An experiment to see how much sugar can be dissolved in different volumes of wate...

I am going to do an experiment to test how much sugar can be dissolved in different volumes of water. I will measure different volumes of water out and then add a certain amount of sugar to it and stir it until it dissolves fully, I will keep adding more and more sugar until the sugar stops dissolving.

In my experiment I could change:

* The type of sugar that I use.

* The temperature of the water.

* The amount of water that I use.

* The amount of sugar that is added to the water.

In my experiment I will change:

* The amount of water that I use.

In my experiment I will use:

Precise Digital Scales Granulated sugar Water

Beaker Stopwatch 10mg measuring spoon

Spoon Digital Thermometer

Prediction

My prediction is that as we gradually add the sugar to the water, it should be able to hold about the same volume of sugar, as there is water. I think this because as the sugar (the solute) is deposited into the water (the solvent),

the water molecules are constantly moving in random directions, sugar molecules are broken off from the crystal by the collisions, they are then spread out by the continual movement of the water molecules. As more sugar is added to the water the solution becomes will become saturated and eventually it will become so saturated that there will not be any space left between the water molecules, so it wont be able to hold the sugar anymore, so it will stop dissolving and will be left at the bottom of the beaker. Also I predict that as the volume of water is increased the amount of sugar that I will able to be dissolve into the water, will also increase because there are more spaces between the molecules of water, because there are more water molecules, for the sugar molecules to fit in between.

Diagram

Method

To set up my experiment first I will set up my scales I will then measure how much the beaker I am using to hold the water weighs, I will then zero the scales and add the water to the desired volume (weight). I will then do the same with the sugar; first I will weigh the measuring cups (that I will use to hold the sugar in before I add it to the water) then I will zero the scales and then measure out the sugar to 10 grams in each measuring cup. I am doing it at this amount because then I have a greater scale to work with and from my preliminary testing I found that adding greater amounts meant that I couldn’t tell when the sugar really stopped Dissolving, doing it at this amount ensures I am able to. I will then start to add the sugar 10 grams at a time and I will stir it until the sugar is completely dissolved, I will also time it

with a stopwatch for the sugar to completely dissolve. I will then another 10 grams and will time that while stirring it until the sugar is completely dissolved, I will repeat this process of adding more sugar and timing it to dissolve until it stops dissolving, will then note this on my table. Then I will change the volume of water by weighing the beaker, zeroing the scales and then adding the required volume of water then I will repeat the experiment by adding the sugar and timing its time to dissolve until the sugar stops dissolving. I will repeat the experiment 6 times in total, each time I will only change the volume of water and noting when the sugar stops dissolving in the water.

Results

Table 1

Volume of water (cm3) = 50ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 41

Clear

20

Yes

2. 47

Clear

30

Yes

3. 10

Translucent

40

Yes

4. 20

Translucent

50

No

5. 50

Filled with granules of un-dissolved sugar

Table 2

Volume of water (cm3) = 100ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 38

Clear

20

Yes

1. 53

Clear

30

Yes

2. 01

Clear

40

Yes

2. 20

Clear

50

Yes

2. 45

Clear

60

Yes

3. 00

Clear

70

Yes

3. 20

Clear

80

Yes

4. 20

Slightly Translucent

90

Yes

4. 52

Slightly Translucent

100

Yes

6. 00

Translucent

110

No

7. 00

Filled with granules of un-dissolved sugar

Table 3

Volume of water (cm3) = 150ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 43

Clear

20

Yes

1. 50

Clear

30

Yes

1. 56

Clear

40

Yes

2. 10

Clear

50

Yes

2. 30

Clear

60

Yes

2. 38

Clear

70

Yes

2. 58

Clear

80

Yes

3. 30

Clear

90

Yes

3. 50

Clear

100

Yes

5. 10

Slightly Translucent

110

Yes

5. 40

Slightly Translucent

120

Yes

6. 08

Slightly Translucent

130

Yes

6. 20

Slightly Translucent

140

Yes

7. 40

Slightly Translucent

150

Yes

8. 30

Translucent

160

Yes

9. 16

Translucent

170

Yes

10. 00

Translucent

180

Yes

10. 30

Translucent

190

No

11. 59

Filled with granules of un-dissolved sugar

Table 4

Volume of water (cm3) = 200ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 30

Clear

20

Yes

1. 53

Clear

30

Yes

2. 02

Clear

40

Yes

2. 15

Clear

50

Yes

2. 28

Clear

60

Yes

2. 37

Clear

70

Yes

2. 46

Clear

80

Yes

3. 00

Clear

90

Yes

3. 30

Slightly Translucent

100

Yes

3. 40

Slightly Translucent

110

Yes

3. 51

Slightly Translucent

120

Yes

4. 10

Slightly Translucent

130

Yes

4. 50

Slightly Translucent

140

Yes

5. 01

Slightly Translucent

150

Yes

5. 25

Slightly Translucent

160

Yes

5. 40

Slightly Translucent

170

Yes

6. 02

Translucent

180

Yes

6. 34

Translucent

190

Yes

7. 14

Translucent

200

Yes

7. 49

Translucent

210

Yes

8. 10

Translucent

220

Yes

9. 20

Translucent

230

Yes

10. 10

Translucent

240

No

12. 00

Filled with granules of un-dissolved sugar

Table 5

Volume of water (cm3) = 250ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 40

