CBSE Class 12 Chemistry Chapter 12 Aldehydes, Ketones, and Carboxylic Acids Worksheet with a– Set 1

Q1. What is the hybridisation of carbon in the carbonyl group?
(a) sp
(b) sp^2
(c) sp^3
(d) None of the above

Answer:

(b) The hybridisation of carbon in the carbonyl group is sp^2.

Q2. Carbonyl group take part in the _____ or _____ and _____ reactions.
(a) Electrophilic addition reaction
(b) Nucleophilic addition reaction
(c) Electrophilic and nucleophilic addition reaction
(d) None of the reactions

Answer:

(b) Carbonyl group take part in the nucleophilic addition reactions.

Q3. Both aldehyde and ketones give an addition reaction with
(a) HCN
(b) $NaHSO_3$
(c) Both (a) and (b)
(d) None of the above

Answer:

(c) Both aldehyde and ketones give addition reaction with HCN and $NaHSO_3$.

Q4. Which of the following carbonyl compound does not undergo aldol condensation?
(a) HCHO
(b) CH_3CHO
(c) CH_3CH_2CHO
(d) None of the above

Answer:

(a) HCHO does not undergo aldol condensation.

Q5. Aldol condensation between the following compounds followed by the dehydration gives methyl vinyl ketone.
(a) Methanal and ethanal
(b) Two moles of formaldehyde
(c) Methanal and propanone
(d) None of the above

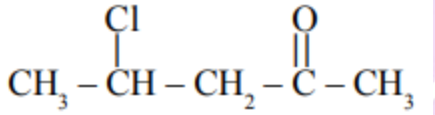
Answer:

(c) Aldol condensation between methanal and propanone followed by the dehydration gives the methyl vinyl ketone.

Q6. Draw the structure of the compound whose IUPAC name is 4-chloropentan2-one.

Answer:

The structure of the compound whose IUPAC name is 4-chloropentan2-one is mentioned below.



Q7. Name an aldehyde that does not give Fehling solution test.

Answer:

Benzaldehyde does not give Fehling solution test.

Q8. Why does benzaldehyde give a positive Tollen's reagent test but not Fehlings or Benedict solution test?

Answer:

Benzaldehyde gives a positive Tollen's reagent test but not Fehlings or Benedict's solution test because of the stronger oxidising nature of Tollen's reagent compared to Fehling
and Benedict's solution. Fehling and Benedict's solution cannot oxidise benzaldehyde to benzoic acid.

Q9. What type of aldehydes can undergo the Cannizaro reaction?

Answer:

Aldehydes that do not contain alpha hydrogen atoms undergo a Cannizzaro reaction, e.g. Formaldehyde (HCHO) and Benzaldehyde (C_6H_5CHO).

Q10. Can we consider the Gattermann-Koch reaction similar to Friedel Craft's acylation reaction? Explain.

Answer:

Yes, we can consider the Gattermann-Koch reaction identical to the Friedel-craft acylation reaction because benzene (or any other arene) is treated with an acid chloride in Friedel-craft acylation reactions in the presence of anhydrous $AlCl_3$. Since HCOCl (formyl chloride) is not stable, the Gattermann-Koch reaction is prepared in situ by reacting CO with HCl gas in the presence of anhydrous $AlCl_3$. Thus, the Gattermann-Koch reaction is considered similar to the Friedel-craft acylation reaction.

Q11. Alkene shows electrophilic addition reactions, whereas carbonyl compounds show nucleophilic addition reactions even though they both contain a pie bond. Justify.

Answer:

Alkene contains a (C=C) bond, whereas carbonyl contains a (C=O) bond. Where alkenes undergo electrophilic addition, whereas aldehydes and ketones undergo nucleophilic addition because, in alkenes, the double bond joins two carbon atoms, and there is no resultant polarity. While in carbonyl compounds, the double bond joins atoms having different polarities. The polarity in the carbonyl bond makes it vulnerable to a nucleophile addition reaction.
Thus, alkene shows electrophilic addition reactions, whereas carbonyl compounds show nucleophilic addition reactions.

Q12. What is Tollen's reagent?

Answer:

Tollen's reagent is the ammonical solution of silver nitrate. It is used to test aldehydes. Both aliphatic and aromatic aldehydes reduce Tollen's reagent test to give a shiny silver mirror. It is also used to distinguish aldehydes from ketones.

