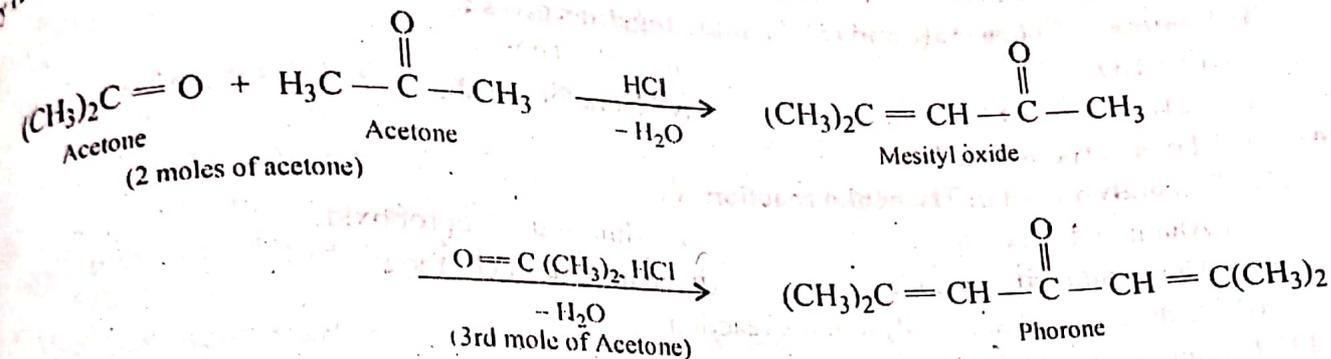


Used as tear gas.

10.2. PHORONE (2, 6-dimethylhepta - 2, 5-diene-4-one)

Preparation : Phorone can be prepared by the condensation of Acetone (3 moles) in the presence of HCl forming mesityl oxide and then phorone.



OBJECTIVE TYPE QUESTIONS

1. Write the correct answer from the given alternatives with reason :

[A] Acetaldehyde and vinyl alcohol are :

- (i) Chain isomers
- (ii) Position isomers
- (iii) Tautomers
- (iv) Metamers

Ans. : (iii) Are keto and enolic forms.

[B] IUPAC name of CH_3CHO is :

- (i) Acetaldehyde
- (ii) Methyl methanol
- (iii) Ethanal
- (iv) Methanal

Ans. : (iii) It is a two carbon aldehyde.

[C] Formaldehyde on heating with conc. NaOH forms :

- (i) Brown resin
- (ii) Methyl formate
- (iii) Methyl alcohol and Sodium formate
- (iv) Formose

Ans. : (iii) Undergoes Cannizzaro's reaction.

[D] Formaldehyde on heating with calcium hydroxide forms :

- (i) Resin
- (ii) Methyl alcohol + Cal. formate
- (iii) Formose
- (iv) Para formaldehyde

Ans. : (iii) It is formed by the polymerisation reaction.

[E] Aldehydes and Ketones may be distinguished by :

- (i) Phenyl hydrazine
- (ii) Sod. bisulphate
- (iii) Tollen's reagent
- (iv) All of the above

Ans. : (iii) Tollen's reagent reduces aldehydes but not ketones.

[F] Acetaldehyde and formaldehyde may be distinguished by :

- | | |
|--------------------------|-----------------------|
| (i) Tollen's reagent | (ii) Schiff's reagent |
| (iii) Fehling's solution | (iv) Hypiodite |

Ans. : (iv) Acetaldehyde reacts with hypiodite to form haloform while formaldehyde does not react.

[G] Formalin is :

- | | |
|---|-----------------------------------|
| (i) Formic acid | (ii) Formaldehyde gas |
| (iii) Mix. of formaldehyde and acetaldehyde | (iv) Aq. solution of formaldehyde |

Ans. : (iv) Formaldehyde is a gas, its aqueous solution is called Formalin.

[H] Heating of Cal. acetate and cal. formate together gives :

- | | |
|---|--------------------------|
| (i) HCHO | (ii) CH ₃ CHO |
| (iii) CH ₃ COCH ₃ | (iv) None of the above |

Ans. : (ii) Found experimentally.

