is more stable than A  
(d) No comparison of stability can be made
12. Benzalacetone is the product of mixed aldol condensation between benzaldehyde ( $\text{C}_6\text{H}_5\text{CH}=\text{O}$ ) and acetone [ $(\text{CH}_3)_2\text{C}=\text{O}$ ]. What is its structure ?

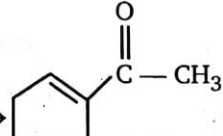


13. Identify the major product P in the following reaction:



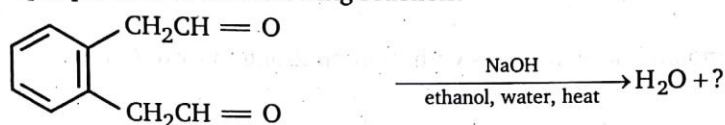
Product (B) is:



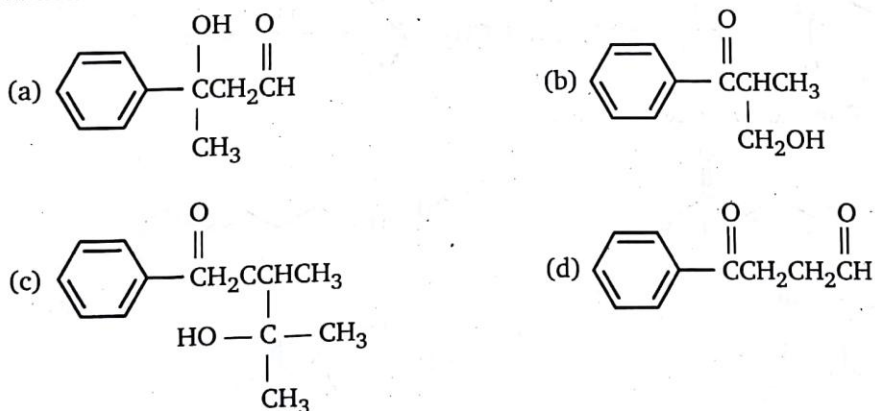
15. (A)  $\xrightarrow[\text{(ii) Zn, H}_2\text{O}]{\text{(i) O}_3}$  (B)  $\xrightarrow[\Delta]{\text{NaOH}}$   the reactant (A) will be :



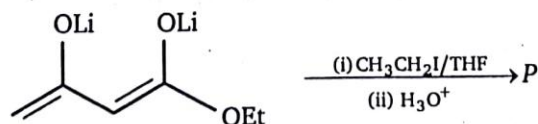
16. Identify the principal product of the following reaction?

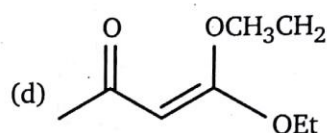
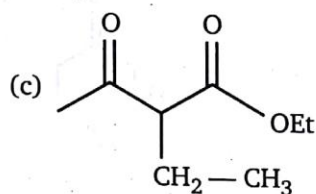
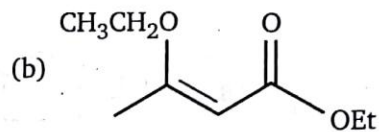
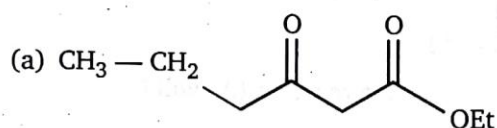


17. Which one of the following compounds is the best choice for being prepared by an efficient mixed aldol addition reaction?

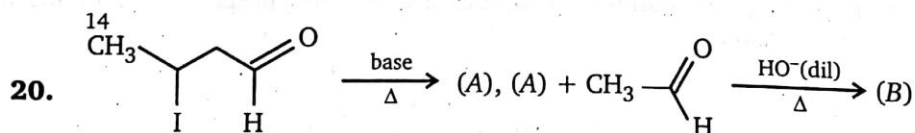
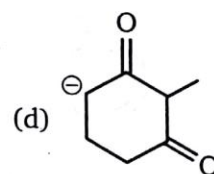
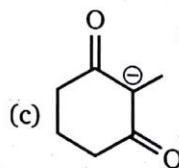
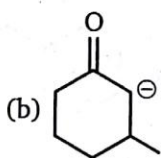
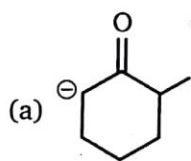
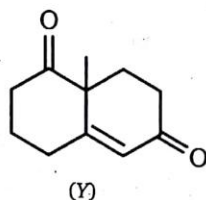


