

Lab 15B: Preparation of Esters

Name:

Block:

Introduction:

Esters are a group of organic compounds best known for their interesting odours and flavours. Many natural odours and flavors were discovered to be esters and therefore, many synthesized esters are used in perfumes and foods.

In the laboratory, an ester is usually formed from the reaction of a carboxylic (organic) acid and an alcohol, giving an ester and water as the products. This is an example of a condensation reaction, in which two molecules link up by the elimination of a small molecule between them; in this case, water. We can write a general equation for the formation of esters as follows:



The first part of the name of an ester is derived from the alkyl group of the alcohol used and the second part is from the carboxylic acid, using the ending -oate. As an example, if ethyl alcohol (ethanol) combines with propanoic acid, the resulting ester is named ethyl propanoate.

The reaction between the alcohol and acid is rather slow at room temperature. In order to speed it up and get an appreciable yield in the time available, you will use a temperature of about 60°C and add sulfuric acid to act as a catalyst in the reaction. In this experiment, you will prepare four esters and carefully smell them to see if there are any odours you recognize

Objectives:

1. To synthesize several esters and to try to identify the odour of each
2. To write the chemical equations for the formation of each ester using structural formulas

Procedure:

1. Put on your safety goggles
2. Label your four test tubes "1," "2," "3," and "4"
3. Into the appropriate test tubes, pour the correct amount of the carboxylic acid and alcohol as indicated on the table below (which glassware will allow you to measure accurately?)

Test Tube	Carboxylic Acid	Alcohol
1	1 mL acetic acid	1 mL ethanol
2	1 mL butanoic acid	1 mL methanol
3	1 g salicylic acid	1 mL methanol
4	1 mL butanoic acid	1 mL ethanol

***All of the acids used in this experiment are corrosive to skin, eyes, and clothing. Any spills or splashes must be washed off your skin and clothing immediately, using plenty of water. Report spills to teacher.**

4. Call teacher over to add **4 drops** of concentrated sulfuric acid into each test tube (**Concentrated sulfuric acid is a powerful oxidizing agent and dehydrating agent. If mixed incorrectly with other chemicals used in this experiment a fire can result. If added to a small amount of water, a large temperature rise can occur, which can result in severe burns. Follow the directions exactly!**)
5. Put about 150 mL of water in a 250 mL beaker. Place the test tubes in the water and heat the water on a hot plate to a temperature of about 60°C. Leave the test tubes in the hot water bath for 15 mins
6. While waiting, write out the structural formulas to the chemical equations that occur in your lab report (#1 of Analysis of Results)
7. Put about 150 mL of water in a second 250 mL beaker. Cool the test tubes by immersing them the cold water bath
8. Add 5 mL of water into each of the test tubes
9. Carefully note the odour of the contents of each of the test tubes on your data table. Hold the test tube about 30 cm away from your nose and gently **waft** the vapours toward your nose without inhaling deeply. The odours you should smell are: *wintergreen, pineapple, apple, and pear*
10. Add enough water to each test tube to completely fill it up, and then rinse down the sink with plenty of water.
11. Wash the glassware
12. Wash your hands with soap and water
13. Give your partner(s) a high five 😊