

Rate of Solution

Task Information

Grade: 8th Grade

Content:

Block H (The Chemistry of Matter). Section VI.B.2. Appendix H-68
Block J (STS) Section IV Process 15

Format: Manipulative

Purpose: To determine the amount of agitation necessary to dissolve various sized sugar particles.

Skills:

Primary - graph interpolation, generalizing
Secondary - measuring, observing

Time: 15 minutes

Materials:

- 1 sugar cube
- granulated sugar in a sealed container
- waste container (cups or small buckets)
- teaspoon
- graduated cylinder
- 2 bottles with screw on caps, labeled A and B
- super fine sugar sample
- water (500 ml)
- safety goggles
- hand lens

Preparation:

Mark the sealed container of granulated sugar;

"granulated sugar - Do Not Open"

Bottle size and water temperature must be consistent at every student station.

Safety:

- Safety goggles must be worn for this activity
- See MSDS - materials etc. for further safety precautions.
- proper laboratory safety procedures are required.

Extensions/ Modifications:

- Different types of sugar may be substituted in the shaking process;
granulated and super fine - extrapolate cube
granulated and cub - extrapolate super fine
- correlate particle size with surface area

Rate of Solution

Task: At this station, you will determine the number of shakes necessary to dissolve various sized sugar particles.

Materials

- 1 sugar cube
- water (500 ml)
- granulated sugar in a sealed container
- 2 bottles with caps, labeled A and B
- waste cup
- safety goggles
- teaspoon
- super fine sugar sample
- graduated cylinder

Directions

Procedure

1. Put on safety goggles. Do not taste any substance in this activity. Clean up any spills immediately.
2. Use your hand lens to carefully observe the sugar cube and the super fine sugar. Which form of sugar has the smaller size particles?

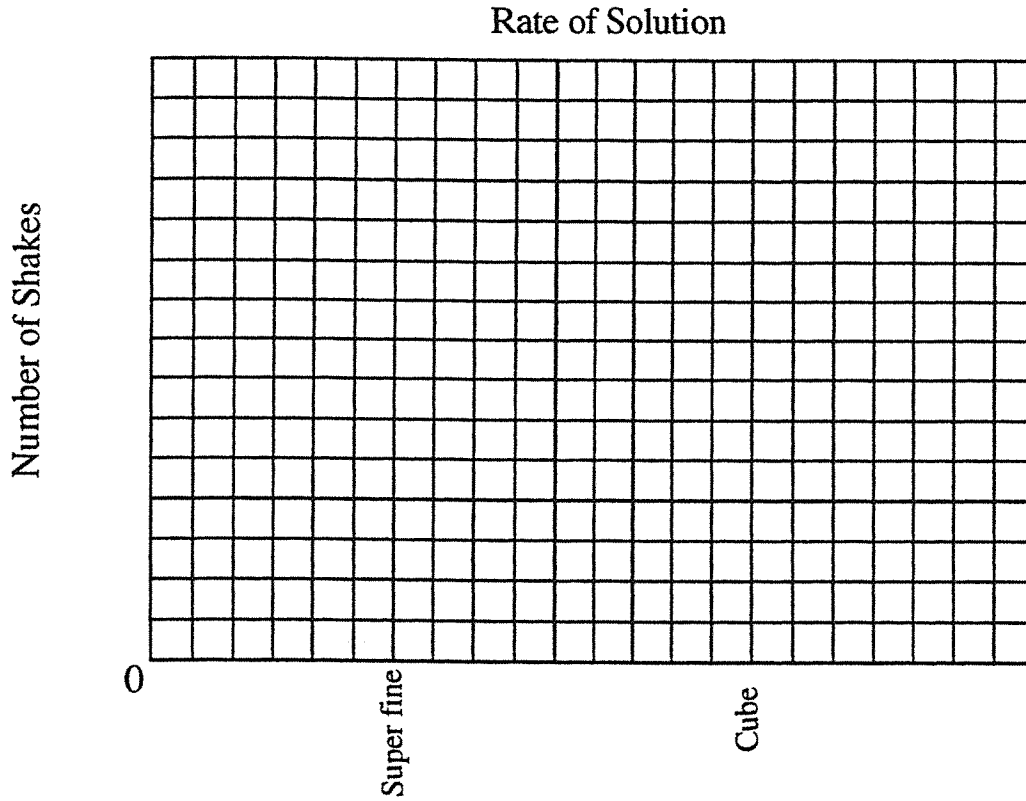
3. Add 50 ml of water to the two (2) bottles.
4. Drop one **sugar cube** into bottle A and close the bottle tightly.
5. Count how many shakes it takes to totally dissolve the sugar cube.
6. Record you data in the data table below.
7. Place one level teaspoon of **Super fine sugar** into Bottle B and repeat steps 5 and 6.
8. Dump the contents of the two (2) bottles into the waste cup and rinse the bottles. Leave one bottle on the desk and let it stand without movement.