18. Identify the major product P in the following reaction:

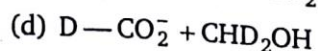
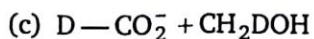
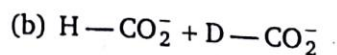
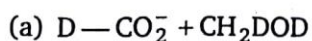
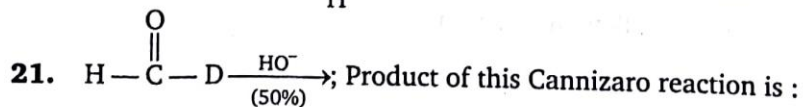
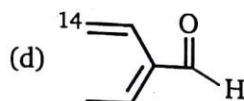
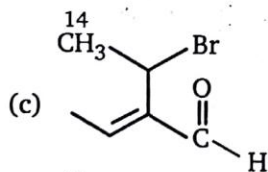
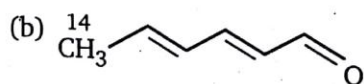
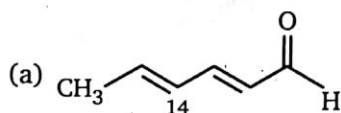




19. The enolate ion that reacts with 3-buten-2-one to form (Y) is :

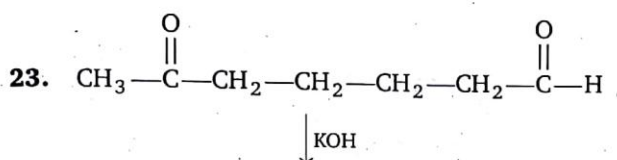
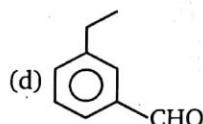
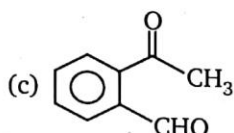
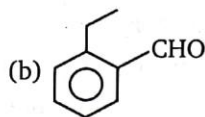
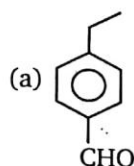


Product (B) in the above reaction is :





22. An organic compound with the molecular formula  $C_9H_{10}O$  forms a 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro reaction, on vigorous oxidation it gives 1,2-benzenedicarboxylic acid. Structure of organic compound is:

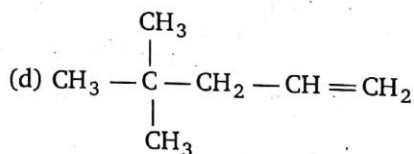
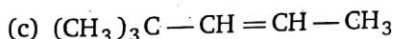
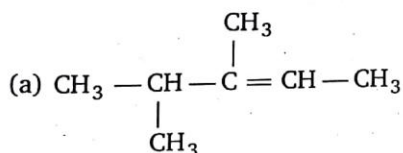


Number of intramolecular aldol condensation product is :

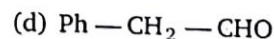
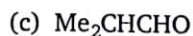
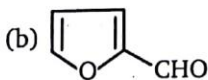
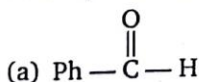
- (a) 1 (b) 2 (c) 3 (d) 4
24. 
$$(A) \xrightarrow[Zn/AcOH]{O_3} (B) + (C)$$
  
 $C_7H_{14}$

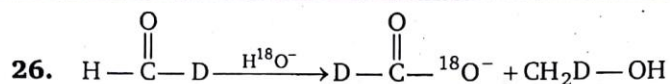
Compound (A) exist in geometrical isomers and (B) gives Cannizzaro reaction.

(A) will be :



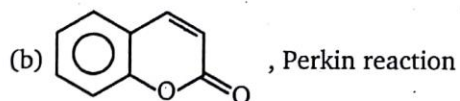
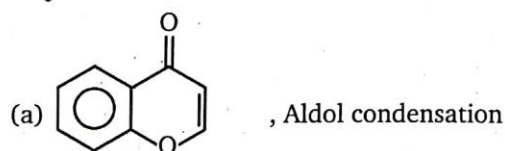
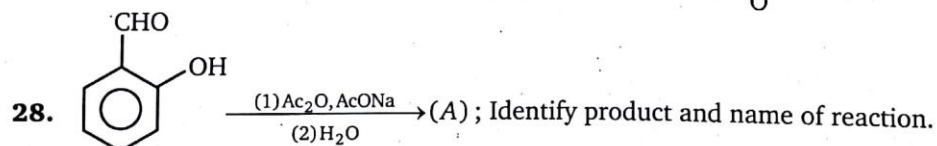
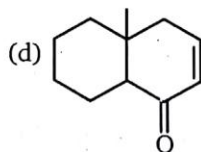
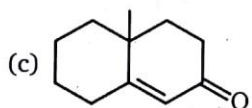
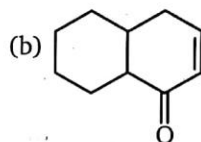
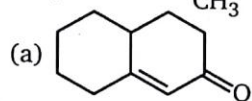
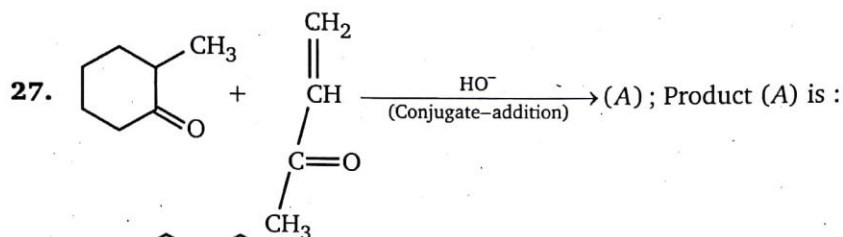
25. Which of the following compounds will not undergo Cannizzaro reaction, when treated with 50% aqueous alkali?



