Solution

CET25C8 ALDEHYDES KETONES AND CARBOXYLIC ACIDS

Class 12 - Chemistry

1.

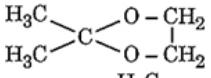
(b) 2 – butene

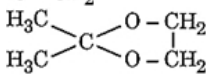
Explanation: 2-butene on reductive ozonolysis with O_3/Zn will give CH_3CHO which has a molecular mass of 44u.

$CH_3CH=CHCH_3 + O_3/Zn \rightarrow 2CH_3CHO$

Molecular mass of $CH_3CHO = 12 + 3 + 12 + 1 + 16 = 44u$

2.

(d) 

Explanation: 

3.

(d) Iodine/NaOH

Explanation: 2-pentanone ($CH_3COCH_2CH_2CH_3$) will give an iodoform test (reaction with I_2 + NaOH) because of the presence CH_3CO- group and yellow precipitate will be formed. But 3-pentanone ($CH_3CH_2COCH_2CH_3$) does not have CH_3CO- group hence will not give the iodoform test. The reaction is as follows:

$CH_3COCH_2CH_2CH_3 + I_2 + NaOH \rightarrow CHI_3$ (yellow precipitate) $+ CH_3CH_2CH_2COO^-Na^+$

$CH_3CH_2COCH_2CH_3 + I_2 + NaOH \rightarrow$ No reaction

4. **(a)** 1-aminoethane

Explanation: 1-aminoethane

5.

(b) HCHO

Explanation: HCHO is most reactive towards nucleophilic addition reaction.

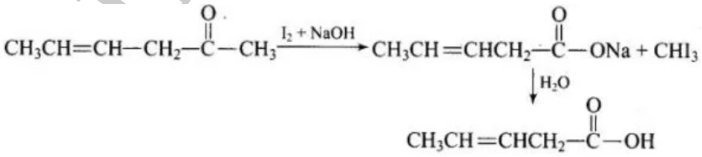
6.

(c) I_2 and NaOH

Explanation: I_2 and NaOH

7. **(a)** I_2 and NaOH solution

Explanation:

The reaction involved is- 

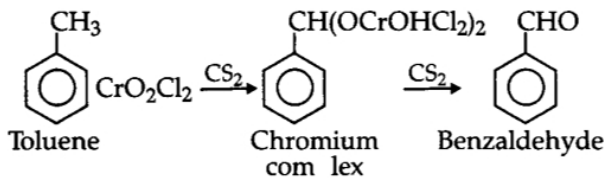
8.

(d) Pentan-2-one

Explanation: Pentan-2-one

9.

(c) Etard reaction

Explanation: 

This reaction is known as Etard reaction.

10.

(b) Benzyl alcohol and sodium formate

Explanation: They will undergo Cannizzaro reaction as neither benzaldehyde nor formaldehyde has alpha hydrogen. HCHO will be more reactive towards Cannizzaro compared to benzaldehyde because of less steric hindrance.

So, OH^- nucleophile will attack HCHO first, and then the hydride shift from HCHO to benzaldehyde will occur and thus HCHO will oxidize to $HCOO^-$ ion and benzaldehyde will reduce to benzyl alcohol.

11.

(d) Wolff – Kishner reduction

Explanation: This is Wolff Kishner reduction of Carbonyls to alkanes. Wolff kishner reaction uses hydrazine (NH_2-NH_2) and conc base like NaOH or KOH for reduction of carbonyl to alkanes.

12.

(d) $(CH_3)_2$ CH - CHO

Explanation: $(CH_3)_2$ CH - CHO doesn't give cannizaro reaction.

13. **(a)** saponification

Explanation: Base hydrolysis of ester produces the salt of carboxylic acid and alcohols as the product, and soaps are salts of carboxylic acids. Therefore, this reaction is called a saponification reaction.

14.

(d) Glutaric acid

Explanation:

- Pentanedioic acid is known as glutaric acid.
- $(COOH)_2$ is known as oxalic acid.
- Butanedioic acid is known as succinic acid.
- Hexanedioic acid is known as adipic acid.
- Heptanedioic acid is known as pimelic acid.

