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Exploring Sensory Thresholds



In the last activity you tried to identify bottled spring water by taste. In this activity, you will investigate the ability of two more senses—sight and smell—to detect substances dissolved in water.

CHALLENGE

Determine which one of your senses—taste, smell, or sight—can detect the lowest **concentration** of a drink mix solution. (Here, a concentration means the amount or proportion of a substance dissolved in the water.) Use a bar graph to compare the range of these senses for all the members of your class.



MATERIALS	
	For each group of four students
	10 9-ounce plastic cups, labeled 1–10
	4 small tasting cups
	1 paper towel
	1 2-liter bottle of tap water, labeled “Tap Water”
	1 stir stick
	For each student:
	graph paper (or photocopy of Transparency 2 “Grids for Sensory Threshold Bar Graph”)

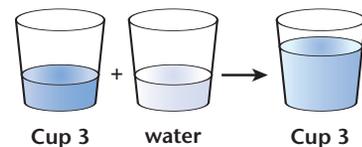
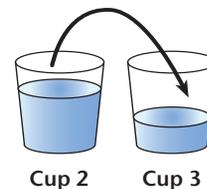
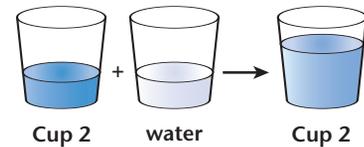
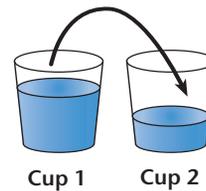


SAFETY NOTE: Use clean plastic cups for this investigation. Do not share the tasting cups, and do not add anything to the plastic cups, including your fingers. Remember, taste chemicals in science class only when your teacher tells you to do so.

PROCEDURE

Part One

1. Set up your investigation report.
2. Based on your own personal experiences, predict which of your senses—sight, smell, or taste—can detect the lowest concentration of drink mix dissolved in water. Record your prediction. In your science notebook, give two reasons for your choice.
3. Your teacher will fill Cup 1 half full of concentrated drink mix solution.
4. In your group fill the cup to the 200-mL mark with tap water from the bottle. Mix with the stir stick.

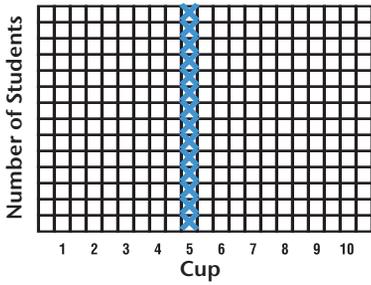


5. Pour half of the liquid from Cup 1 into Cup 2 so that the levels in the two cups are equal.
6. Fill Cup 2 to the 200-mL mark with tap water from the bottle. Mix well.
7. Now pour half of the liquid from Cup 2 into Cup 3 so that the levels in the two cups are equal.
8. Fill Cup 3 with water to the 200-mL line with tap water. Mix.
9. Repeat this procedure, using Cups 4 through 9, until all nine cups have been filled. **Note:** Cup 9 will be completely full of solution.
10. To Cup 10 add 200 mL of tap water.
11. Record the dilutions in a data table like the one on page A-14.

Part Two

1. Each person in your group should take a clean, small tasting cup. This will be your tasting cup, so do not mix it up with the others. Beginning with the tap water in Cup 10, pour a small amount of water (about 15 mL, or enough to half fill the tasting cup) into your small tasting cup. This will represent the control—a solution that contains no drink mix. Look at the sample, smell it, and then take a taste. Record your observations. Empty your cup after each taste.
2. Pour a small amount from Cup 9 into each person's tasting cup.
3. Again, look at the sample, smell it, and then take a taste of the solution. Do not tell your group whether you can see, taste, or smell anything. Record your observations in your data table.
4. Repeat the process for Cups 8 through 1, in that order. For each cup, record whether you are able to see, smell, and taste the drink mix in each cup. Results of the tests should be kept private until all 10 solutions have been tested. Take care not to let your partners know through your body language or facial expressions whether you can detect the drink mix.
5. Circle on your data table each instance where you were first able to detect the drink mix (for example, circle the box under "Appearance" where you were able to see the mix).

Activity 2 • Exploring Sensory Thresholds



If everyone first saw the drink mix in Cup 5, your bar graph would look like this.

6. Record on Transparency 2, “Grids for Sensory Threshold Bar Graphs,” the cups in which you were first able to see, smell, and taste the drink mix. Remember, you started with the very dilute drink mix in Cup 9, so the first cup in which you detected the drink mix was the highest, not the lowest, cup number.
7. Share your results with the other members of your group of four.
8. Complete the Analysis section.
9. Clean up as directed by your teacher.

Sensory Thresholds				
Cup	Dilution	Appearance?	Smell?	Taste?
10				
9				
8				
7				
6				
5				
4				
3				
2	1/2			
1	1			

ANALYSIS

1. Use the bar graph sheet provided by your teacher or a sheet of graph paper to make a bar graph for each of the three senses. Record the information from the class results on your graph. Use a different color for each test.
2. According to the graph, in what cup were the most students first able to:
 - a. Detect the color of the drink mix?
 - b. Detect the smell of the drink mix?
 - c. Detect the taste of the drink mix?

These represent the most common values (modes) for vision, taste, and smell thresholds.

3. From your investigation, which sense is best able to detect the drink mix at low concentrations?
4. How did your personal results compare to those of the other members of your group?
5. Give two reasons that could explain why different people reported first seeing, tasting, or smelling the drink mix in different cups.
6. Describe an experiment you could do to check one reason you suggested for people sensing the drink mix at different concentrations. Include a statement of your problem and how you would do the experiment.
7. Based on the class discussion:
 - a. Define the term threshold.
 - b. Give an example of a threshold from this activity.
 - c. Give an example of a threshold for a substance you use.
 - d. Represent the concept of threshold. Use a labeled drawing and written description to express your ideas.