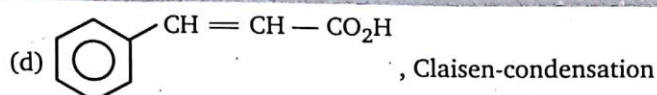


Above reaction is known as :

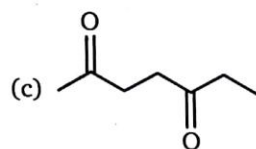
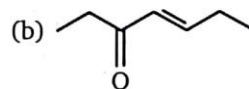
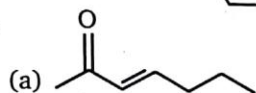
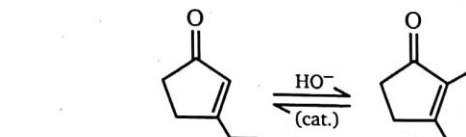
- (a) Cannizaro reaction, Disproportionation reaction
- (b) Tischenko reaction, Disproportionation reaction
- (c) Cross Cannizaro reaction, Redox reaction
- (d) Tischenko reaction, Redox reaction



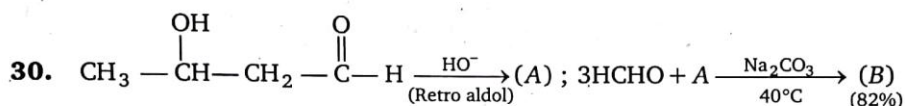




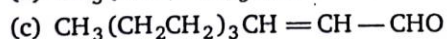
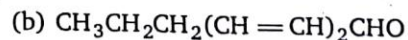
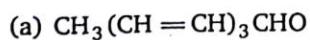
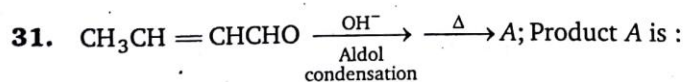
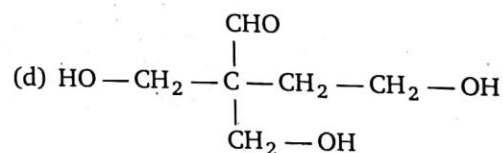
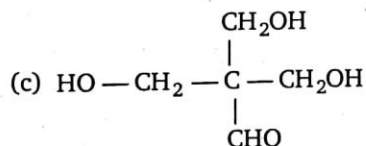
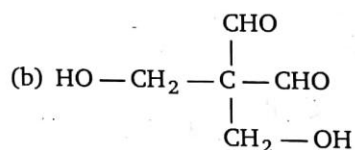
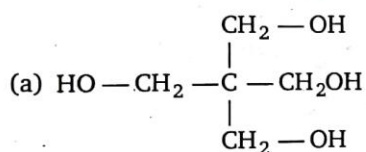
29. Choose the most reasonable reaction intermediate for the following reaction.



