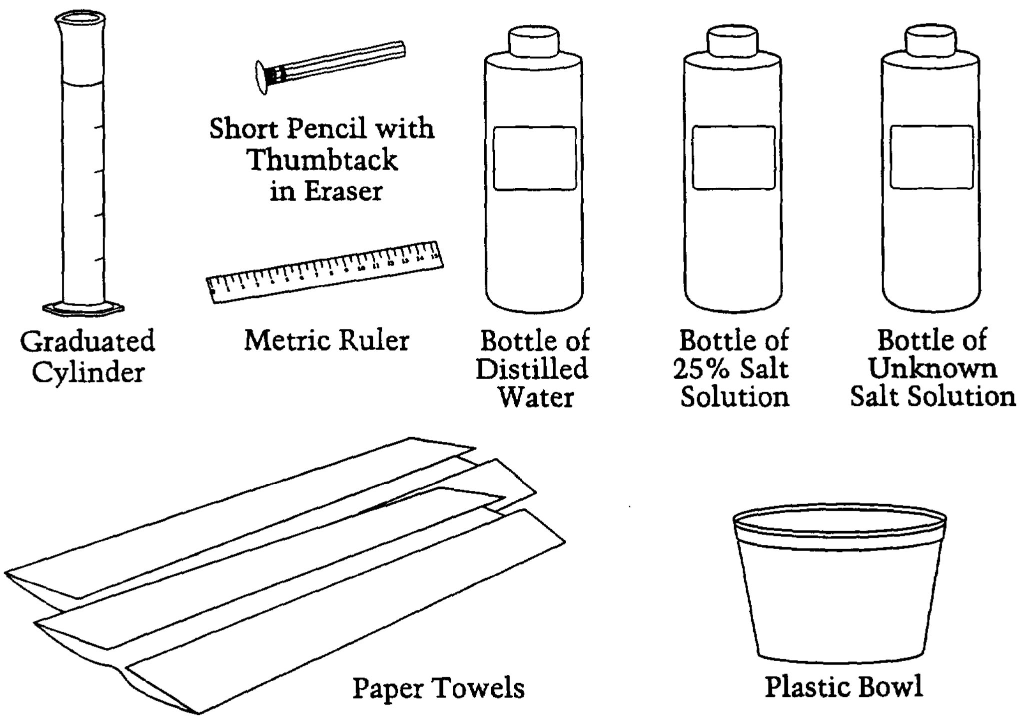
SALT SOLUTIONS

Estimating the Salt Concentration of an Unknown Salt Solution Using the "Floating Pencil Test"

For this task, you have been given a kit that contains materials that you will use to perform an investigation during the next 30 minutes. Please open your kit now and use the following diagram to check that all of the materials in the diagram are included in your kit. If any materials are missing, raise your hand and the administrator will provide you with the materials that you need.



STOP

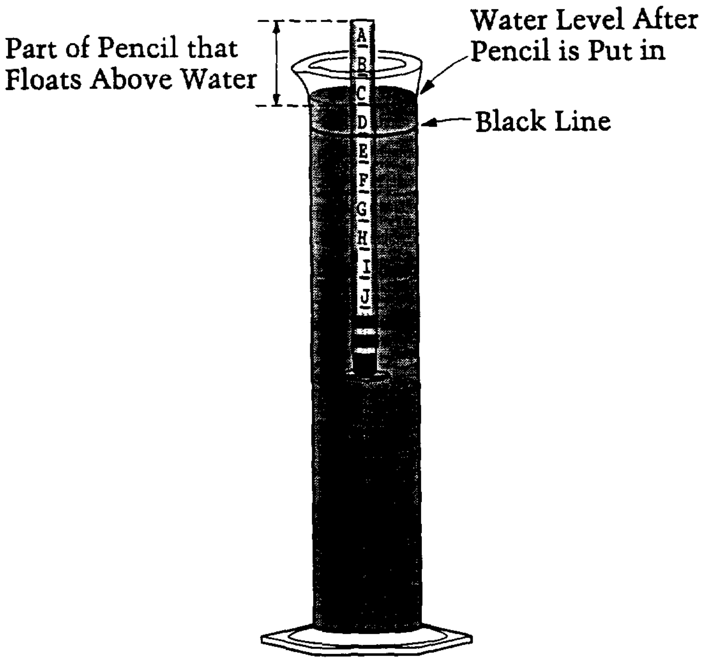
Section 123

Every body of water in natural ecosystems has salts and other substances dissolved in it. The concentration of dissolved salt varies from less than 0.2 percent in most freshwater streams and lakes to about 3.5 percent in most of the world's oceans. In this task, you will observe and measure how much of the length of a pencil floats above the water surface in water with very low salt concentration and in water with very high salt concentration. You will then use the same procedures to estimate the salt concentration of an unknown solution. Follow the directions step-by-step and write your answers to the questions in the space provided in your booklet.

