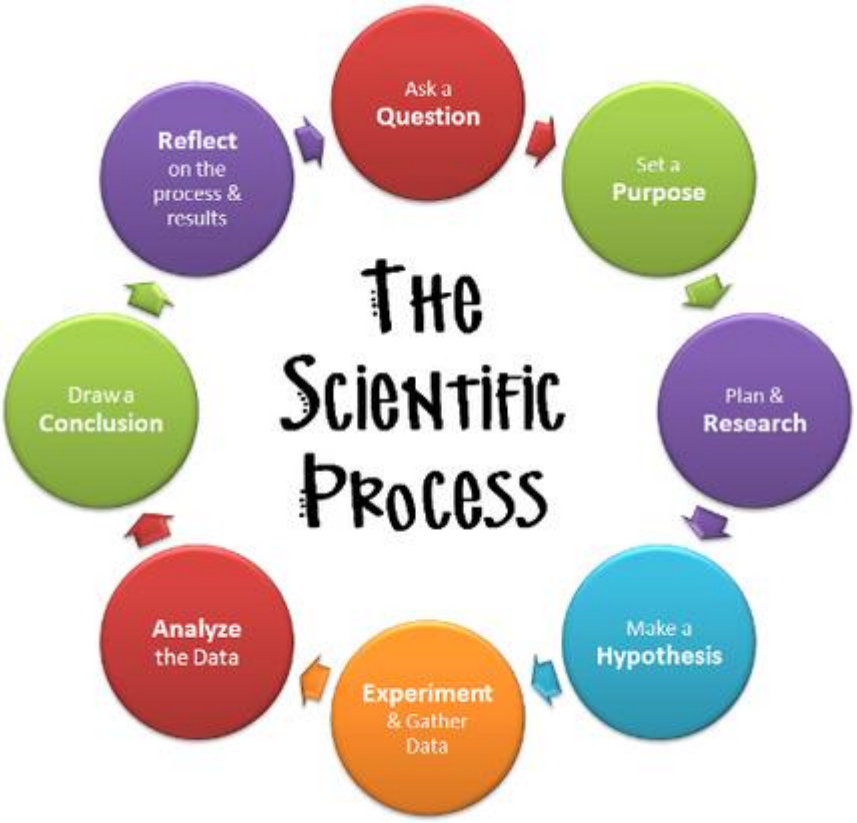
Scientific Investigation Skills



Name _____

Class _____

Teacher _____

Activity 1: Using the right language

Write down the correct key word/term from the box next to the definition.

Key word	Definition
	What it is that you are trying to find out
	An outline of how you will carry out your investigation
	A prediction of what you think your results will be
	The variable that you will be *changing*
	The variable that you will be *measuring*
	The variables that you will be *keeping the same*
	Identifying the possible dangers of doing the investigation
	The data/values you got from your investigation
	A summary of what you have found out from your investigation
	A reflection of how you think your investigation went

	How close a measurement is to its true value
	Whether the results will be the same if carried out by another person
	A test where only the independent variable was changed
	A result that does not fit the pattern and could be due to an error

Hypothesis Dependent variable Method

Fair test Evaluation Conclusion

Repeatability Control variable Results

Risk assessment Accuracy

Independent variable

Research Question Anomaly

Activity 2: using the correct units.

A unit tells us what we have measured something in.

Write down all the units we can use to measure the following. *Hint: there may be more than one.*

Ext: Think of 2 more units and write them down in the table.

Length	
Mass	
Volume of a liquid	
Time	
Temperature	
Speed	

Activity 3: Identifying the variables

It is very important that you know what the variables are in an investigation. Remind yourself what each of them means using the key words list in activity 1.

Here is an example:

Steve wants to investigate whether the temperature of water affects the time it takes for sugar to dissolve.

Independent variable (IV): He will be changing the **temperature** of the water.

_____

Dependent variable (DV): He will be measuring the **time** it takes for sugar to dissolve.

_____

Control variables (CV): He will keep the **volume of water**, **mass of sugar** and **type of sugar** the same throughout the investigation. This will make it a fair test because the results would *only* be affected by the change in temperature.