Clear

20

Yes

1. 59

Clear

30

Yes

2. 10

Clear

40

Yes

2. 19

Clear

50

Yes

2. 29

Clear

60

Yes

2. 40

Clear

70

Yes

2. 55

Clear

80

Yes

3. 15

Clear

90

Yes

3. 38

Clear

100

Yes

3. 50

Clear

110

Yes

4. 02

Clear

120

Yes

4. 19

Clear

130

Yes

4. 46

Clear

140

Yes

5. 10

Clear

150

Yes

5. 25

Slightly Translucent

160

Yes

5. 40

Slightly Translucent

170

Yes

6. 10

Slightly Translucent

180

Yes

6. 39

Slightly Translucent

190

Yes

7. 08

Slightly Translucent

200

Yes

7. 32

Slightly Translucent

210

Yes

8. 14

Slightly Translucent

220

Yes

8. 49

Translucent

230

Yes

9. 45

Translucent

240

Yes

9. 55

Translucent

250

Yes

10. 20

Translucent

260

Yes

11. 34

Translucent

270

Yes

12. 56

Translucent

280

No

15. 00

Filled with granules of un-dissolved sugar

Table 6

Volume of water (cm3) = 300ml

Amount of sugar (g)

Dissolving

Time to Dissolve

Looks

10

Yes

1. 35

Clear

20

Yes

1. 48

Clear

30

Yes

2. 02

Clear

40

Yes

2. 10

Clear

50

Yes

2. 27

Clear

60

Yes

2. 38

Clear

70

Yes

2. 50

Clear

80

Yes

3. 07

Clear

90

Yes

3. 21

Clear

100

Yes

3. 36

Clear

110

Yes

3. 49

Clear

120

Yes

4. 05

Clear

130

Yes

4. 28

Clear

140

Yes

4. 56

Clear

150

Yes

5. 10

Clear

160

Yes

5. 20

Clear

170

Yes

5. 45

Clear

180

Yes

5. 59

Clear

190

Yes

6. 19

Slightly Translucent

200

Yes

6. 43

Slightly Translucent

210

Yes

7. 11

Slightly Translucent

220

Yes

7. 40

Slightly Translucent

230

Yes

8. 02

Slightly Translucent

240

Yes

8. 31

Slightly Translucent

250

Yes

9. 00

Slightly Translucent

260

Yes

9. 29

Slightly Translucent

270

Yes

10. 24

Slightly Translucent

280

Yes

11. 05

Slightly Translucent

290

Yes

12. 11

Translucent

300

Yes

13. 02

Translucent

310

Yes

14. 02

Translucent

320

Yes

14. 56

Translucent

330

Yes

15. 55

Translucent

340

Yes

16. 45

Filled with granules of un-dissolved sugar

Analysis

From my experiments I can see that, as the volume of water is increased so to is the volume or weight of the sugar increased with it. This is because there are more water molecules (randomly moving about) and so there are more spaces between the water molecules as they move around for the sugar molecules to dissolve into. I have also noticed that the amount of sugar that I can dissolve is in proportion to the water with a ratio of about 1: 1. 2 this is reflected in my tables above, after that the sugar stops dissolving and is left at the bottom of the glass. I have also recorded the time that it took for each 10gram amount of sugar to completely dissolve into the water. From the tables above I can see that as the as more sugar is added the time that it takes the sugar to dissolve increases each time this is shown in my graphs, and when it is getting near the end it starts to take quite a long time to dissolve. This is because as more and more sugar is added there becomes less and less spaces for the sugar to dissolve into and so it takes longer and longer for the sugar molecules to dissolve into the water.

Evaluation

Overall I think that my experiment was a complete success as the things I predicted were all proved correct. There were a few things I could have changed and also a few things that I noticed over the course of the experiment. If I was going to the experiment again I could reduce the amount of sugar that I added each time to 2 or 5grams, by doing this I could I could get a more precise result and would be able to pinpoint exactly at

what amount that the sugar stopped dissolving. I could also decrease the amount that the water was increased by to 25ml instead of 50ml, by doing this I could find out for definite if the proportionate ratio of 1: 1. 2 between the water and the sugar was correct up to 300ml.

Over the course of the experiment I took some temperature measurements with a precise digital thermometer at the start and at the end of the experiment. Throughout the day when I was retrieving the water from the tap and then taking its temperature its started to rise, this could have been because of warmth from the sun and warmth from the central heating warming the water pipes through the day. During the test however I noticed that the warmer water dissolved the sugar faster than the colder, the water was only warmer by a couple of Celsius but it was still noticeable. This could be because with the water being warmer it made the water molecules move around faster and bang into the sugar particles breaking them up and then carrying them away and spreading them around the solution of course to be absolutely sure of this I would have to do further testing.

I also noticed that the sugar I was using was granulated and that all the smaller pieces of granulated sugar had fallen to the bottom and that all the larger pieces were on the top. Through the course of my test I used all the larger pieces and then when I got to the bottom I used them as well I measured them out to the same weight of 10 grams and then poured them into the water and stirred until they dissolved, I noticed that the time that it took for the smaller granules of granulated sugar to dissolve was quicker than the time it took for the larger granules to dissolve. This could be just a radical result but I do not think so, my theory is that because the sugar is in

smaller pieces there is a greater surface area and so the water molecules dissolve the sugar faster because there is more places for it to knock into the sugar and break off a molecule and carry it away throughout the solution. I think that extra results need to be done with different types of sugar such as icing, caster, granulated and cubes to prove this.