[I] The catalyst used in Tischenko reaction is :

- | | |
|--------------------------------|-----------------------------|
| (i) Aluminium ethoxide | (ii) Aluminium isopropoxide |
| (iii) Aluminium tert. butoxide | (iv) Aluminium chloride |

Ans. : (i) Tischenko used this catalyst in the reaction.

[J] Isomers of an aldehyde may be :

- | | |
|---------------------------|------------------------|
| (i) Ketone | (ii) Unsaturated ether |
| (iii) Unsaturated alcohol | (iv) All of the above |

Ans. : (iv) Molecular formula of all the three class of compounds will be same.

[K] Iodoform test is not given by :

- | | |
|--------------------|--------------|
| (i) Diethyl ketone | (ii) Ethanol |
| (iii) 2-Pentanol | (iv) Ethanol |

Ans. : (i) It has no CH₃CO group.

[L] Formaldehyde and ammonia react to form :

- | | |
|--------------------------|----------------|
| (i) Formaldehyde ammonia | (ii) Formamide |
| (iii) Urotropin | (iv) Formose |

Ans. : (iii) Found experimentally.

[M] Reaction of Acetaldehyde with conc. NaOH forms :

- | | |
|-----------------|-------------------|
| (i) Metaldehyde | (ii) Paraldehyde |
| (iii) Aldol | (iv) Yellow resin |

Ans. : (iv) Found experimentally.

[N] Formation of cyanohydrin by the reaction of carbonyl compounds with HCN is :

- | | |
|----------------------------|----------------------------|
| (i) Electrophilic addition | (ii) Nucleophilic addition |
| (iii) Addition elimination | (iv) Elimination addition |

Ans. : (ii) HCN furnishes CN^- ion which is a nucleophile.

[O] Reduction of ketones by Zn - Hg/HCl is called :

- | | |
|-------------------------|------------------------------|
| (i) Rosenmund reduction | (ii) Clemmensen's reduction |
| (iii) MPV reduction | (iv) Wolff-Kishner reduction |

Ans. : (ii) Clemmensen's reduced ketones by this reagent.

[P] Reaction of C_6H_5CHO with CH_2O in presence of $NaOH$ is called :

- (i) Aldol condensation (ii) Perkin reaction
(iii) Crossed Cannizzaro's reaction (iv) Claisen condensation

Ans. : (iii) Both are aldehydes containing no α -hydrogen atom.

[Q] The compound that gives Fehling's test is :

- (i) Acetone (ii) Benzaldehyde
(iii) Formic acid (iv) None of the above

Ans. : (iii) It contains $H - \overset{\overset{O}{\parallel}}{C} -$ group. Ketone and benzaldehyde do not give this test.

[R] The compound that undergoes aldol condensation is :

- (i) Chloral (ii) Benzaldehyde
(iii) Trimethyl acetaldehyde (iv) None of the above

Ans. : (iv) All have no α -hydrogen atom.

[S] Formation of acetaldehyde from ethylene by oxidation with air in presence of $PdCl_2 / CuCl_2$ is called :

- (i) Sandmeyer reaction (ii) Wurtz reaction
(iii) Wacker's reaction (iv) Stephen's reaction

Ans. : (iii) Wacker prepared aldehyde by this method.

[T] The reactivity in aldehydes and ketones in decreasing order is :

- (i) $CH_2O > CH_3CHO < (CH_3)_2C = O > CCl_3CHO$
(ii) $CH_2O > CCl_3CHO > CH_3CHO < (CH_3)_2CO$
(iii) $CCl_3CHO > CH_2O > CH_3CHO > (CH_3)_2C = O$
(iv) $CCl_3CHO > CH_3CHO > CH_2O > (CH_3)_2C = O$

Ans. : (iii) Electron withdrawing groups attached to carbonyl group increase while electron repelling group decrease the reactivity.

[U] In the reaction $A + H_2O \xrightarrow{H_2SO_4/HgSO_4} B \xrightarrow{OI^-} \text{Iodoform, the compounds:}$

- (i) A is ethylene, B is acetone (ii) A is acetylene, B is acetone
(iii) A is acetylene, B is acetaldehyde (iv) A is ethylene, B is ethanol

Ans. : (iii) Acetylene upon hydration forms acetaldehyde which with hypoiodite forms iodoform.

