20C – FRAGRANT ESTERS

1. Use the model set to build molecular structures of the alcohol and carboxylic acid reactants for test tube #1. Draw the structures in Table 1. Circle the functional groups that are involved in the reaction.

2. Take the –OH from the carboxylic acid (–COOH) group, and the –H from the alcohol (–OH) group to build water and the ester product for test tube #1.

3. Draw the ester product that forms in test tube #1 in Table 1.

4. Circle the ester functional group in the product. Repeat steps 1-4 for test tubes #2 and #3.

Table 1: Esterification

Test tube #	Alcohol reactant	Carboxylic acid reactant	Ester product and odor
1	Isoamyl alcohol structure ($(CH_3)_2CHCH_2CH_2OH$):	Acetic acid structure (CH_3COOH):	Isoamyl acetate structure: Isoamyl acetate odor:
2	Methyl alcohol structure (CH_3OH):	Salicylic acid structure [Hint: The parent is a ring structure and functional groups sit next to each other] ($2\text{-}HOC_6H_4COOH$):	Methyl salicylate structure: Methyl salicylate odor:
3	Ethyl alcohol structure (C_2H_5OH):	Butanoic acid structure ($CH_3CH_2CH_2COOH$):	Ethyl butanoate structure: Ethyl butanoate odor:

Questions

1. The general reaction you observed is an equilibrium reaction: carboxylic acid + alcohol ↔ ester + water. Sulfuric acid was not a reactant. It was added to each of the test tubes to absorb water as it was produced. Use Le Châtelier's principle to explain why adding an acid that absorbs water helps to form more ester products.

2. Isobutyl alcohol ($(CH_3)_2CHCH_2OH$) and formic acid ($HCOOH$)combine to produce a raspberry odor. Draw the molecular structures for the reactants and products (one product is water).

3. Review Table 1 to help you predict the name of the ester that is responsible for the raspberry odor.

4. Describe the importance of esters to the food industry. Cite examples of their use.

5. In addition to food products, what other products do you suspect contain esters? Why?

6. Investigate the ingredients of 3 common household products with pleasant aromas (i.e. vanilla extract, perfumes, soaps, lotions etc.). Identify the 3 products and the esters responsible for their scents.

7. If you could create an ester of any odor, what odor would you choose? Why?