Saint Andrew's RC Secondary School

Putting Young People First

STEM NUMERACY SKILLS
Steps to Success
And
Worked Examples

CONTENTS

S3

STEM Numeracy Skills: Worked examples and Steps to Success

STEM is the term used to describe Science, Technology, Engineering and Maths based subjects.

The STEM subjects offered in St Andrews are

- Maths
- Science (Biology, Chemistry, Physics, Lab Science and Health Sector)
- ICT (Accounts, Administration, Business Management and Computing)
- Geography
- Technical (Design and Manufacturing, Graphics and Practical Craft)

All of the subjects above use numeracy skills and maths skills to solve problems.

Practical Numeracy is a course run from S1-S3. The Practical Numeracy course will help to develop the numeracy skills you will use in your practical STEM subjects.

The numeracy skills you will use in Practical Numeracy are the same skills you will be using in all your other STEM subjects. These are called **transferable skills.**

The transferable skills you will learn are:

- To understand different types of data.
- To change to and from scientific notation
- To use the correct number of significant figures
- To change between standard units
- To display and use information in tables
- To calculate averages
- To use a range
- To calculate a percentage
- To use ratios correctly
- To solve and rearrange equations
- To draw bar graphs
- To draw line graphs
- To draw a pie chart
- To make conclusions from a graph.
- To use grid references

This booklet will take you through each of the skills above and detail the steps to success in using these skills. It will also give you examples of them being used.

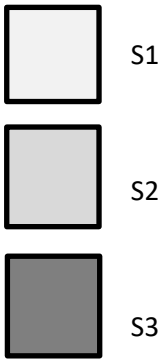
Numeracy skills in the BGE (S1-S3)

Most of the numeracy skills listed above will be met at all levels of the Senior Phase (S4-S6). They will also be met across the different STEM subject areas in the BGE (S1-S3).

The table below shows

- the Numeracy Skills used,
- the subjects they are used in and
- the year pupils will first meet the skill

Numeracy Skill	ICT	Geography	Technical	Science
Data Types				S1
Rounding	S1	S1	S1	S1
Significant figure				S3
Scientific notation	S3			S3
Unit conversions	S2	S1	S1	S1
Averages and range	S2			S1
Constructing and using tables	S3		S3	S1
Plotting bar graphs	S2	S2		S1
Plotting line graphs	S2	S2		S1
Using information on a graph	S2	S2		S1
Conclusion from a graph	S2	S2		S1
Pie Charts	S2	S2		S3
Ratios	S2			S3
Percentages	S2	S3		S1
Using equations	S2			S2
Batch data				S2
Grid references		S3		
Precision and Accuracy			S2	S2



Types of data

Steps to success:

1. Identify which types of data cannot be measured in numbers. This is **qualitative** data.
2. Identify why types of data can be assigned a numerical value. This is **quantitative** data.
3. If the **quantitative** data set can only have 1 specific value it is said to be discrete.
4. If the **quantitative** data set can only have all range of numerical values it is said to be continuous.

Example:

Hair colour, height, hand span, number of freckles, gender, and blood group are all ways of describing characteristics of human beings.

Separate these characteristics into qualitative quantities and quantitative quantities. You must say if the quantitative information is continuous or discrete.

Answer:

Qualitative:

Hair colour, gender, blood group

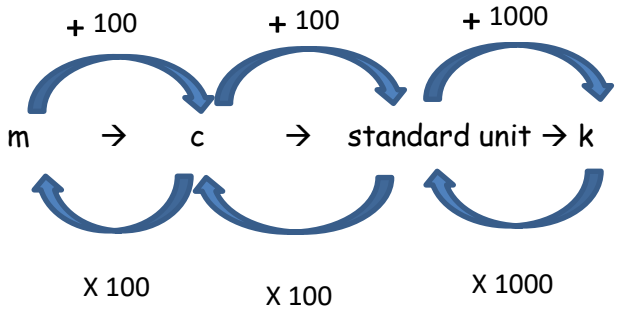
Quantitative:

height (continuous), hand span (continuous), number of freckles (discrete)

Unit conversions

Steps to Success:

1. **Identify** the prefix that you wish to change to. This is the letter before the standard units you will have been taught, e.g. mV the prefix is m. You will mostly use k, c or m prefixes.
2. **Identify** the prefix of the unit you currently have.
3. Work along the flow chart below.

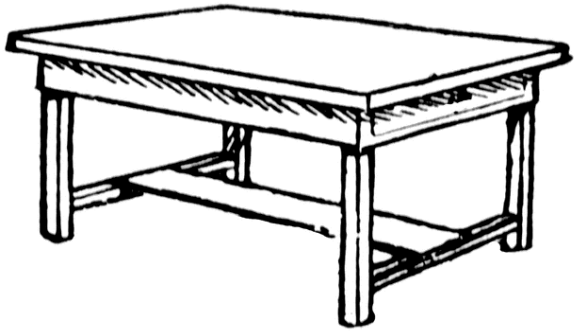


Example:

Convert the following table measurements into mm.

Length: 1.5m

Depth: 70cm



Answer

	For length	For Depth
Step 1 and 2.	Length: m to mm	Depth: cm to mm
Step 3:	1.2m x 100 = 120cm 120 cm x 100 = 1200mm	70 cm x 100 = 700mm

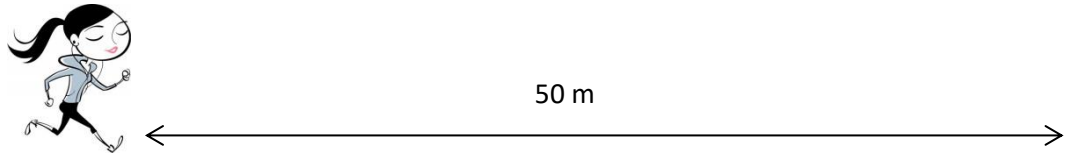
Averages (mean)

Steps to Success:

1. **Add** all of the values up.
2. **Divide** the total number by how many values you have.
3. **Record** the mean with units.

Example:

Chloe runs is timed for running 50 m. She repeats this 7 times and records the information in the table below.



Trial	1	2	3	4	5	6	7
Time (s)	12	14	11	10	12	13	12

Calculate the average (mean) time taken for the trials.