[V] $A + [O] \xrightarrow[CuCl_2]{PdCl_2/H_2O} B \xrightarrow{Cl_2} C \xrightarrow{NaOH} CHCl_3$

In the above reaction the compound A is :

- (i) Acetylene (ii) Ethylene
(iii) Propene (iv) Propyne

Ans. : (ii) Ethylene is converted to acetaldehyde by Wacker's reaction which with Cl_2 and $NaOH$ forms chloroform.

II. Write the correct answer from the given alternatives with reason :

[A] Preparation of benzaldehyde from toluene by chromyl chloride oxidation method is called :

- (i) Gattermann synthesis (ii) Stephens reaction

(iii) Etard reaction

(iv) Rosenmund reaction

Ans. : (iii) Etard prepared benzaldehyde by this method.

[B] Preparation of benzaldehyde by reduction of benzoyl chloride in presence of Pd-BaSO₄ is called :

(i) Etard reaction

(ii) Rosenmund reaction

(iii) Stephen reaction

(iv) Tischenko reaction

Ans. : (ii) Rosenmund prepared benzaldehyde by this method.

[C] Which of the following does not reduce Fehling solution ?

(i) Phenylacetaldehyde

(ii) Cinnamaldehyde

(iii) Benzaldehyde

(iv) Salicylaldehyde

Ans. : (iii) In alkaline medium (Fehling's solution) benzaldehyde undergoes Cannizzaro's reaction.

[D] Formation of benzyl alcohol and sod. benzoate from benzaldehyde by the reaction of NaOH is called :

(i) Perkin reaction

(ii) Benzoin condensation

(iii) Cannizzaro's reaction

(iv) Tischenko reaction

Ans. : (iii) It does not contain α -hydrogen atom.

[E] Which of the following does not undergo Cannizzaro's reaction ?

(i) HCHO

(ii) CH₃CHO(iii) C₆H₅CHO

(iv) Chloral

Ans. : (ii) It has α -hydrogen atom.

[F] Formation of benzaldehyde from phenyl cyanide by SnCl₂ / HCl reduction is called :

(i) Gattermann reaction

(ii) Stephens reaction

(iii) Etard reaction

(iv) Clemmensen reaction

Ans. : (ii) Stephen prepared benzaldehyde by this method.

[G] Reaction of benzaldehyde with acetaldehyde in presence of alkali is called :

(i) Crossed Cannizzaro's reaction (ii) Cross Aldol condensation

(iii) Calisen condensation (iv) None of the above

Ans. : (ii) One aldehyde has α -H while other does not.

[H] Reaction of benzaldehyde with acetic anhydride in presence of sod. acetate is called :

(i) Calisen-Schmidt reaction

(ii) Knoevenagel reaction

(iii) Perkin reaction

(iv) Michael reaction

Ans. : (iii) Perkin prepared cinnamic acid by this reaction.

[I] Reaction of benzaldehyde with methylenetriphenylphosphorane to form styrene is called :

(i) Michael reaction

(ii) Reformatsky reaction

(iii) Wittig reaction

(iv) Knoevenagel reaction

Ans. : (iii) Wittig carried out the reaction of aldehydes and ketons with ylids.

[J] Reaction of benzaldehyde with ethyl α -bromopropionate in presence of zinc to form cinnamic acid is called :

(i) Perkin reaction

(ii) Wurtz reaction

(iii) Reformatsky reaction

(iv) Michael reaction

Ans. : (iii) The reaction is named after its discoverer.

[K] Less solubility in water and high volatility of salicylaldehyde is because of :

(i) High molecular weight

(ii) Intramolecular hydrogen bonding

Ans. : (iii) Intermolecular hydrogen bonding(iv) Absence of polar group
 (ii) It results in the formation of unit molecule.

[L] Acetophenone on bromination in ether at 0°C forms :

- (i) *m*-Bromo acetophenone
 (ii) Dypnone
 (iii) Phenacyl bromide
 (iv) *m*-Bromobenzoic acid
 (iii) Bromination takes place at the side chain alkyl group.

[M] Which of the following does not react with HCN ?

- (i) C_6H_5CHO
 (ii) $C_6H_5CH=CH-CHO$
 (iii) $C_6H_5COCH_3$
 (iv) $C_6H_5COC_6H_5$
 (iv) Due to steric hindrance.