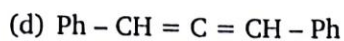
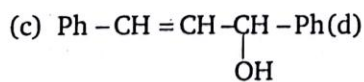
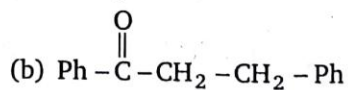
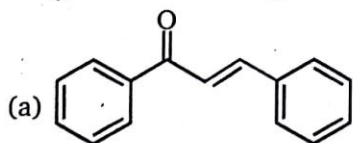
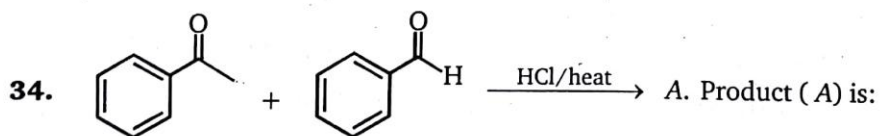
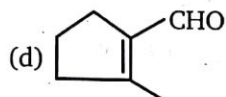
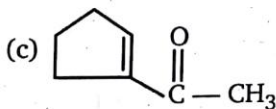
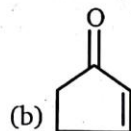
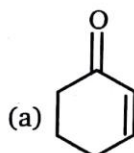
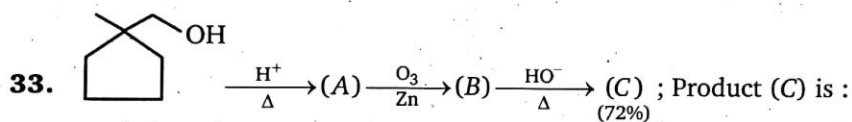
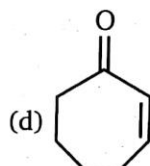
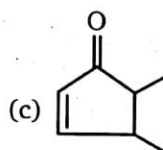
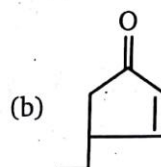
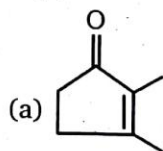
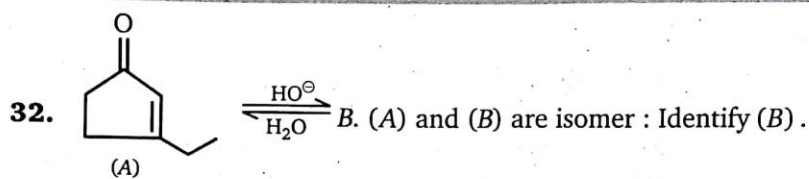
(d) None of these



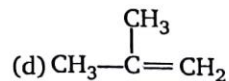
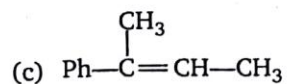
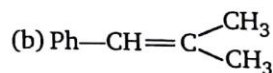
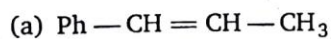
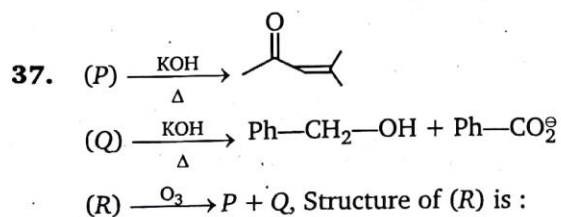
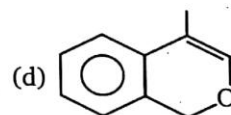
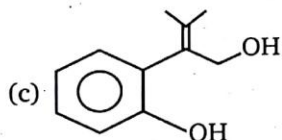
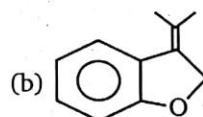
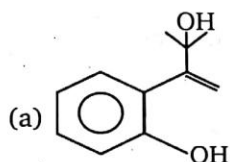
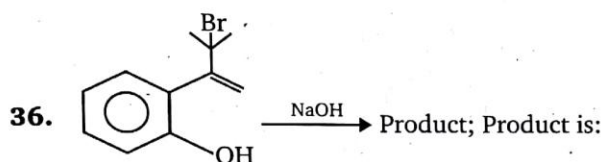
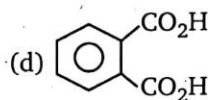
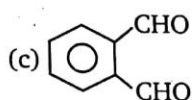
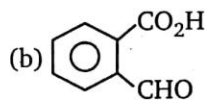
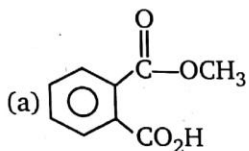
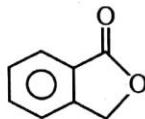
Product (B) of the above reaction is :



