Dissolving Detectives

Investigate what changes how quickly a solid dissolves.

PS.6.a "Plan and carry out investigations to determine how various factors, including temperature, surface area, and stirring, affect the rate at which a solute dissolves in a solvent."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each factor the students test, circle what they measure, and number the conditions they keep the same. These marks will help you judge whether each test shows cause and effect.

The Drink Mix Investigation

1. At a school food lab, students want to know how to make a drink mix dissolve faster. First, they test sugar as the solute and water as the solvent. Dissolving rate describes how quickly a measured amount of solute dissolves in a solvent. The students decide that a trial ends when no solid sugar is visible at the bottom of a clear cup. They start a stopwatch as the sugar enters the water and stop it at that endpoint. A shorter time means a faster dissolving rate under their testing conditions. They check each cup in the same way so their times are comparable.

2. For a temperature test, one cup holds water at 20°C and another at 40°C. Both get 100 mL of water and 5 g of sugar from the same container. The students use identical cups and keep both liquids still. They measure 71 seconds in the cooler cup and 38 seconds in the warmer cup. The difference supports the idea that warming the water increased the dissolving rate in these trials. To check whether the pattern is reliable, they repeat each condition several times rather than trusting a single stopwatch reading. They do not claim that temperature is the only factor that can matter.

3. Next, the students could test surface area by comparing a whole sugar cube with the same mass of crushed sugar. Smaller pieces expose more sugar to water at once. For this comparison, they would keep water volume, temperature, and stirring the same. A separate stirring test would use equal amounts of the same kind of sugar in equal volumes of water at the same temperature. One cup would be stirred at a steady pace; the other would remain still. Changing surface area and stirring together would hide which change caused a difference in time. The students would use the same endpoint for both cups.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which temperature produced the faster dissolving rate? Use the trial times to explain your answer.

2. A student stirs crushed sugar but leaves a whole sugar cube still. Can the times isolate the effect of surface area? Explain one change the student should make.

3. To test the effect of stirring, how should the two cups differ? Name two conditions that must stay the same.

4. A student starts the stopwatch when sugar enters one cup but several seconds later for the other cup. What should the student change, and why?

3 YOUR TURN

Your own words

Design a fair test using a soluble solid other than sugar to investigate one factor: water temperature, exposed surface area, or stirring. In 4 to 5 sentences, name both conditions, list at least three controls, explain how you will time and repeat the trials, and predict which condition will dissolve faster.

Dissolving Detectives

PART 1 · READ AND MARK

Underline each factor the students test, circle what they measure, and number the conditions they keep the same. These marks will help you judge whether each test shows cause and effect. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which temperature produced the faster dissolving rate? Use the trial times to explain your answer.	**The 40°C water produced a faster rate because the sugar dissolved in 38 seconds, compared with 71 seconds in the 20°C water.**
2	A student stirs crushed sugar but leaves a whole sugar cube still. Can the times isolate the effect of surface area? Explain one change the student should make.	**No. Stirring and surface area both change. The student should keep stirring the same in both cups, such as leaving both still.**
3	To test the effect of stirring, how should the two cups differ? Name two conditions that must stay the same.	**Stir one cup at a steady pace and leave the other still. Keep conditions such as sugar amount and water temperature the same.**
4	A student starts the stopwatch when sugar enters one cup but several seconds later for the other cup. What should the student change, and why?	**Start the stopwatch as sugar enters each cup. Using different starting points makes the dissolving times difficult to compare.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will compare 5 g of finely ground salt with 5 g of coarse salt in separate cups of water. Both cups will contain 100 mL of water at 25°C, and neither cup will be stirred. I will start a timer when I add the salt and stop when no solid is visible, using identical clear cups. I will run each condition three times and compare the average times. I predict fine salt will dissolve faster because more of it touches the water at once.

Accept other soluble solids and reasonable predictions if the plan changes only one tested factor, holds at least three conditions constant, uses the same timing endpoint, and repeats both conditions.