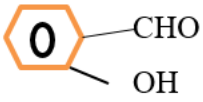
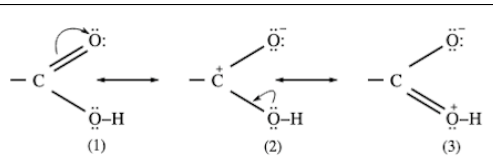
INDIAN SCHOOL NIZWA- WORKSHEET

	CHEMISTRY CH: 12ALDEHYDES, KETONES &CARBOXYLIC ACIDS	
Name: _____	Date:_____	Class: XII Sec: ___

1.	**Answer the following** 1. Write IUPAC names. a. $CH_2 = CH\ CO\ CH_3$ b. $CH_3\ CH_2\ CO\text{-}CH_2\text{-}CHO$ c. $CH_3 - CO\ CH{=}C - (CH_3)_2$ d. 
	1.a But-3-en-2-one b. 3 -oxo pentanal c. 4- methyl,pent-3-en-2- one d. 2- hydroxy benzaldehyde
2.	1. Write the structure of the following compounds. a.3- oxo pentanal b. 6-Chloro-4- methyl hexanal c. 1- phenyl propanone. d. Hex-4-en -2 - one.
	2 a. $CH_3\text{-}CH_2\text{-}CO\ CH_2CHO$ b. $CH_3\text{-}CH(CH_2CH_2Cl)\text{-}CH_2\text{-}CHO$ c. $Ph - COCH_2\ CH_3$ d. $CH_2\text{-}\ CO\text{-}CH_2\text{-}CH{=}CH\text{-}CH_3$
3.	Give chemical tests to distinguish between the following pairs of compounds a. Ethanal and propanone b. Propanoyl chloride and propanoic acid

	c. Benzaldehyde and ethanal. (acetaldehyde) d. Benzaldehyde and benzoic acid.
	Chemical tests a. **Ethanal and propanone** On warming with iodine and alkali, propanone gives yellow precipitate of iodoform.Ethanal does not. Or Ethanal gives Silver mirror or black precipitate with Tollen's reagent.Propanone does not Or Ethanal gives red precipitate of Cu2O when warmed with Fehling's reagent. Propanone does not. b. **Propanoyl chloride and propanoic acid**. On treating with $NaHCO_3$, propanoic acid gives brisk effervescence of CO_2, but propanoyl chloride does not. c. **Benzaldehyde and ethanal. (acetaldehyde)** Ethanal on warming with Fehling's reagent gives red precipitate of Cu2O and with Tollen's reagent black precipitate or silver mirror is formed. Benzaldehyde gives black precipitate/silver mirror with Tollen's reagent , but does not give Fehling's test.. d. **Benzaldehyde and benzoic acid** Benzoic acid gives brisk effervescence with sodium bicarbonate due to the evolution of CO2, benzaldehyde does not.
4.	2. Give reasons for the following. a. Monochloro ethanoic acid has a higher pKa value than di chloro ethanoic acid. b. Ethanoic acid is weaker than benzoic acid. c. Aldehydes are more reactive than ketones towards nucleophiles. Or Ethanal is more reactive than acetone towards nucleophilic addition reactions. Or CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. d. The aldehydes and ketones undergo a number of addition reactions.

	e. The boiling points of aldehydes and ketones are lower than corresponding acids. f. $(CH_3)_3C$-CHO does not undergo aldol condensation. g. Carboxylic acids are higher boiling liquids than alcohols. h. Oxidation of aldehydes is easier than ketones. or Oxidation of CH3 – CHO is easier than CH3 – COCH3. i. Carboxylic acid does not give reactions of carbonyl group j. The α-hydrogen atoms of aldehydes and ketones are acidic in nature. k. Carboxyl group in benzoic acid is meta directing. l. Carboxylic acid does not undergo Friedel Craft's reaction.
	a. Electron withdrawing groups increase the acidity. Since there are two Cl atoms with -I effect dichloro ethanoic acid is more acidic than mono chloro ethanoic acid. Or mono chloro ethanoic acid has higher pKa. b. Ethanoic acid has electron donating methyl group which decreases acidity whereas benzoic acid has electron withdrawing benzene ring which increases the acidity. c. For steric and electrical reasons, aldehydes are more reactive than ketones in nucleophilic addition processes. In ketones, the presence of two relatively big substituents makes it more difficult for a nucleophile to access the carbonyl carbon than in aldehydes with only one such substituent. d. The carbonyl group in aldehydes & ketones is polar with carbon having positive charge and oxygen with negative charge. So nucleophiles can attack electrophilic carbon and hence they undergo nucleophilic addition reactions. e. In carboxylic acids there is strong intermolecular hydrogen bonding between its molecules whereas in aldehydes and ketones there is weak dipole -dipole interactions between the molecules. f. Aldol condensation reaction is given by compounds which have α hydrogen. Since $(CH_3)_3C$-CHO does not have α hydrogen it does not undergo aldol condensation. g. The hydrogen bonding in carboxylic acid is stronger and more extensive than in alcohols. Hence carboxylic acids have higher boiling point than aldehydes. h. Oxidation of aldehydes involves cleavage of C-H bond whereas oxidation of ketones involve cleavage of C-C bond which is stronger than C-H bond. i. Carboxylic acids contain a carbonyl group, but it does not show nucleophilic addition reactions like aldehyde and ketone. It is due to resonance, as shown below. So, the partial positive charge on the carbonyl carbon atom is reduced.



(1) (2) (3)

j. Due to strong electron withdrawing effect of carbonyl group and resonance stabilization of the conjugate base. (refer text book for resonance structure)

k. In benzoic acid the Carboxyl group is meta directing because it is electron-withdrawing group with –R effect. There is +ve charge on ortho and para positions. So Electrophillic substitution takes place at meta position.

l. Carboxyl group is deactivating group and the catalyst aluminium chloride gets bonded to -COOH group.

5. An alkene with molecular formula C5H10 on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C.

Alkene A on ozonolysis gives the products B & C

Since B gives Fehling's test it contains aldehyde group & as it gives iodoform test B has a CH_3CO group.

As C gives only iodoform test it is a ketone.

So **the structure of alkene A is CH_3 -CH =C (CH_3)- CH_3** .

On ozonlysis, the molecule breaks at the double bond giving CH_3 -CHO and $(CH_3)_2$ CO as products.

Reactions

CH_3 -CH =C-(CH_3)$_2$(A) +O_3 → CH_3CHO (B)+ CH_3COCH_3 (C) $\xrightarrow{\text{Iodoform test}}$ →

CH3COOH +CHI_3

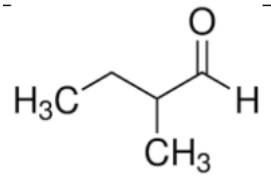
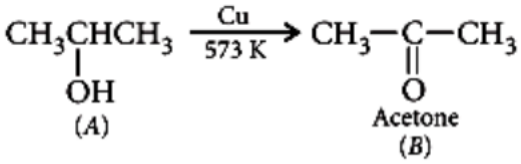
Fehlings's test

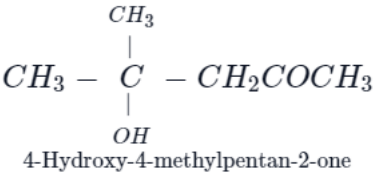
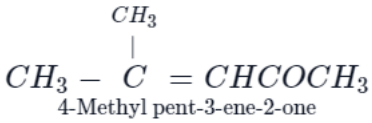
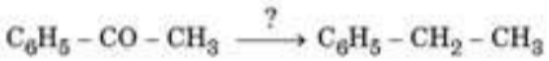
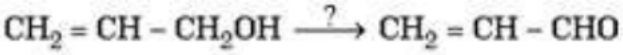
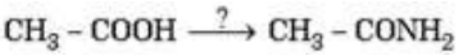
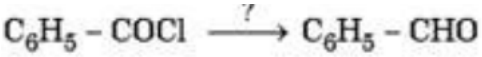
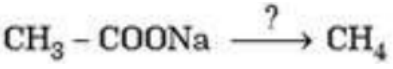
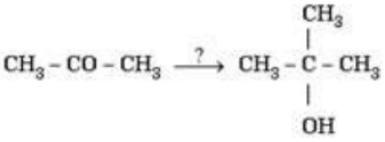
$CH_3CHO \rightarrow Cu_2O + CH_3COOH + H_2O$

