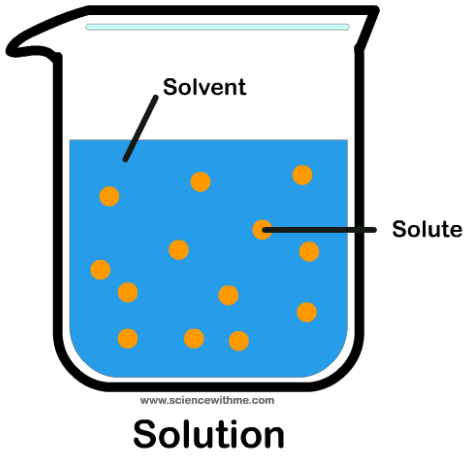
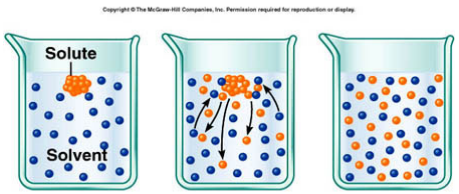
Chemistry Project

Investigate and compare how the solubilities, in water, of (a) potassium chloride and (b) sodium carbonate (anhydrous) change with temperature.





Background -
Solutes dissolve in a solvent to form a solution.

Solubility curves show how substances dissolve in water at different temperatures. The general rule is that you can dissolve more and more of a substance as the temperature increases. However, when you reach a certain temperature the water can't dissolve (hold) any more of the substance. The solution is then called a saturated solution.

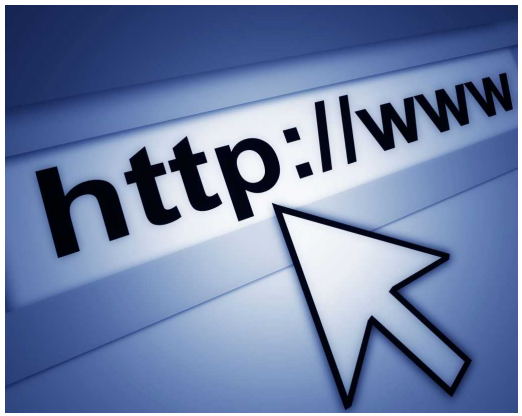
If the solution cools then crystals of the solute are formed as the water cannot hold them anymore.

Part 1 (Introduction)

(i) Statement or problem to be investigated - What you are going to do **in your own words**

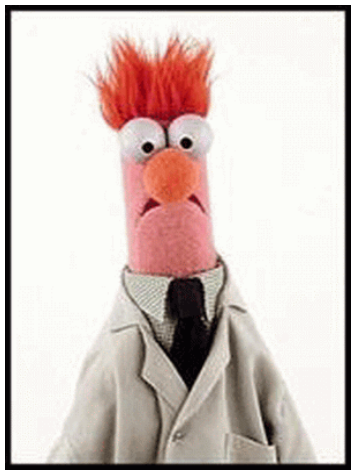
(ii) Background research undertaken - You will have to look up a few websites and books to find information for your investigation.
You may even have to ask your teacher or someone at home for information.
This is your background research you will need to give **at least 3 pieces** of background research. Make sure for all three you mention where you got the piece of information and what you used it for.

Internet (Give full link!)



Books (Author and Publisher Page and Details)

Teacher



Part 2 (Preparation and Planning)

(i) Variables

1. The **Independent** Variable (what I will change - Water Temperature)
2. The **Dependent** Variable (what I measure - **Solubility - How much dissolves**)
3. **Controls** (what I will keep the same -
   - **Amount of Water**
   - **Beaker and Heater**
   - **Thermometer**

(ii) Equipment: List every piece of equipment you use, leave nothing out!
e.g. Safety glasses, gloves, heating plate or bunsen burner, beaker, spatula, distilled water, thermometer, stirring rod, electric balance, Potassium Chloride and Sodium Carbonate, notebook and pencil.

(iii) Tasks: ***This is the list of jobs that need to be done in order.***
e.g. We will dissolve substance 1 in 20^{o} C water until the solution is saturated (stops dissolving). We will note that amount of solute. We will repeat this for the other substance also. We will then increase the water temperature to 40^{o} C and repeat the steps above. We will do this for 60^{o} and 80^{o} C also to get a range of results.