Answer:

$$Average = \frac{Sum}{Number\ of\ values}$$

$$Average = \frac{(12 + 14 + 11 + 10 + 12 + 13 + 12)}{7}$$

$$Average = \frac{84}{7}$$

$$\underline{Average = 12}$$

Ranges

Steps to Success:

1. Find the **biggest** number and the **smallest** number
2. **Subtract** the smallest number from the biggest number.
3. The answer is the range of the set of values.

Example:

Calculate the range of values in time below.

Trial	1	2	3	4	5	6	7
Time (s)	12	14	11	10	12	13	12

Answer:

Step 1: *Biggest number = 14s Smallest number = 10s*

Step 2: *Range = 14 -10 = 4*

Step 3: *Range = 4 s*

Note: In Physics and Geography a range is considered to be between 2 values i.e. in the example above, the range would be from 10s to 14s

Subject Notes:

Physics: A range is considered to be between two values. In the example given the range would be from 10s to 14s.

Creating Percentages

Steps to Success:

1. **Identify** the whole (original amount) and the part (new value) in the same units
2. **Divide** the part by the whole (this creates a fraction)
3. **Multiply** the fraction by 100. Use "%" as units.

Example :

A power station uses 348 MJ of chemical energy to generate 194MJ of electrical energy and 154MJ of waste energy. Calculate the percentage of chemical energy changed to electrical.

Answer:

Step 1: *Energy in (Whole) = 348MJ, Energy out (Part)=194MJ*

Step 2: *Fraction is* $\frac{194}{348}$

Step 3 *%* = $\frac{194}{348}$ *X 100*

% = 55.7 %

Creating tables

Steps to Success:

1. **Find** out how many columns you need from looking at the information the question wants you to display.
2. **Find** out how many rows you need by counting how many matching sets of data you have and add an extra row for your headings.
3. **Draw** outline of table using a ruler.
4. **Mark** your headings in the top of these columns (remember units).
5. **Fill** in table, with the matching sets of data going in the same row.

Example:

The population of Scotland reached its highest in 2014. It is estimated to be 5347600. This is a rise of 19,000 people since the middle of 2013. This is much larger than in the 1800's. In 1800 it was estimated to be 1.6 million. In 1820 there was 2 million and 2.5 million in 1840. This was due to people moving from the Highlands and Ireland during the potato famine. By 1860 the population was 3 million. By 1920 the population reached 5 million. It has increased and decreased around this mark since.

Construct a table to show the population in Scotland between1800-2014. You must include 5 pieces of information.

Answer:

(Year and population = 2 columns). (6 years with 6 matching populations = 6 sets of data so 7 rows)

Year	*Population (million)*
1800	*1.6*
1820	*2.0*
1840	*2.5*
1860	*3.0*
1900	*5.0*
2014	*5.0*

Using information from a table

Steps to Success:

1. **Write** down what you are asked to find from the rows and columns
2. **Move** along the row headings until you find the heading asked for.
3. **Move** along the column headings until you find the heading asked for.
4. **Find** where this column and row meet. This is the table value you require
5. Carry out any further calculations as asked using this value.

Example:

You have been asked to design a table for a client. The client has specified that the table must have a 100mm clearance above the knees. Using the information from the table calculate the minimum height of the table from the ground for a 50th percentile user.

No.	Dimension	5th percentile	50th percentile	95th percentile
758	Sitting height	889	942	995
330	Eye height, sitting	768	819	869
529	Knee height, sitting	526	567	609
678	Popliteal height	406	444	481

All sizes in mm

Answer: 50th percentile and knee height.

No.	Dimension	5th percentile	50th percentile	95th percentile
758	Sitting height	889	942	995
330	Eye height, sitting	768	819	869
529	Knee height, sitting	526	567	609
678	Popliteal height	406	444	481

From the table the 50th percentile user has a Knee height, sitting of 567mm.

Table height = knee height + 100mm clearance = 567+100 = 667mm

Bar Graph

Steps to Success:

1. **Label** your axis (with units).
2. **Mark** your scale (each division should be worth the same amount).
3. **Plot** your bars. First bar should not touch axis.
4. Give it a **title**.

Subject Notes:

Geography: In geography you must draw your bars touching.

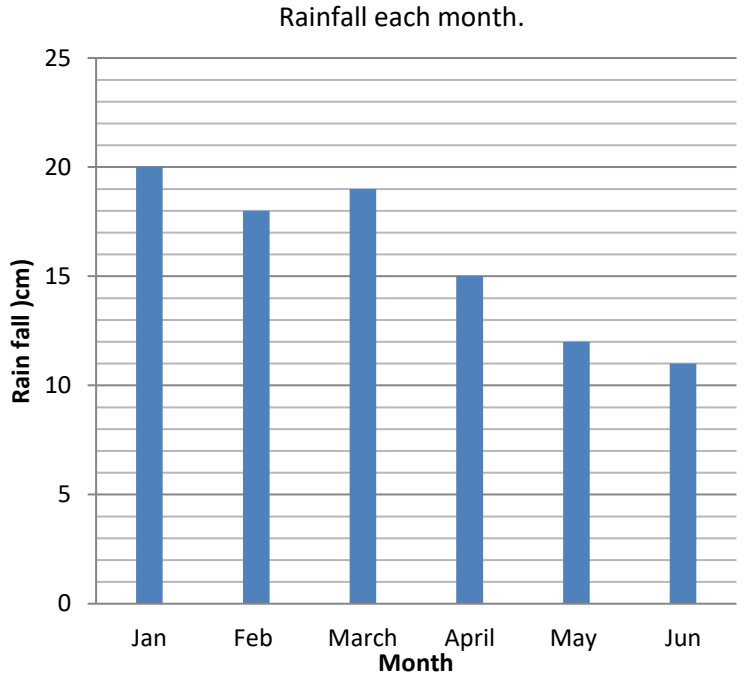
Example:

An experiment is carried out to measure how much rainfall occurs in the first 6 months if the year. The results rerecorded in the table below

Month	Jan	Feb	March	April	May	Jun
Rain fall (cm)	20	18	19	15	12	11

Plot a graph of these results.

Answer:



Line Graph

Steps to Success:

1. **Label** your axis (with units).
2. **Mark** your scale (each division should be worth the same amount).
3. **Plot** your points.
4. **Draw** the best fit line/connect points (subject dependant).
5. Give it a **title**.

Subject Notes:

In practical subjects the term "line graph" is used when talking about line graphs, curved graphs and scatterplots.

Depending on the subject you may be asked to draw a best fit line or connect the points. As a general rule draw a best fit line in Physics and Chemistry, connect the points in Geography and Biology.

