



Ministry of Higher Education and Scientific Research

University of Anbar

Science College

Department of Chemistry



ORGANIC DIAGNOSIS PRACTICAL

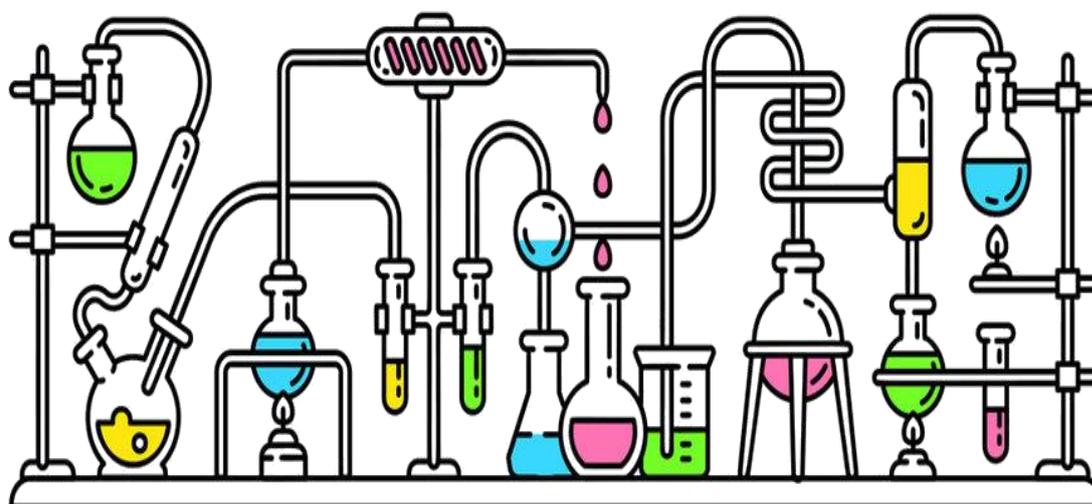
Fourth stage

EXPERIMENT 3

By

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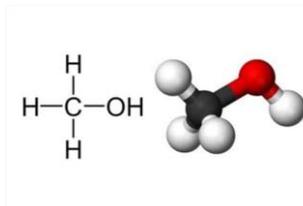


2024-2025

EXP3 :- IDENTIFICATION OF ALCOHOLS

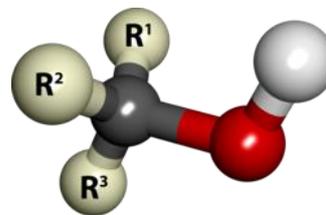
Alcohols are organic compounds containing an -OH functional group bonded to a carbon atom. There are three classes (types) of alcohols: primary, secondary, and tertiary as shown below.

- **Primary alcohol:** RCH_2OH the 'R', an alkyl group, and the -OH are attached to a primary carbon atom, a carbon bonded to one other carbon atom (highlighted).



- **Secondary alcohol:** R_2CHOH , the 2 'R' alkyl groups, and the -OH are attached to a secondary carbon atom, a carbon attached to two other carbon atoms from the 2 'R' (CH_3-),

- **Tertiary alcohol:** R_3COH the 3 'R' alkyl groups, and the -OH are attached to a tertiary carbon atom (highlighted), a carbon attached to three other carbon atoms from the 3 'R' (CH_3-). The International Union of Pure and Applied Chemistry (IUPAC) method of nomenclature for alcohols use the ending ol. Change the 'e' ending of an alkane to ol (i.e methane to methanol ethane to ethanol).



