

Problem: Which factor is the most effective in dissolving sugar the fastest: temperature, particle size due to surface area or stirring?

Your Hypothesis: _____

Materials:

- goggles
- water
- thermometer
- 2 stop watches
- apron
- hot plate
- stirring rod
- 2-100 mL beakers
- graduated cylinder
- 8 sugar cubes
- heat resistant gloves
- paper towel or filter paper

SAFETY NOTE: Use heat resistant gloves to handle hot glassware.

Procedure:

Set 1

1. Measure 50 mL of water and place in a 100 mL beaker. Make sure there are no cracks or chips in the glass before you place the beaker on the hot plate and turn it to high. Bring to a slight boil.
2. Measure 50 mL of cold water and place in a 100 mL beaker of water.
3. On paper towel, carefully crush a sugar cube and label it A. Repeat the process for the second cube, labeling it B.
4. Once the water reaches the boiling point, use heat resistant gloves to carefully remove the beaker and set on the table. Do not add the sugar when water is on the hot plate.
5. Place the crushed sugar sample A in the hot water and time how long it takes for the sugar to completely dissolve using a stop watch. Do not shake or stir the solution. Record your observations in your data table.
6. Place the crushed sugar sample B in the cold water and time how long it takes for the sugar to completely dissolve using a stop watch. Do not shake or stir the solution. Record your observations in your data table.
7. Rinse out your beakers.



Set 2

Repeat Set 1; however this time, do not crush the sugar cube. (Hot water with sugar cube, do not stir & cold water with sugar cube, do not stir.) Record the time it takes for the sugar to completely dissolve. Rinse out beakers.

Set 3

Repeat the process; however this time, crush the sugar cubes and stir the solution as the sugar is dissolving. (Hot water with crushed sugar cube, stir & cold water with crushed sugar cube, stir.) Record the time it takes for the sugar to completely dissolve. Rinse out beakers.

Set 4

Repeat the process; however this time, do not crush the sugar cubes, but stir the solution as the sugar is dissolving. (Hot water with sugar cube, stir & cold water with sugar cube, stir.) Record the time it takes for the sugar to completely dissolve.



8. Wash and dry your beakers, thermometer, and glass stirring rods.
Wipe down your area.

Data & Observations:

	Beaker	Sugar Sample	Water Conditions	Time
<i>Set 1</i>	A	Crushed	Hot	
	B	Crushed	Cold	

	Beaker	Sugar Sample	Water Conditions	Time
<i>Set 2</i>	A	Cube	Hot	
	B	Cube	Cold	

	Beaker	Sugar Sample	Water Conditions	Time
<i>Set 3</i>	A	Crushed	Hot Stirred	
	B	Crushed	Cold Stirred	

	Beaker	Sugar Sample	Water Conditions	Time
<i>Set 4</i>	A	Cube	Hot Stirred	
	B	Cube	Cold Stirred	

Analysis:

1. Complete the data tables identifying the variables/constants in each set.

<i>Set</i>	Independent Variable
<i>1</i>	
<i>2</i>	
<i>3</i>	
<i>4</i>	

<i>Set</i>	Dependent Variable
<i>1</i>	
<i>2</i>	
<i>3</i>	
<i>4</i>	

<i>Set</i>	Constants
<i>1</i>	
<i>2</i>	
<i>3</i>	
<i>4</i>	

- How does the particle size affect the rate at which sugar dissolves in water?
- How does temperature affect the rate at which sugar dissolves in water?
- How does stirring affect the rate at which sugar dissolves in water?
- If you wanted to dissolve a larger amount of substance, say 10 sugar cubes, what should you do to dissolve the sugar faster?

Connections:

- Many people drink both iced tea and hot tea with lemon juice and sugar to enhance the flavor.
 - Will lemon juice dissolve faster in hot tea or in cold tea? Why?
 - Will sugar dissolve faster in hot tea or in cold tea? Why?
- Based on lab observations, what effect would surface area and particle size have on starting a fire with wood.
- Provide an example of how cooking uses the observations on the effect of particle size (surface area), and stirring on the rate of dissolving.