Data Table: Number of Shakes

Types of Sugar	Super fine Sugar	Sugar Cube
Number of Shakes		

Please Continue on the Next Page

9. draw a **line graph** showing the number of shakes needed to dissolve the two forms of sugar. Use the grid below. Make sure you include the appropriate range and interval of numbers on the y- axis.



10. Use your hand lens to carefully observe the particle size of the granulated table sugar. Use the information from the line graph. Predict the number of shakes it would take to completely dissolve one level teaspoon of the granulated table sugar in the same amount of water.

11. Write a generalized statement which explains the relationship between the particle size of the sugar and the number of shakes needed to dissolve the sugar.

Rate of Solution - Scoring Rubric**Maximum Score - 8 points****2. Identifying the smallest sized particle of sugar 1 point total**

- Allow 1 point for identifying the super fine sugar as having the smallest particles.

Data Table 1 point total

- Allow 1 point for appropriate numbers showing a greater number of shakes for the sugar cube.

9. Graph 3 points total

- Allow 1 point for appropriate number range and interval on the Y - axis based on the student's data.
- Allow 1 point for correctly plotting **both** points (+/- 5)
- Allow 1 point for correctly connecting **only** the two (2) plotted points.

10. Predicting 1 point total

- Allow 1 point for any number between the student derived data for super fine and sugar cube shakes.

11. Relationship between particle size and # of shakes 2 points total

- Allow 2 points for the correct relation of both variables.
Sample of acceptable answers
~ As the particle size increases, shakes increase
~ As the sugar sizes get bigger it takes longer to dissolve
- Allow 1 point for a restatement of data
Sample of acceptable answers
~ It took the cube longer to dissolve
~ It took less time to dissolve the super fine sugar

Highest possible score - 8 points

Student ID _____

Scoring Form - Rate of Solution

Male or Female (Circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
2. Identify smallest particle	0 1	_____
Data Table Appropriate number of shakes	0 1	_____
9. Graph • Y - axis • plotting points • Drawing Line	0 1 0 1 0 1	_____
10. Prediction	0 1	_____
11. Relationship Statement	0 1 2	_____

Total Score _____

Highest possible score - 8 points

Male or Female (Circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
2. Identify smallest particle	0 (1)	<u>1</u>
Data Table Appropriate number of shakes	0 (1)	<u>1</u>
9. Graph • Y - axis • plotting points • Drawing Line	0 (1) (0) 1 (0) 1	<u>1</u>
10. Prediction	(0) 1	<u>0</u>
11. Relationship Statement	(0) 1 2	<u>0</u>

Total Score 3
Highest possible score - 8 points

Rate of Solution

Task: At this station, you will determine the number of shakes necessary to dissolve various sized sugar particles.

Materials

- 1 sugar cube
- water (500 ml)
- granulated sugar in a sealed container
- 2 bottles with caps, labeled A and B
- waste cup
- safety goggles
- teaspoon
- powdered sugar sample
- graduated cylinder