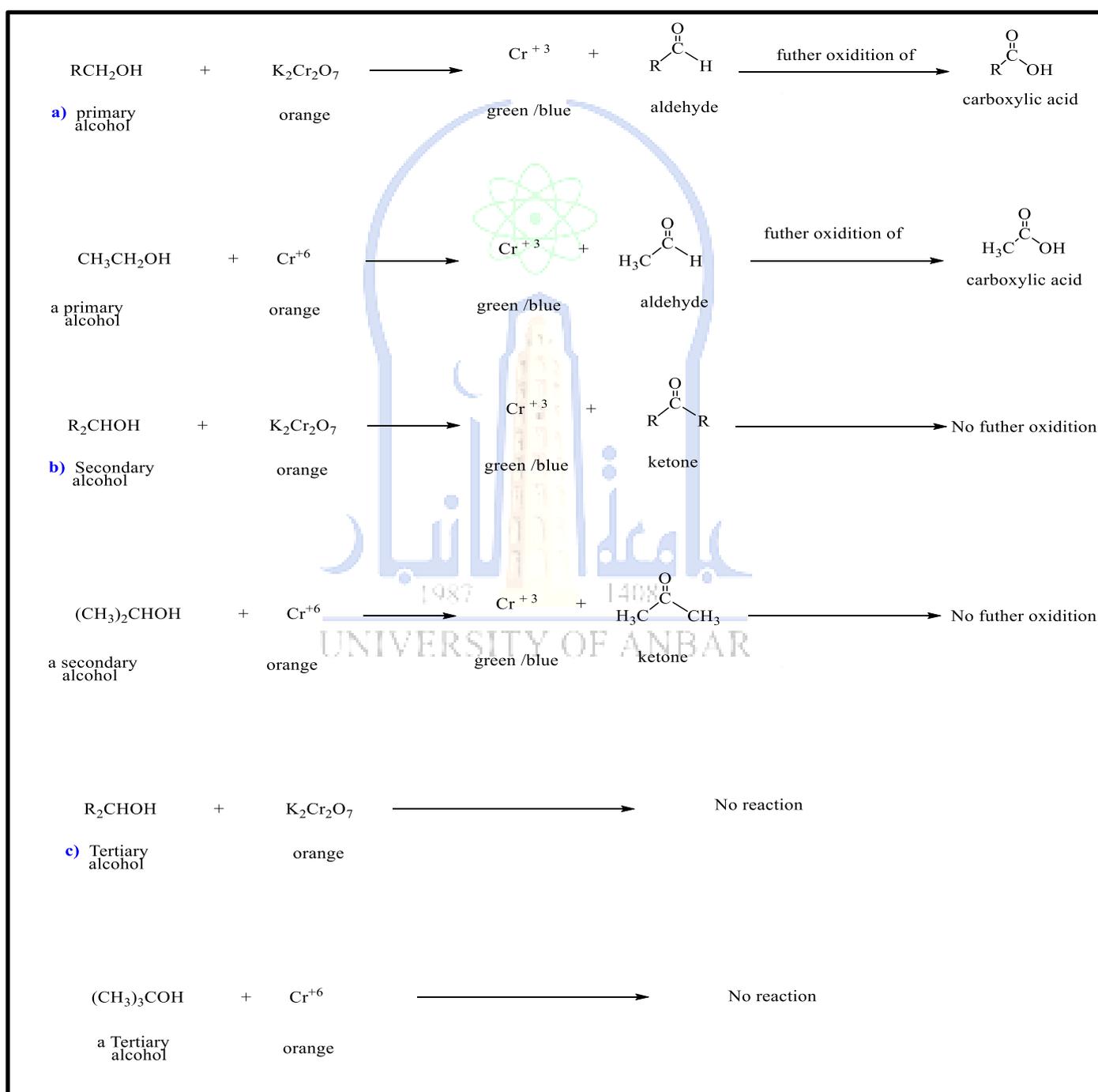
R = represents any alkyl group



Oxidation

Oxidation of alcohols by strong oxidants such as $K_2Cr_2O_7$ in H_2SO_4 is possible, but differs depending on the degree of alcohol.