15. **(a)** $C_6H_5COCH_3$

Explanation: $C_6H_6 + CH_3COCl \xrightarrow{AlCl_3} C_6H_5COCH_3$

This is known as Friedel craft acylation reaction. $AlCl_3$ acts as a lewis acid and will generate CH_3CO^+ carbocation and this will attack benzene to give $C_6H_5COCH_3$.

16.

(b) size and solubility of the aldehyde and ketone molecule.

Explanation: Size and solubility of aldehyde and ketone determine fragrance. For example, aldehyde C-10 is used in floral blends like rose, jasmine, etc. While aldehyde C-11 has a strong citrus smell and aldehyde C-16 has a strong strawberry smell.

17.

(d) Iodoform test

Explanation: Iodoform test

18.

(b) Iodoform test

Explanation: $CH_3COR + I_2 + NaOH \rightarrow CHI_3 + RCOO^-Na^+$

Iodoform test is a characteristic test given by methyl ketones. CHI formed is yellow precipitate.

19. **(a)** CH_3CH_2CHO

Explanation: CH_3CH_2CHO will give aldol reaction because of the presence of alpha hydrogen in it.

20.

(b) $(CH_3)_2C(OC_2H_5)(OC_2H_5)$

Explanation: Ketones or aldehydes react with alcohols to form acetals. This reaction of alcohol on aldehydes or ketones is catalyzed in the presence of acid and is a reversible reaction. Firstly a hemiacetal $(CH_3)_2C(OH)(OC_2H_5)$ is formed which further reacts with alcohol to give acetal.

$(CH_3)_2C(OC_2H_5)(OC_2H_5)$ $CH_3COCH_3 + 2C_2H_5OH \overset{H^+}{\rightleftarrows} (CH_3)_2C(OC_2H_5)(OC_2H_5)$

21.

(c) C_6H_5CHO

Explanation: C_6H_5CHO

22.

(c) Oxalic acid

Explanation: Structural formula of Ethan-1, 2-dioic acid is

$$\begin{array}{l} COOH \\ | \\ COOH \end{array}$$

∴ It is oxalic acid.

23.

(b) $(CH_3)_2Cd$

Explanation: $(CH_3)_2Cd$

24.

(c) Acetaldehyde

Explanation: Cyanohydrin formed from aldehydes or ketones followed by complete hydrolysis that is used to produce alpha hydroxycarboxylic acids and on complete hydrolysis, CN converts to COOH. The complete reaction as follows:

$CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

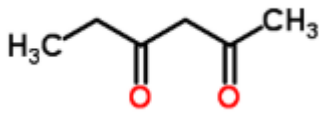
$CH_3CH(OH)CN + H_3O^+ \rightarrow CH_3CH(OH)COOH$

25.

(c) 2, 4 – Hexanedione

Explanation: 2,4-hexanedione will have active methylene group.

The structure of 2,4-hexanedione is



$-CH_2$ group present between the two carbonyl group is active methylene group, these hydrogens are highly acidic as their conjugate base is highly stable.

26.

(b) Benzoic Acid

Explanation: $C_6H_5(CH_3) + Cl_2/hv \rightarrow C_6H_5(CCl_3)$

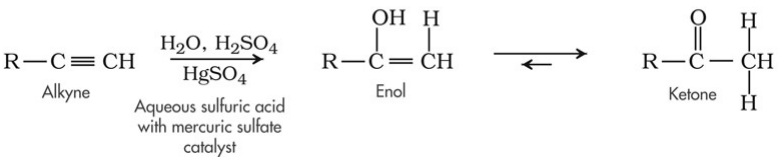
$C_6H_5(CCl_3) + H_3O^+ \rightarrow C_6H_5(C(OH)_3) \rightarrow C_6H_5COOH$

27.

(b) $PhCOCH_2CH_3$

Explanation: Hydration of given alkyne will occur according to Markovnikoff's rule leading to the formation of enol which will tautomerise to give keto form.

