STEM Sims™

Body Fluid Dilution

STEM Sims™

Body Fluid Dilution

Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about how to dilute a sample of a fluid taken from a human body. Take the following brief quiz to see how much you already know about the body fluid dilution process. See the bottom of page 4 to check your answers.

1. About how many total grams of salt (NaCl) would be in a typical 50-kilogram person?
   a. 50 grams
   b. 200 grams
   c. 2,000 grams
   d. 5,000 grams

2. What is total volume of blood in an average human adult?
   a. 1 liter
   b. 3 liters
   c. 5 liters
   d. 9 liters

3. In a typical adult human, plasma makes up about what percentage of the total volume of blood?
   a. 27%
   b. 39%
   c. 55%
   d. 73%

4. What is the scientific name for “ear wax?”
   a. cerumen
   b. apocrine
   c. ambercen
   d. nanocrine

5. On a normal day when a person is *not* ill, about how much mucus is secreted by the nasal lining cells in a person’s nose?
   a. 5 tablespoons
   b. 10 tablespoons
   c. 1 cup
   d. 4 cups

A "Cereal" Dilution

Scientists have a technique, called a serial dilution, in which the concentration of a sample is reduced in a step-wise fashion. This method is used to make very dilute solutions of highly accurate concentrations in relatively small volumes. In this activity, you'll simulate this technique using cereal.

Materials

1- small mixing cup
4- large cereal bowls
1- spoon
1- box regular corn puffs cereal (e.g. *Corn Pops*™)
1- box chocolate flavored corn puffs cereal (e.g. *Cocoa Puffs*™)
1- roll masking tape and marker

Procedure

1. Line up the four large cereal bowls on the countertop and label them bowls 1, 2, 3, and 4.
2. Fill bowl #1 to the top with the regular corn puffs cereal. This bowl represents a concentrated substance.
3. Note and record in Table 1 the appearance and color of the cereal in bowl #1.
4. Using the mixing cup, remove 1 cup of the cereal from bowl #1. Place this cup of corn puffs in bowl #2.
5. Slowly add chocolate flavored corn puffs to bowl #2, making sure to stir with the spoon to make sure both flavors of puffs are evenly spread out. Completely fill bowl #2 with the chocolate puffs.
6. Note and record in Table 1 the appearance and color of the cereal in bowl #2.
7. Using the mixing cup, remove 1 cup of the cereal from bowl #2. Place this cup of corn puffs in bowl #3.
8. Slowly add chocolate flavored corn puffs to bowl #3, making sure to stir with the spoon to make sure both flavors of puffs are evenly spread out. Completely fill bowl #3 with the chocolate puffs.
9. Note and record in Table 1 the appearance and color of the cereal in bowl #3.
10. Using the mixing cup, remove 1 cup of the cereal from bowl #3. Place this cup of corn puffs in bowl #4.
11. Slowly add chocolate flavored corn puffs to bowl #4, making sure to stir with the spoon to make sure both flavors of puffs are evenly spread out. Completely fill bowl #4 with the chocolate puffs. Note and record your data in Table 1 and when done, eat some cereal!

Bowl #	Appearance and Color Inside the Bowl
1	
2	
3	
4	

Questions

1. Which bowl contained the most concentrated solution of regular corn puffs?
2. Which bowl contained the most dilute solution of regular corn puffs?

Body Fluid Dilution

Why Dilute?

Determining how to make various dilutions for a given solution is a topic that causes many students difficulties. Most dilution calculations require students to use ratios and other mathematical tools. For many students, the mathematics component is what causes them the greatest problems. This begs the question, why are dilutions required in the first place? Why not just use the original concentrated substance for all chemical tests?

Here's an analogy that illustrates the reason for diluting a substance. A human body needs a small amount of salt in the body fluids to maintain good health. What do you think would happen if a person suddenly swallowed one kilogram of table salt? The lethal dosage of table salt for a typical person is only about 100 grams, so most likely ingesting this much salt would result in death. The large amount of salt taken into the person's body would overwhelm the organs' and systems' delicate machinery. Body fluid dilution for quantitative and qualitative analysis reflects a similar process. If too large a quantity of the solutes in a body fluid is placed into an electronic device that analyses the fluid, the device's sensors can be inundated with the fluid's solute components and rendered useless, or even worse, be damaged so much that they never work again. Some fluid detectors only operate with solutions containing very small amounts of solute, with some operating using sample sizes of nanograms, which is one-billionth of a gram. Now, that's a dilute solution.

Please visit our site for more helpful information:
STEMsims.com

Answers: **Page 2 Answers:** 1) b, 2) c, 3) c, 4) a, 5) d. **Page 3 Answers: A "Cereal" Dilution:** 1) bowl #1, 2) bowl #4.

The project was supported, in part, by Grant Number DA10394 from the National Institute on Drug Abuse (NIDA). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIDA or the National Institutes of Health.