PRACTICAL ORGANIC CHEMISTRY

(III)

SECOND LEVEL

SECOND SEMESTER

1443 - 1444

2022 - 2023

LECTURER: RAWNAQ THAMER

EXPERIMENT (2)

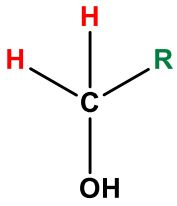
IDENTIFICATION OF ALCOHOLS

In chemistry :-

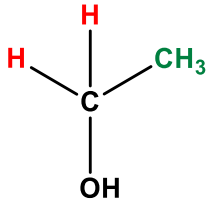
Alcohols are compounds have (C,H, and O atoms) which are characterized by the presence of one, two or more hydroxyl groups (−OH) that are attached to the carbon atom in an alkyl group or hydrocarbon chain. Based on that, when define alcohol we say:

An organic compound with a hydroxyl (OH) functional group on an aliphatic carbon atom. Because OH is the functional group of all alcohols, we often represent alcohols by the general formula ROH, where R is an alkyl group. It have three types:-

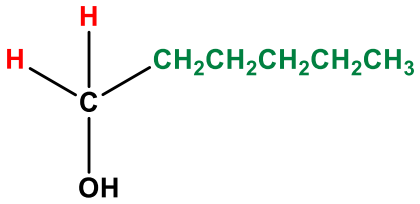
- **<u>Primary alcohol :-</u> when hydroxyl group (-OH) attached with primary aliphatic carbon atom (carbon bonded to only one other carbon atom), it must called primary alcohol, with a general chemical formula (RCH_2OH):- for example: ethanol, hexanol.**



Primary alcohol
(1^0)
RCH_2OH

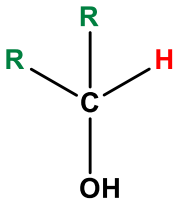


Ethanol
(1^0)
CH_3CH_2OH

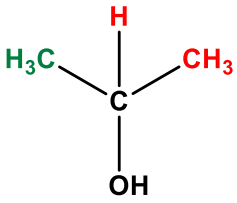


Hexanol
(1^0)
$C_5H_{11}CH_2OH$

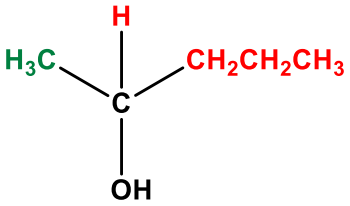
❖ **Secondary alcohol :-** when hydroxyl group (-OH) attached with secondary aliphatic carbon atom (carbon bonded to two other carbon atoms), it must called secondary alcohol, with a general chemical formula (R_2CHOH):- for example: isopropanol($CH_3)_2CHOH$, pentan-2-ol.



Secondary alcohol
(2^0)
R_2CHOH

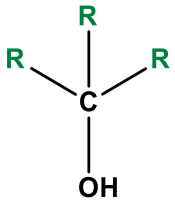


Isopropanol
(2^0)
$(CH_3)_2CHOH$

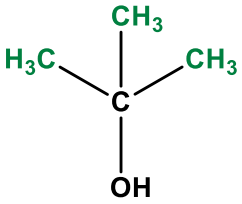


pentan-2-ol
(2^0)
$CH_3C_3H_7CHOH$

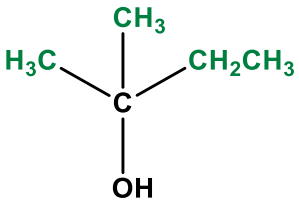
❖ **Tertiary alcohol:-** when hydroxyl group (-OH) attached with tertiary aliphatic carbon atom (carbon bonded to three other carbon atoms), it must called Tertiary alcohol, with a general chemical formula (R_3COH):- for example: 2-methylpropan-2-ol ($CH_3)_3COH$, pentan-2-ol.



Tertiary alcohol
(3^0)
R_3COH



2-methylpropan-2-ol
(3^0)
$(CH_3)_3COH$



2-methylbutan-2-ol
(3^0)
$(CH_3)_2C_2H_5COH$

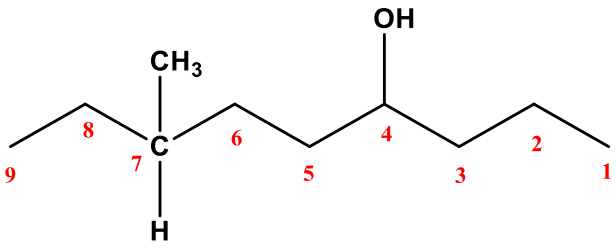
Nomenclature of Alcohols:-

1. **The longest continuous chain (LCC) of carbon atoms containing the OH group is taken as the parent compound an alkane with the same number of carbon atoms. The chain is numbered from the end nearest the OH group.**