Directions

Procedure

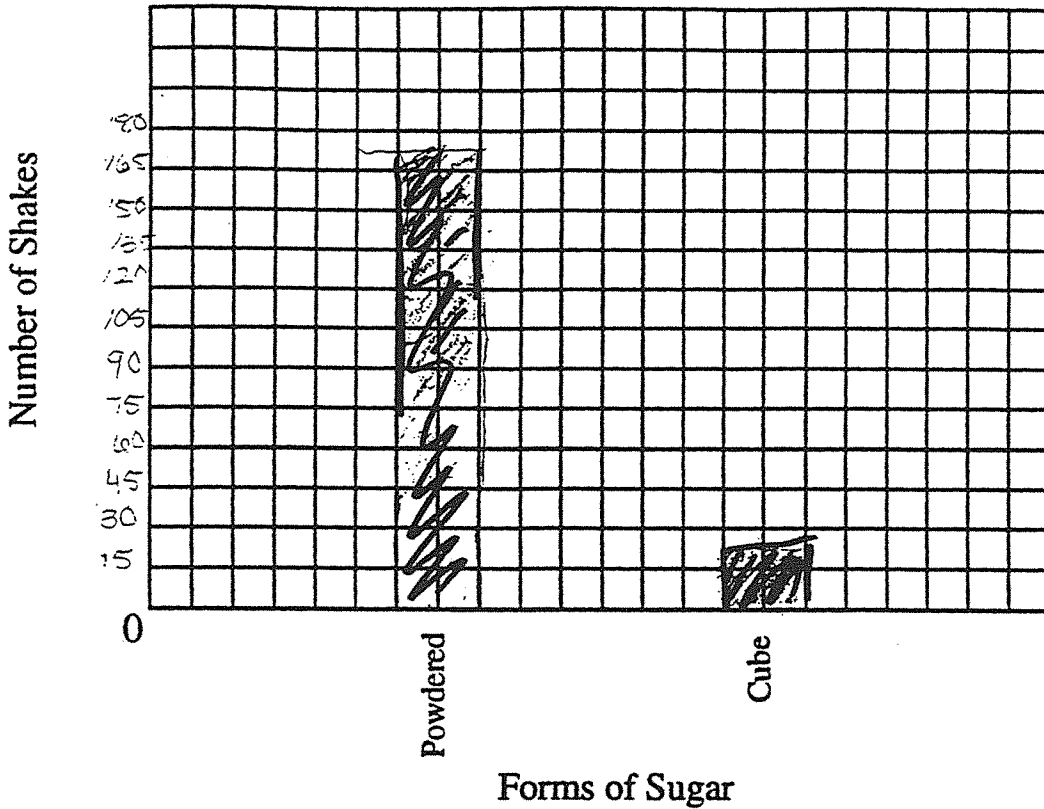
1. Put on safety goggles. Do not taste any substance in this activity. Clean up any spills immediately.
2. Use your hand lens to carefully observe the sugar cube and the powdered sugar. Which form of sugar has the smaller size particles?
powdered
3. Add 50 ml of water to the two (2) bottles.
4. Drop one sugar cube into bottle A and close the bottle tightly.
5. Count how many shakes it takes to totally dissolve the sugar cube.
6. Record you data in the data table below.
7. Place one level teaspoon of powdered sugar into Bottle B and repeat steps 5 and 6.
8. Dump the contents of the two (2) bottles into the waste cup and rinse the bottles. ~~Leave one bottle on the desk and let it stand without movement.~~

Data Table: Number of Shakes

Types of Sugar	Powdered Sugar <i>Super Fine</i>	Sugar Cube
Number of Shakes	20	170

9. draw a line graph showing the number of shakes needed to dissolve the two forms of sugar. Use the grid below. Make sure you include the appropriate range and interval of numbers on the y- axis.

Rate of Solution



10. Use your hand lens to carefully observe the particle size of the granulated table sugar. Use the information from the line graph. Predict the number of shakes it would take to completely dissolve one level teaspoon of the granulated table sugar in the same amount of water.

10 ✓ -1

11. Write a generalized statement which explains the relationship between the particle size of the sugar and the number of shakes needed to dissolve the sugar.

They both have the same kind of crystals

Student ID HM-10

Scoring Form - Rate of Solution #2

Male or Female (Circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
2. Identify smallest particle	0 (1)	<u>1</u>
Data Table Appropriate number of shakes	0 (1)	<u>1</u>
9. Graph • Y - axis • plotting points • Drawing Line	0 (1) (0) 1 (0) 1	<u>1</u>
10. Prediction	0 (1)	<u>1</u>
11. Relationship Statement	0 1 (2)	<u>2</u>

Total Score 6
 Highest possible score - 8 points

Rate of Solution

Task: At this station, you will determine the number of shakes necessary to dissolve various sized sugar particles.

Materials

- 1 sugar cube
- water (500 ml)
- granulated sugar in a sealed container
- 2 bottles with caps, labeled A and B
- waste cup
- safety goggles
- teaspoon
- powdered sugar sample ^{Super fine}
- graduated cylinder

