

# Investigation to see how different forms of Sugar affect the rate of Dissolving

I have chosen this investigation because it will show how the investigation that I did involved preliminary work before I got under way with the real experiment. This was important because it gave me the chance to eradicate un-necessary problems that I might suffer from during the experiment.

## Preliminary Work

This preliminary work was mainly to find a good temperature at which I could keep throughout the investigation as a control. Obviously it makes sense to start the investigation with tap water. We took the temperature and recorded the following results. The weight of the sugar was defined by how much the sugar cube weighed as I could not change this. So the sugar now weighed 3.4 grams

Type of Sugar	Temperature of Water	Time Taken To Dissolve
White Caster	20 Celsius	116.81 seconds
White Granulated	20 Celsius	146.16 seconds
White Cubed	20 Celsius	247.34 seconds

(During this experiment I took 100 ml of water and didn't stir the solution at all)

From these results I came to conclusion that the sugar took too long to dissolve and I had to change one of either of the controls. How I also realised that the temperature was ok and changing this would be a waste of time and an unnecessary risk. So I then decided to start stirring. After 30 seconds for 10 seconds this came out with the below results.

Type of Sugar	Temperature of Water	Time Taken To Dissolve
White Caster	20 Celsius	78.97
White Granulated	20 Celsius	98.90
White Cubed	20 Celsius	120.74

This was a much more suitable time and although I couldn't be 100% certain that these results weren't anomalies I came to the conclusion that if the controls were kept constant then these were as accurate as I was ever going to get.

## Real Test

## **Apparatus**

**Beaker:** To hold the solution – I chose this because it has a wide diameter and enables me to stir the solution very easily.

**Measuring Cylinder:** To measure the 100 ml accurately – I have chosen this because it's the most accurate measuring equipment available to me. This is because it is long and thin.

**Scales:** To weigh the sugar – I have chosen this because it's the most accurate weighing equipment available to me.

**Glass Rod:** To stir the solution – I have chosen this because it is at no risk of taking any sugar onto itself.

**Stopwatch:** To count the time – I have chosen this because it is very accurate and measures to two decimal places.

## **Plan**

1. Measure sugar accurately with scales
2. Measure 100 ml of water in measuring cylinder
3. Add Sugar – while simultaneously starting timer
4. Wait for 30 seconds, stir for 10 seconds. And repeat
5. When sugar has completely dissolved - stop timer.
6. Record results
7. Clean beaker thoroughly and dry. Repeat 3 times with each type of sugar\*.

\*This will give me more accurate results and will hopefully eradicate the chance of anomalies.

## **Factors to Control**

- To keep the investigation fair I am going to control the amount of times I stir the solution of water and sugar. I will do this by using the stopwatch.
- To keep the investigation fair I am going to keep the amount of water. I will do this by using a measuring cylinder and cleaning and drying the beaker before each use.

- The equipment I use will also stay the same to prevent unfairness. The water will always be taken from the same tap – this should help the water temperature being constant throughout.

### Prediction

I predict that the caster sugar will dissolve the quickest and the granulated next. My theory for this is that the caster sugar is already broken down into very fine crystals and so the water won't have to work so hard. There is a larger surface area on the smaller crystals and so the water molecules can break them down quicker. The sugar cube will dissolve slower because the water can only break down the edges of the cube and so the larger the surface area the quicker the water will dissolve the sugar.

By the stirring the solution with a glass rod I am making the water molecules move faster and more violently and so hitting the sugar particles harder and more frequently resulting in the sugar being dissolved

### Results

Form of Sugar	Temperature of Water	Time taken to dissolve
Caster	20 Celsius	78.50
Granulated	20 Celsius	99.86
Cubed	20 Celsius	129.87
Caster	20 Celsius	74.01
Granulated	20 Celsius	101.40
Cubed	20 Celsius	134.76
Caster	20 Celsius	83.65
Granulated	20 Celsius	100.00
Cubed	20 Celsius	132.63

All temperatures were roughly 20 degrees but could have differed negligible amounts either way.

### Conclusion

These results support my prediction; the results clearly say that the caster sugar dissolved in the fastest time, then the granulated sugar and then the sugar cubes. This has happened

because the sugar has a much larger surface area when it is broken down in smaller particles. As I stated in my prediction it is a lot easier for the water to break down the caster sugar than the sugar cube because it can dissolve more parts at once. The sugar cube has the smallest surface area and thus took the longest time to dissolve. By doing the test 3 times it has given me 3 averages and these are as below.

Form of Sugar	Surface Area	Average Time Taken
Caster Sugar	Very Large	78.82
Granulated Sugar	Large	100.42
Sugar Cube	Small	132.42

These results give me a more accurate guide to how the test worked and reflects the importance on the surface area.

### **Evaluation**

The investigation ran smoothly and as a result didn't have any obvious anomalous results. This is shown very clearly in the results table and none of the results were far away from the mean time. I also know that there are no anomalous results as the time taken for the sugar to dissolve has increased by an adequate amount and the results heavily are heavily backed up with scientific reason.

To make the experiment work better I should probably have used more accurate equipment, this would enable me to get the water at the accurate level.

Also the stirring was inconsistent – although I tried to keep it the same it was impossible by hand to stir for precisely 10 seconds and also to put precisely the same amount of energy into stirring the solution.

From my results I can conclude with authority that the greater the surface area of a the sugar the faster the water is able to break it down.