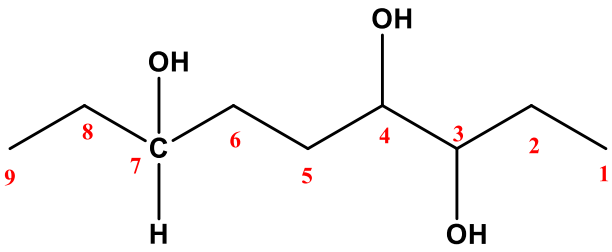
2. **The number that indicates the position of the OH group is prefixed to the name of the parent hydrocarbon, and the(e – ending) of the parent alkane is replaced by the suffix -ol.**

3. **If more than one OH group appears in the same molecule (polyhydroxy alcohols), suffixes such as -diol and -triol are used. In these cases, the (e- ending) of the parent alkane is retained.**

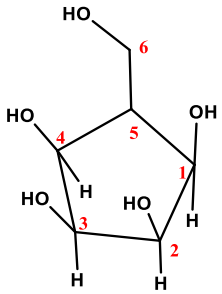
Examples:-



7-methylnonan-4-ol



nonane-3,4,7-triol



5-(hydroxymethyl)cyclopentane-1,2,3,4-tetraol

In Daily Life, Medicines, Pharmacy :-

1- During the coronavirus pandemic, sanitizers and masks rose to fame overnight. We were and still are advised to wash and apply sanitizers to our hands continuously. But did you know that these sanitizers contain 99.5% alcohol? The alcohol present in sanitizers is isopropyl alcohol.

Uses of Alcohol are plenty , they are used in diverse range of applications from medicine to cooking.

2- Ethanol is usually mixed with gasoline to produce 'gasohol", which is about 10%m ethanol, Using ethanol as a fuel reduces our dependency on natural fossil fuels such as petrol.

3- Propanol also finds its use in different cosmetics. For example, acetate is used as a remover for acrylic nails and fingernail polish. It is also used in perfumes.

4- Propanol, being alcohol, exhibits antibacterial properties. Bottles of rubbing alcohol and sanitizers contain isopropyl alcohol. It is also used as a depressant or pain reliever.

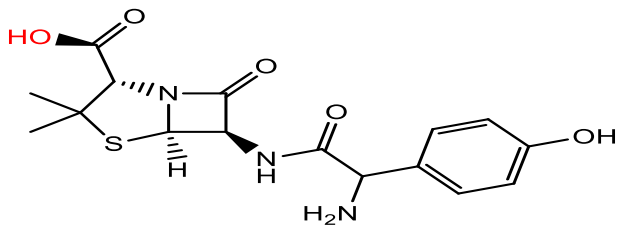
5- **Ethanol, is used to disinfect the hands before handling patients. Also, during surgery, the surgical area is cleaned with alcohol to stem infections.**

6- Used as a diluent Alcohols act as a diluent for many drugs, especially in homoeopathy treatment. A small number of drugs can be diluted in low quantities of alcohol. In these low quantities, alcohol is harmless to the body and increases the drug's volume.

7- As a Local Rubefacient, alcohol is applied to the skin leads to the dilate of blood vessels. As a result, the skin area becomes tender and absorbent to medicinal ointment application.

8- Dent's Toothache Drops, Dent's Toothache Drops are used to lessen toothache pain. It comprises almost 60% alcohol.

9- In Pharmacology, alcohol is an essential l ingredient in some medicines like cough syrups, respiratory treatment drugs. Pain relievers also contain a high percentage of alcohol, ex.