The general reaction of alkyne hydrations shown below:



Same reaction will occur with

$PhC \equiv CMe \xrightarrow{H_3O^+, Hg^{2+}} ? \; PhC(OH) = CHCH_3 \Leftrightarrow PhCOCH_2CH_3$.

28.

(b) Oxime

Explanation: Oxime

29.

(b) $C_4H_8O_2$

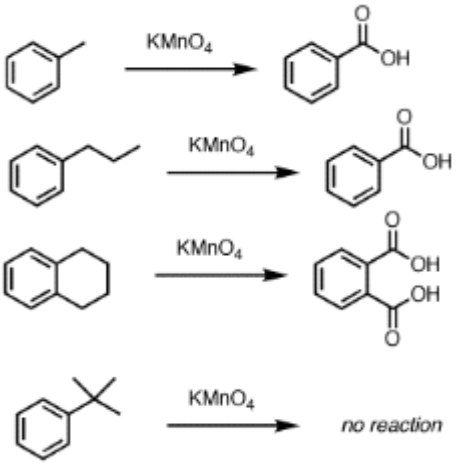
Explanation: Its molecular formula is $C_4H_8O_2$ and its chemical formula is $CH_3COOC_2H_5$.

30.

(c) Benzoic acid

Explanation:

Alkylbenzenes having at least one alpha hydrogen when reacts with $KMnO_4$ then, alkyl group oxidises to COOH group.



$C_6H_5C_2H_5 + KMnO_4 \rightarrow C_6H_5COOH$

31.

(c) Aldehydes with no α- hydroge

Explanation: Aldehydes with no α-hydrogen undergo Canizzaro reaction.

32.

(b) NH_2OH

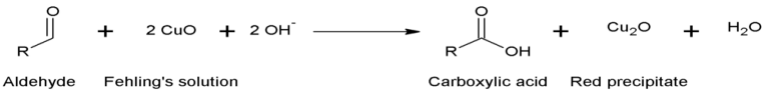
Explanation: Aldehydes and ketones react with NH_2OH (hydroxylamine) to form oximes as shown in the given reaction.

$RCOR' + NH_2OH \rightarrow RR'C=NOH$ (oxime)

33.

(d) Cu_2O

Explanation:



aldehydes give positive fehling's test with a red precipitate of Cu_2O

34.

(c) CH_3-CH = CH-CHO

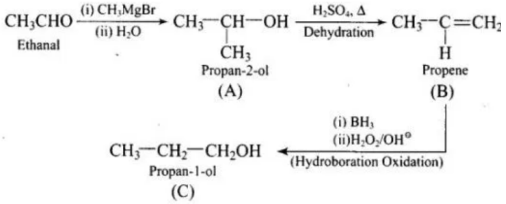
Explanation: CH_3-CH=CH-CH_2-OH $\xrightarrow{PCC}$ CH_3-CH=$CH-\underset{\underset{O}{\|}}{C}-H$

Where PCC: Pyridinium chloro oxochromate. PCC oxidises primary alcohols to aldehyde.

35.

(d) positional isomers

Explanation:

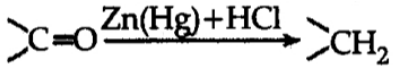


Thus, $CH_3\ \underset{CH_3}{\overset{|}{C}}\ H-OH$ and CH_3-CH_2-CH_2OH are positional isomers(differs in position of functional group).

36.

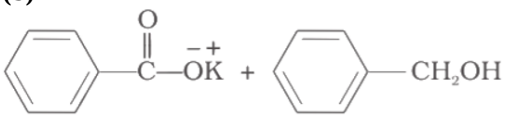
(d) zinc amalgam + HCl

Explanation: Clemmensen reduction is used to convert carbonyl group to CH_2 group as follows:



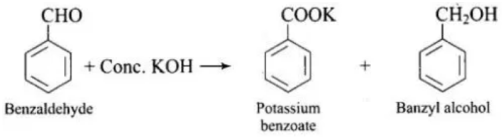
37.