17
19

Directions

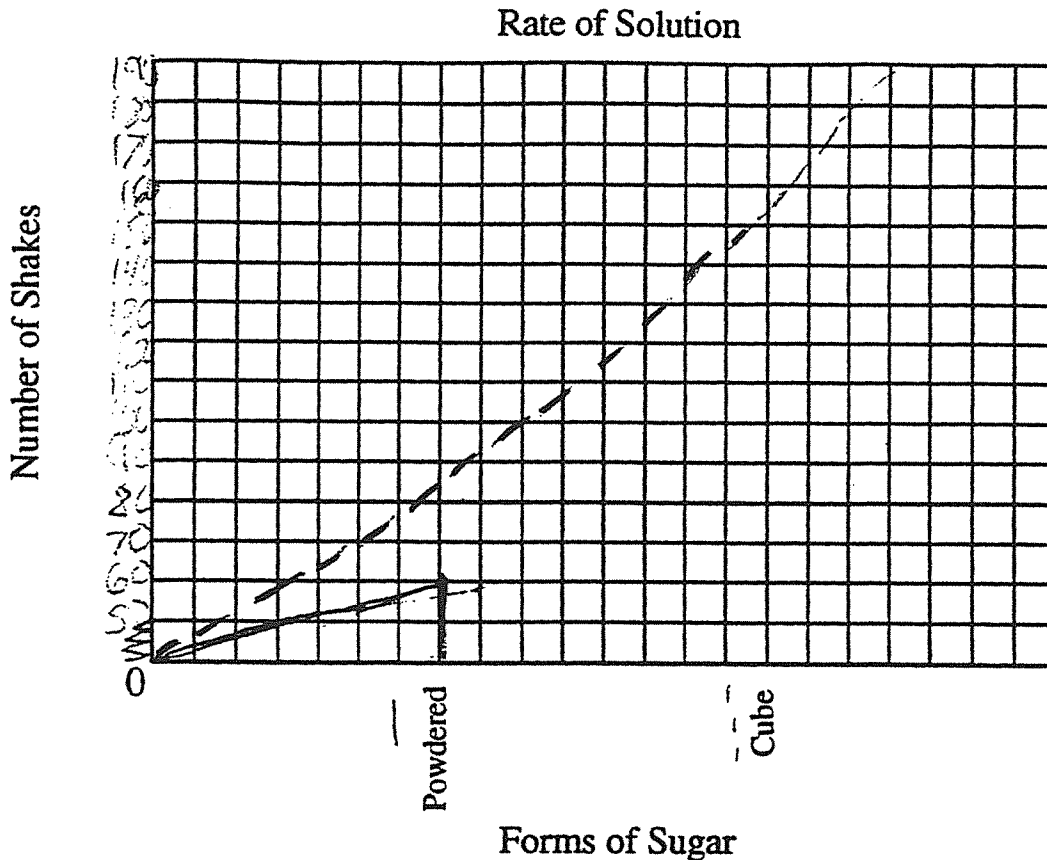
Procedure

1. Put on safety goggles. Do not taste any substance in this activity. Clean up any spills immediately.
2. Use your hand lens to carefully observe the sugar cube and the powdered sugar. ^{Super fine} Which form of sugar has the smaller size particles?
Super fine
3. Add 50 ml of water to the two (2) bottles.
4. Drop one sugar cube into bottle A and close the bottle tightly.
5. Count how many shakes it takes to totally dissolve the sugar cube.
6. Record you data in the data table below.
7. Place one level teaspoon of ^{Super fine} powdered sugar into Bottle B and repeat steps 5 and 6.
8. Dump the contents of the two (2) bottles into the waste cup and rinse the bottles. ~~Leave one bottle on the desk and let it stand without movement.~~

Data Table: Number of Shakes

Types of Sugar	Powdered Sugar	Sugar Cube
Number of Shakes	60	183

9. draw a line graph showing the number of shakes needed to dissolve forms of sugar. Use the grid below. Make sure you include the appropriate range and interval of numbers on the y-axis.



line graph?
points plotted?

10. Use your hand lens to carefully observe the particle size of the granulated table sugar. Use the information from the line graph. Predict the number of shakes it would take to completely dissolve one level teaspoon of the granulated table sugar in the same amount of water.

120 shakes

11. Write a generalized statement which explains the relationship between the particle size of the sugar and the number of shakes needed to dissolve the sugar.

the larger the particle size the more
shakes it will take, the smaller
the particle size the less shakes
it will take to dissolve.

Student ID HM-4
Male or Female (Circle one)

Scoring Form - Rate of Solution #3

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
2. Identify smallest particle	0 (1)	<u>1</u>
Data Table Appropriate number of shakes	0 (1)	<u>1</u>
9. Graph • Y - axis • plotting points • Drawing Line	0 (1) 0 (1) 0 (1)	<u>3</u>
10. Prediction	0 (1)	<u>1</u>
11. Relationship Statement	0 1 (2)	<u>2</u>

Total Score 8
Highest possible score - 8 points

Rate of Solution

Task: At this station, you will determine the number of shakes necessary to dissolve various sized sugar particles.