Q13. Organise the following hydrocarbons in increasing ranking of their reactivity in nucleophilic addition reactions.
CH_3CHO, CH_3CH_2CHO, CH_3COCH_3, $CH_3COCH_2CH_3$

Answer:

We can arrange the hydrocarbons as $CH_3COCH_2CH_3 < CH_3COCH_3 < CH_3CH_2CHO < CH_3CHO$.

Q14. How can you distinguish between benzoic acid and phenol?

Answer:

We can distinguish between benzoic acid and phenol by reacting it with sodium bicarbonate. Benzoic acid reacts with sodium bicarbonate with a brisk effervescence due to the liberation of carbon dioxide gas while phenol does not react with sodium bicarbonate.
$C_6H_5COOH + NaHCO_3 \rightarrow C_6H_5COONa + H_2O + CO_2$
$C_6H_5OH + NaHCO_3 \rightarrow$ No reaction.

Q15. Why can not we use formaldehyde in an aldol condensation reaction?

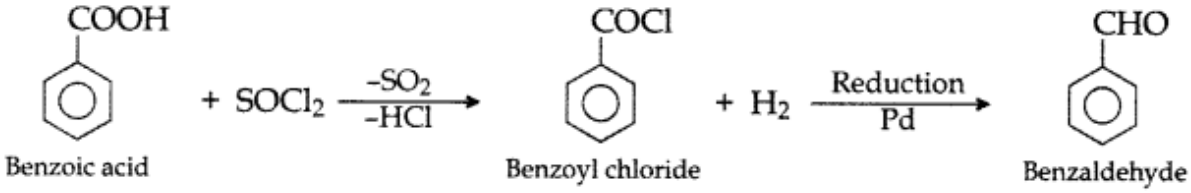
Answer:

We can not use formaldehyde in an aldol condensation reaction because it does not contain any alpha hydrogen. Therefore, it does not take part in the aldol condensation reaction.

Q16. Convert benzoic acid to benzaldehyde.

Answer:

We can convert benzoic acid to benzaldehyde by reacting it with thionyl chloride followed by the reduction with palladium.



Q17. What is Hell-Volhard-Zelinsky reaction?

Answer:

Hell-Volhard-Zelinsky reaction: It is a reaction of a carboxylic acid with chlorine or bromine in presence of small quantities of red phosphorous to yield solely α-Chloro or α-Bromo acids.

$CH_3COOH + Cl_2$ + Red Phosphorous → $ClCH_2COOH + Cl_2$ + Red Phosphorous → $Cl_2CHCOOH + Cl_2$ + Red Phosphorous → $Cl_3C\ COOH$.

Q18. How will you distinguish between propanal and propanone?

Answer:

We can distinguish between propanal and propanone by carrying out the Fehling solution test. Propanal gives a positive test Fehling solution test forming a red precipitate of cuprous oxide while propanone does not respond to the Fehling solution test.

$CH_3CH_2CHO + 2\ Cu^{2+} + 5\ OH^- \rightarrow CH_3CH_2COONa + Cu_2O + 3\ H_2O$

Q19. How will you distinguish between benzaldehyde and acetophenone?

Answer:

We can distinguish between benzaldehyde and acetophenone by performing the iodoform test. Acetophenone, being a methyl ketone gives a positive iodoform test to yield a yellow precipitate CHI_3.while benzaldehyde does not give a positive iodoform test.

$C_6H_5COCH_3 + 3\ NaOI \rightarrow C_6H_5COONa + CHI_3 + 2\ NaOH$
$C_6H_5CHO + NaOI \rightarrow$ No Yellow Precipitate.

Q20. A has a characteristic odour, on treating with NaOH, and forms two compounds (B) and (C). Compound (B) has the molecular formula C_7H_8O, which on oxidation with CrO_3, gives back compound (A). Compound (C) is the sodium salt of the acid. Compound (C), when heated with soda lime, yields an aromatic hydrocarbon (D). Deduce the structures of (A), (B), (C) and (D). Write chemical equations for all reactions taking place.

Answer:

As A gives a characteristic odour, which on treatment with NaOH gives two compounds, B and C. Hence, A should be benzaldehyde.

Reactions: