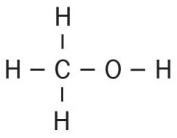
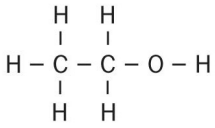
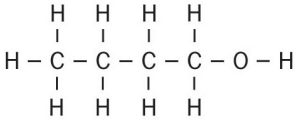
Name:_____ Class:_____ Date:_____

AFL WORKSHEET
Alcohols and Carboxylic Acids

Structure of Alcohols

1. Alcohols are a homologous series of organic compounds which contains the _____ functional group.

2. General molecular formula: _____ (where n = 1, 2, 3 etc.)

No. of carbon atoms	Alcohol	Molecular formula	Full structural formula
1		CH_3OH	
2	ethanol		
3	propanol	C_3H_7OH	
4			

Properties of Alcohols

1. Alcohols are _____ liquids at room temperature and pressure.

2. Their boiling point _____ down the series but their solubility _____.

3. Alcohols burn in excess air to produce carbon dioxide and water vapour.

E.g.: $C_2H_5OH(aq) + 3O_2(g) \rightarrow$ _____

4. Alcohols undergo oxidation to produce _____. An example of an oxidising agent is _____.

E.g.: $C_2H_5OH(aq) + 2[O] \xrightarrow{\text{heat}}$ _____

Producing Ethanol

1. Ethanol can be produced from _____ by the catalytic addition of _____.
Conditions: 300ºC, 60 atm, _____ catalyst

$$C_2H_4(g) + H_2O(g) \xrightarrow[H_3PO_4]{300°C,\ 60\ atm} C_2H_5OH(aq)$$

2. Ethanol can also be produced by _____ in fruits, vegetables or grain.

3. _____ is a process in which micro-organisms such as yeast act on carbohydrates in the _____ of oxygen to produce ethanol and carbon dioxide gas.

$$C_6H_{12}O_6(aq) \xrightarrow{\text{yeast}} \text{\_\_\_\_\_}$$

4. The enzymes in yeast work best at a temperature of about _____. Above this temperature, the enzymes are _____ and fermentation stops.

5. Carbon dioxide and a _____ solution of ethanol are produced. If the alcohol content is higher than _____, the enzymes in the yeast will also die and cause fermentation to stop.

6. Ethanol is then extracted from the mixture by _____.

7. Fermentation of carbohydrates takes place only in the _____. Otherwise, the ethanol produced will be oxidised to _____.

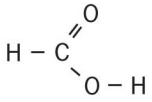
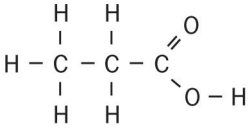
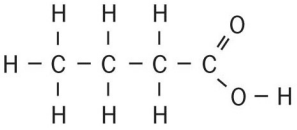
Uses of Ethanol

1. Ethanol can be used in alcoholic drinks, as a _____ and as a _____.

Structure of Carboxylic Acids

1. Carboxylic acids are a homologous series of organic acids which contain the _____ _____ functional group.

2. General molecular formula: _____ (where n = 0, 1, 2 etc.)

No. of carbon atoms	Carboxylic acid	Molecular formula	Full structural formula
1			
2	ethanoic acid	CH_3COOH	
3		C_2H_5COOH	
4	butanoic acid		

Properties of Carboxylic Acids

Physical Properties of Carboxylic Acids

1. Carboxylic acids are very _____ in water.

2. Their boiling point _____ with molecular size.

Chemical Properties of Carboxylic Acids

1. Carboxylic acids are _____ as they ionise partially in water.

2. They have acidic properties due to the _____ produced.

3. They react with metals to produce a salt and _____.
   E.g.: $2CH_3COOH(aq) + Mg(s) \rightarrow$ _____

4. They react with carbonates to produce a salt, _____.
   E.g.: $2CH_3COOH(aq) + Na_2CO_3(s) \rightarrow$ _____

5. They react with bases to produce a salt and _____.
   E.g.: $CH_3COOH(aq) + NaOH(aq) \rightarrow$ _____

6. They react with alcohols to produce _____.

Producing Ethanoic Acid

1. Ethanol can be _____ into ethanoic acid by acidified potassium manganate(VII). As a result, acidified potassium manganate(VII) changes colour from _____ to _____.

2. Certain _____ in the air oxidise _____ to ethanoic acid. Thus, alcoholic drinks _____ when left exposed to air for a few days.

Esters

Esterification

1. Esters contain the _____ functional group.

2. An ester is formed when a carboxylic acid is warmed with an alcohol in the presence of a few drops of _____. The reaction is called _____.

carboxylic acid + alcohol $\xrightarrow{\text{concentrated sulfuric acid}}$ ester + water

E.g.: $CH_3COOH(aq) + C_2H_5OH(aq) \xrightarrow{\text{concentrated } H_2SO_4}$ _____

3. Conditions for esterification: _____ catalyst, warming

Naming Esters

Alcohol	Carboxylic acid	Ester formed
methanol	methanoic acid	
methanol	ethanoic acid	
ethanol	methanoic acid	
ethanol	ethanoic acid	

Uses of Esters

1. Esters have a sweet, fruity smell. Hence they are used in _____ and as artificial food flavourings.

2. They are also used as solvents for _____ and in soaps.