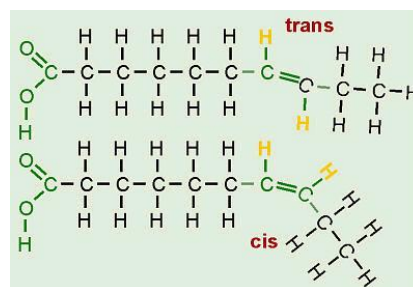


# Mass and Length of an Oleic Acid Molecule

Oleic acid (cis-9-octadecenoic acid) is a fatty acid found in olive oil. The chemical formula is  $C_{18}H_{34}O_2$ . The structures, not to scale, are shown at the right. The molecule's length is approximately 4x its width. Oleic acid is less dense than water (0.890 g/mL) and is insoluble in water but soluble in methanol. The molecule itself is polar, with the  $-COOH$  end being hydrophilic and the  $CH_3$  end being hydrophobic. When a drop of 4% oleic acid in methanol is dropped on the surface of water, the methanol dissolves into the water while the oleic acid molecules spread into an oil slick that is one molecule deep. The oleic acid molecules "stand" on the surface of the water with their hydrophilic "feet" touching the water and their hydrophobic "heads" away from the water.



Your job is to make the measurements needed and use clear calculations needed to answer these questions:

1. What is the length (long dimension) and width (short dimension) of oleic acid molecules?
2. What is the mass of a single oleic acid molecule?
3. Based on your data, what is an approximate value for Avogadro's number?

Given (you may choose not to use all items):

- basic lab equipment in the lab table (beakers, droppers, graduated cylinders)
- analytical balance
- ruler
- overhead transparency and marker
- graph paper
- 4% by volume oleic acid in methanol
- a low, flat pan or tray (or the tabletop)
- a tiny pinch of lycopodia powder (helps oleic acid make a thin film on the surface of water)

With your group, list the things you will need to know and be able to do. Consider the measurements you can take, how they will be helpful, and the calculations you will need to do to answer the 3 questions, above.

What data should you collect? How will you collect those data? How will you calculate the answers, and how will you explain your thinking?

Please submit your findings for in a simple report that includes the problem statement, summary of your process, data tables, calculation table, calculations with descriptions and all steps shown, and of course your final results for each of the 5 values. For each calculation, show:

1. A statement explaining what you are calculating
2. An equation justifying your math,
3. The math, with a unit for every number.

## Possibly helpful information:

Mathematics and measurements used to find density will be useful, as will your most precise measuring skills. Actual data collection might take 5-15 minutes, depending on your group's decisions, workload sharing, and efficiency.

Check one another's measurements.

Multiple trials are sound scientific practice.

You may Google, but you must have actual measurement data and calculations with explanations to justify your findings.

Oleic acid molecule image retrieved on July 21, 2016 from

[http://intranet.tdmu.edu.ua/data/kafedra/internal/i\\_nurse/classes\\_stud/ADN%20Program/Full%20time%20study/Second%20year/nutrition%20and%20diet%20therapy/05.%20The%20Lipids.htm](http://intranet.tdmu.edu.ua/data/kafedra/internal/i_nurse/classes_stud/ADN%20Program/Full%20time%20study/Second%20year/nutrition%20and%20diet%20therapy/05.%20The%20Lipids.htm)