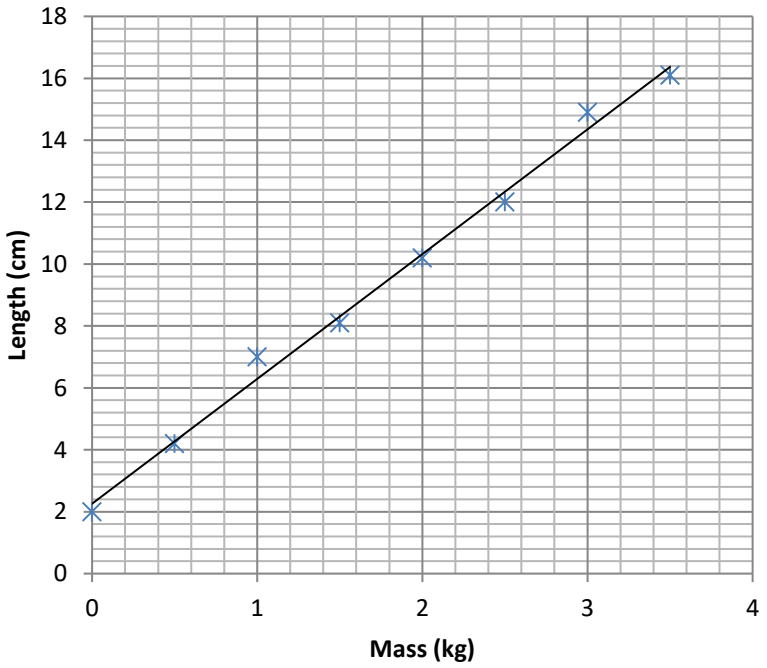
Example:

An experiment is carried out to measure how the length of a spring changes depending on the mass attached to it. The results are shown below.
Plot a graph of these results.

Mass (kg)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Length (cm)	2.0	4.2	7.0	8.1	10.2	12.0	14.9	16.1

Answer:

Mass vs Length of Spring



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Pie Chart

Steps to Success:

1. **Find** how many total parts you have by adding up each type of data you have
2. **Find** the number degrees 1 part is worth by **dividing** 360 by the number of parts.
3. **Find** the number of degrees for each different type of data by multiplying the value by your answer to step 2.
4. **Draw** a full circle
5. Using a protractor **divide** your circle into the correct number of degrees for each data type
6. **Label** each part with the percentage or value.
7. You can include a key if you wish

Example:

Display the land use survey results below on a pie chart

Land use	No. of buildings
Commercial	3
Residential	5
Services	2

Answer:

Step1: *Total number of buildings: 3 + 5 + 2 = 10*

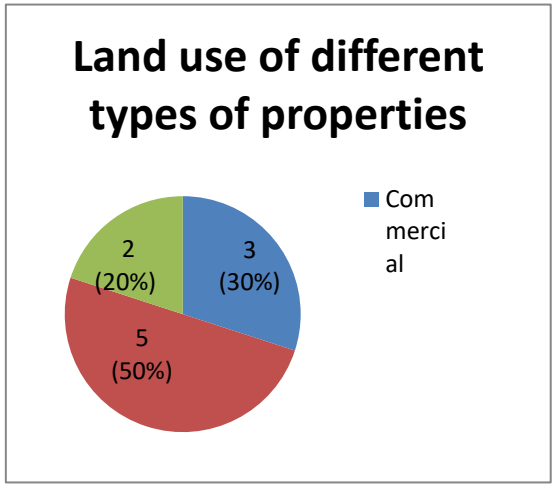
Step 2: *1 building is worth = 360/10 = 36°*

Step 3: *Commercial = 3 x 36 =108°*

Residential = 5 x 36 =180°

Services = 2 x 36 =72°

Step 4-7:



Multiple Graphs (Batch Data)

Steps to Success:

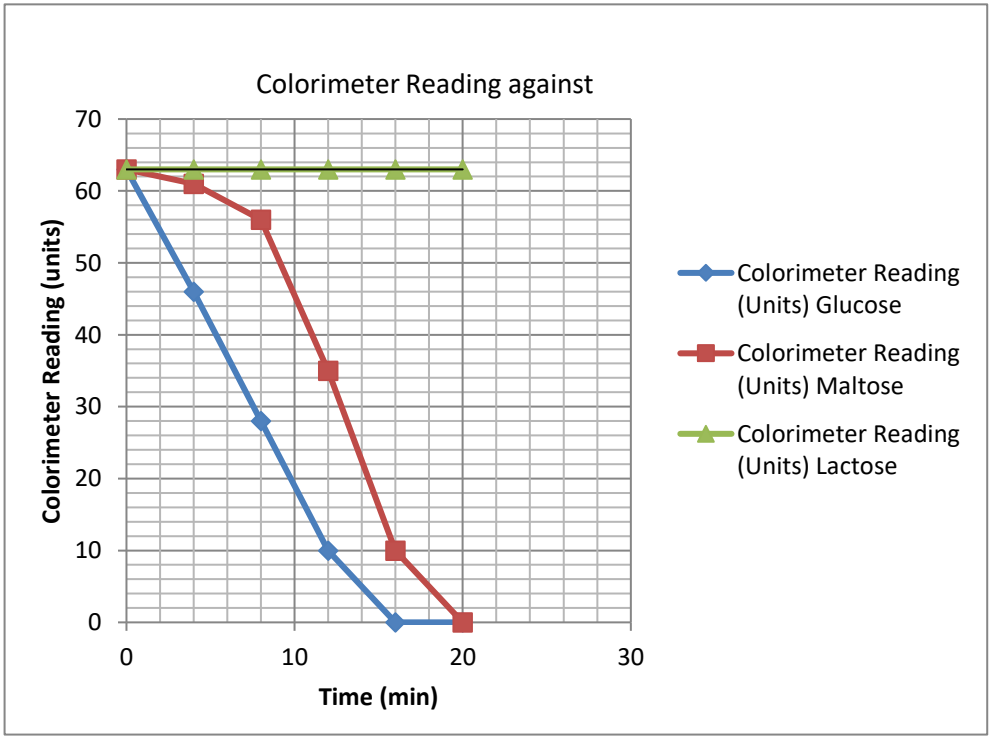
1. **Label** your axis (with units).
2. **Mark** your scale.
3. **Plot** your points for the initial reading.
4. **Draw** the best fit line/connect points (subject dependant).
5. **Plot** your points for the next data set using a different colour of pen or different mark (e.g. cross, dots, square) and mark a best fit line/join points (subject dependant).
6. **Repeat** step 5 for remaining data sets.
7. Give it a **title**.