[N] Which of the compounds forms bisulphite addition product with $NaHSO_3$:

- (i) Benzophenone
 (ii) Acetophenone
 (iii) Cinnamaldehyde
 (iv) All of the above
 (iii) Others do not react due to steric hindrance.

[O] Reaction of Cl_2 with *p*-benzoquinone forms :

- (i) *p*-dichlorobenzene
 (ii) Chlorohydroquinone
 (iii) Tetra chloro-*p*-benzoquinone
 (iv) Quinhydrone
 (iii) Found experimentally.

[P] The compound chloranil is :

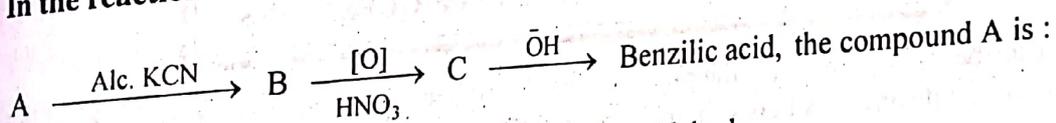
- (i) Trichloroaniline
 (ii) Dichloroaniline
 (iii) Tetrachloro-*p*-benzoquinone
 (iv) 2,3-Dichloro *p*-benzoquinone
 (iii) It is tetrachloro *p*-benzoquinone.

[Q] Cinnamaldehyde on reduction with M.P.V. reagent forms :

- (i) Benzaldehyde
 (ii) Cinnamic acid
 (iii) Cinnamyl alcohol
 (iv) β -phenylpropionaldehyde

Ans. : (iii) M.P.V. reagent is a selective reducing agent which reduces aldehyde group but not double bond.

[R] In the reaction series :



- (i) Salicylaldehyde
 (ii) Benzaldehyde
 (iii) Cinnamaldehyde
 (iv) Benzil
 (ii) Benzilic acid is formed from benzil which in turn is obtained from benzoin and benzoin is formed from benzaldehyde..

[S] Schiff's base is :

- (i) Paraorsaniline
 (ii) Benzaldoxime
 (iii) Benzylideneaniline
 (iv) Malachite green

Ans. : (iii) It is obtained by the reaction of aniline and Benzaldehyde.

[T] Vanillin is :

- (i) *m*-Hydroxy *p*-methoxybenzaldehyde
 (ii) *m*-Methoxy *p*-hydroxybenzaldehyde
 (iii) *o*-hydroxy *p*-methoxybenzaldehyde
 (iv) *o*-methoxy *p*-hydroxybenzaldehyde
 (ii) Meta-methoxy, *p*-hydroxy benzaldehyde has smell of vanilla and so called vanillin.

[U] Acetophenone on nitration forms :

- (i) Ortho + para nitroderivative
(ii) Meta nitro derivative
(iii) Oxidation takes place
(iv) No reaction

Ans. : (ii) Keto group is meta directing.

[V] *p*-Benzoquinone reacts with PCl_5 to form :

- (i) Tetra chloro *p*-benzoquinone
(ii) *p*-Dichlorobenzene
(iii) Dichloro *p*-benzoquinone
(iv) No reaction

Ans. : (ii) Found experimentally.

[W] The reaction of butadiene with *p*-benzoquinone to form tetra hydronaphtha-quinone is called

- (i) Mannich reaction
(ii) Willgerodt reaction
(iii) Diels-Alder reaction
(iv) Michael reaction

Ans. : (iii) It is a reaction of $[4 + 2]$ π electron system.

[X] Hydrobenzamide is formed by the reaction of ammonia with :

- (i) Benzoic acid
(ii) Benzaldehyde
(iii) Hydrazoic acid
(iv) Hydrazine

Ans. : (ii) Found experimentally.

[Y] Coumarin can be obtained by the reaction of 'A' with acetic anhydride and sod. acetate. The compound 'A' is :

- (i) Benzaldehyde
(ii) *o*-Hydroxybenzaldehyde
(iii) *p*-Hydroxy benzaldehyde
(iv) Cinnamaldehyde

Ans. : (ii) Coumarin is an unsaturated lactone obtained by heating ortho-hydroxy cinnamic acid. Latter prepared by Perkin reaction.