_____

1. Write down the units for each variable.

2. For each research question, identify the **independent (IV), dependent (DV)** and **control variables (CV). Don't forget to include the units.**

a) Does the mass of a car affect how fast it can travel?

IV:

DV:

CV:

b) Do all metals have the same melting point?

IV:

DV:

CV:

c) Does the thickness of a branch affect how much mass it can hold before it snaps?

IV:

DV:

CV:

Activity 4: Results table

Normally your results table should have 1 column for what you changed (the **independent variable**) on the left hand -side and a number of columns for what you measured (the **dependent variable**) on the right hand side. The number of columns will usually be 4 (3 for the trials and 1 for the average), bringing the total number of columns to 5.

Remember: PUT UNITS IN THE **COLUMN HEADINGS**!

What you changed (Units)	What you measured TEST 1 (Units)	What you measured TEST 2 (Units)	What you measured TEST 3 (Units)	What you measured Average (Units)

Findingthe average - Add together the results for test 1, 2 and 3 and divide by the number of results, in this case 3

Anomalousresults - An anomaly or anomalous result is one that does not fit the pattern. If you have an anomalous result then you can either ignore it, or perform the test again. In the example it has been ignored and has not been used when finding the average

For example:

Thickness of branch (mm)	Mass taken to snap TEST 1 (g)	Mass taken to snap TEST 2 (g)	Mass taken to snap TEST 3 (g)	Mass taken to snap average (g)
2	200	200	300	233
4	400	500	600	500
6	600	600	600	600
8	800	700	900	800
10	900	400 (anomalous)	1000	950

1. Using the information on the previous page to help you, draw a suitable results tables for:

a) Does the temperature of water affect the time it takes for sugar to dissolve?
Remember to use pencil for drawing the table and pen for any words/numbers.

Checklist:

Have you put the independent variable and dependent variable in the right columns?

How many results will you be collecting?

Where have you placed the units?

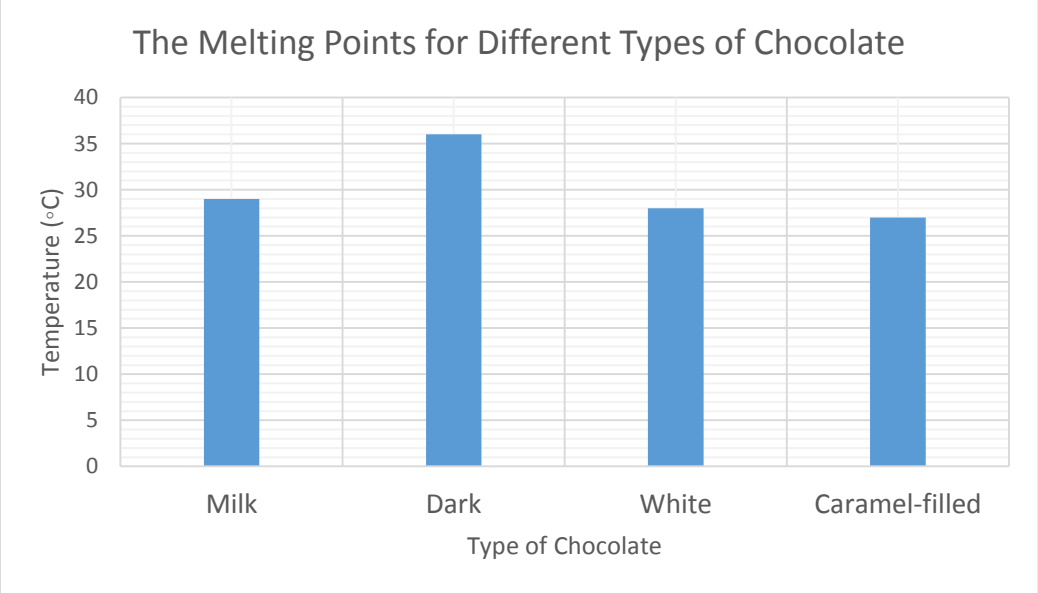
Activity 5: displaying your results on a graph.