Materials

- 1 sugar cube
- water (500 ml)
- granulated sugar in a sealed container
- 2 bottles with caps, labeled A and B
- waste cup
- safety goggles
- teaspoon
- powdered sugar sample
- graduated cylinder

Directions

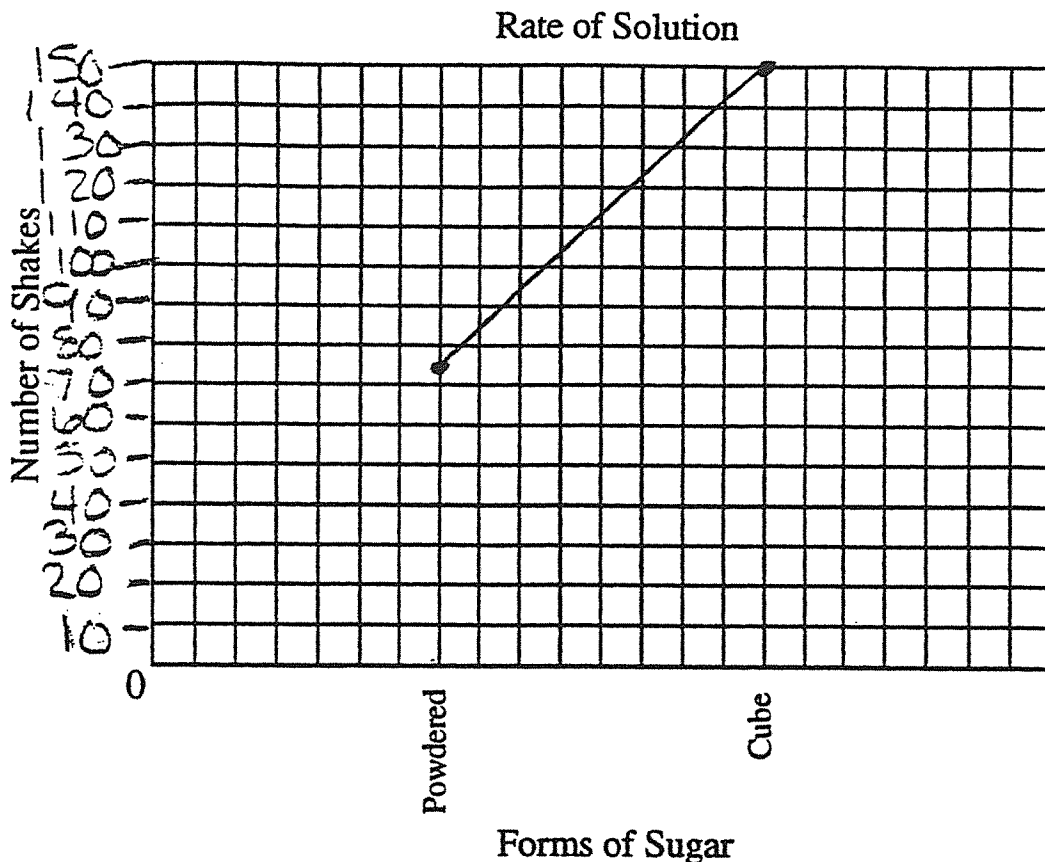
Procedure

1. Put on safety goggles. Do not taste any substance in this activity. Clean up any spills immediately.
2. Use your hand lens to carefully observe the sugar cube and the powdered sugar. Which form of sugar has the smaller size particles?
Powder sugar
3. Add 50 ml of water to the two (2) bottles.
4. Drop one sugar cube into bottle A and close the bottle tightly.
5. Count how many shakes it takes to totally dissolve the sugar cube. 150 shakes
6. Record you data in the data table below.
7. Place one level teaspoon of powdered sugar into Bottle B and repeat steps 5 and 6.
8. Dump the contents of the two (2) bottles into the waste cup and rinse the bottles. ~~Leave one bottle on the desk and let it stand without movement.~~

Data Table: Number of Shakes

Types of Sugar	Powdered Sugar	Sugar Cube
Number of Shakes	75	150

9. draw a line graph showing the number of shakes needed to dissolve the two forms of sugar. Use the grid below. Make sure you include the appropriate range and interval of numbers on the y- axis.



10. Use your hand lens to carefully observe the particle size of the granulated table sugar. Use the information from the line graph. Predict the number of shakes it would take to completely dissolve one level teaspoon of the granulated table sugar in the same amount of water.

55 shakes

11. Write a generalized statement which explains the relationship between the particle size of the sugar and the number of shakes needed to dissolve the sugar.

The powdered sugar is dissolved faster
because chunks are faster than
particles.