**Molecules in Two Dimensions**

**Adapted from Living By Chemistry’s “Molecules in Two Dimensions”**

**Purpose**

To compare the structures of molecules.

**Part 1: Smell Predictions**

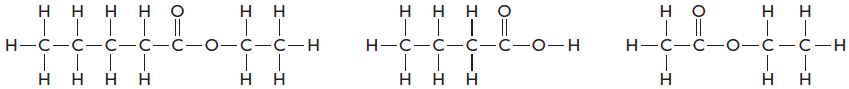
Write your predictions in the table.

|  |  |  |
| --- | --- | --- |
| **Chemical name** | **Molecular formula** | **Smell** |
| ethyl pentanoate | C7H14O2 |  |
| butyric acid | C4H8O2 |  |
| ethyl acetate | C4H8O2 |  |

What could account for two molecules with the same molecular formula having different smells?

**Part 2: Examine the Structures**

Below are structural formulas of each of the three substances. They show how the atoms in each molecule are connected.



ethyl pentanoate butyric acid ethyl acetate

**Questions**

1. List three similarities between butyric acid and ethyl acetate.

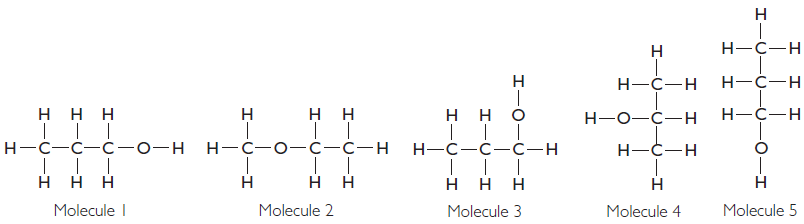
2. List two differences between molecules butyric acid and ethyl acetate.

3. List three similarities between the two sweet-smelling molecules.

4. What do you suppose the lines in these drawings represent?

5. From the evidence you have seen so far, how would you explain the differences in smell between butyric acid and ethyl acetate?

6. Five more structural formulas are shown here.



Write their molecular formulas:

7. Molecules 1, 3, and 5 smell exactly the same. They represent the same molecule. Explain why.

8. Molecules 1, 2, and 4 have different smells. Explain why.

**Part 3: Examining Other Structures**

9. Contrast the four smell pages that you have. What are some *structural* features(not formula features) that make the smell molecules on each page different from smell molecules on another page?

Minty Fishy Sweet Putrid

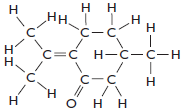
10. **Making Sense:** What evidence is there that the structure of a molecule is related to how it smells?

11. **If You Finish Early:** Draw molecule 4 so that it looks different on paper but still represents the same molecule.

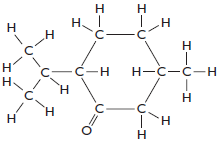
**Minty**

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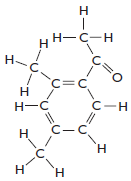
C10H14O

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C10H16O

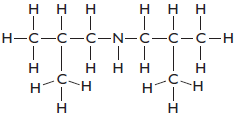
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C10H18O

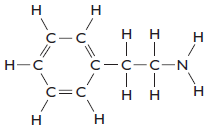
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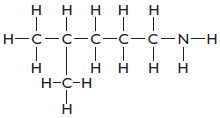
C10H12O

**Fishy**

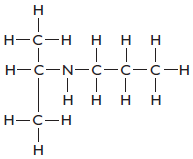
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C8H19N

****C8H11N

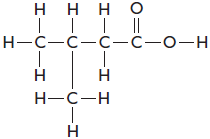
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C6H15N

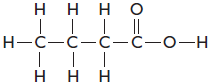
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C6H15N

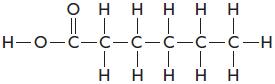
**Putrid**



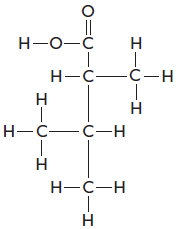
C5H10O2



C4H8O2

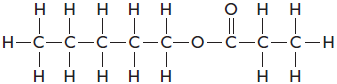


C6H12O2

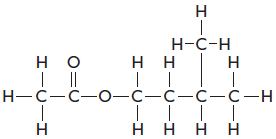


C6H12O2

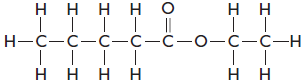
**Sweet**

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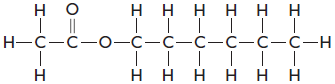
C8H16O2

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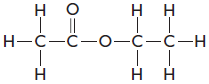
C7H14O2

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C7H14O2

****

C8H16O2

****

C4H8O2

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**Part 1: Test Your Predictions**

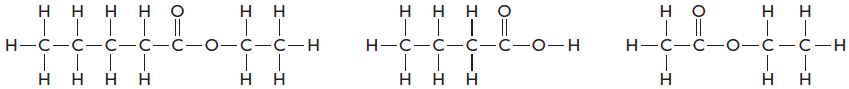
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**Questions**

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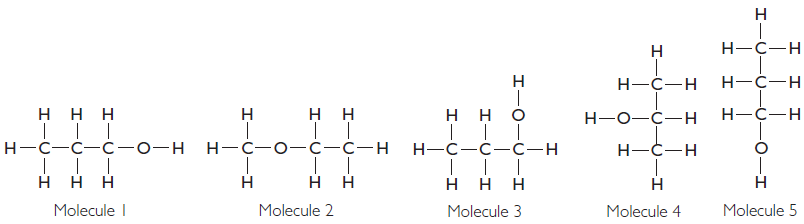
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Explain why.

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**Purpose:** In this lesson you are introduced to the structural formulas of the molecules you have smelled plus some new molecules. You will look for patterns in the ways the atoms are connected.

**Instructions:** Sort the structural formula cards any way you wish, as long as it is consistent and makes some sense. Then, complete the following:

1. Describe how your group sorted the structural formula cards.

2. Look for patterns in your groups. Write down as many patterns as you can find within the groups.

3. Look for differences between groupings. Write down as many differences between the groupings as you can find.

**Making Sense:**

What structural features seem to be the best predictors of the smell of a molecule?