Example:

Draw a graph to detail the information below.

Time (min)	Colorimeter Reading (Units)		
	Glucose	Maltose	Lactose
0	63	63	63
4	46	61	63
8	28	56	63
12	10	35	63
16	0	10	63
20	0	0	63

Answer:



Grid References (4 fig)

Steps to Success:

4 figure:

1. **Find** the symbol on the map.
2. **Move** along to bottom of the map (Eastings) and find the bottom left corner of the box with the symbol in it.
3. **Write** this down as a two digit number.
4. **Move** up the side of the map (Northings) and find the bottom left corner of the box it the symbol in it.
5. **Write** this down as a two digit number after the previous number.
6. **Combine** the numbers to get your grid reference.

Example:

Find the grid reference for the Museum in the map shown.

Answer:

4 figure gridline

Step 2 and 3: *92*

Step 4 and 5: *93*

Step 6: *9293*

Grid References (6 fig)

6 figure:

1. **Find** the symbol on the map.
2. **Move** along to bottom of the map (Eastings) and find the bottom left corner of the box with the symbol in it. **Write** this down as a two digit number.
3. **Split** the box that the symbol in into 10 imaginary sections (called 0-9) along the Eastings, and up the Northings.
   The middle of the line is 5. After the line is 6. Before the line is 4. On the line is 0.
4. **Identify** where the symbol falls on the imaginary line. **Write** this number after your first two digits.
5. **Repeat** for the Northings line.
6. **Combine** these numbers to get the grid reference.

Example:

Find the gridline for the Museum in the map shown

Answer:

6 figure –

Step 2 and 3 : 92

Step 4 and 5: 3

Step 6: 93 and 8

Step 7: 923 938

Interpreting Graphs: Extrapolation

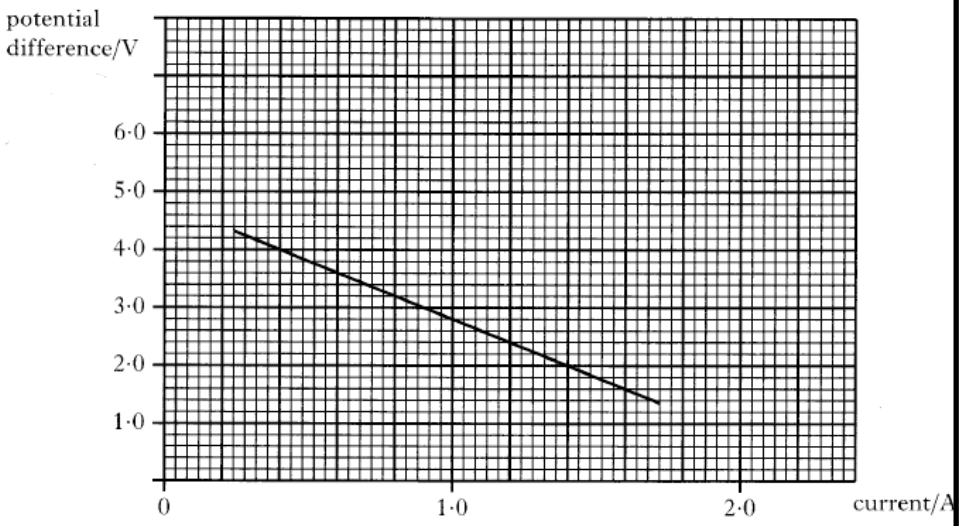
Steps to Success:

1. **Line up** your ruler up with a best fit line.
2. **Drag** the line back with your finger or a pencil until it meets the axis. Where the line meets the axis is your answer.

Example:

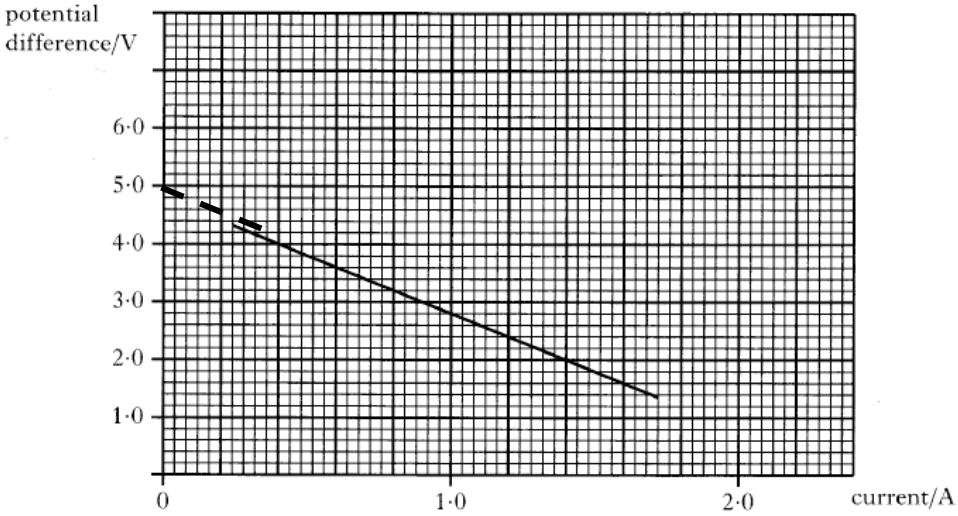
The graph shows how Voltage varies with current across a resistor.

Using the information from the graph find the voltage supply (where it cuts the potential difference axis).



