

## Exp #07: FAT CONTENT

*Introductory Chemistry*

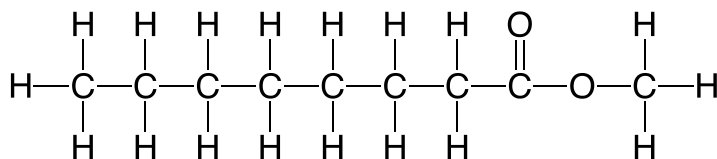
Name: \_\_\_\_\_

Student ID: \_\_\_\_\_

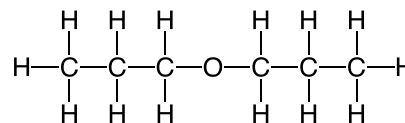
Chem 10 — De Anza College

### Objective

- Extract fat from potato chips.
- Compare the percent fat (by mass) in regular and low-fat potato chips.



Fat Molecule



Petroleum Ether

**Process:** Fat molecules are long chains of carbon with a few oxygen atoms near one end. These long floppy molecules have no dipole, this substance is non-polar and does not dissolve in water. Having no dipole, it cannot break the dipole-dipole attraction of water to itself and so cannot mix with water. Fats and other oils stick to themselves instead and often float on the surface of water. This is why oil and water do not mix.

But non-polar substances like fats (oils) can be dissolved in other non-polar substances. Petroleum ether is a non-polar solvent that can form a homogenous mixture (solution) with fat molecules. Fat can dissolve in petroleum ether. In our experiment today, we will use this property of petroleum ether to separate fat from a common food product, potato chips. By mixing crushed potato chips in ether, we will dissolve and pull out (extract) the fat from the chips. We will then transfer the solution of fat dissolved in ether to another container and boil off the ether, to leave pure fat behind. By weight, we will be able to see how much of the original chips were made of fat.

Using this technique, we will be able to put number to the claim that some chips are “low” in fat. By comparing the amount of fat we can extract from regular and non-fat chips, we will know how much “lower” in fat low-fat chips.

### Procedure:

#### Part A — Prepare the Potato Chips

1. Pre-weigh a test tube, 100 mL beaker, and a 25 mL Erlenmeyer flask and record the weights.
2. Collect 3-5 regular potato chips and crush them to dust using the mortar and pestle. Transfer the crushed potato chips to a watch glass.
3. Using a spatula add about 1/2 gram of crushed chips to your pre-weighed test tube.
4. Set the test tube in your pre-weighed beaker (so the test tube will not fall over) and weigh the beaker, test-tube and crushed chips. Record the combined weight.
5. By difference, determine and record the precise weight of your sample of crushed chips. Record the weight of the crushed chips.

### **Part B** — Extract Fat from the Potato Chips

1. Collect about 10 mL of petroleum ether.
  1. Transfer 3 mL of your petroleum ether to your test tube containing the crushed potato chips.
  2. Stopper your test tube and shake it for several seconds.
    - CAUTION: PRESSURE WILL BUILD UP IN THE TEST TUBE AS YOU DO THIS.
  3. After a few seconds, stop. Slowly remove the stopper to release pressure in the test tube.
  4. Re-stopper, shake and release the pressure from the test tube two more times.
  5. Let the tube stand for 1-2 min so the solid chips can settle to the bottom of the test tube.
  6. Using your pipet, transfer the ether solution from the test tube to your pre-weighed 25 mL Erlenmeyer flask. Be careful not to transfer any solid.
2. Transfer another 3 mL of ether to the test tube. Repeat this process to extract more fat.

### **Part C** — Separate the Fat & Petroleum Ether Solution

CAUTION: PETROLEUM ETHER IS VOLATILE AND FLAMMABLE. DO THIS PART IN A FUME HOOD.

The fats you extracted have a boiling point of 200°C, the petroleum ether boils around 40°C.

1. Add approximately 25 mL of tap water to a 100 mL beaker.
2. Place your beaker on a hot plate.
3. Using a ring stand, secure your 25 mL Erlenmeyer flask, containing your fat and ether solution, in the 100 mL beaker. Be careful not to allow any water to get into the flask.
4. Slowly increase the heat of the hot plate until the ether begins to boil.
5. Over about 10-15 minutes, the ether will boil off leaving only the fat.
6. Let the flask cool to room temperature.
7. Weigh and record the weight of the flask with fat. By difference, determine the weight of the fat you extracted.

Repeat parts A-C using low-fat potato chips. Determine the fat content of about 1/2 gram of low-fat chips.

### **Analysis:**

- C1 — Calculate the mass of regular potato chips you started with.
- C2 — Calculate the mass of fat you extracted from those chips.
- C3 — Calculate the % fat, by mass, in your sample of regular potato chips.
- C4 — Calculate the mass of regular potato chips you started with.
- C5 — Calculate the mass of fat you extracted from those chips.
- C6 — Calculate the % fat, by mass, in your sample of regular potato chips.

**Report:**

Report your observations and measurements (data). Show your calculations. Report your the following conclusions:

- What is the percent fat, by mass, in regular potato chips?
- What is the percent fat, by mass, in low-fat potato chips?
- Is calling the chips you analyzed low-fat a fair claim?

**Post-Lab Questions:**

- 1) Is it likely that you did not extract as much fat from each sale as the label suggests you could have. Give two possible reasons.
- 2) Were significant or insignificant amounts carried away when you evaporated the petroleum ether? Explain.
- 3) Which is the most important intermolecular force between fat molecules and petroleum ether?
- 4) Would the extraction be more or less efficient if you extracted only once using 6 mL of petroleum ether instead of twice using 3 mL each time? Explain.
- 5) How would the extraction efficiency change if you did not crush the chips before adding petroleum ether?