OXFORD OPEN LEARNING

GCSE
Physics

AQA Introduction

GCSE Physics

Introduction

Welcome to your GCSE Physics course. This introduction will serve as a guide to what you can expect from the course, and it will show you how to plan your study of this course effectively. Take the time to read this Introduction thoroughly before you start the lessons.

The course is designed to prepare students for the **AQA GCSE Physics specification (syllabus).**

The AQA subject code is **4451 GCSE Physics**.

Please note that this course has four examined components:

Examination paper Physics 1
Examination paper Physics 2
Examination paper Physics 3 plus

An ISA (see below), which consists of

- An item of practical coursework, *and*
- An examination paper based on the practical work

Full details of these components are given below and during the course.

Oxford Open Learning

The Course

The course is different from GCSE Physics courses of the past in that it attempts to look at the way Physics affects your everyday life and how you can evaluate the scientific material that you come across in newspapers, magazines and on television. The course is ideal preparation for those who wish to go on to study Physics at AS and A2 Level.

If you have some background in Physics then you will find that some of the lessons touch upon things that you have encountered before, but the course is designed to be fully understandable by those who have little or no previous background in science.

Arrangement of Lessons

The lessons are planned so that material for the four examination papers is covered by the four modules of the course:

Physics 1
Physics 2
Physics 3
Science Skills

You should note that the fourth module is common to examinations for GCSE Biology and GCSE Chemistry. If you are doing more than one of these courses with Oxford Open Learning then you will find that this material is common to all three courses. TMA J, however, based on this material is different, so you will need to send separate TMAs to each of your tutors for science subjects.

You should do the three main Physics modules in order but the Science Skills module can be completed whenever you like; this *must* be before you start on your practical assessment (see below).

Textbook

The textbook that is referred to throughout this course is

AQA Science GCSE Physics
Jim Breithaupt – Nelson Thornes – ISBN 978-0-7487-9647-2

You will need a copy of *AQA Science GCSE Physics* throughout the course; you can buy a copy through the

Oxford Open Learning website. It is referred to in almost every lesson and provides excellent coverage of the material. By using the textbook and the course you will have very full coverage of all the material.

You should not need other books during the course but you may like to look in other science books from time to time. If you feel that you would like to use a revision guide before the examination you should ask your tutor which one they recommend.

Lesson Contents and Textbook References

Physics Module 1		
Lesson	*Title*	*Book Reference*
1	Moving Heat	P1.1
2	Efficient Energy/ **TMA A**	P1.2
3	Electrical Devices	P1.3
4	Generating electricity/ **TMA B**	P1.4
5	Using Waves	P.1.5
6	The Uses and dangers of Radioactivity/ **TMA C**	C.1.6
7	Our Place in the Universe	C1.7

Physics Module 2		
Lesson	*Title*	*Book Reference*
8	Movement 1	P2.1
9	Movement 2 / **TMA D**	P2.2 P2.3
10	Static Electricity	P2.4
11	Electric Circuits	P2.5

12	Electrical Appliances/ **TMA E**	P2.6
13	Atoms and Radioactivity	P2.7
14	Nuclear Power/ **TMA F**	P2.7

Physics Module 3		
Lesson	*Title*	*Book Reference*
15	The Turning Effect	P3.1
16	Movement in Circles	P3.1
17	Mirrors and Lenses/ **TMA G**	P3.2
18	Sound and Ultrasound	P3.2
19	Electromagnetic Fields	P3.4
20	The History of Stars/**TMA H**	P3.5

Science Skills		
Lesson	*Title*	*Book Reference*
21	What is Science All About?	H1
22	Can we Believe Scientists? / **TMA I**	H8 and H9
23	Investigating and Observing	H3 and H4
24	Gathering Data	H H6 and H7
25	Coursework / **TMA J**	-
26	Your Practice ISA Test	-
Appendices	Glossary/More on ISAs	

Internet Resources

In most lessons of the course, internet sites are given which have been carefully selected to illustrate points in the course and to provide additional activities. These are an important tool in your understanding of your Physics course and you

should make every effort to view them and use the activities that they contain. If you do not have an internet connection at home, consider building in regular trips to a library or internet café as part of your study schedule.

The Structure within each Lesson: how to study

Front Page

The front page of each lesson shows:

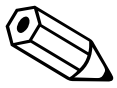
- The title.
- **Aim(s)** for the lesson. These set out the position that you should reach after working through the lesson; keep these in mind while reading the lesson material.
- **Context**. This gives a very brief summary and shows how the lesson fits in with the rest of the course.
- **Reading**. The individual references for each lesson.

Lesson Notes

There then follow the notes; these are an outline of the subject material to be studied in the lesson. Read the notes carefully several times until you feel that you have understood the broad outline of the theory involved, and then tackle the reading references. The textbook may deal with the subjects in greater detail, and, as with the notes, you will probably need to read the passages several times.

Activities

Most activities in the course are placed in the notes at the relevant point. Activities are indicated as follows:

Activity 7	Investigate how a nucleus is held together, particularly how the binding energy of the nucleus relates to Einstein's equation, $E = mc^2$.
	

