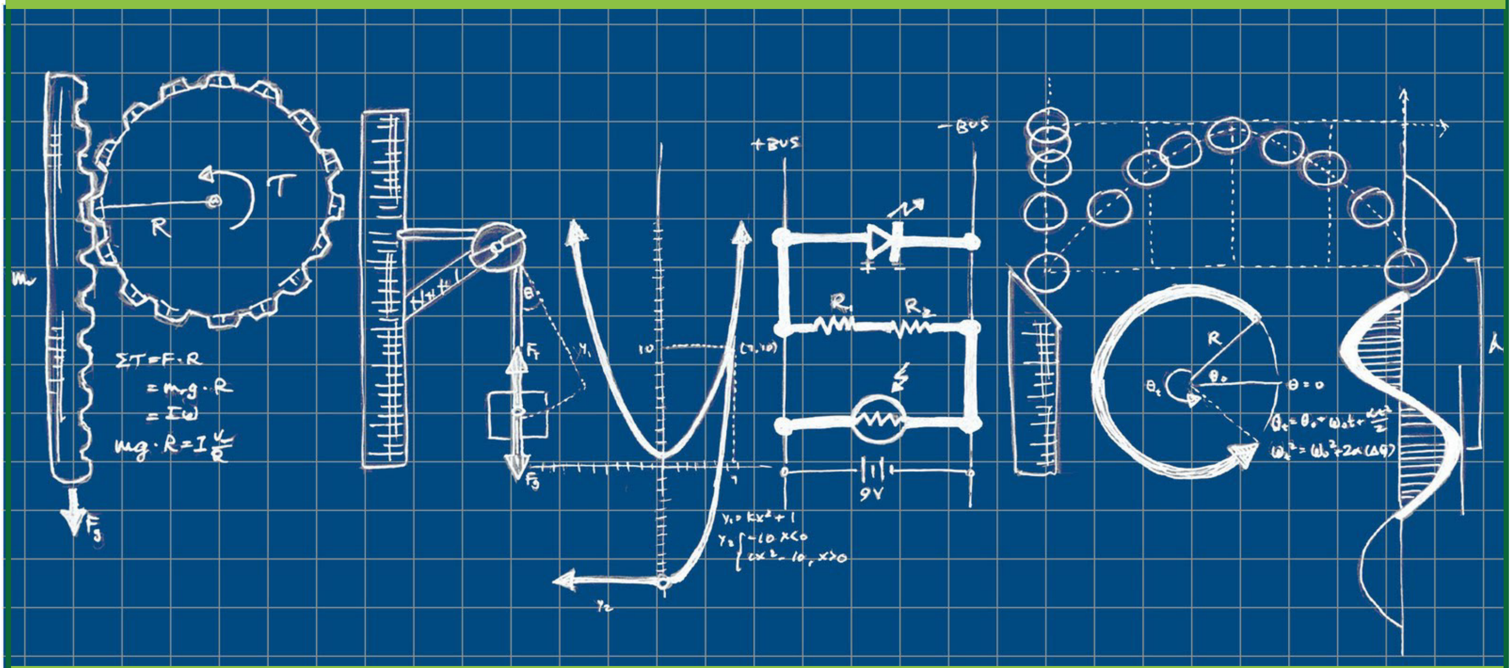
Bentley Wood

High School for Girls

Physics
GCSE to A level

Bridging Work

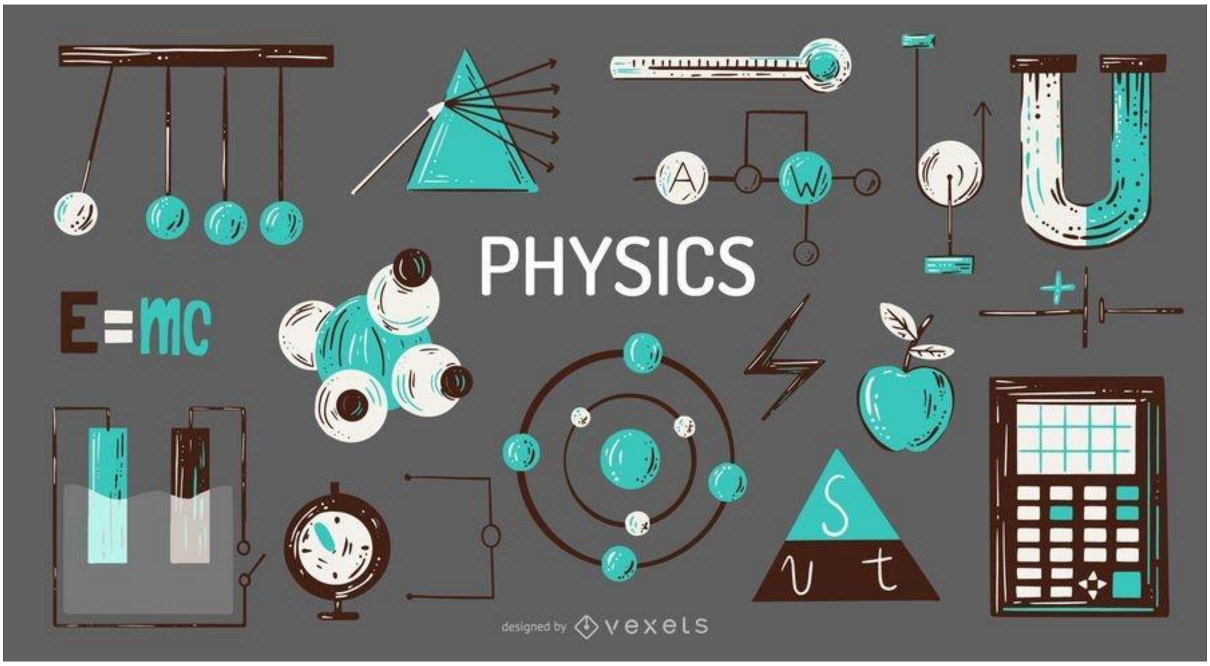
Year 11 into 12 for 2024/25



Name: ______________________

Tutor Group: ________________

Teacher: ____________________________



Yr 11 – 12 Bridging work

Congratulations on completing your GCSE's. Your break has been well earnt.

However, there is some work to do and some information you need in the lead up to taking A level Physics.

1. Exam board? Pearson Edexcel Level 3 Advanced GCE (9PHO)
2. Exams? We are no longer doing AS exams, so that means that you will have 3 exams at the end of your year 13.
   Paper 1 – 1 hour 45 minutes, 90 marks
   Working as a physicist, mechanics, electric circuits, further mechanics, electric and magnetic field, nuclear and particle physics
   Paper 2 – 1 hour 45 minutes, 90 marks
   Working as a physicist, materials, waves and particle nature of light, space, thermodynamics, nuclear radiation, gravitational fields, oscillations.
   Paper 1 and 2 have 10 multichoice questions the followed by 7/9 longer former questions
   Paper 3 – 2 hour 30 minutes, 120 marks
   All topics are included in the paper and is characterised as containing questions that will include more than one topic in them.
   All of the questions are longer form
3. Course load? You are expected to completed 3 sets of homework per week aiming at around 1 hour and 30 maximum for each set. Work will be set by both teachers.
   They will take the form of:
   C – based on content covered in the lesson
   A – Exam questions or work focused on independent work
   P – Notes to be written for the next lesson.
4. Testing? Throughout the year you will tested formally and informally. You will low stakes tests in the form of pink sheet every lesson or so. These are to identify areas of the most recent lessons content that may need support and end of topic tests that are aimed at covering content from that topic.
5. Will you need your GSCE stuff? Yes the majority of A level physics, both year 12 and 13, start with the content in GCSE physics and then moves on from there.

6. Will it be hard? Yes but we (your teachers) will be here to support you. A levels are a massive step up and it is ok for you to find this hard. Stick to your guns, ask for help and you will make it through just fine.