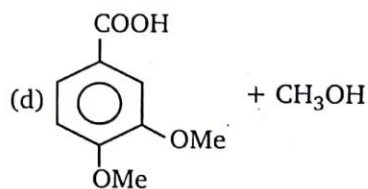
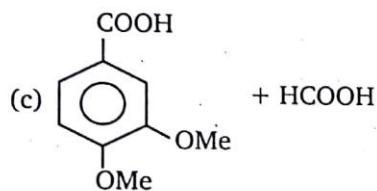
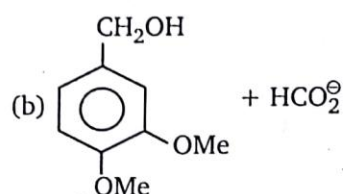
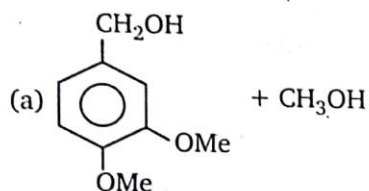
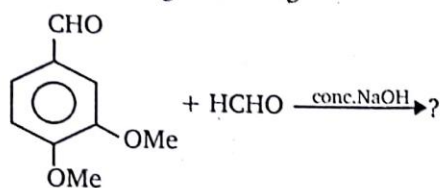
(d) none is correct



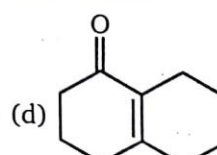
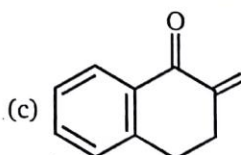
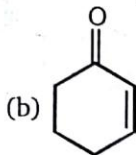
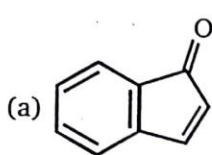
35. Which of the following reactant on reaction with conc. NaOH followed by acidification gives the following lactone as the product ?



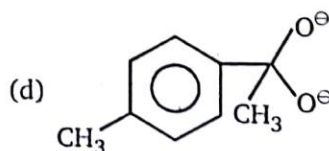
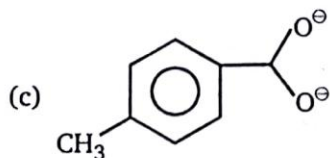
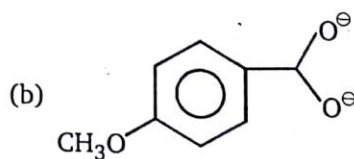
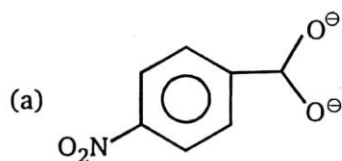
38. The following reaction gives:



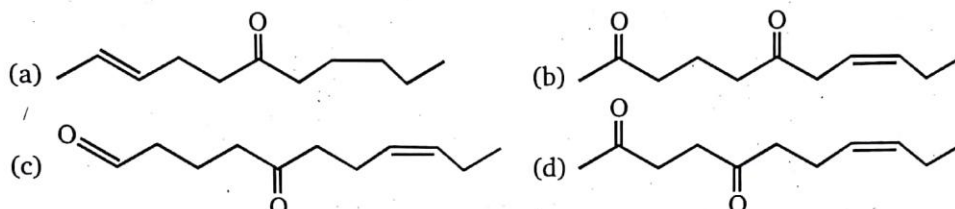
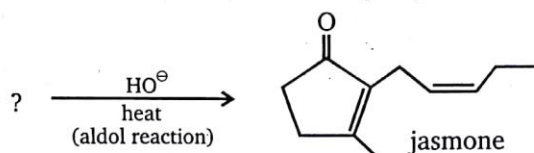
39. Which of the following is not the product of an intramolecular aldol condensation ?



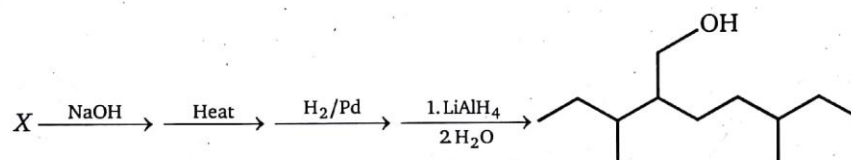
40.  $x$  = no. of compound better hydride donor than  $\text{Ph}-\text{C}(\text{H})(\text{O}^-)-\text{O}^-$



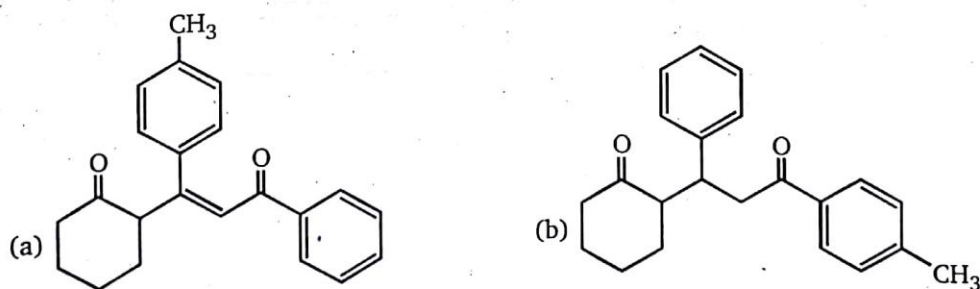
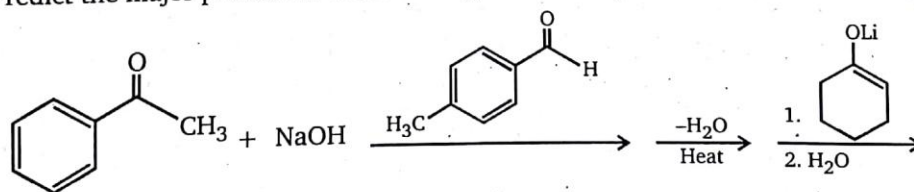
41. Choose the reactant whose aldol reaction would give jasmone.