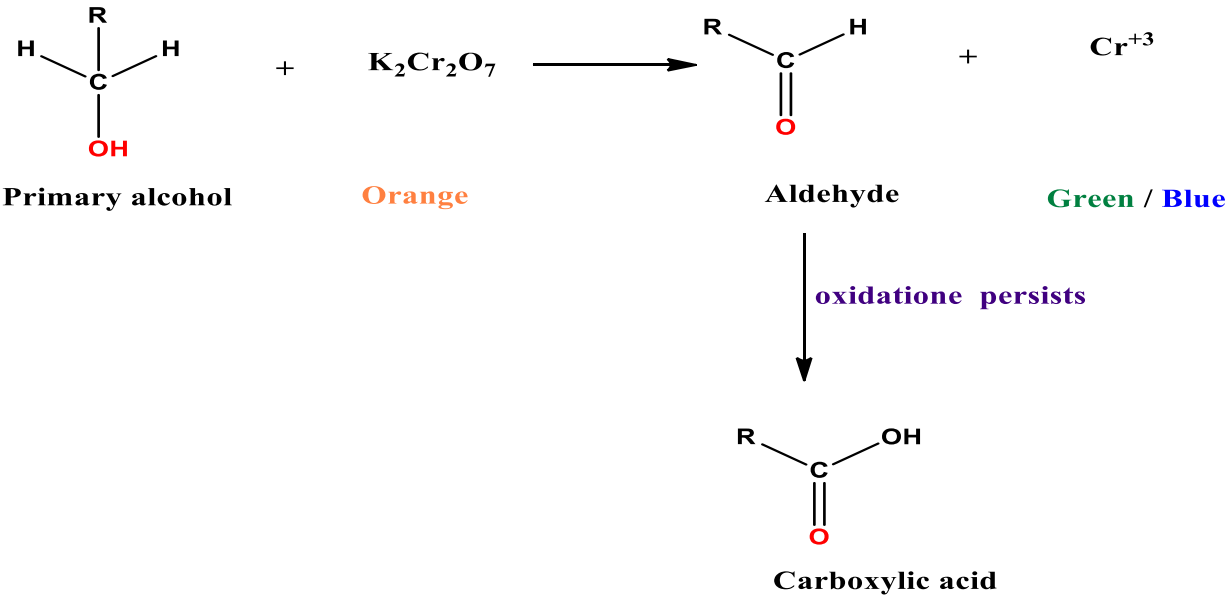
Amoxicillin

10 Anbesol Gel, Anbesol Gel contains benzocaine and is used as a local anesthetic. It blocks nerve endings and numbs the skin and mouth surface. Anbesol Gel is made of almost 70% alcohol.

Oxidation of alcohols:-

Oxidation of alcohols by strong oxidants such as potassium dichromate ($K_2Cr_2O_7$) in sulphuric acid (H_2SO_4) is possible, but differs depending on the degree of alcohol. 1,2 and 3 below show how a primary, secondary, and tertiary alcohol respectively respond to treatment of oxidants. If a reaction has occurred using $K_2Cr_2O_7$ in H_2SO_4, there is a color change from orange to green.

1



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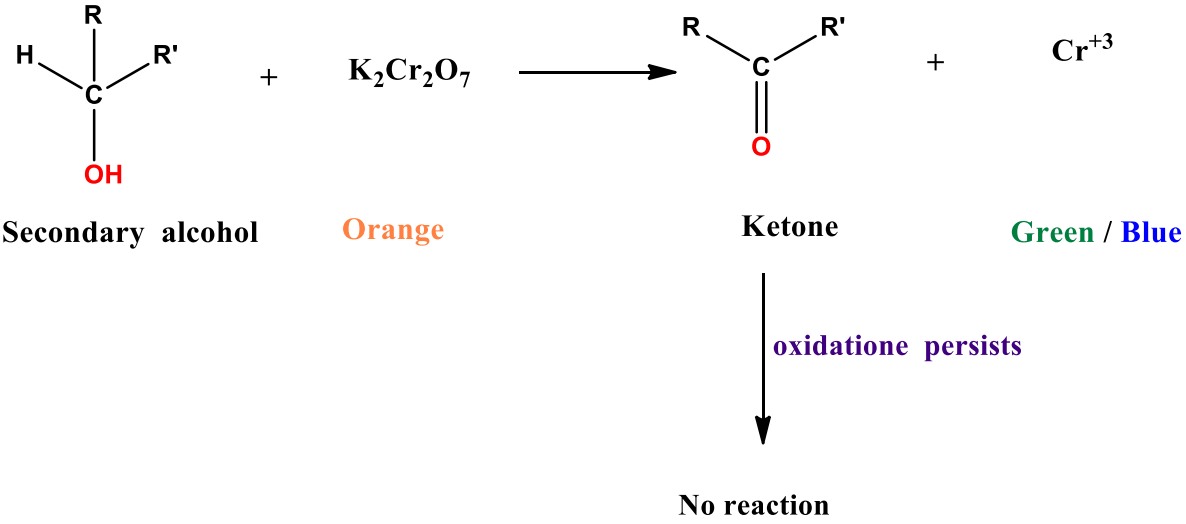

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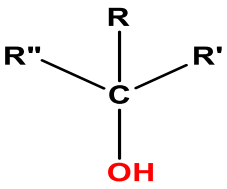


+ $K_2Cr_2O_7$ ⟶ No reaction

Tertiary alcohol — Orange — Still orang

Part I :- Jones Reagent (Chromic acid test)

Jones reagent is a solution prepared by dissolving chromium trioxide in aqueous sulfuric acid.

To effect a Jones oxidation, this acidic mixture is then added to an acetone solution of the substrate. Alternatively, potassium dichromate can be used in place of chromium trioxide. The oxidation is very rapid and quite exothermic. Yields are typically high. The reagent is convenient and cheap.