We really look forward to help and guiding you through the next step in your Physics journey and continue to expand your knowledge of how the world works.

This bridging work is going to aim to help your transmission from GSCE to A level and start you off right 😊

Section 1: Note taking

Section 2: Maths

Section 3: GCSE content

Section 1: Notes taking

Part of your journey to independence is your ability to make and take your own notes.

There are many ways to make notes. This part will be for you to try the different types of note taking.

Please use some of this time to research the different types of note taking.

We will look over

1. Cornell Notes
2. Boxing Method
3. Mapping Note-Taking Method
4. Flow Note-Taking Method
5. Focused Question Clusters Method

[The 13 Most Effective Note-Taking Methods - E-Student]()

1. Cornell

The Cornell note-taking method, developed over half a century ago, is a tried-and-true strategy for taking effective notes. It uses two top columns (the “cue” and “note” columns), together with a single bottom row (the summary section), to record notes.

The method is versatile, usable for most subjects, and one of the simplest yet most effective note-taking methods. By mastering the Cornell system, you’ll always have at least one solid note-taking skill under your belt. The Cornell system is one of the most popular note-taking strategies in the world for a good reason.

Advantages:

- Organized and systematic for both recording and reviewing notes
- Time-efficient and requires little effort,
- Taking Cornell notes is very easy to learn,
- Suitable for most subjects (except equation-based subjects),
- Fulfills a natural learning cycle within one single page,
- Ideal for extracting major concepts and ideas.

Disadvantages:

- Requires creating or purchasing Cornell-style pages,
- Large quantities of Cornell notes can be challenging to organize,
- Not great at reducing the size of notes,
- Research on the Cornell method is mixed.

The topic you will write some notes on will be **Rules of Series and Parallel Circuits**

Cornell Notes

Topic / Objective:	Name:
	Class / Period:
	Date:

Essential Question:

Questions:	Notes:

Summary:

2. Boxing method

The boxing method of note-taking uses boxes to visually separate topics within a page. While the boxing method was designed for digital devices, it's a technique that can be easily adapted to handwritten notes.

Using the boxing strategy results in notes that are visually pleasing and easy to review. The method also takes full advantage of digital-only features such as lassoing, resizing, and moving notes after writing. Together with mind mapping, it's one of the most effective note-taking strategies for visual learners.

Advantages:

- Takes advantage of digital note-taking tools,
- Great for learners with a visual learning style,
- Aesthetically pleasing notes,
- Notes reduce well.

Disadvantages:

- Slightly time-intensive,
- Not always practical for note-taking during lectures.

The topic you will be taking notes will be **Energy transfer of a swing pendulum**

3. Mapping Note-Taking Method

The mapping method of note-taking, also known as "concept mapping," connects different thoughts, ideas, concepts, and facts through visualization. Both Leonardo Da Vinci's and Albert Einstein's notebooks reportedly contained mapping-style notes that connected drawings to words and notes.
The mapping method starts with a central topic in the middle of the page before branching into smaller subtopics, supporting topics, and more minor details. The method provides a one-of-a-kind graphical overview of lecture content that is irreplaceable for visual learners.

Mapping is best used in content-rich college classes where the information is structured. However, taking notes in a live class with this method is very rarely possible due to its time-consuming nature.

Advantages:

- An excellent method for visual learning styles,
- It gives a comprehensive overview of a large subject,
- It helps you understand the connections between small elements within a major topic,
- Maximizes active participation,
- Reviewing mapped notes is very efficient.

Disadvantages:

- Requires a good understanding of the topic,
- Requires strong concentration,
- It cannot be used effectively during class,
- It can be difficult to correctly include all relationships,
- Mapping is very time-consuming.

The topic you will be taking notes on will **Waves**

4. Flow note-taking method

While linear note-taking methods (such as the sentence and outline methods) have their place in your toolkit, you will want to complement these with non-linear methods that force you to actively engage with the topic at hand as a whole. Using such methods translate into a better understanding of an area and how its different component parts relate to each other. One of the main non-linear approaches that you should become familiar with is the flow method of note-taking.