(b)



Explanation:

Benzaldehyde has no hydrogen. So, on reaction with aqueous KOH solution, it undergoes Cannizzaro's reaction. One molecule of aldehyde is reduced and other is oxidized to carboxylic acid salt.



38.

(d) CH_3COCH_3

Explanation: CH_3COCH_3 will not give a silver mirror test (Tollens Test). Tollens test is given by aldehydes only and HCOOH is the only acid that gives tollen's test. Ketones do not give tollen's test.

39.

(c) Prop-1-en-2-ol, tautomerism

Explanation: $CH_3 - C \equiv CH \xrightarrow[1\%HgSO_4]{40\%H_2SO_4} \underset{\underset{(A)}{Prop-1-en-2-ol}}{CH_3 - \overset{OH}{\overset{|}{C}} = CH_2} \xrightarrow{Isomerisation} \underset{Acetone}{CH_3 - \overset{O}{\overset{||}{C}} - CH_3}$

Prop-1-en-2-ol (A) acetone are tautomers.

40.

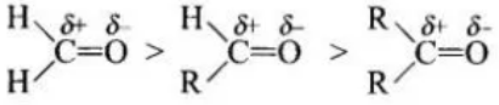
(b) $(CH_3)_2$ CH - CHO

Explanation: $(CH_3)_2$ CH - CHO doesn't give cannizaro reaction.

41. **(a)** $CH_3 - \overset{O}{\overset{||}{C}} - H$

Explanation:

CH_3CHO is most reactive towards nucleophilic addition reactions. Carbonyl compounds are polar with the positive charge on a carbon atom which is attacked by nucleophiles. Two electron releasing alkyl groups in ketones make carbonless electron deficient than aldehydes. Benzene(C_6H_6) ring exhibits +R-effect which thereby decreases the ease of nucleophilic addition reaction in benzaldehyde and acetophenone. Hence the reactivity order is as follows



42.

(d) Hexan-3-one

Explanation: Hexan-3-one

43.

(b) Adipic acid

Explanation: Conc. $KMnO_4$ will cause oxidative ozonolysis and ring-opening forming adipic acid.

Cyclohexene + conc. $KMnO_4 \rightarrow HOOC(CH_2)_4COOH$

44.

(c) HCHO

Explanation: Those aldehydes which do not have α-hydrogen atom like HCHO, does not give alcohol condensation reaction.

45.

(d) 2,2-Dimethylbutanoic acid

Explanation: 2,2-Dimethylbutanoic acid

46. **(a)** Butan-2-ol

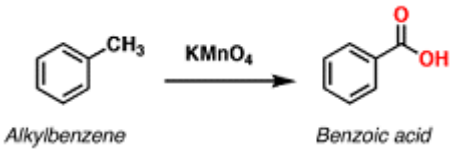
Explanation: $\underset{Bu\tan-2-ol}{CH_3CH_2\underset{OH}{\underset{|}{C}}HCH_3} \xrightarrow[KMnO_4]{alk} \underset{Bu\tan one}{CH_3CH_2COCH_3}$ Butan-2-ol converted to butanone

47.

(b) Benzoic acid

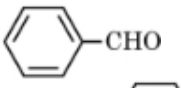
Explanation: Oxidation of aromatic alkanes with KMnO4 to give carboxylic acids.

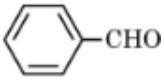
Description: Treatment of an alkylbenzene with potassium permanganate results in oxidation to give the benzoic acid.



Key bonds formed	Key bonds broken
C-O(π)	C-H
C-O	C-H
C-OH	C-H

48.

(b) 

Explanation: 

49.

(b) Etard reaction

Explanation: Etard reaction

50.

