

Chemistry 51
Experiment 11
Analysis of Fat in Food

Fat is a food component that worries nutritionists and provides copy for newspaper editors because Americans tend to consume too much of it, making obesity a national epidemic. In this experiment you will measure the amounts of fat in some foods that could be part of a typical fast food meal.

Percent Fat in Potato Chips

Each pair of students will do two measurements on each of two kinds of potato chips or other snack chips, then pool their results with those of other students. The essential procedure is very simple: petroleum ether (a commercial mixture of hydrocarbons that is widely used as a solvent) is mixed with ground-up chips to extract the fat. After separating the solvent mixture from the chips, the petroleum ether is allowed to evaporate, leaving behind the fat that can then be weighed.

SAFETY NOTE:

Part I uses petroleum ether, a gasoline-like solvent that is extremely flammable. Therefore it is absolutely essential that no open flames be present anywhere in the laboratory during this experiment. Under no circumstances should the heating be done with a Bunsen burner.

This procedure will be done twice, using two samples of chips. If there is sufficient equipment available, two students working as a team can do the two samples simultaneously.

1. Obtain two small beakers that are clean and dry. Label them with your initials and identifying numbers (#1 and #2).
2. Take a bag of chips, the two beakers, and your lab notebook to a laboratory balance. Accurately weigh out two samples of chips of about 4-5 grams each. This is done most conveniently by using small sheets of paper or small plastic weighing dishes. Record the mass of the first paper or dish to the nearest 0.01 gram, add 4-5 grams of chips, and again record the mass to the nearest 0.01 g. Repeat with the second sample. Keep track of which sample is which.

REMINDER ABOUT WEIGHING: It is important to check the balance each time it is used to be sure it reads 0.00 g when there is nothing on the balance pan.

3. Also weigh the two beakers and record their masses to the nearest 0.01 gram in the appropriate places in the data table. (First check to be sure that the balance reads 0.00 g when empty.)
4. Put chip sample #1 in a clean porcelain mortar and use a pestle to crush the chips into very small pieces. (Because of the fat, the mixture may be rather sticky.)
5. Add approximately 15 mL of petroleum ether to the mortar and grind the mixture thoroughly.

6. Prepare a glass funnel with folded filter paper (as shown by the instructor). Mount it over weighed beaker #1. Using a spatula, carefully transfer the potato chip mixture into the filter. Try to get most of the mixture into the filter.
7. In order to rinse out any remaining fat in the mortar and on the chip mixture, add about 5 mL more petroleum ether to the mortar, stir it around with the pestle, then pour it onto the chip mixture in the filter.
8. Repeat with another 5 mL rinse of the mortar and the chip mixture in the filter.
9. Repeat steps 4-8 with the second sample of chips using the same mortar and pestle but a fresh piece of filter paper and weighed beaker #2.
10. When both mixtures have finished filtering, the next step is to remove all of the petroleum ether by evaporation. There are two ways this can be done.
 - (a) You can leave the beakers in a fume hood until the next day or the next lab period, by which time the solvent will have evaporated.
 - (b) A much faster way is to place the beakers on a hot plate in a fume hood. Do not overheat the beakers. Leave them for about 15 minutes or until all of the petroleum ether has evaporated. Then remove the beakers from the hot plate and let them cool for a few minutes.
11. Re-weigh the beakers and record the masses to the nearest 0.01 gram. (First check to be sure the balance reads zero when empty.)

CLEAN UP: Discard the filter paper and chip mixtures in a designated container. The instructor will specify what to do with the mortar and pestle (which should be nearly clean) and the beakers (which are quite greasy).

Calculations for Section 1:

For each sample, on your report sheet (or notebook), calculate by subtraction the mass of chips and the mass of fat. Then calculate the percent fat in the chips:

$$\text{Percent fat} = \left(\frac{\text{mass of fat}}{\text{mass of chips}} \right) \times 100\%$$

Sharing Your Results:

Finally, share your results with others in your class or lab section. It will probably be advantageous to report your two results separately rather than as an average. If others analyzed the same brand, you can see how closely you agree. Examining the class data as a whole, you can look for differences and possible generalizations about different types of snack chips.

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Section I - Fat in Potato Chips

	Trial #1	Trial #2	Trial #3	Average
Type of Chip:				
Weight of chips				
Weight of beaker				
Weight of beaker + fat residue				
Weight of fat residue				
% of fat in potato chips				

Show sample calculations below:

Class Results:

Type of Snack Chip	Average % Fat	Maximum % Fat	Minimum % Fat

Questions:

1. Looking at the class results, can you make any generalizations? For example, do potato chips have more or less fat than tortilla chips? If your class analyzed any "low fat" products, do the results support this claim? How precise are the class data? Do you think you can justify your generalizations based on the precision of the data?

2. A snack pack of potato chips or other kinds of chips holds one ounce (28 grams) of chips. Based on your data, how much fat is present in a snack pack? In such a bag of chips there are about 15 grams of carbohydrate and about 1 gram of protein. Given that carbohydrates and protein provide about 4 Calories of energy per gram and fats provide about 9 Calories per gram, what is the energy equivalent (in Calories) of a 1 ounce bag of chips? What percent of the Calories are from the fat?

3. Suppose you wished to use potato chips as a major source of protein in your diet. How many 1 ounce (28 grams) bags of potato chips would you have to eat to satisfy the recommended minimum daily allowance for protein (60 grams for a typical young adult)? How many grams of fat are in this amount of potato chips?