It can look similar to the mapping method, but the focus of this method is on the higher-level concepts and ideas and how they relate to each other. Detailed descriptions and paraphernalia have to take a step back. The relationships are indicated using arrows and lines, in whichever way you find useful.

Advantages:

- The flow method aims to have you learn during class by having you engage actively with the content.
- Even though you are actively learning during class, you also get useful notes for revision – while the notes are not in the most useful format for revision, they tend not to be terrible
- It's a flexible method that suits most subjects.
- It is a good choice for note-taking after having followed a class or after having read all material to solidify your understanding.
- The method can be personalized to suit individuals' needs and preferences.

Disadvantages:

- The flow method is not well suited for topics of which you have no prior understanding, as it can be difficult to pick out what is more or less important and figure out how they relate to each other during the class.
- While engaging mainly with the bigger picture, you risk missing important details during lectures.
- Flow notes can easily turn out quite messy and are not ideal for revision (you can try to mitigate this by adding cue words to your notes to prompt you to describe relationships during revisions).
- It can be difficult to find the time to actively engage with a topic during fast-paced lectures, forcing you to take detailed notes and apply the flow method after class instead.
- Practice with the method is needed as you need to figure out how to best use it to suit your learning style.

The notes you will be taking will be on **Density**

5. Focused Question Clusters Method

Focused Question Clusters is a method, proposed by Cal Newport, to help students use their textbooks and existing lecture notes to prepare for MCQ-style exams by writing questions and then quizzing themselves.

Focused Question Clusters involve the following main steps:

1. Identify your main topic and the relevant subtopics.
2. For each subtopic, write a series (or a “cluster”) of questions that relate to it, covering the main points. The questions should be clear and possible to answer with a few words.
3. Write a few background topics to the topic as a whole.
4. Use these questions to review (you might want to employ one of the relevant study methods for how you quiz yourself, such as active recall)

Although this kind of rapid-fire questions will help most with preparing for multiple-choice style exams, the engagement with the material will also help your brain to make the connections to get a deeper understanding of the topic.

Advantages:

- An effective way to gain and retain knowledge about a topic
- Particularly effective for MCQ-style exams
- A useful tool for studying in groups
- Question drafting can be divided up and the results shared as a resource between students studying together

Disadvantages:

- Drafting the questions takes a considerable amount of time and effort
- Not the best way to engage with more argumentative topics

The notes you will take will be on **Acceleration**

1. Prefixes and units

In Physics we have to deal with quantities from the very large to the very small. A prefix is something that goes in front of a unit and acts as a multiplier. This sheet will give you practice at converting figures between prefixes.

Symbol	Name	What it means		How to convert	
P	peta	10^{15}	1000000000000000		↓ x1000
T	tera	10^{12}	1000000000000	↑ ÷ 1000	↓ x1000
G	giga	10^{9}	1000000000	↑ ÷ 1000	↓ x1000
M	mega	10^{6}	1000000	↑ ÷ 1000	↓ x1000
k	kilo	10^{3}	1000	↑ ÷ 1000	↓ x1000
			1	↑ ÷ 1000	↓ x1000
m	milli	10_{-3}	0.001	↑ ÷ 1000	↓ x1000
μ	micro	10_{-6}	0.000001	↑ ÷ 1000	↓ x1000
n	nano	10_{-9}	0.000000001	↑ ÷ 1000	↓ x1000
p	pico	10_{-12}	0.000000000001	↑ ÷ 1000	↓ x1000
f	femto	10_{-15}	0.000000000000001	↑ ÷ 1000	

Convert the figures into the units required.

6 km	=	6×10^{3}	m
54 MN	=		N
0.086 μV	=		V
753 GPa	=		Pa
23.87 mm/s	=		m/s

Convert these figures to suitable prefixed units.