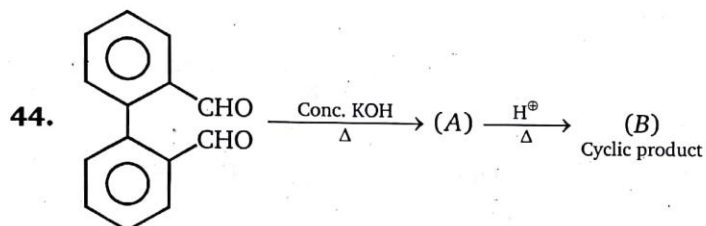
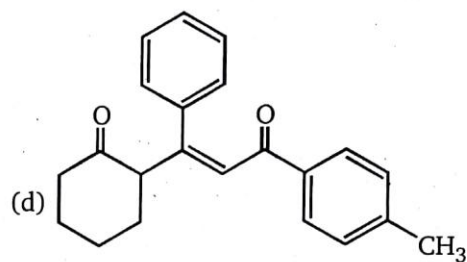
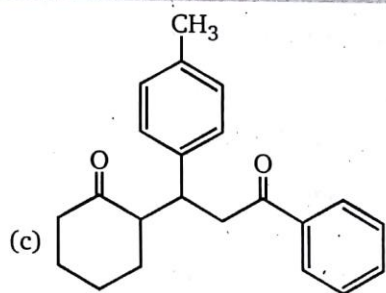


42. Compound X undergoes the following reaction sequence. What is the structure of compound X?

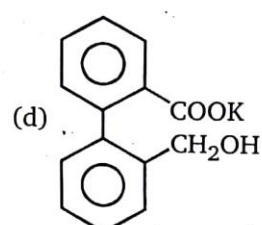
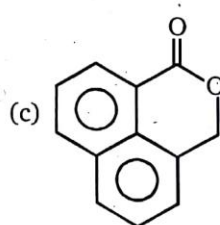
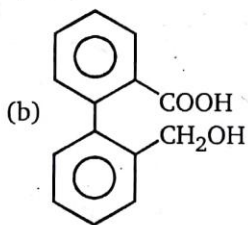
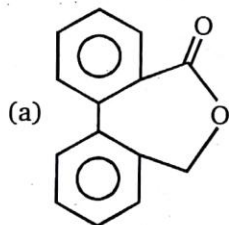


43. Predict the major product of the following reaction sequence





Structure of (B) is :



### ANSWERS — LEVEL 1

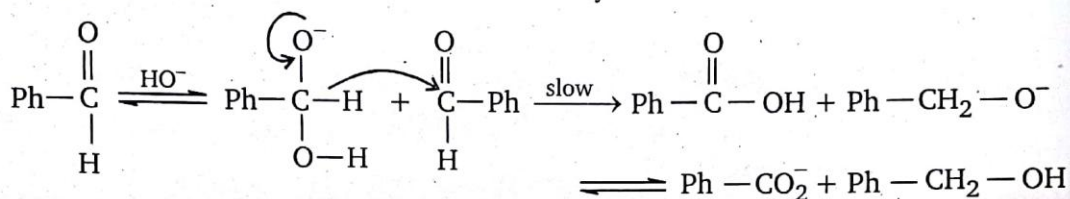
1.	(a)	2.	(b)	3.	(a)	4.	(b)	5.	(b)	6.	(c)	7.	(b)	8.	(b)
9.	(b)	10.	(c)	11.	(a)	12.	(a)	13.	(a)	14.	(b)	15.	(a)	16.	(b)
17.	(b)	18.	(a)	19.	(c)	20.	(a)	21.	(c)	22.	(b)	23.	(c)	24.	(c)
25.	(d)	26.	(a)	27.	(c)	28.	(b)	29.	(c)	30.	(c)	31.	(a)	32.	(a)
33.	(c)	34.	(a)	35.	(c)	36.	(b)	37.	(b)	38.	(b)	39.	(c)	40.	(b,c)
41.	(d)	42.	(d)	43.	(c)	44.	(a)								