(b) $CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$

Explanation: The product obtain is

$CH_3CH_2C \equiv CH + H_2O \xrightarrow{H^-, Hg^{2+}} \underset{OH}{CH_3CH_2\underset{|}{C}=CH_2} \rightleftharpoons \underset{O}{CH_3CH_2\underset{\|}{C}-CH_3}$

51. **(a)** Pentan-3-one

Explanation: Pentan-3-one

52. **(a)** CH_3CHO

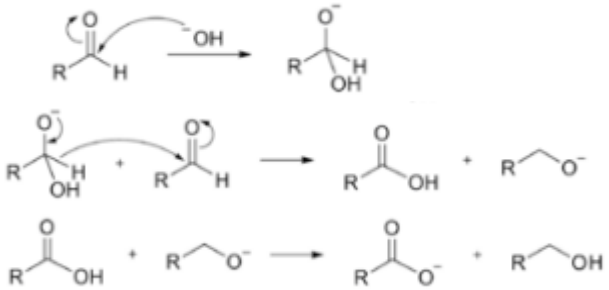
Explanation: Acetaldehyde (CH_3CHO) have alpha hydrogen hence will undergo aldol reaction in presence of base rather than cannizaro reaction. Cannizaro reaction is given when there is no alpha hydrogen present on carbonyl group.

53.

(d) nucleophilic attack, transfer of H^- and transfer of H^+

Explanation: In Cannizzaro reaction 1st nucleophile OH^- attacks on carbonyl carbon. Then hydride shifting takes place.

Followed by proton transfer as shown below (in, RCHO, R group has no alpha hydrogen) :



Cannizaro is a kind of disproportionation reaction where aldehyde or ketones having no alpha hydrogen get oxidised to acid and reduced to alcohol.

54.

(d) Cross-Aldol condensation

Explanation: Cross-Aldol condensation

55.

(d) 1, 1 dichloroethane

Explanation: $CH_3CHCl_2 + OH^- \rightarrow CH_3CH(OH)_2 \rightarrow CH_3CHO + H_2O$

Gem diols like ($CH_3CH(OH)_2$) are generally not stable. The 2 -OH group attached to the same C removes H_2O and forms carbonyl compounds.

56.

(d) higher aldehydes

Explanation: Higher aldehydes like aldehyde C-10 etc. are used in floral blends like rose, jasmine, etc.

57.

(c) Fehling’s solution

Explanation: Fehling's solution oxidises aliphatic aldehydes very easily but does not react with acetone and aromatic aldehyde; benzaldehyde.

58.

(b) Acetic acid

Explanation: Acetic acid is the strongest acid because it loses H^+ ion to form carboxylic ion (CH_3COO^-)which gets stabilised by resonance.

59.

(b) Tollen's reagent

Explanation: Tollen's Test is used to distinguish between aldehyde and ketone. It uses the fact that aldehydes are easily oxidised to their corresponding acids while ketones are not.

Tollen's reagent is aqueous ammonical silver nitrate solution which reacts with aldehydes as shown.

$RCHO + 2Ag^+ + 2OH^- \rightarrow RCOO^- + Ag + H_2O.$

$RCOR + 2Ag^+ + 2OH \rightarrow$ No reaction

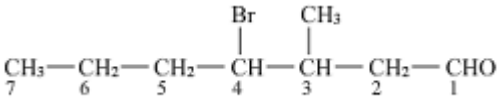
If this test is carried in a glass tube, the Ag formed forms a mirror on the sides of the test tube so the test is also known as the silver mirror test.

Aldehydes show Tollen’s test while acetone which is a ketone does not give Tollen’s test.

60. **(a)** 4 – Bromo – 3 – methylheptanal

Explanation: The IUPAC of the above compound will be more clear if we open up the structure:

The structure of the above compounds is (longest chain contain 7 carbon)



Hence the IUPAC name of the above compound is 4-Bromo-3-methylheptanal.

61. **(a)** Using H_2-Pd,$BaSO_4$

Explanation: Catalytic hydrogenation of acid chloride using H_2-Pd, $BaSO_4$ converts acid chloride selectively to aldehydes

(**$BaSO_4$** reduces the activity of palladium). This is known as Rosenmund Reduction.

Rosenmund Reduction