640	GV	=	$640 \times 10_{9}$	V
		=	$0.5 \times 10_{-6}$	A
		=	93.09×10^{9}	m
	kN	=	$32 \times 10_{5}$	N
	nm	=	0.024×10^{-7}	m

Convert the figures into the prefixes required.

s	ms	µs	ns	ps
0.00045	0.45	450	450 000 or 450 $\times 10^{3}$	450×10^{6}
0.000000789				
0.000 000 000 64				

mm	m	km	µm	Mm
1287360				
295				

2. Significant Figures

1. **All non-zero numbers ARE significant.** The number 33.2 has THREE significant figures because all of the digits present are non-zero.
2. **Zeros between two non-zero digits ARE significant.** 2051 has FOUR significant figures. The zero is between 2 and 5
3. **Leading zeros are NOT significant.** They're nothing more than "place holders." The number 0.54 has only TWO significant figures. 0.0032 also has TWO significant figures. All of the zeros are leading.
4. **Trailing zeros when a decimal is shown ARE significant.** There are FOUR significant figures in 92.00 and there are FOUR significant figures in 230.0.
5. **Trailing zeros in a whole number with no decimal shown are NOT significant.** Writing just "540" indicates that the zero is NOT significant, and there are only TWO significant figures in this value.

(THIS CAN CAUSE PROBLEMS!!! WE SHOULD USE POINT 8 FOR CLARITY, BUT OFTEN DON'T - 2/3 significant figures is accepted in IAL final answers - eg 500/260 = 1.9 to 2 sf. Better 5.0 x 10^2 / 2.6 x 10^2 = 1.9)

8. **For a number in scientific notation: N x 10^x, all digits comprising N ARE significant by the first 5 rules; "10" and "x" are NOT significant.** 5.02 x 10^4 has THREE significant figures.

For each value state how many significant figures it is stated to.

Value	Sig Figs	Value	Sig Figs	Value	Sig Figs	Value	Sig Figs
2		1066		1800.45		0.070	
2.0		82.42		2.483 x 10^4		69324.8	
500		750000		0.0006		0.0063	

3. Converting length, area and volume

Whenever substituting quantities into an equation, you must always do this in SI units – such as time in seconds, mass in kilograms, distance in metres…

If the question doesn't give you the quantity in the correct units, you should always convert the units **first**, rather than at the end. Sometimes the question may give you an area in mm^2 or a volume in cm^3, and you will need to convert these into m^2 and m^3 respectively before using an equation.

To do this, you first need to know your length conversions:

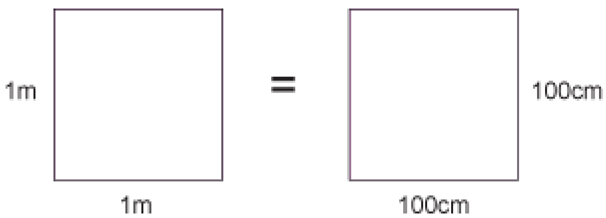
1m = 100 cm = 1000 mm (1 cm = 10 mm)

m to cm	x 100	cm to m	÷ 100
m to mm	x 1000	M to mm	÷ 1000

Always think –

"Should my number be getting larger or smaller?" This will make it easier to decide whether to multiply or divide.

Converting Areas



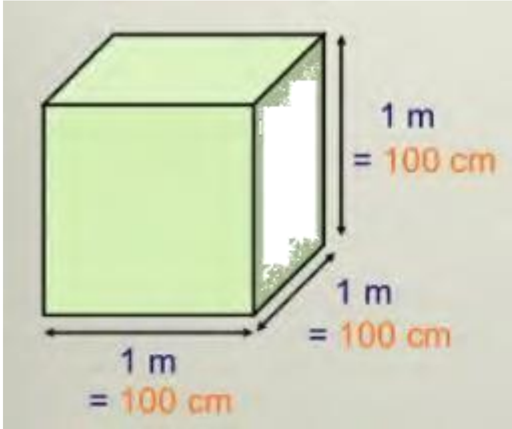
A 1m x 1m square is equivalent to a 100 cm x 100 cm square.