Part 3 (Procedures, apparatus etc.)

(i) Safety - Safety goggles to stop salt getting in eyes.
Take care using heat source, tie hair up.
Check glassware for cracks. Ensure you use a alcohol thermometer that is not damaged in any way.

(ii + iii) Procedure with diagram - Write it like a recipe.
If people cannot copy the experiment using your steps then you need to do them again.

Measure out 100g of distilled water into a beaker.
Take the Sodium Carbonate and onto an electric balance measure out 50g using a spatula.
Get the water temperature to 20^{o}C using a hot plate and check the temperature with a thermometer.
Add in a spatula at a time of Sodium carbonate while stirring the solution with a glass rod. Wait till all the salt has dissolved before adding more. As soon as some salt can be seen not dissolved you should reweigh the salt that is left and subtract this from 50g. This will give you the amount that is dissolved at 20^{o}C. Repeat this step at 40, 60 and 80^{o} C.
Repeat this whole experiment twice with Sodium Carbonate and then do it twice with Potassium Chloride.

(iv) Data and observations - Decide what results you are going to take and when you are going to take them before starting the test.
e.g. Measure 50g of the salt, add some to water and reweigh remainder at end to calculate how much salt was added to the solution at different temperatures.

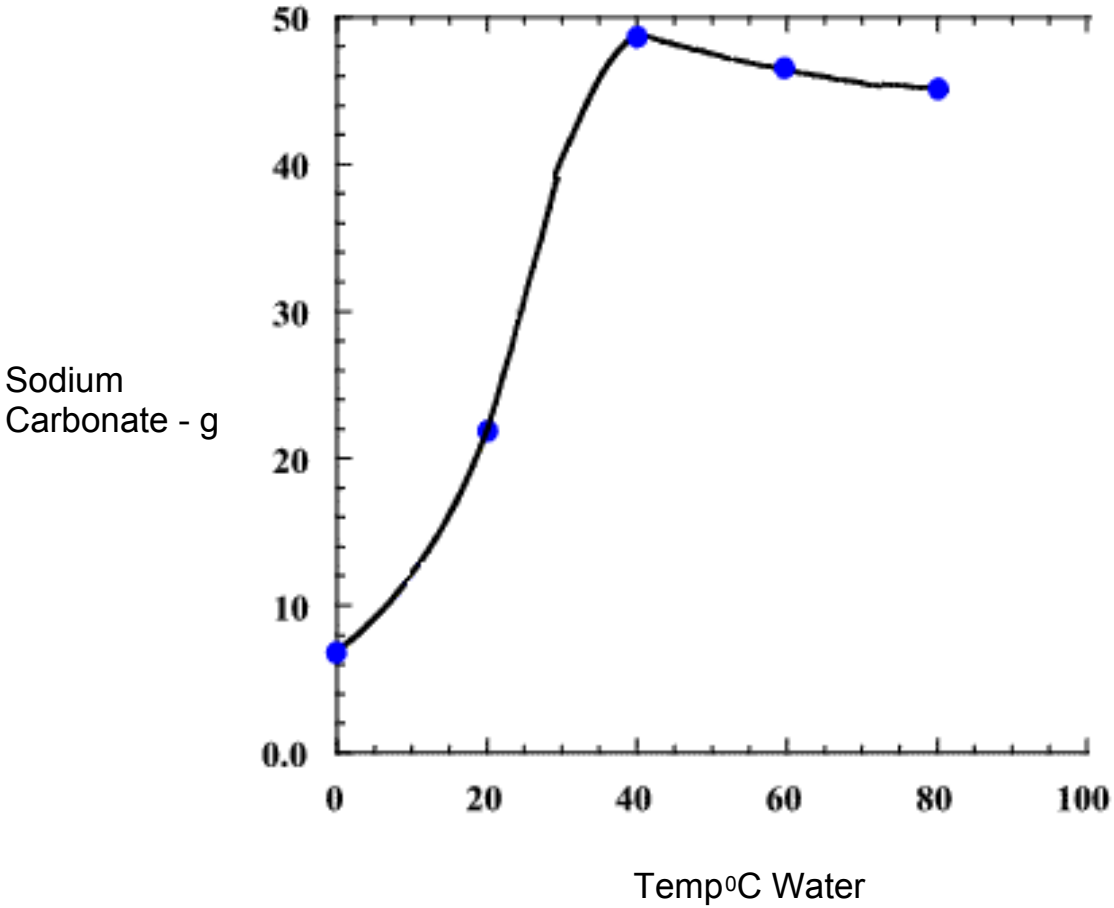
Make a data table before you start your experiment so you can record your measurements as soon as you observe them. This will ensure that you are consistent in the way that you record your results and it will also make it easier to analyse. Make sure to give your tables and graphs a name or number.
e.g.