Answer:

Line cuts potential difference axis at 4 boxes above 4.0.
4 boxes = 4 x 0.2 = 0.8 so;
4.8 V



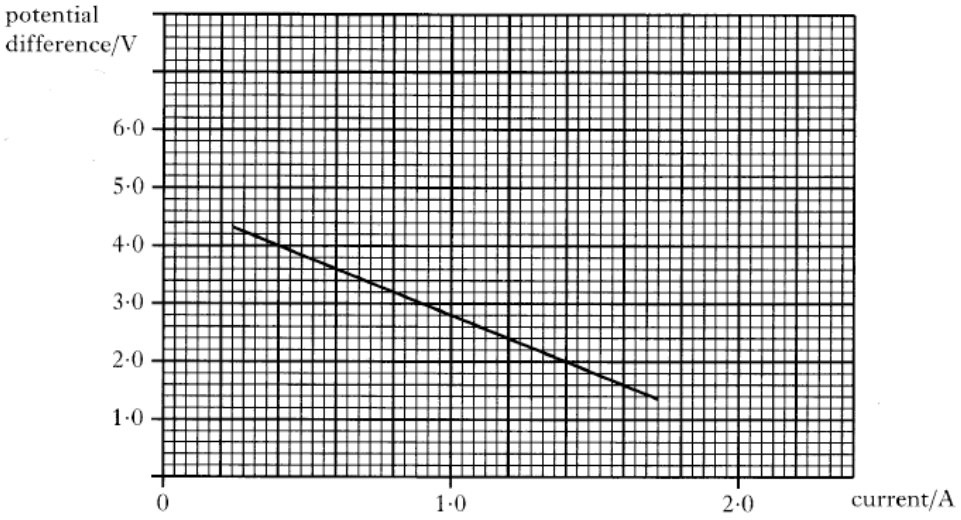
Interpreting Graphs: Finding Values

1. **Calculate** how much each box is worth in both scales. (e.g. take the value at 10 boxes and divide by 10. This details how much each small box is worth).
2. **Move** a ruler along the x axis to required value.
3. **Move** up the y axis at this point until we meet the line.
   Read from the y-axis the value

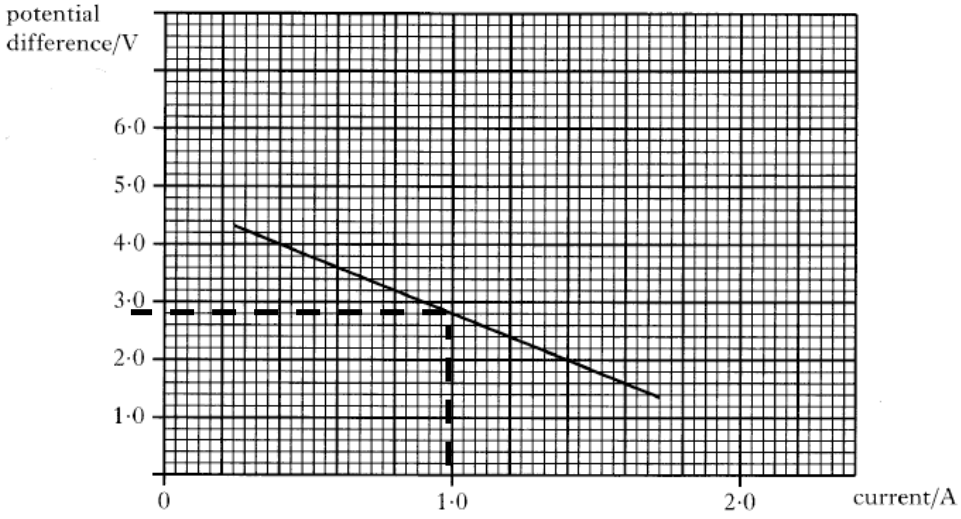
Example:

The graph shows how Voltage varies with current across a resistor.

Using the information from the graph find the potential difference at a current of 1.0A.



Answer: 2.8 V



Accuracy and Precision.

Steps to Success:

1. **Calculate** the maximum value of the range (x).
2. **Calculate** the minimum value of the range (y).
3. **Write** range is between x and y.
4. If the range is very small then the result is **precise**.
5. If accepted value is between x and y then result is **accurate**.

Example:

The value of g is measured to be 9.9 ± 0.04 Nkg^{-1}. The accepted value of g is 9.82 Nkg^{-1}. Is the student's value of g accurate?

Answer:

Student value of g = 9.9 ± 0.04 Nkg^{-1}

Step 1: Student's maximum g = 9.9+0.04 = 9.94 Nkg^{-1}

Step 2: Student's minimum g = 9.9-0.04 =9.86 Nkg^{-1}

Step3: Range of students value for g= 9.86 to 9.94 Nkg^{-1}

Step 4 and 5: Students result is not accurate as accepted value of g is not within the range of the experimental result.

Counting significant figures

Steps to Success:

1. Find the first zero from the left hand side. This is your first significant figure
2. Including this digit count all numbers that follow. This is the number of significant figures.
3. In practical subjects we do not count trailing zeros as significant unless they are finished with ".0" or come after a decimal point.

Example:

How many significant figures are in the numbers below?

a. 124 mm
b. 10.0 mm
c. 100 mm
d. 0.015 mm
e. 0.010 mm

Answer:

a. 3
b. 3
c. 1 (in practical subjects), 3 (in maths)
d. 2
e. 2

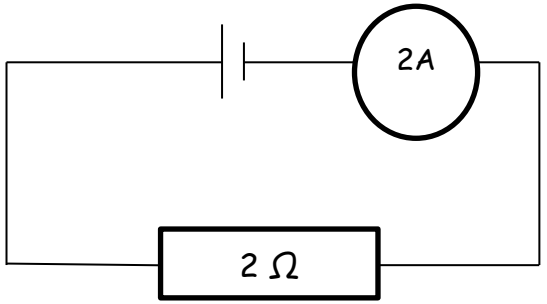
Solving an equation (substitution)

Steps to Success:

1. **Identify** and **write** down all given values in the question.
2. **Select** equation to be used using the symbols given.
3. **Substitute** values.
4. **Solve** with correct units.

Example:

A resistor of 2 Ω is measured to have a current of 2A passing through it. Calculate the voltage across the resistor



Answer:

Step 1: *I= 2A, R=2 Ω V=?*

Step 2: *V=IR*

Step 3: *V=2 X 2*

Step 4: *V= 4V*

Changing to scientific notation

Steps to Success:

1. Move the first non-zero number to immediately before your decimal point and drop all trailing zeros. This gives you your coefficient.
2. Count how many places you have moved your first significant figure. This will give you your power.
3. If moving numbers right then the power will be positive. If moving decimal point left the power will be negative.
4. Write in form " coefficient x 10 power ".

Example:

Change the numbers below into scientific notation

a. 1230000 m
b. 0.000123A

Answer:

a. *Step 1:* *1230000 becomes 1.23*
   Step 2+3 *Number of places the number has moved = 6 right*
   Step 4 *1.23×10^{6} m*

b. *Step 1:* *0.000123 becomes 1.23*
   Step 2+3 *Number of places the number has moved = 4 left*
   Step 4 *1.23×10^{-4} A*

Subject Notes: In Science it is perfectly acceptable to have 123×10^{4} as an answer. In fact this is encouraged when using prefixes (e.g. 670 nm = 670×10^{-9}m). We will look at prefixes later.