Therefore, 1 m^2 = 10 000 cm^2

Similarly, this is equivalent to a 1000 mm x 1000 mm square;

So, 1 m^2 = 1 000 000 mm^2

m^2 to cm^2	x 10 000	cm^2 to m^2	÷ 10 000
m^2 to mm^2	x 1 000 000	m^2 to mm^2	÷ 1 000 000



Converting Volumes

A 1m x 1m x 1m cube is equivalent to a 100 cm x 100 cm x 100 cm cube.

Therefore, 1 m^3 = 1 000 000 cm^3

Similarly, this is equivalent to a 1000 mm x 1000 mm x 1000 mm cube;

So, 1 m^3 = 10^9 mm^3

m^3 to m^3	x 1 000 000	cm^3 to m^3	÷ 1 000 000
m^3 to mm^3	x 10^9	m^3 to mm^3	÷ 10^9

6 m_2	=	cm^2	750 mm^2	=	m^2
0.002 m^2	=	mm^2	5 x 10^{-4} cm^3	=	m^3
24 000 cm^2	=	m^2	8.3 x 10^{-6} m^3	=	mm^3
46 000 000 mm^3	=	m^3	3.5 x 10^2 m^2	=	cm^2
0.56 m^3	=	cm^3	152000 mm^2	=	m^2

Now use the technique shown on the previous page to work out the following conversions:

31 x 10^8 m^2	=	km_2
59 cm^2	=	mm_2
24 dm^3	=	cm_3
4 500 mm^2	=	cm_2
5 x 10^{-4} km^3	=	m_3

(*Hint: There are 10 cm in 1 dm)*

For the following, think about whether you should be writing a smaller or a larger number down to help decide whether you multiply or divide.

Eg. To convert 5 m ms^{-1} into m s^{-1} – you will travel more metres in 1 second than in 1 millisecond, therefore you should multiply by 1000 to get 5000 m s^{-1}.

5 N cm^{-2}	=	N m_{-2}
1150 kg m^{-3}	=	g cm^{-3}
3.0 m s^{-1}	=	km h^{-1}
65 kN cm^{-2}	=	N mm^{-2}
7.86 g cm^{-3}	=	kg m^{-3}

7. Accuracy, Precision, Resolution

An ***accurate*** result is one that is judged to be close to the true value. It is influenced by random and systematic errors.

The true value is the value that would be obtained in an ideal measurement.

The true value is the value that would be obtained in an ideal measurement.

A ***precise*** measurement is described when the values 'cluster' close together. We describe measurements as precise when repeated values are close together (consistent). It is influenced by random effects.
Resolution is the smallest change in the quantity being measured that causes a perceptible change in the output of the measuring device. This is usually the smallest measuring interval. It does not mean a value is accurate.
Uncertainty is variation in measured data and is due to random and systematic effects. We usually assume the uncertainty is the same as the resolution of the measuring instrument.
example ruler, resolution +/- 1 mm so uncertainty is also +/- 1 mm

Stop watch used by a pupil, resolution +/- 0.01 s but uncertainty estimated as +/- 0.2 s due to human reaction time.

For our exam we estimate uncertainty and as long as you have a sensible justification your answer will be ok.

Eg. The true temperature of the room is 22.4 °C. One thermometer gives a reading of 22 °C *and another gives a reading of* 23.4 °*C* . Which is most accurate and estimate its uncertainty?

23.4 °*C* has the best resolution but is not close to the correct value.
22°C has less resolution but is more accurate as it is closer to the correct result.

The uncertainty in this reading is 22 +/− 1°C

Example
Isabelle is finding the mass of an insect, but the insect moves while on the electronic balance.
She records a set of readings as 5.00 mg, 5.01 mg, 4.98 mg, 5.02 mg.
The true value of the insect's mass is 4.5 mg.
1. Calculate an average value with estimated uncertainty for her results and compare this value with the true value using the terms above.

