

Teaching Suggestions

Science and Mathematics Lab

(Course 1, Lesson 1-6)

Digestion of Fats

OVERVIEW

This activity is designed to demonstrate one of the ways math is applied in science. Students will see how recording observations by using numerical values creates a data set of numbers. They will use the numbers to interpret the results of the experiment. They will draw conclusions based on their numerical totals.

RECOMMENDED TIME

1 class period

MATERIALS

- bile, 5% solution
- liquid detergent
- 5 droppers
- lemon juice
- masking tape
- vegetable oil
- metric ruler
- 4 stoppers to fit test tubes
- 4 test tubes, 18 × 150 mm
- test tube rack

PREPARATION

Bile must be obtained before the class period and can be purchased from any biological supply company or may be available in the school chemistry or biology laboratory. It is a good idea to try the experiment before class to anticipate the results students are likely to achieve.

TEACHING THE LAB

1. Have students work in groups of three. Each group member should work with the test tubes and take measurements for some of the data.
2. Stress precision in measuring all liquid amounts. It is important that students understand that a scientific variable is something that can change. All other parts of the experiment must be equal or remain the same. If not, it is impossible to see how the change in the variable affects the results. In this experiment, if the amounts of water and oil greatly vary, the action of the bile and detergent may not be as visible.

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Digestion of Fats (continued)

3. To help students determine which mixture appears cloudy or clear, point out that they should hold each test tube in front of their worksheet. They can make their decision based on how clearly they can see the print through each solution. Also, point out that to determine relative cloudiness, they should compare each test tube to tube 1 by holding both tubes against the worksheet background at the same time.
4. Once students have familiarized themselves with the mechanics of the exercise, have them summarize the objective of the experiment. Be sure they understand what they are trying to analyze and how they will do it.

Answers and Conclusions

1. No. The mixture in tube 1 did not appear cloudy after shaking.
2. The chemicals with the highest number totals will be the best at breaking down fats.
3. bile, detergent, and lemon juice
4. water and oil
5. The lemon juice did not break down the oils.
6. It is the tube in which no chemical was added and is the lowest possible number.
7. Numbers are more precise than words. It is easier to compare things with numbers.

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Digestion of Fats

INTRODUCTION

A chemical compound called *bile* in your liver helps to break down fats and oils so that digestion can occur more easily. Eventually, the fat and oil are changed into a form that can be used by the body for energy.

In a scientific experiment, a *variable* is something that can change. There are three variables in this experiment. A *constant* is something that does not change. There are two constants in this experiment.

OBJECTIVES

In this lab, you will:

- perform an experiment to see if fats (oils) mix with water.
- see if certain chemicals help to mix fat with water.
- learn how scientists use variables and constants.
- write your observations as numbers.
- use your numbers to make conclusions.
- think of a better way to use numbers in the experiment.

MATERIALS

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PROCEDURE

1. Use tape to label four test tubes 1, 2, 3, and 4 and place them in a test tube rack.
2. Add water to a height of 4 centimeters in each test tube.
3. With a dropper, place four drops of vegetable oil into each test tube. Observe whether the oil remains on the top or the bottom of the water.

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Digestion of Fats (continued)

4. Add nothing to tube 1, add five drops of bile to tube 2, add five drops of detergent to tube 3, and add five drops of lemon juice to tube 4. Use a different dropper for each substance. CAUTION: *Bile will stain.*
5. Stopper each test tube and shake it vigorously five times.
6. Replace the tubes in the test tube rack and allow them to remain undisturbed. After ten minutes, examine each tube. If a mixture is cloudy, some of the fat has broken down and mixed with the water.
7. Record your results as clear (0), slightly cloudy (1), or very cloudy (2).
8. Some oil will remain on top of the water in each test tube. Determine whether the line that forms between the oil and water is sharp (3) or fuzzy (4). Record your answers on the table.

DATA AND OBSERVATIONS

Test Tube Number	Chemical Added	Appearance of Mixture	Appearance of Line	Total
1 (water, oil)				
2 (water, oil)				
3 (water, oil)				
4 (water, oil)				

Questions and Conclusions

1. Does water mix with fats (oils)? How can you tell?
2. How can you tell if fats are broken down so that they mix with water?
3. Which three chemicals are the variables?
4. What are the two constants in this experiment?
5. According to your totals, which chemical(s) did not break down oil?
6. Why is the number total for tube 1 important?
7. Attaching numbers to scientific observations is very important. Why do you think that this is so?