[Z] Formation of benzyl alcohol and benzyl benzoate from benzaldehyde by heating it with aluminium ethoxide is called :

- (i) Tischenko reaction
(ii) Cannizzaro reaction
(iii) M.P.V. reaction
(iv) Cross Cannizzaro reaction

Ans. : (i) Tischenko used aluminium ethoxide catalyst. In its presence, the acid and alcohol formed combine to give ester.

SHORT AND DESCRIPTIVE TYPE QUESTIONS

- (a) Describe two methods for the preparation of pure benzaldehyde. Give the reaction which brings about the differences between aromatic and aliphatic aldehydes. (K.U., 1988; R.U., 2003)

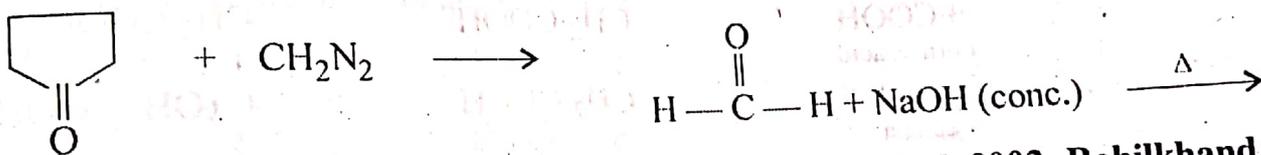
(b) What happens when benzaldehyde reacts with (i) PCl_5 , (ii) 2, 4-dinitrophenylhydrazine.
- (a) How benzaldehyde is prepared from :
(i) Benzoyl chloride, (ii) Phenylmagnesium bromide. How will you convert it into (a) aniline, (b) Phenylacrylic acid.
(b) How will you prepare salicylaldehyde from Phenol? How you convert it into : (i) Coumarin, (ii) Benzoic acid. (K.U., 1986)
- (a) Explain, why benzaldehyde undergoes Cannizzaro's reaction? Give its mechanism. (K.U., 1984)

(b) What happens when benzaldehyde is treated with (i) PCl_5 , (ii) NH_3 and acetophenone undergoes self condensation in presence of aluminium tert. butoxide. (K.U., 1983)

(c) Quinones do not behave like aromatic compounds although they have six membered ring structure.

tures.

- (d) Write the mechanism of Gattermann's Kock reaction and Perkin reaction. (K.U., 1994)
4. Give two methods for the preparation of an aldehyde which is found in the oil of bitter almond. (R.U., 2003)
5. Write any two reactions of benzaldehyde which are different from acetaldehyde.
6. Why benzaldehyde does not reduce Fehling solution even though it has an aldehyde group?
7. Why benzaldehyde does not undergo Friedel-Crafts reaction? Explain.
8. Explain the directive influence of $-CHO$ group when attached to benzene ring.
9. Why benzophenone does not form addition product with $NaHSO_3$?
10. What is benzoin condensation? Give its one example.
11. Why *o*-hydroxybenzaldehyde is more steam volatile than its *p*-isomer?
12. Write down the two geometrical isomers of the product formed in Perkin reaction of salicylaldehyde.
13. Why benzophenone on reaction with sodium produces dark green colour?
14. What is phenacyl bromide? How it is prepared? What are its uses?
15. What are quinones? Give the structures of known isomers.
16. Complete the following reaction and give its mechanism. (Gorakhpur, 2003)



17. Write short notes on the following : (Rajasthan, 2000; Purvanchal, 2002; Rohilkhand, 2001)
- (i) Perkin's reaction
- (ii) Benzoin condensation
- (iii) Claisen reaction
18. What is the order of reactivity of benzaldehyde, benzophenone and acetophenone towards nucleophilic reagent. (Purvanchal, 2002)
19. What happen when acetophenone is treated with sodium hydroxide and zinc. (Purvanchal, 2002)
20. Explain the following reactions :
- (i) Cannizzaro's reaction
- (ii) Benzoin condensation
- (iii) Rosenmund reaction
21. Discuss the general mechanism of nucleophilic addition reaction of aldehydes. Identify the product (A), (B) and (C) in the following set of reaction. (Agra, 1994)

