

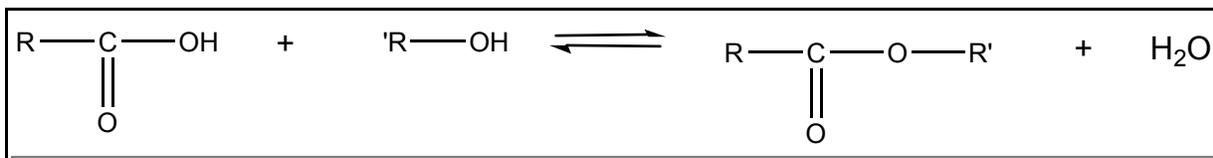
# Making Esters

## PROBLEM

What are esters?

## INTRODUCTION

Esters are found in almost all living things. Low molecular weight esters have pleasant fruity aromas. In fact, the flavor of many fruits is caused primarily by esters. Esters are formed by the reaction between an organic acid and an alcohol in the presence of a strong acid.



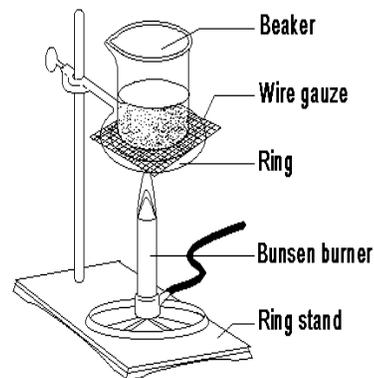
In this laboratory investigation, you will prepare some esters and examine their odors.

## MATERIALS (per group)

Amyl alcohol; balance; 400 mL beaker; Bunsen burner; concentrated acetic acid; concentrated sulfuric acid; graduated cylinder; medicine dropper; methanol; ring stand and iron ring; safety goggles; salicylic acid; scoop; test tube holder; test tubes (2); tongs; weighing paper; wire gauze

## PROCEDURE

1. Set up a hot water bath with a ring stand, ring, wire gauze, Bunsen burner, and a beaker half filled with water as shown in the diagram to the right. Put on safety goggles. *CAUTION: Always wear safety goggles when working with heat.* Light your Bunsen burner.
2. Using a graduated cylinder, transfer 2 mL of methanol to a test tube. *CAUTION: Methanol is flammable. Do NOT work near an open flame.*
3. Place a piece of weighing paper on a balance, and tare the balance (set to zero). Using a scoop, transfer 1 g of salicylic acid to the weighing paper.
4. Pour the salicylic acid from the weighing paper into the test tube of methanol. Ask your teacher to add 4 drops of concentrated sulfuric acid to the mixture. Place the test tube in the hot water bath and bring the contents to a boil.
5. Using a test tube holder, remove the test tube from the hot water bath. Note the odor of the mixture in the test tube by wafting the air above the test tube toward your nose and sniffing. To do this, hold the test tube a short distance from your nose and cup your free hand over the mouth of the test tube. Then push the air over the mouth of the test tube toward your nose as shown in the diagram to the right. *CAUTION: Never hold a container directly under your nose and sniff.* Record your observations in the data table on the next page.
6. Using a graduated cylinder, transfer 2 mL of amyl alcohol to a clean test tube.



- Ask your teacher to add 2 mL of concentrated acetic acid and 4 drops of concentrated sulfuric acid to the amyl alcohol. Place the test tube in the hot water bath and bring the contents to a boil.
- Using a test tube holder, remove the test tube from the hot water bath. Note the odor of the mixture in the test tube by wafting the air above the test tube toward your nose and sniffing as described above.

#### OBSERVATIONS

Test Tube Number	Ester	Description of Odor
1	Methyl Salicylate	
2	Amyl Acetate	

#### CONCLUSIONS

- Which industries might be able to use synthetic esters? Why? \_\_\_\_\_  
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 \_\_\_\_\_

- What are esters? \_\_\_\_\_  
 \_\_\_\_\_  
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- The table below lists some esters and their characteristic odors:

Structure	Name	Odor
$\text{HCOOCH}_2\text{CH}_3$	Ethyl formate	Rum
$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	<i>n</i> -Pentyl acetate	Banana
$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	<i>n</i> -Octyl acetate	Orange
$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$	Ethyl butyrate	Pineapple
$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	<i>n</i> -Pentyl butyrate	Apricot

Pick an odor and describe how you would synthesize it. (*HINT*: Look at the names of the esters you synthesized and the names of the alcohols and acids you used to do it.) \_\_\_\_\_  
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 \_\_\_\_\_  
 \_\_\_\_\_  
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- Why do many living things produce esters? \_\_\_\_\_  
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