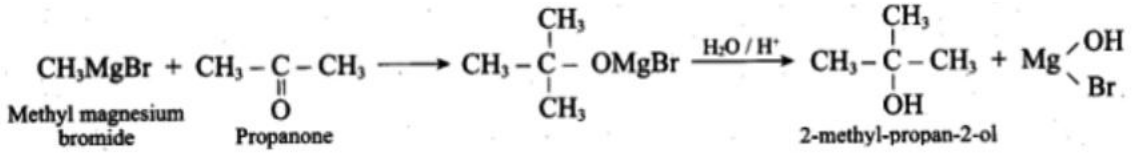
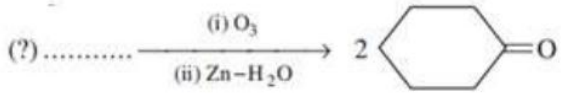
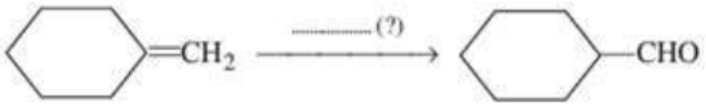
Iodoform test

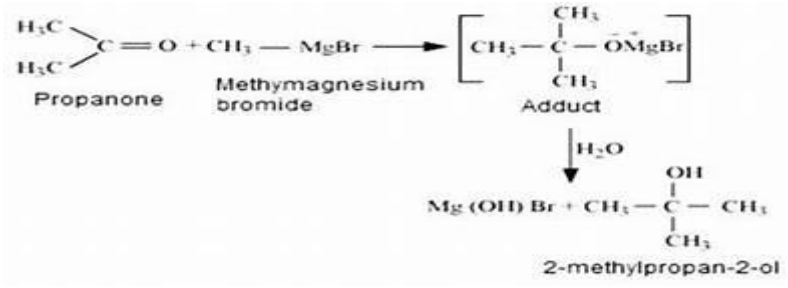
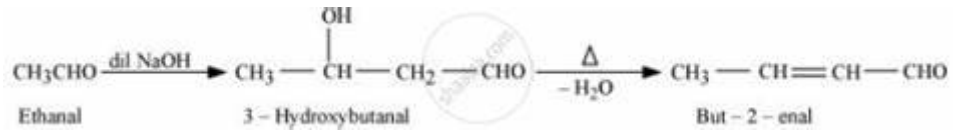
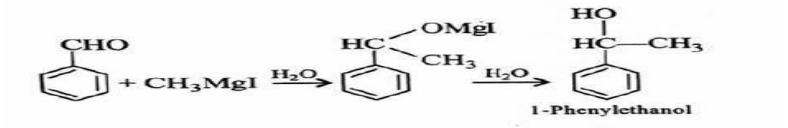
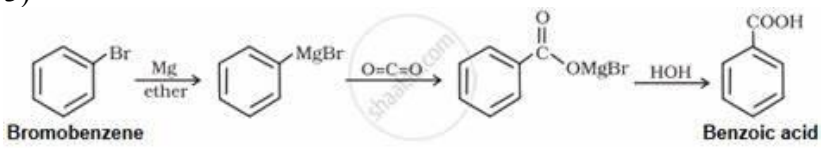
$CH_3CHO \rightarrow$ HCOOH +CHI_3

6. a) An organic compound A having molecular formula $C_5H_{10}O$ gives negative Tollen's test, forms n- pentane on Clemmenson's reduction but doesn't give iodoform test. Identify A and give all the reactions involved.