There are two typical graphs that you will draw in scientific investigations - bar charts and scatter graphs. Normally, it is the **average** result that is plotted.

Bar charts - These are used when either what you changed (independent) or what you measured (dependent) are not numerical for example car colour, type of metal or type of wood. The bars should be of an equal width and should be separated by a small gap.

Scatter graphs - These are used when both what you changed and what you measured are numerical. The table you drew in activity 4 is a good example of this.

Example 1: Do all types of chocolate have the same melting temperature?



Success criteria:

The type of chocolate is **non-numerical** therefore a bar chart is drawn.

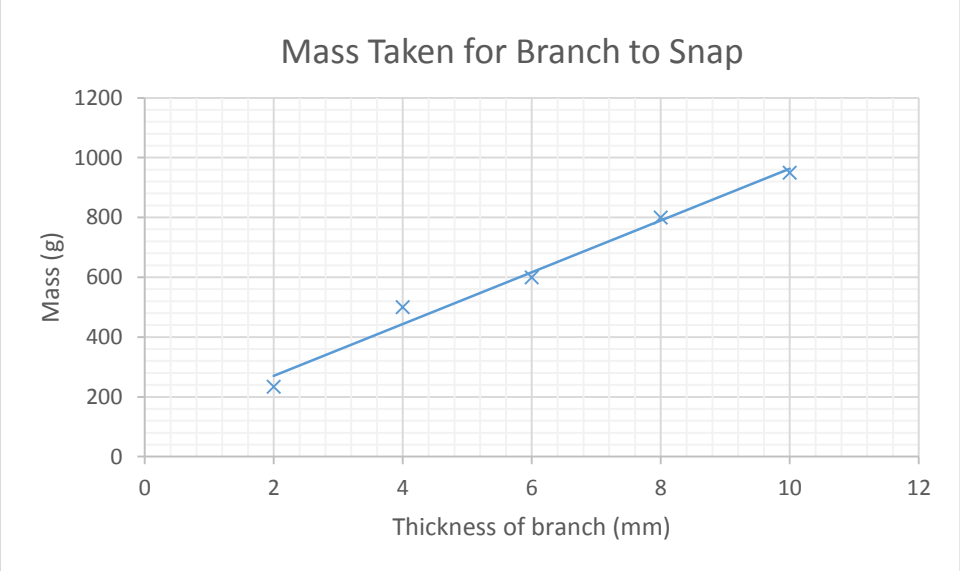
There is a chart title.

The independent variable is on the y-axis, dependent variable on the x-axis. Units included.

Each bar is the same width.

There is equal space between the bars.

Example 2: Does the thickness of a branch affect how much mass it can hold before is snaps?



Success criteria:

Both variables (thickness and mass) are numerical so a scatter graph is drawn.

There is a chart title.

The independent variable is on the y-axis, dependent variable on the x-axis. Units included.