LD000020

1. Open the plastic bottle labeled **<u>Distilled Water</u>.** The salt concentration of this water is very close to 0 percent. Pour the distilled water into the cylinder <u>up to the black line.</u> Put the cap back on the bottle.

Now take the pencil and put it in the water in the cylinder, eraser-end down. Part of the pencil will float above the water, as shown in the picture below.



Explain why the pencil floats when it is put in the water. LD000021

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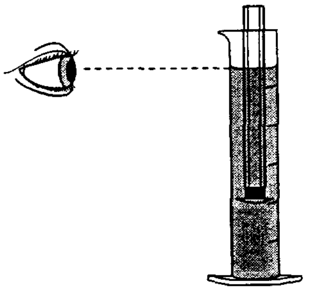
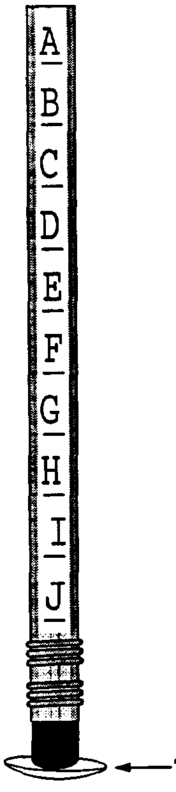
Section 123

2. Look at the pencil in the water. There are letters along the side of the pencil. Make sure that the pencil is not touching the side of the cylinder. Note the exact level where the water surface meets the side of the pencil, as shown in Picture A. Then draw a line on Picture B where the water surface comes to on your pencil. This line will help you to remember where the water level came to on your pencil for the next step (3).



Picture A



Picture B

3. Now take the pencil out of the water and dry it with a paper towel. Use the ruler to measure the length of the pencil that was above the water. Record the length in Table 1 below under **Measurement 1.**

TABLE 1

Type of Solution	Length of Pencil Above Water Surface (cm)		
	Measurement 1	Measurement 2	Average
Distilled Water			
Salt Solution			
Unknown Salt Solution			

LD000022

4. Now place the pencil back in the distilled water and repeat steps 2 and 3. Record your measurement in Table 1 under **Measurement 2.** LD000023

5. Calculate the average of Measurements 1 and 2 and record the result in the data table.

(You can calculate the average by adding Measurement 1 + Measurement 2 and then dividing by two.) LD000024

6. Explain why it is better to measure the length of the pencil that was above the water more than once. LD000025

Now pour the distilled water out of the cylinder into the large plastic bowl. Later you will throw this water away.

Open the plastic bottle labeled **Salt Solution.** This solution contains 25% salt. Pour the salt solution into the cylinder up to the black line. Put the cap back on the bottle.

7. Now take the pencil and put it in the 25 % salt solution in the cylinder, eraser-end down. How does the pencil float in this solution compared to how it floated in the distilled water? (Fill in the oval in front of the correct answer.)

- Ⓐ In the salt solution, more of the pencil is above the surface.
- Ⓑ In the salt solution, more of the pencil is below the surface.

LD000026

8. Now use the same procedure that you used with the pencil in the distilled water to obtain two measurements of the length of the pencil that floats above the surface of the 25% salt solution. Record these two measurements in Table 1. Then calculate the average and record this result in the table. LD000027

9. Why does the pencil float at a different level in the salt solution than in the distilled water? LD000028

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10. If you added more salt to the 25% salt solution and stirred the solution until the salt was dissolved, how would this change the way that the pencil floats? (Fill in the oval in front of the correct answer.)

Ⓐ Less of the pencil would be above the surface.

Ⓑ More of the pencil would be above the surface.

Ⓒ There would be no difference in the amount of pencil above the surface.

Now pour the 25% salt solution out of the cylinder into the large plastic bowl. Later you will throw this solution away. LD000029

Section 123

Now open the plastic bottle labeled **Unknown Salt Solution.** You will now estimate the concentration of this unknown salt solution. Pour the unknown solution into the cylinder up to the black line. Put the cap back on the bottle.

11. Put the pencil in the solution in the cylinder, eraser-end down. Then repeat the same procedure that you used for the distilled water and the 25% salt solution. Obtain two measurements of the length of the pencil that floats above the surface of the unknown salt solution. Record these two measurements in Table 1. Then calculate the average and record this result in the table. LD000030

12. On the graph below, plot the average values you obtained for the distilled water and the 25% salt solution. Draw a straight line between the two data points. Assume that this line represents the relationship between the length of pencil that is above the water surface and the concentration of salt in the water. LD000031