Changing from scientific notation

Steps to Success:

1. Identify if your power is positive or negative

For positive powers

2. If it is positive then add zeros until the amount of numbers after the decimal is the same as the power.
3. Drop the decimal point

For negative powers

2. If it is negative then add this number of zeros before.
3. Drop the old decimal point and place new decimal point between the first two zeros.

Example:

Change the numbers below into scientific notation

a. 1.23×10^{6} m
b. 1.23×10^{-4} A

Answer:

a. *Step1:* *+6 (6 numbers after decimal)*
   Step2: *1.230000*
   Step 3: *1230000 m*

b. *Step1:* *-4 (4 zeros before first digit)*
   Step 2 *00001.23*
   Step3 *0.000123 A*

Prefixes

Example:

Convert the following values into SI units.

a. 12MW
b. 0.3mA
c. 2.3km

Answer:

a. 12MW
   Step 1: Prefix is M
   Step 2: M is $x\ 10^6$ or x 1 000 000
   So 12MW = 12×10^6 W or 12 000 000 W

b. *0.3×10^{-3} A or 0.003A*
c. *2.3×10^3 m or 2300 m*

Steps to Success

1. **Identify** the prefix. This is the letter before the standard units you will have been taught.
2. Using the prefix table shown, either **substitute** the prefix with the scientific notation value OR **multiply** the value given by the decimal number given.
3. If you are now attempting to add a prefix then divide the number given by the decimal number in the table.
4. Finish with the SI unit.

Prefix	Symbol	Scientific notation	Decimal number
Tera	T	$\times 10^{12}$	1 000 000 000 000
Giga	G	$\times 10^{9}$	1 000 000 000
Mega	M	$\times 10^{6}$	1 000 000
kilo	k	$\times 10^{3}$	1 000
centi	c	$\times 10^{-2}$	0.01
milli	m	$\times 10^{-3}$	0.00 1
Micro	μ	$\times 10^{-6}$	0.00 000 1
Nano	n	$\times 10^{-9}$	0.00 000 001
pico	p	$\times 10^{-12}$	0.00 000 000 000 1

Equations with Significant figures

Steps to Success:

1. **Identify** and **write** down all given values in the question.
2. **Highlight** the value that has the lowest number of significant figures using the rules for a practical subject. This is how many significant figures your answer should be to.
3. **Solve** question following the steps you normally would for solving an equation.
4. **Round** the answer to the number of significant figures identified in step 2.

Example:

A resistor of 2500 Ω is measured to have a current of 0.00169A passing through it. Calculate the voltage across the resistor

Answer:

Step 1 + 2: *I= 0.00169A (3 sig fig), R=2500 Ω (2 sig fig) V=?*

Step 3: *V=IR*

V=0.00169 X 2500

V= 4.225 (4 sig fig)

Step 4 *V= 4.2 V (2 sig fig)*

Subject Notes: Your answer is allowed to be within a range of significant figures. It can be 1 significant figure less than step 2 and 2 significant figures more than step 2.

In Maths R=2500Ω would have 4 significant figures but in practical subjects we would say it has 2 because it has been measured. You will be instructed how many significant figures to round to in Maths.

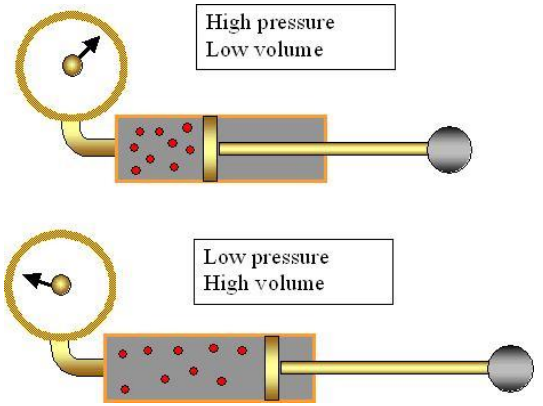
Solving equations (changing the subject)

Steps to Success:

1. **Identify** and **write** down all given values in the question..
2. **Select** equation to be used using the symbols given.
3. **Substitute** values.
4. **Rearrange** by balancing.
5. **Solve** with units (applying sig. fig. rule).

Example 1:

$100cm^3$ of gas is expanded to $200cm^3$ at constant temperature. Its initial pressure was measured to be 100kPa. Calculate its final pressure at its new volume.



Answer:

Step 1 *V1 = 100cm³, V= 200cm³, P1= 100kPa, P2=?*

Step 2 *P1V1=P2V2*

Step 3 *100 x 100 = P2 X 200*

Step 4 *Divide both sides by 200 gives*

$P2 = \frac{100\ X100}{200}$

Step 5 *P2 = 50 kPa*

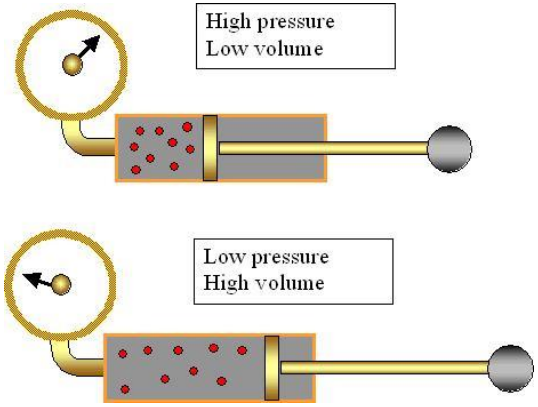
OR

Steps to Success:

1. **Identify** and **write** down all given values in the question..
2. **Select** equation to be used using the symbols given.
3. **Rearrange** using balancing.
4. **Substitute** values.
5. **Solve** with units (applying sig. fig. rule).

Example 1:

$100cm^3$ of gas is expanded to $200cm^3$ at constant temperature. Its initial pressure was measured to be 100kPa. Calculate its final pressure at its new volume.