The numbers are going up in equal amounts in the x and y axis

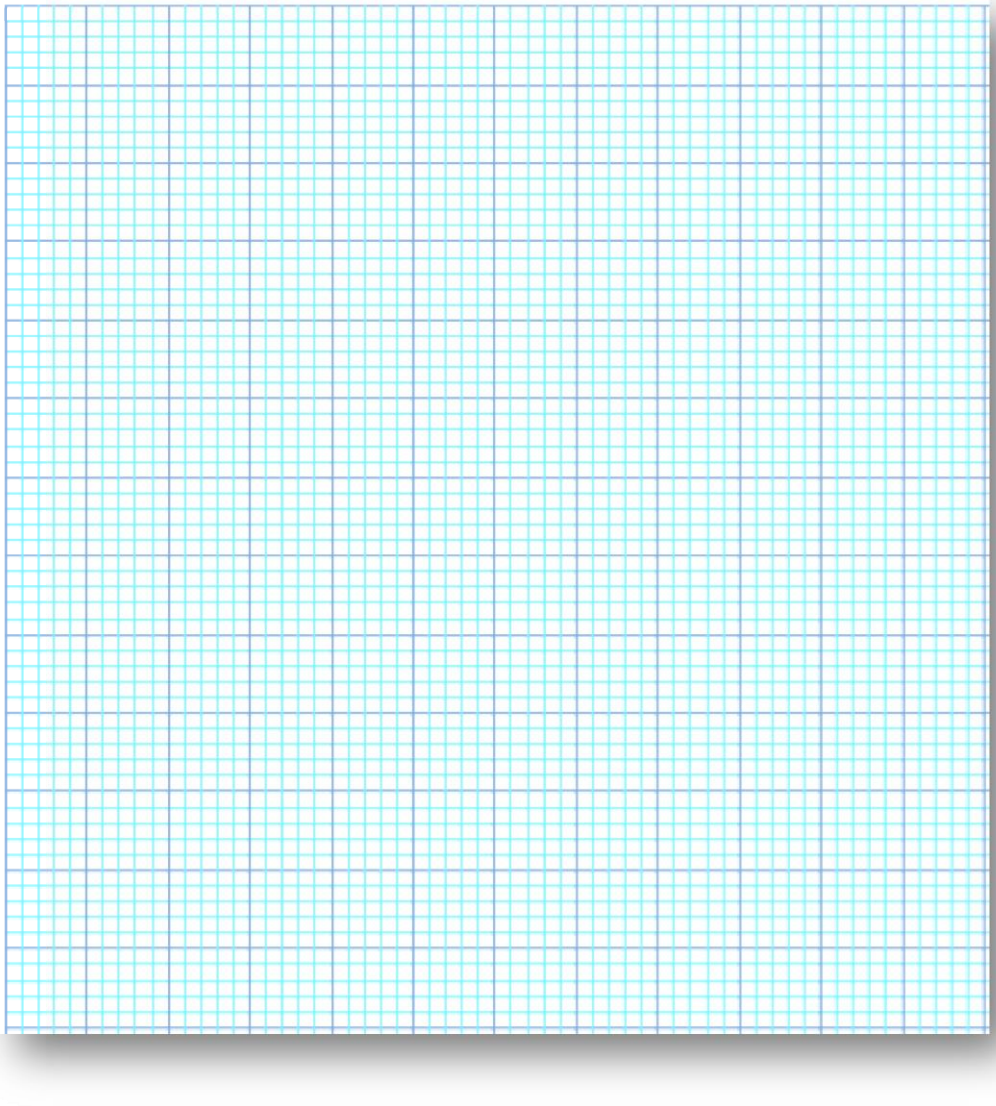
An x has been drawn for each point.

A line of best fit has been drawn.

Plot a suitable graph for the following investigation. Look at the success criteria on the previous page to help you. Draw a line of best fit.

1) How far will a car travel on different volumes of petrol?

Volume of petrol (l)	Distance Travelled (km)
1	13
2	25
3	38
4	46
5	58
6	72
7	85
8	93
9	105
10	120



Line of best fit: On a line of best fit, the line does **not** need to touch all the points. But there should roughly be the same number of points on either side of the line.

It is also a good idea to ask the question "If the independent variable is zero (in this case petrol) will what I measure also be zero (the distance a car will travel)?". If you don't put petrol in a car then it will not travel anywhere! So in this case the line of best fit will certainly go through the origin (0,0).

Activity 6: think you've got (investigation) skills?

Answer the following questions about scientific investigations. All of the information is in this booklet, so read through it again if you are unsure.

1) What should be done before an experiment to make sure it will be carried out **safely?**

_____

2) If the dependent variable is non-numerical, what type of graph should you draw?

_____

3) If both variables are numerical, what type of graph should you draw?

_____

4) How many sets of results should you collect in an experiment?

_____

5) In a results table, where should the independent variable be?

_____

6) What must be included in the results table column headings?

_____

7) What **two** things should you do if you notice an anomalous result?

a) _____

b) _____

8) Steve commented about his investigation that "some of the results did not fit the pattern. This might be because the exact mass of sugar was not properly measured out". Circle which part of the investigation this is.

Conclusion **Hypothesis** **Evaluation** **Results**