PROCEDURE:- Jones Reagent (Chromic acid test)

In a small test tube, place about 1.0 mL acetone, 1.0 mL alcohol, and 2 –3 drops of the Jones reagent. Observer the color change from clear to orange (formation of Cr^{+6} as CrO_3), or blue-green (formation of

Cr^{3+}).

Try this test with 1-butanol, 2-butanol, 2-methyl2-propanol, phenol, and. Based on your results of the Chromic acid test determine the type of your alcohol (1^o, 2^o, or 3^o).

Part II :-

Lucas Test:

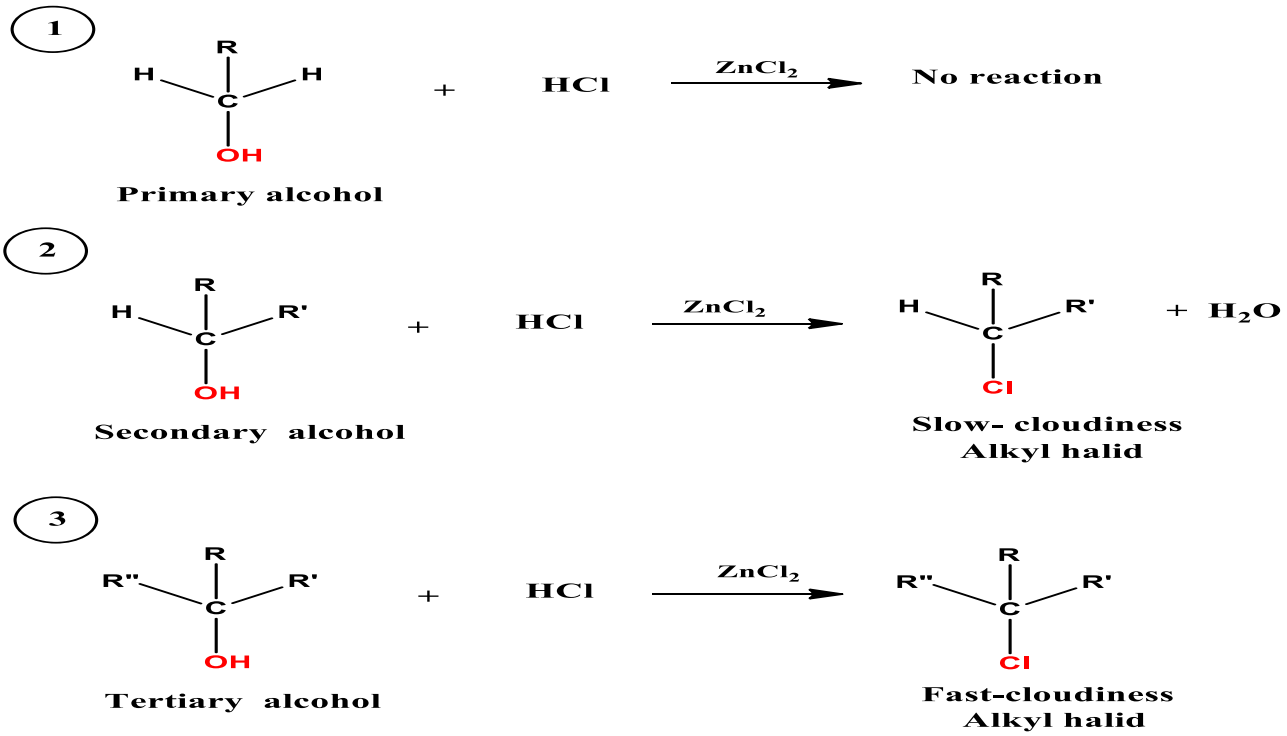
This test is for low molecular weight alcohols and it distinguishes the rates of reaction of alcohols with the Lucas reagent (HCl) and ($ZnCl_2$).

Positive indicator of the reaction is the formation of a water insoluble alkyl chloride as cloudiness or a precipitate.

The formation of an alkyl chloride with

1- **Tertiary alcohol is very rapid.**
2- **Secondary alcohol that may take from 5 to 20 minutes to form visible cloudiness.**
3- **Primary alcohols do not react with Lucas reagent or it may show very little result in a very long time.**

The chemical reaction involves replacing the –OH group of the alcohol with a chloride ion from hydrochloric acid (HCl), forming an alkyl chloride, as shown in the following equation.



PROCEDURE:- (Lucas Test)

In a small test tube place 2.0 mL Lucas reagent, and add 4-5 drops of alcohol, shake the mixture well and observe the time required for the mixture to become cloudy or to form two different phases (layers). Try this test with 1-butanol, 2-butanol, 2-methyl-2-propanol (t-butyl alcohol), phenol . Based on your results of the Lucas test, determine the type of your alcohols (1^{o}, 2^{o},3^{o}).