

**Exercise 4: Stoichiometry of biodiesel, and writing chemical recipes**

Biodiesel, the methyl ester of  $\omega$ -6,9-linoleic acid has the chemical formula  $C_{20}H_{36}O_2$ .

4. Given that chemical formula, determine the percent composition (text section 3.11) of biodiesel. In other words, find the mass percents of carbon, hydrogen and oxygen in biodiesel. (Hint: there is a built-in check)

5. Write the **balanced equation** for the complete **combustion** of biodiesel (for a definition of combustion, see text section 4.12). Keep in mind that biodiesel contains some oxygen!

6. If 20.000 g of biodiesel was completely combusted (this means that oxygen gas is in excess), what mass of **carbon dioxide** would be introduced into the atmosphere? (Text section 3.4) Keep this number for a later date.

Chemical recipes: There are many different ways of writing these, but the two principal tasks in preparing solutions are given below. Text sections 3.7 and 3.8 may help.

**Making a solution from a dry material:** "Add \_\_\_ grams of (the name of the dry chemical) to a sufficient volume of distilled water. Stir thoroughly to dissolve the solute, then add enough distilled water to make \_\_\_\_\_ L (or mL) of \_\_\_ M (the name of the dry chemical) solution, and stir thoroughly again."

**Diluting a concentrated solution:** "To a small volume of distilled water, add \_\_\_ mL (or L) of \_\_\_ M stock (name of chemical) solution. Stir thoroughly, then add enough distilled water to make \_\_\_\_\_ L (or mL) of \_\_\_ M (the name of the chemical) solution, and stir thoroughly again."

For the following questions, decide which type of recipe is needed, then write out the recipe, using the appropriate template above. Note that these are solutions you are using in exercise 5. Assume that you are trying not to make excess reagent in the scenarios below.

7. Each partnership in Chemistry 140 will use 2 mL of 0.1 M HCl for exercise 5. There are seventy partnerships in the different sections of Chem 140 this quarter. On the stockroom shelf, you find 12 M stock HCl solution in a bottle.

8. Each partnership in Chemistry 140 will use 2 mL of 0.1 M AgNO<sub>3</sub> for exercise 5. There are seventy partnerships in the different sections of Chem 140 this quarter. On the stockroom shelf, you find powdered AgNO<sub>3</sub> in a bottle.