	b) An organic compound X having molecular formula C_3H_8O on treatment with Cu at 573K gives Y. Y doesn't react with Fehling's solution but gives a yellow precipitate of the compound Z with I_2& NaOH. Deduce the structure X,Y and Z c) An organic compound (X) having molecular formula $C_5H_{10}O$ can show various properties depending on its structures. Draw each of the structures if it i) gives positive iodoform test. ii) shows Cannizzaro's reaction iii) reduce Tollen's reagent and has a chiral carbon atom.
	6. A) Since it gives negative Tollen's test it is not an aldehyde. As n– pentane is formed on Clemmenson's reduction , the compound contains -C=O group. It gives positive iodoform test, so it can be methyl ketone So the compound is pentan -2-one $CH_3COCH_2CH_2CH_3$ **Reactions** $CH_3COCH_2CH_2CH_3$ Zn -Hg/HCl $CH_3CH_2CH_2CH_2CH_3$ (Clemmenson) $CH_3COCH_2CH_2CH_3$ I_2/ NaOH $CHI_3 + CH_3CH_2CH_2COOH$ b) compound A is, $CH_3CH(OH)\text{-}CH_3$ c) i) Pentan-2-one CH3CO-CH3 ii) (CH3)3C-CHO iii) 2-Methyl butanal.   Acetone $\xrightarrow[\text{solution}]{\text{Fehling}}$ No reaction $CH_3COCH_3 + 3I_2 + 4NaOH \longrightarrow CH_3COONa + 3NaI + CHI_3\downarrow + 3H_2O$ Iodoform (C)
7.	Complete the following sequence of reactions: $CH_3COCH_3 \xrightleftharpoons{Ba(OH)_2} A \xrightarrow[-H_2O]{\Delta} B \xrightarrow{NaOH,\ I_2} C + D$

	(A)  4-Hydroxy-4-methylpentan-2-one (B)  4-Methyl pent-3-ene-2-one (C) CHI_3 Iodoform (D)  Sodium 3-methylbut-2-enoate
8.	Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction: i) a) CH3COCH3, C6H5COCH3, CH3 – CHO. b) ethanol ,Butanone, propanal, propanone. c) Acetaldehyde , Benzaldehyde ,Acetophenone, Acetone. ii) CH3CHO,(CH3)3C-COCH3, CH3COCH3,CCl3CHO (Towards CH3MgBr)
	Aromatic aldehydes & ketones are less reactive towards nucleophilic addition than corresponding aromatic aldehydes and ketones. This is due to the electron donating +R effect of benzene ring which increases the electron density on carbonyl carbon and another factor is the steric hindrance. Thus. a) C6H5COCH3, CH3COCH3,CH3 – CHO b) Butanone, propanone, propanal, ethanol c) Acetophenone, Acetone,Benzaldehyde, Acetaldehyde d) (CH3)3C-COCH3, CH3COCH3,CH3CHO,CCl3CHO
9.	Write the reagents used in the following reactions : a) *(i)*  b)  c)  d)  e)  f) 

	a).Zn(Hg) &HCl (Clemmenson) or NH2-NH2 ,KOH/Ethylene glycol (Woff-Kishner reduction) b) PCC c) NH_3 &heat d) H_2 ,Pd/$BaSO_4$(Rosenmund's) e) Benzoic acid→ Sodium benzoate $\xrightarrow[NaOH,CaO(sodalime)]{decarboxylation}$ Benzene f) 
10.	Complete the following reactions Complete the following reaction by giving the missing starting material, reagent or product as required: a)  b)  c)  d)  e) $CH_3-CH=CH-CH_2CN \xrightarrow[(ii)\ H_2O]{(i)\ DIBAL\text{-}H}$
	. a. CH3CH=NNHCONH2 b)  c) Diborane(B_2H_6), H2O2/OH → Primary alcohol + PCC or Cu at 573 K→ aldehyde d) C6H5COCl, anhydrous AlCl3 (Friedel Craft's acylation) e) CH3-CH=CH-CH2-CHO

	Convert i) a) propanone to 2methyl propan- 2-ol b) Ethanal to But-2-en-1-al c) Propanoic acid to 2-chloropropanoic acid d) CH_3CN to propanone. e) Benzoic acid to benzene f) Benzaldehyde to 1-Phenylethanol ii) How can you convert each of the following compounds to Benzoic acid ? (1) Acetophenone (2) Ethylbenzene (3) Bromobenzene (4) Phenyl ethene
	a)  b)  c) Cl_2/Red P (HVZ) d) CH_3MgBr i) Dry ether ii) H_2O e) NaOH +CaO (Decarboxylation) f)  ii) 1)  2) Alk.KMnO4,H3O$^+$ 3)  4) Alk.KMnO4,H3O$^+$