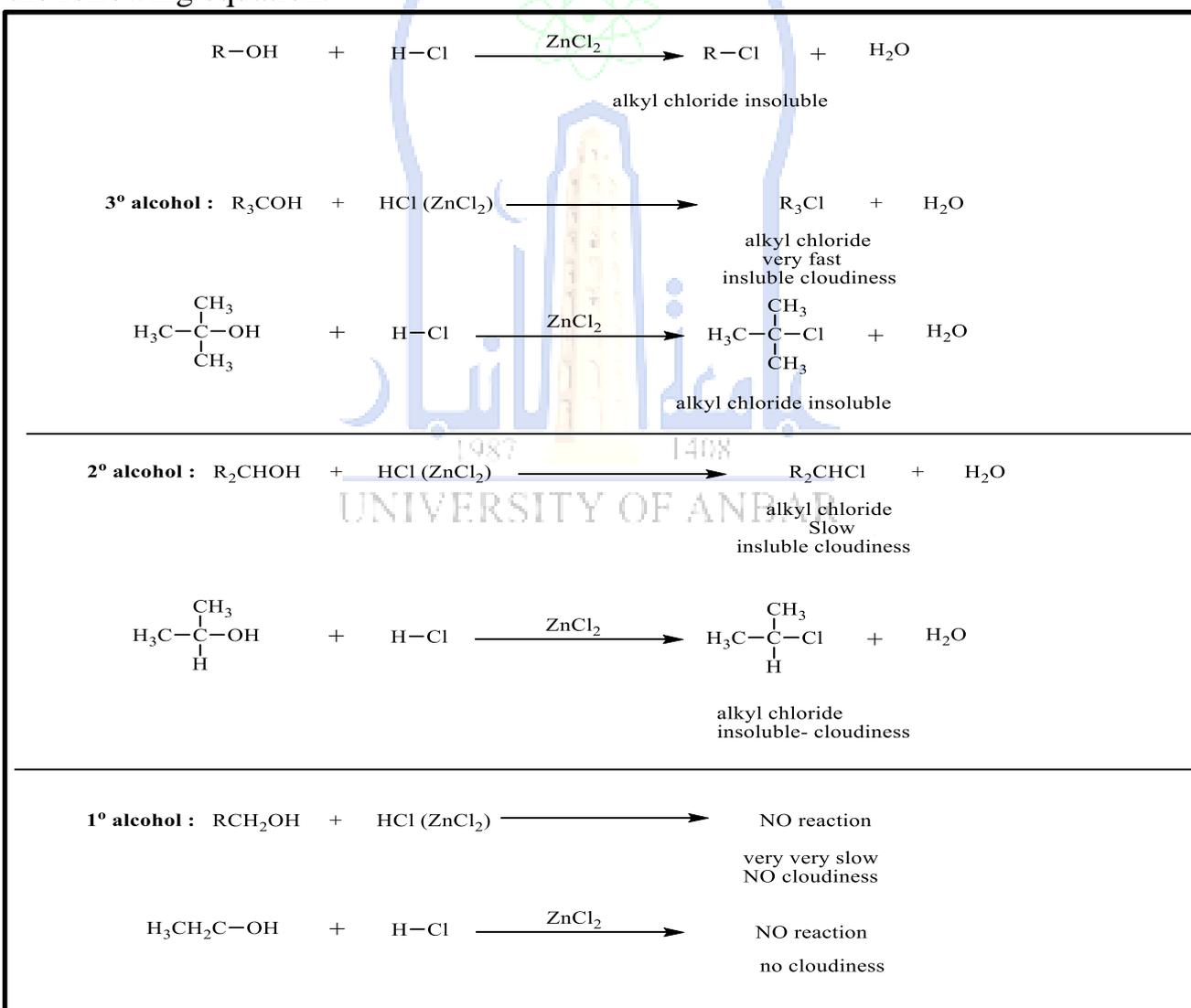
Examples a, b, and c below show how a primary, secondary, and tertiary alcohol respectively respond to treatment of oxidants. If a reaction has occurred using $K_2Cr_2O_7$ in H_2SO_4 , there is a color change from orange to green.



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 ZnCl₂). 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 tertiary alcohol is very rapid, followed by the secondary alcohol that may take from 5 to 20 minutes to form visible cloudiness. 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

➤ Part I – Reaction with sodium

Under the hood place a small piece of sodium metal in to a 50 mL beaker of half filled with water. Observe the reaction and after completion of the reaction, add 1 or 2 drops of phenolphthalein indicator to the solution in the beaker. Write a balance equation for the reaction of sodium and water.

Repeat the reaction of 2.0 mL alcohol with small piece of sodium metal in a large dry test tube. Note the reactivity of sodium metal with alcohol in compare (less or more reactive) to water. Test the resulting solution with phenolphthalein. Write the balance equations for reactions of sodium with ethanol and 1-butanol, phenol, and unknown.

➤ Part II – Solubility in water

Place 2.0 mL of water in a small test tube, dropwise add ethanol and shake the mixture. Count the number of drops until the alcohol is no longer soluble in water, but do not use more than 10 drops. Repeat the same procedure using 2-propanol, 1-butanol, cyclohexanol, phenol, and unknown. Record your results as very soluble (for 6-10 drops), soluble (for 2-5 drops), and insoluble (1 drop).

➤ Part III. 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, and unknown. Based on your results of the Lucas test, determine the type of your unknown alcohols (1° , 2° , or 3°).

➤ **Part IV. 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. Observe the color change, clear, orange (formation of Cr^{+6} as CrO_3), or blue-green

(formation of Cr^{3+}). Try this test with 1-butanol, 2-butanol, 2-methyl-2-propanol, phenol, and unknown. Based on your results of the Chromic acid test determine the type of your unknown alcohol (1° , 2° , or 3°).

➤ **Part V. Esterification**

In a small test tube, mix ethanol (4-5 drops) and acetic acid (4-5 drops). Add one drop of concentrated sulfuric acid, warm the mixture in a hot water bath for about 5 minutes and then add 2.0 mL of cold water. Note the odor and write a complete equation for the reaction of ethanol and acetic acid.

In a small test tube, mix 1-butanol (4-5 drops) and acetic anhydride (4-5 drops). Stir well, and warm the solution in hot water bath. Add 2.0 mL of cold water and make mixture slightly basic by adding 4-5 drops dilute NaOH. Note the odor and write a complete equation for the reaction of 1-butanol and acetic anhydride.