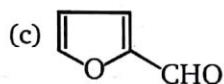
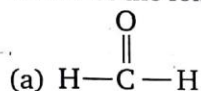
## LEVEL-2

## 1. Comprehension

Mechanism of Cannizzaro's reaction of benzaldehyde is



A. Which of the following reactants can undergo Cannizzaro's reaction?



(d) All of these

B. Order of the above reaction is:

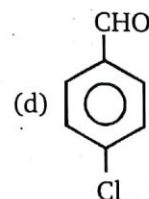
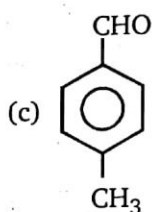
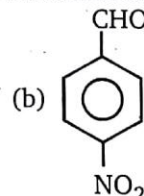
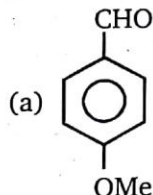
(a) 1

(b) 2

(c) 3

(d) 4

C. Which of the following is best hydride donor in Cannizzaro's reaction?



D. Cannizzaro's reaction is:

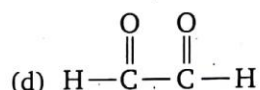
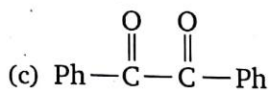
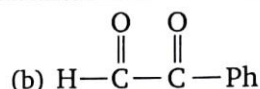
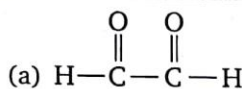
(a) Reduction

(b) Disproportionation reaction

(c) Oxidation

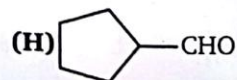
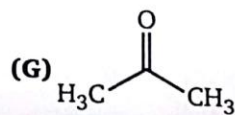
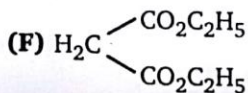
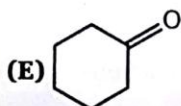
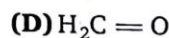
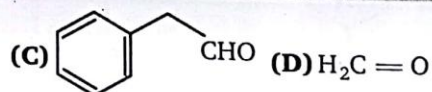
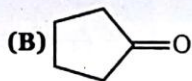
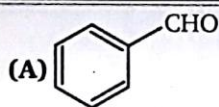
(d) Ion-exchange reaction

E. Which of the following cannot undergo intramolecular Cannizzaro's reaction?



2. Aldol condensation proceeds by carbon-carbon bond formation between an enolate donor and a carbonyl acceptor. For each of the following aldol products (a through e) select a donor and an acceptor compound from the list at the bottom of the page (compounds A through H). Write the letter corresponding to your selection in the appropriate answer box.

	Aldol Product	Donor	Acceptor
a.			
b.			
c.			
d.	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{COCH}_3$		
e.			



**3. Comprehension**

During an experimental workup procedure, a chemist treated a starting material with NaOH in the solvent acetone  $[(\text{CH}_3)_2\text{C}=\text{O}]$ ; however, the starting material was recovered unreacted. Instead, the chemist isolated a small amount of Product A (shown below).

**Product A**

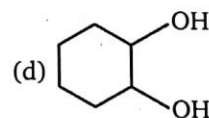
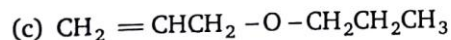
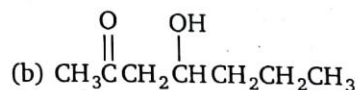
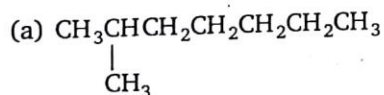
The chemist determined that Product A resulted from the aldol self-condensation of acetone. Product A was identified based on the following observations.

*Observations about Product A*

1. Elemental analysis of Product A indicated that it consisted only of carbon, hydrogen, and oxygen.
2. product A had a molecular weight of 116 g/mol.
3. Product A was a methyl ketone because it gave a positive iodoform test.
4. When product A was treated with  $\text{Br}_2$  in  $\text{CCl}_4$ , the red bromine colour persisted, because no carbon-carbon double bonds were present to react with the bromine.

The structure of Product A was further confirmed when treatment with hot sulfuric acid resulted in the corresponding dehydration product, Product B.

