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DEPARTMENT: AERONAUTICAL AND ASTRONAUTICAL ENGINEERING
MATRIC NO:- 19/ENG09/019
COURSE TITLE: GENERAL CHEMISTRY II

ANSWER TO ASSIGNMENT

1. The two major ways of classifying Alkanols are:-
(i) Based on the number of hydrogen that is attached to the Carbon carrying the 'OH' functional group that determines the chemical properties of the parent compound. Here we have four examples,
- Primary alcohols ($1^0$) e.g ethanol i.e $C_2H_5OH$
- Secondary alcohols ($2^0$) e.g Butan-2-ol i.e $CH_3CH_2CH(OH)CH_3$

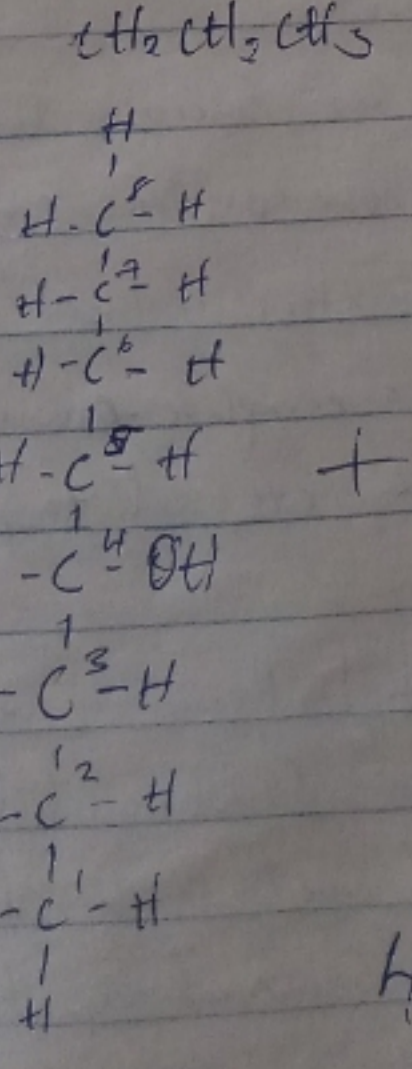
(ii) It may also depend on the number of "OH" present in the compound, under this we talk about;
- Monohydric alcohol containing one OH e.g methanol i.e $CH_3OH$
- Dihydric alcohol containing 2 OH e.g Butan-1,2 diol etc

2. $CH_3CH_2CH_2CH_2MgBr + CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}CH_2CH_2CH_3 \longrightarrow$

$CH_3CH_2CH_2CH_2$
$CH_3CH_2CH_2-\overset{|}{C}-OMgBr \xrightarrow[\text{hydrolysis}]{H_2O}$
$CH_2CH_2CH_3$

$CH_3CH_2CH_2CH_2$
$OH-\overset{|}{C}-CH_2CH_2CH_2 + OHMgBr$
$CH_3CH_2CH_3$

Products:



+ $MgCOHBr$

H propylocta-4-ol is the product.

from Butylmagnesium Bromide
! The named grignard reagent is Butylmagnesium bromide and once it reacts with $CH_3CH_2CH_2CH_2C=O$ $CH_2CH_2CH_3$, it gives H propyl octan-4-ol.

3. Making ethanol by fermentation.
This method only applies to ethanol. You can not make any other alcohol this way.
* the process: the starting material for the process varies widely, but will normally be some form of starchy plant material such as maize (corn), wheat, Barley or potatoes. starch is a complex carbohydrate and other carbohydrates can also be used. for example, in the lab, Sucrose (sugar) is normally used to produce ethanol. Industrially, this would not make sense. It would be silly to refine sugar if all you want to use it for was fermentation. There is no reason why you should not start from the original sugar cane though.
The first step is to break complex carbohydrates into simpler ones. for example, if you were starting from starch in grains like wheat for barley, the grain is heated with hot water to extract the starch and then warmed with malt. malt is a germinated barley ~~which~~ which contains ~~enzyme~~ enzymes which break the starch into simpler carbohydrates called "Maltose" ($C_{12}H_{22}O_{11}$).
Maltose has the same molecular formula as sucrose but contains two glucose units joined together, whereas Sucrose contains one glucose and fructose unit. Yeast is then added and the mixture is kept warm (eg 35°C) for perhaps several days until fermentation is complete. Air is kept out of the mixture to prevent oxidation of the ethanol to produce ethanoic acid (vinegar).
Enzymes in the yeast first convert carbohydrates like maltose or sucrose into even simpler ones like glucose and fructose, both $C_6H_{12}O_6$ and then convert these in turn into ethanol and carbon dioxide.
You can show these changes as simple chemical equations, but

the bio-chemistry of the reactions is much, much more complicated than this suggests.

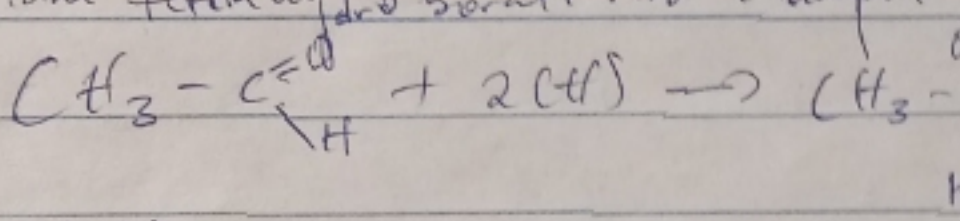
$$C_{12}H_{22}O_{11} + H_2O \longrightarrow 2C_6H_{12}O_6$$

$$C_6H_{12}O_6 \longrightarrow 2CH_3CH_2OH + 2CO_2$$

Yeast is killed by ethanol concentrations in excess of about 15% and that limits the purity of the ethanol that can be produced. Distillation to give 96% pure ethanol. For theoretical reasons, it is impossible to remove the last 4% of water by fractional distillation.

H Alkanals!

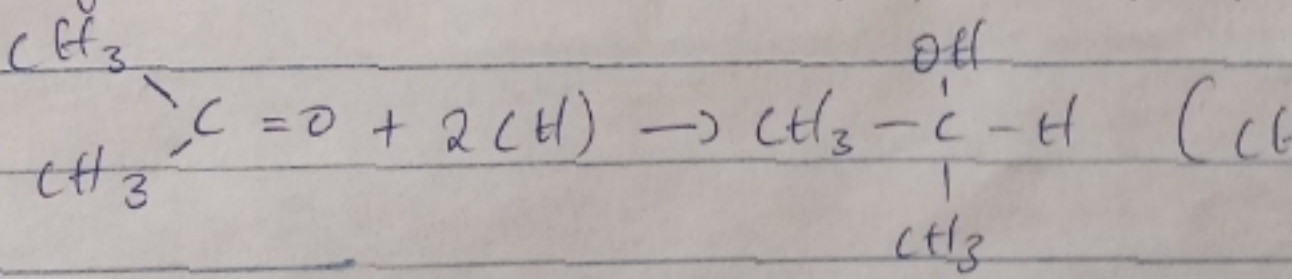
Alkanals can be reduced to primary alcohols. You get exactly the same organic product whether you use lithium tetrahydroaluminate or sodium tetrahydroborate. For example with ethanal, you get ethanol.



Notice that this is a simplified equation. Perfectly acceptable to UK A level examiners. H is the reducing agent.

Alkanone!

Again the product is the same whichever of the two reducing agents you use. For example with propanone you get propan-2-ol.



Reduction of ketone leads to the production of a secondary alcohol.