Table No. 1 - Sodium Carbonate (average of 2 tests)

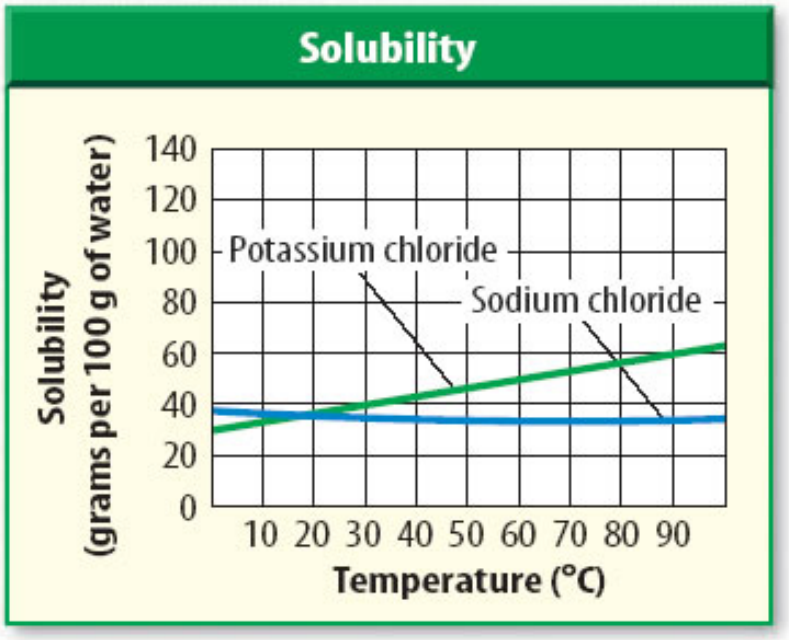
Temperature/°C	Solubility/gram per 100g H_2O
20	21.80
40	48.81
60	46.41
80	45.14

Do another table like this for Potassium Chloride.

Graph No. 1 - Sodium Carbonate



You may get results like this also....



Here we can see that the Potassium chloride has a higher solubility as the temperature of the water increases.

However we can see that the Sodium Chloride has a lower solubility as the temperature increases.

Part 4 (Analysis)

(i) Calculations and Data Analysis -

Make sure you outline any calculations (e.g. finding averages)

To find the average for Sodium Carbonate we did the experiment twice and then added our results together and divided by 2. We then plotted a graph of the results.

We did the same for the Potassium Chloride.

(ii) Conclusion and Evaluation of result

Some useful sentence starters in this section are:

· I can see from my results that ……..

· When I changed ……..., …….. changed by……..

· From the graph I can see that …….

Answer some of the following questions in your written report.

· Do your results answer the question you were asking at the start?

· Were the results what you were expecting?

· Is there a trend in your results or did anything unusual happen?

· If you got an unusual result why do you think this happened?

· If you drew a graph did you get a straight line or a curve – what does this show?

e.g. In general my results show that for Potassium Chloride as the temperature of the water increased then the amount of salt I could add also increased.
However the Sodium Carbonate then showed a decrease in solubility as the temperature of the water went over 40oC. This shows that the solubilities of the salts do change as the temperature changes and different salts act in different ways.

Part 5 (Comments)

(i) Refinements, extensions and sources of error

· Do your results answer the what you were trying to find out
· Were you surprised by these results?
· Was there anything that might have affected your results.
Use more water and salts to see results more clearly?
· Are there any changes you would make if you did the experiment again?
Use larger amounts for more accurate results.
· Is there any way of making it more accurate - do more repetitions
· Could you develop your experiment further, how?
Use a wider range of temperatures with more points.
Go from 0^{o}C to 100^{o}C and measure every 10^{o} C.