

# Ethanol: Composition, Structure, and Reaction

This demonstration is appropriate for an early lecture in an intro chemistry course.

It uses ethanol to give a simple introduction to the terms  
composition, structure, and reaction.

## Chemicals and Equipment Needed

- d-H<sub>2</sub>O
- 95% ethanol – **R2**
  - 1 L bottle
  - Drop bottle
- Black background – **A1**
- Small watch glass – **P3**
- Stick lighter – **U1**
- Wood stick – **U1**
- Ball-and-stick model of ethanol – **B3**
  - Instructor may request dimethyl ether as well
- Fire extinguisher – **next to sink**

## Hazards

- Ethanol is a volatile and flammable organic solvent.
- Be sure your hands are free of ethanol before you use the lighter. Keep the volume to be burned small. The watch glass gets very hot, so do not touch it.

## Preparation

- Make ball-and-stick model of ethanol (and dimethyl ether, if needed)
- On delivery: set watch glass in front of black background

## Presentation

- When you define “composition,” you can refer to both the model and the large bottle of ethanol. The model shows that the composition of one molecule of ethanol consists of two atoms of carbon, six atoms of hydrogen, and one atom of oxygen. The bottle of 95% ethanol illustrates another definition of composition, in this case expressing concentration.
- When you define “structure,” again hold up the model of ethanol. This time call attention to what the model shows us: which atoms are bonded to one another, and the angles of those bonds.
  - You may wish to contrast the model of ethanol with a model of dimethyl ether, pointing out that both compounds have the same composition (2C, 6H, 1O), but different *structures*, with different atoms bonded to one another.
- When you define “reaction,” squirt a small amount of ethanol on the watch glass. Light the wood stick with a match and turn out the lights. Ignite the ethanol with the wood stick. It will burn with a pale blue flame. The reaction you observe is the combustion of ethanol in air (oxygen).

## Discussion

- The demonstration as described above is intentionally simple to make it appropriate for an early lecture. Some people may choose to expand the presentation.
- For example, the model may provide a starting point to explain percent composition:

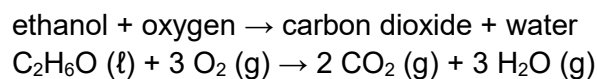
$$\text{MW} = 2(\text{C}) + 6(\text{H}) + \text{O} = 2(12.01) + 6(1.008) + 16.00 = 46.07 \text{ g/mol}$$

$$\% \text{C} = \frac{2(12.01)}{46.07} \times 100 = 52.14\% \text{ C}$$

$$\% \text{H} = \frac{6(1.008)}{46.07} \times 100 = 13.13\% \text{ H}$$

$$\% \text{O} = \frac{16.00}{46.07} \times 100 = 34.73\% \text{ O}$$

- When you burn the ethanol, you may wish to write an equation for the reaction, either in words or using chemical formulas:



- This can also serve as a jumping-off point for discussing chemical formulas and balancing equations