- A.** What is the molecular weight of a compound that undergoes an aldol self-condensation reaction to result in a  $\beta$ -hydroxy ketone with a molecular weight of 144 ?
- (a) 70 g/mol (b) 72 g/mol  
(c) 74 g/mol (d) 76 g/mol
- B.** The aldol self-condensation of acetone is an equilibrium that favours acetone over its condensation product. Which of the following experimental modifications is most likely to shift the position of equilibrium toward Product A ?
- (a) Using only a catalytic amount of NaOH  
(b) Using only a catalytic amount of acetone  
(c) Removing Product A as it is formed  
(d) Increasing the reaction temperature to the boiling point of acetone
- C.** Based only on observation 1 and 2, which of the following compounds could have been Product A ?



- #### 4. Comprehension



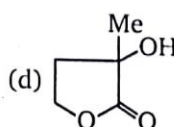
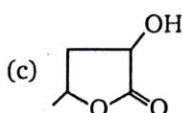
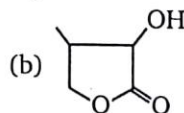
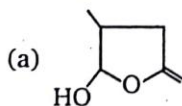
- (b)  $\text{Ph}-\text{CH}=\text{CH}-\text{CH}_3$   
(d)  $\text{Ph}-\text{CH}=\underset{\text{CH}_3}{\text{C}}-\text{CH}_3$

- B.** Structure of (B) and (C) differentiated by :

- (a) Tollen's reagent  
(c) 2,4-DNP

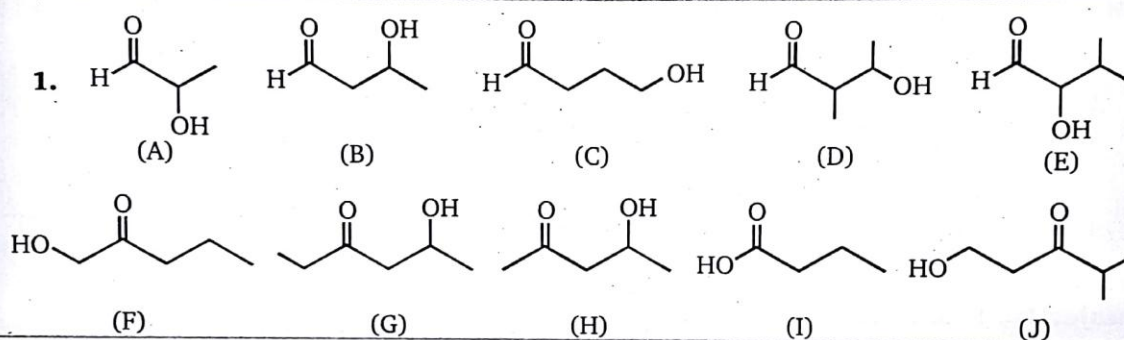
- (b) Fehling solution  
(d)  $\text{NaHSO}_3$

- C.** Structure of  $E$  is :





## SUBJECTIVE PROBLEMS

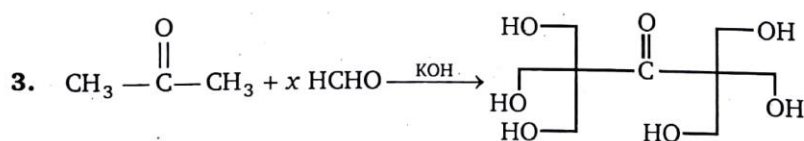
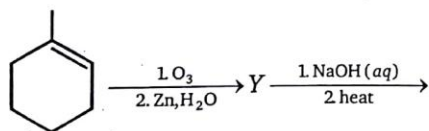


$X$  = Number of compound obtained by aldol reaction

$Y$  = Number of compounds react with  $\text{NaHCO}_3$

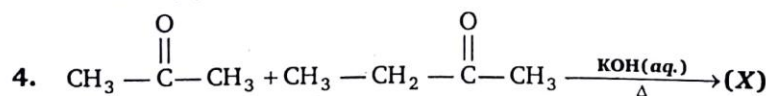
Sum of  $X + Y$  is

2. In the scheme given below, the total number of intramolecular aldol condensation products formed from 'Y' is :



$x$  = moles of  $\text{HCHO}$  consumed.

Value of  $(x)$  will be



$X$  = number of aldol condensation product (including stereoisomer).

Find out the value of  $(X)$ .

**ANSWERS — LEVEL 2**

1. A – d; B – c; C – a; D – b; E – c
2. a – Donor = C, Acceptor = C; b – Donor = E, Acceptor = D;  
c – Donor = B, Acceptor = A; d – Donor = G, Acceptor = G; e – Donor = F, Acceptor = B
3. A – b; B – c; C – d; D – b; E – d
4. A – b, B – b, C – c

**Subjective Problems**

1. 6      2. 3      3. 6      4. 9