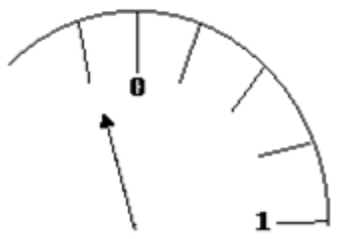
8. Identifying Errors

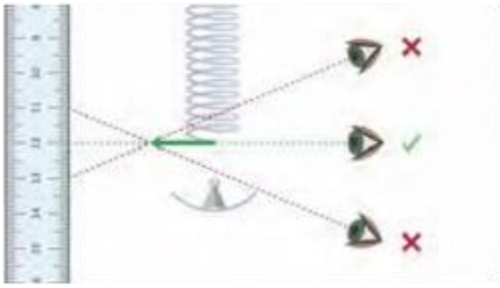
There are two main types of error in Science:

1. Random error
2. Systematic error

Random errors can be caused by changes in the environment that causes readings to alter slightly, measurements to be in between divisions on a scale or observations being perceived differently by other observers. These errors can vary in size and can give readings both smaller and larger than the true value.
The best way to reduce random error is to use as large values as possible (eg. Large distances) and repeat and average readings, as well as taking precaution when carrying out the experiment.

Systematic errors have occurred when all readings are shifted by the same amount away from the true value.
The two main types of systematic error are:
i) *Zero error* – this is where the instrument does not read zero initially and therefore will always produce a shifted result (eg. A mass balance that reads 0.01g before an object is placed on it). Always check instruments are zeroed before using. ii) *Parallax error* – this is where a measurement is not observed from eye level so the measurement is always read at an angle producing an incorrect reading. Always read from eye level to avoid parallax.





Zero Error *Parallax Error*

Repeat and averaging experiments will not reduce systematic errors as correct experimental procedure is not being followed.

There are occasions where readings are just measured incorrectly or an odd result is far away from other readings – these results are called **anomalies**. Anomalies should be removed and repeated before used in any averaging.

1. Choose a practical and list some of the errors associated with the measurements

9. Improving Experiments – Accuracy, Resolution and Reliability

When improving **accuracy**, you must describe how to make sure your *method* obtains the best results possible. You should also try to *use as large quantities as possible as this reduces the percentage error in your results*. Also make your range as large as possible, with small intervals between each reading.
Resolution refers to the smallest scale division provided by your measuring instrument, or what is the smallest nonzero reading you can obtain from that instrument.
Reliability refers to how 'trustworthy' your results are. You can improve reliability by repeating and averaging your experiment, as well as removing anomalies.

1. list the different ways of measuring distance, find 3 different pieces of equipment and their resolution and state where they will be most appropriate.

Appendix - It's all Greek

You are expected to know most of these letters.
The letters we will not use at A level are zeta, chi, psi, iota, kappa, xi, omicron.

Greek alphabet list

Upper Case Letter	Lower Case Letter	Greek Letter Name
Α	α	Alpha
Β	β	Beta
Γ	γ	Gamma
Δ	δ	Delta
Ε	ε	Epsilon
Ζ	ζ	Zeta
Η	η	Eta
Θ	θ	Theta
Ρ	ρ	Rho
Σ	σ,ς *	Sigma
Τ	τ	Tau
Υ	υ	Upsilon
Φ	φ	Phi
Χ	χ	Chi
Ψ	ψ	Psi
Ω	ω	Omega
Ι	ι	Iota
Κ	κ	Kappa
Λ	λ	Lambda
Μ	μ	Mu
Ν	ν	Nu
Ξ	ξ	Xi
Ο	ο	Omicron
Π	π	Pi
Ρ	ρ	Rho

Note.

The second lower case symbol for sigma is used at the end of Greek words and not in our equations.

TASK. Write out the Greek letters that you have used in physics and mathematics.
Can you find other letter you have not used yet? If so write them out.
We often use the upper and lower case letters so learn both.