| **""** | **HANDS-ON LAB** Model Molecules |
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You will observe two compounds that are made of only carbon, hydrogen, and oxygen atoms. You will plan and carry out an investigation to explore how models of each molecule can explain why the compounds are different.

**Purpose:** The purpose of the activity is to determine how many different ways you can put together the same number of carbon atoms.  You will investigate the different ways atoms can bond.

## Materials

* Styrofoam balls- 3 sizes or 3 colors or some combo
* sample of acetic acid
* sample of isopropyl alcohol
* toothpicks

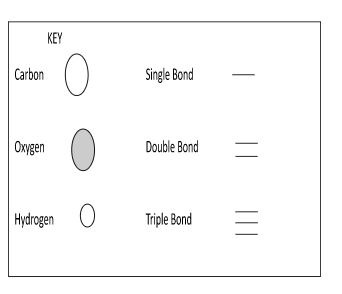
## Procedure

**STEP 1** Look at the samples of acetic acid and isopropyl alcohol. What properties can you observe? Record your observations in the table below.

**STEP 2** On a separate piece of paper, make a plan to build a model of each molecule. Use the structural formulas from the table to help you. Think about how you can use the materials provided by your teacher to build the models.

**STEP 3** Build the models. Then draw what you built in the table.

**STEP 4** Use the Styrofoam balls and toothpicks to building the remaining molecules, these are mostly hydrocarbons. Make sure to follow these rules:

* + Each carbon atom forms four bonds at a time (4 toothpicks)
  + Each hydrogen atom forms only one bond at a time (1 toothpicks)
  + Draw Carbon as a large, shaded circle
  + Draw Hydrogen as a smaller, empty circle
  + A single bond is one line, a double bond is two lines, a triple bond is three lines
  + Use the naming guide to name each model

| **Compound Name** | **Molecule Structure** | **Observations** | **Draw Your Model** |
| --- | --- | --- | --- |
| Acetic Acid | Two carbon (C) atoms are single bonded with each other. First C atom is single bonded to 3 hydrogen (H) atoms and second C atom is double bonded to oxygen (O) atom and single bonded to O H group. |  |  |
| Isopropyl Alcohol | Three C atoms are single bonded to each other. C atoms on each side (first and third) are single bonded to 3 H atoms. Second C atom in the middle is single bonded to 1 H atom and is also single bonded to O H group. |  |  |

| **Molecule to Build** | **Drawing & Observations** | **Name the molecule** |
| --- | --- | --- |
| CH4 |  |  |
| C2H6 |  |  |
| C3H8 |  |  |
| C4H10 | Build this molecule two ways and describe the difference. |  |
| **Molecule to Build** | **Drawing & Observations** | **Name the molecule** |
| C5H12 | How many ways can you build this molecule?  Draw and compare the ways. |  |
| C2H4 | How does this molecule differ from C2H6? |  |
| C2H2 | How does this molecule differ from C2H6? |  |

## Analysis

*Please use complete and detailed sentences to answer the following*

*You can write answers here, type them and post to Compass, or type directly into Compass.*

How are the structures of acetic acid and isopropyl alcohol similar? How are they different?

Why do you think acetic acid and isopropyl alcohol have different properties? Use the models you developed to help you explain.

Did any of your models have a hydrogen atom between two carbon atoms?  Why or why not?

How does a branched chain differ from a straight chain?  Describe the order of the atoms.

What happens to C5H12 if you make the carbon atoms a ring?  Can you actually have C5H12 as a ring?  Why or why not? Draw the ring and write the formula for the molecule.

**Naming Guide**

| **Number of Carbons** | **Name for Alkanes**  Single bonds only between carbon atoms | **Alkenes**  Double bond between two carbons | **Alkynes**  Triple bond between two carbons | **Branched** | **Rings** |
| --- | --- | --- | --- | --- | --- |
| 1 | **meth**ane | **Use suffix**  **-ene** | **Use suffix -yne** | **Add prefix iso-** | **Add prefix Cyclo-** |
| 2 | **eth**ane | **Ethane** | **Ethyne** |  |
| 3 | **prop**ane | **propene** | **propyne** |  |
| 4 | **but**ane |  |  |  |
| 5 | **pent**ane |  |  |  |
| 6 | **hex**ane |  |  |  |
| 7 | **hept**ane |  |  |  |
| 8 | **oct**ane |  |  |  |
| 9 | **non**ane |  |  |  |
| 10 | **dec**ane |  |  |  |