Step 1 *V1 = 100cm³, V= 200cm³, P1= 100kPa, P2=?*

Step 2 *P1V1=P2V2*

Step 3 *Divide both sides by V2 gives*

$$\frac{P1\ x\ V1}{V2} = P2$$

Step 4

$$\frac{100\ x\ 100}{200} = P2$$

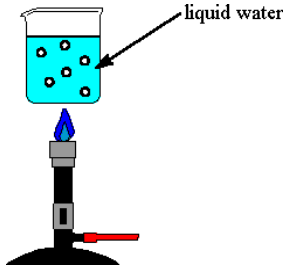
50 = P2

Step 5 *P2 = 50 kPa*

Example 2:

A student heats 0.1 kg of water. It use was 1200 J of energy. The heat capacity of water is 4180 J $^{o}C^{-1}$ kg^{-1}

Calculate the change in temperature of the heated water.



Answer:

m= 0.1 kg, E=1200 J, c=41800 J $^{o}C^{-1}$ kg^{-1}

E= cmΔT

1200 = 4180 x 0.1 ΔT

Divide both sides by (4180 x 0. 1)

1200/(4180 x 0.1) = ΔT

ΔT =287°

OR

m= 0.1 kg, E=1200 J, c=41800 J $^{o}C^{-1}$ kg^{-1}

E= cmΔT Divide both sides by cm

ΔT=E/cm

ΔT=1200/ (4180 x 0.1)

ΔT =287°

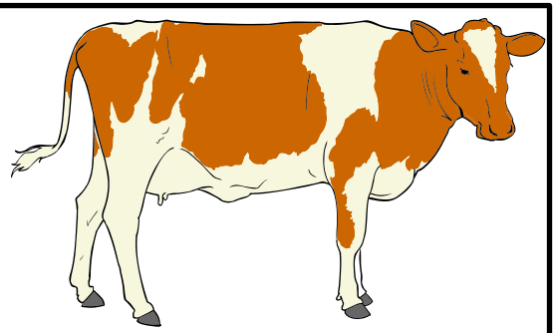
Simplifying ratios

Steps to success:

1. For a ratio you will mainly be interested in 2 values a and b.
2. Count the number of A's you have.
3. Count the number of B's you have.
4. Express answer as A:B.
5. Simplify A and B using common multiples..

Example:

A student wanted to find out what was the ratio of red to white cows in a field. They counted them all and recorded their results in a table.



Type of Cow	Number in the field
Red	55
White	10

Calculate the simple whole number ratio of red cows to white cows.

Answer:

Step 1 *red cows and white cows*

Step2: *55 red cows*

Step3 *10 white cows*

Step 4 *55:10* *(5 is a common multiple. Divide both sides by 5)*

Step 5 *11:2*

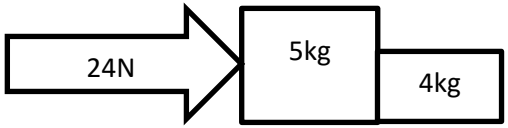
Using ratios

Steps to Success:

1. Write out the original simplified ratio.
2. You will be asked to find how many parts of A to B you have or B to A. Write this value under the corresponding ratio value.
3. Find the multiplying fact (new value/original value)
4. Multiply all other parts of the ratio by this

Example 1:

A force of 24N is acting on a 5kg and 3kg mass as shown below. Using ratios calculate the force acting on the 4 kg mass.



Answer:

Step 1: *F:m*

24: (5+4)

24:9

8:3 (8 parts force per 3 parts mass)

Step 2 *Force on 4kg mass. Put 4 under the 3.*

8:3

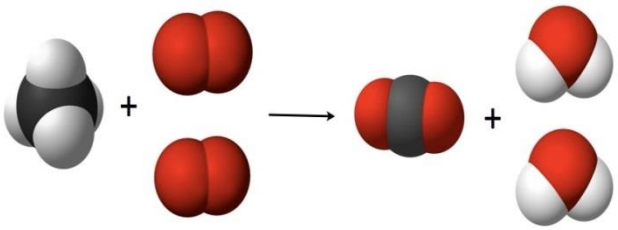
F:4

Step 3 *Multiplying factor is 4/3*

Step 4 *8 x 4/3 = 10N*

Example 2:

When methane reacts with oxygen it forms carbon dioxide and water. This can be shown as;



$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

a) From the balanced equation state the ratio of methane (CH_4) reacting with oxygen (O_2)

b) If 4 moles of methane was to react how many moles of oxygen would be needed?

Answer:

a. Number of CH_4 = 1 Number of O_2=2

Ratio: 1:2Answer:

b.

Step 1: 1:2

Step 2 4 Methane Put 4 under the 1.

1:2

4:Oxygen

Step 3 Multiplying factor is 4/1

Step 4 2x 4/1 = 8 moles of O_2

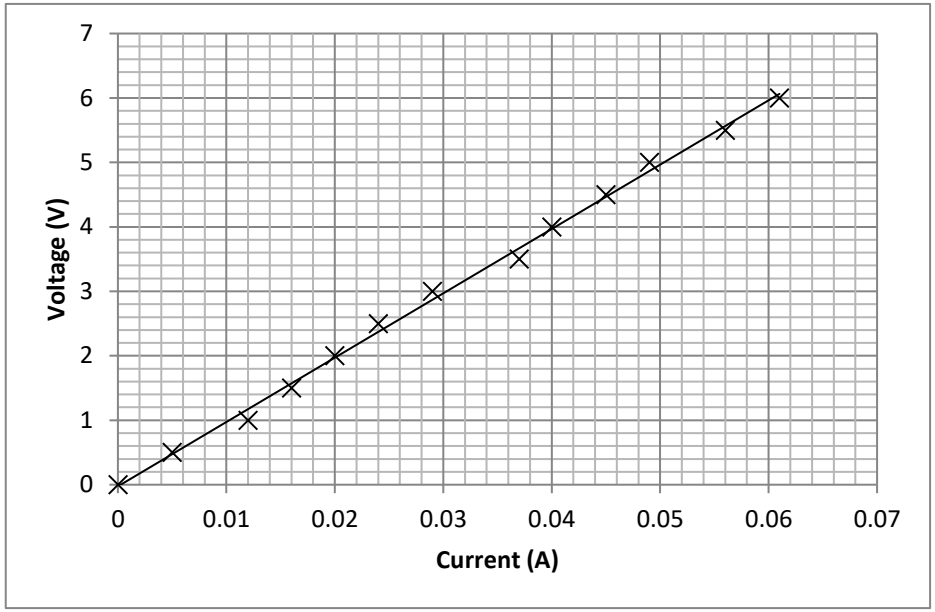
Interpreting Graphs: Gradients

Steps to Success:

1. **Choose** two points from graph that are easy to read.
2. Use ***m = (y2-y1)/(x2-x1)*** to find gradient.

Example:

The graph below shows how voltage across a 100 Ω resistor varies with current through it. Use the graph to show that the resistance of the resistor is the same as the gradient of the best fit line.



Answer:

Step1: *(0.01, 1) and (0.03, 3)*

Step 2: *Gradient = m = (y2-y1)/(x2-x1) = (3-1)/(0.03 – 0.01) =100*

Size of resistor = 100Ω so;

Gradient = resistance

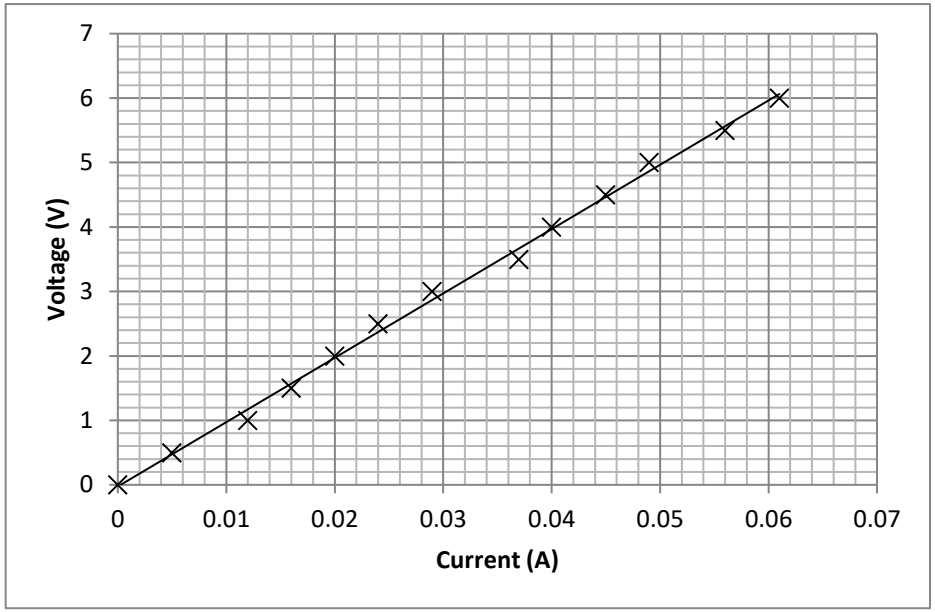
Interpreting Graphs: Equation

Steps to Success:

1. **State** equation of a straight line.
2. From graph **state** what Y axis shows.
3. From graph **state** what X axis shows.
4. From graph **state** what gradient shows.
5. **Substitute** steps 2, 3 and 4 into y=mx.

Example:

Use the graph to show how we get Ohms law.



Answer:

Step 1: *Equation for straight line*
y=mx

Step 2: *from graph above y =Voltage, V,*

Step3: *x= current , I*

Step 4: *gradient = resistance*

Step 5: *So;*

y = mx becomes
V= R x I

Ohms law is V=I

Interpreting Graphs: Conclusion

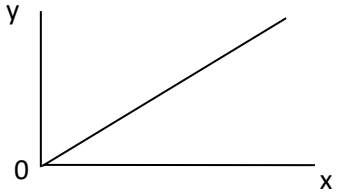
Steps to Success:

1. All conclusions should follow the form "X is _____ proportional to Y."
2. If line passes through the origin then the phrases "directly" or "indirectly" should be applied.
3. If graph is x vs. y with a straight line passing through the origin then we sat they are "directly proportional".
4. If graph is 1/x vs. y with a straight line passing though the origin then we say they are "indirectly proportional".
5. If graph is a straight line that does not pass through the origin we say they are "linearly" proportional followed by a statement to describe what happens to Y as X increases.
6. For the additional statement on linearly proportional graphs if the slope is up we say "As X increases, Y increases". If the slope is down we say "As X increases, Y decreases" as appropriate.

Example:

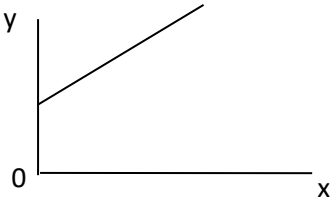
For each graph example below draw a conclusion on the results.

a)



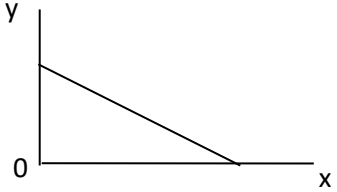
X is directly proportional to Y

b)



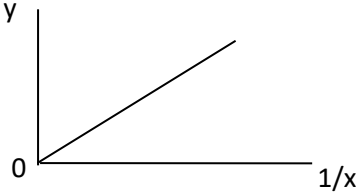
X is linearly proportional to Y. As X increases so does

c)



a) *X is linearly proportional to Y. As X increases, Y decreases*

D)



X is inversely proportional to Y.

Appendix

Qualitative	something that can be described with words
Quantitative	something that can pre described with numbers
Discrete	measurement with a singular whole number value
Continuous	a measurement with a range of decimal values
Prefix	a letter put in front of a standard unit to show that the number shown is a multiple or fraction of the original unit.
Average (mean)	in practical based STEM subjects we use the word average to describe the **mean**. The **mean** is the sum of all values divided by the number of values given. In maths you will learn about other types of averages including modes and medians.
Range	the difference between the highest and smallest number in a given set of numbers.
Percentage	the ratio of two values expressed as a fraction of 100.
Bar graph	a graph that uses bars to display discontinuous and qualitative data. Where the bars touch the y-axis and each other, and show a range this is called a **histogram**.
Line graph	a graph that uses points and lines to show quantitative and continuous data. In practical STEM areas we use the term "line graph" to represent all types of graphs that are plotted in this way. In maths there are some subtle differences, this can be called a line, curve or scatter plot.
Pie chart	a circular graph that is divided into sections proportional to
Extrapolation	where a line is extended to meet an axis or other line.

Accurate	description of how close a measured value is to a true value
Precise	description of how consistent results are when repeated (all measurements made are over a very small range)
Significant Figure	digits that have meaning in a measurement.
Scientific notation	a way of writing very large and small numbers. In maths this is often called **Standard Form**.
Gradient	numerical description of the rate of change of a slope.
Ratio	a way of comparing numbers. The ratio tells us how proportional one value is to another.