The pencil symbol indicates that you should make your own notes in the space provided.

Self-Assessment Tests

When you feel that you have mastered the topics and completed the activities, tackle the practice tests, which are at the end of every lesson that does not contain a tutor-marked assessment.

Tutor-marked Assignments

After every two or three lessons there is a tutor-marked assignment. Most of these are in GCSE examination style. Some students may opt to tackle them under timed conditions as examination practice. These tests will thoroughly check your understanding of the previous few topics. You should send your answers to these tests to your tutor, who will return your marked script, together with a set of suggested answers.

Revision

Do **not** leave all your revision until the end of the course. You will need to revise thoroughly for your examination, but frequent revision throughout the course is **essential**. Plan your revision sensibly and re-read as you feel necessary if your knowledge is beginning to fade.

Coursework

You will need to discuss the coursework with your tutor once you have made a start on the course. AQA will specify the topic that you will be working on. Do not start the coursework before discussing it with your tutor.

You should not need too much in the way of specialist equipment for your coursework – it requires mainly items that you can find in the kitchen. Specific details for equipment used will be found in the coursework notes.

Checking the Syllabus

As you know, this course has been written to cover the contents of the **AQA syllabus 4451**, which is available to download (you will need an Adobe Acrobat® reader on your computer) at www.aqa.org.uk.

You should read the syllabus throughout the course, so either keep a copy on your computer or print it out. If you do not have access to the internet, the syllabus is available from:

AQA Logistics Centre (Manchester)
Unit 2, Wheel Forge Way,
Ashburton Park, Trafford Park,
Manchester
M17 1EH

Past Papers

AQA now makes all (but the very last set) of past papers available online for free download at www.aqa.org.uk.

Discuss with your tutor how to approach these.

A Choice of AQA Exams

Within the individual **Biology, Chemistry** and **Physics** specifications, AQA offers an **alternative Paper 1**. Candidates can take a 45 minute short-answer paper *or* they can tackle *two* (30 minute) multiple choice tests instead. These are Papers 1a and 1b. If so, candidates can *either* do the new MCQ tests on paper *or* on screen. They can do (or re-do) them in November, March *and* June. Nonetheless, OOL recommends sticking to the 45 minute short-answer paper.

When you enter for the 4451 exam, you will need to ensure that the correct Entry Codes are inserted on the entry form. These are:

PHY1 tiers F or H (a written paper) **or PHY1AP** and **PHY1BP** (a paper-based objective test) **or PH1AS** and **PH1BS** (an on-screen objective test), tiers F or H.

plus PHY2 tiers F or H, **plus PHY3** tiers F or H (these are written papers), **plus PHYC** (not tiered, comprising PSA and ISA).

The last normal exam sitting for the main science specifications is **2012** (there is a theoretical possibility of re-taking in January 2013 but it may be hard to find an exam centre holding such exams). Changes to the GCSE Science specifications (i.e. the introduction of controlled assessment) mean that it is unlikely to be possible to take GCSE Science exams after 2012 as a distance learner. If you wish to take exams in 2013 (or later years), you will need to take (or transfer to) an **I**GCSE course. Please see our website for the latest details.

Tiering and Assessment

In each of the main Science GCSEs, there is a choice between Foundation Level and Higher Level examinations papers. These are called "tiers". You do not need to make a choice at the start of your studies. This course is designed to give you a full preparation for the *Higher* Level examinations. Foundation Level exams cover the same topics but not quite to the same depth and the questions are designed to be a lot easier.

As time goes by, your tutor should be in a position to advise which level of examination it would be best to take. Our advice is to aim for the Higher Tier at the outset and then, if you find it hard, set your sights lower.

The ISA is not tiered. In the other assessments for this specification, the papers are tiered with Foundation Tier being aimed at grades C–G, and Higher Tier being aimed at grades A*–D. Questions for the Higher Tier will be more demanding requiring higher level skills allowing candidates to access the higher grades. See Section 9.4 of the specification for information about tiering and subject content. Different tiers can be taken for different papers.

In Physics 1a and Physics 1b, the questions for both tiers are contained within the same question paper. Candidates choose at the time of the examination which tier to take.

Your Tutor

You have a lot of resources to help you in your studies; your course file, textbook, internet resources and your tutor. You should make good use of your tutor to help you with any difficulties that you may have during the course.

And finally... very good luck with your studies.

Physics GCSE ISA

Your Coursework Practical (ISA)

Aims

By the end of this lesson you should be able to:

- understand how to work effectively on the coursework component for your GCSE qualification

Context

This section is designed to give you a preliminary understanding of how the coursework element of your GCSE course is carried out and marked. It is important that you read through it carefully, as many of the procedures for the ISA are different for Private Candidates. More detailed information is given in an Appendix at the back of the pack but this does not need to be studied at the outset.

To prepare for your ISA, carefully read through Section H1 'How Science Works' in your textbook, together with the appropriate part of the syllabus. You can view or download the latter at www.aqa.org.uk.

Oxford Open Learning

Introduction

Your coursework instructions are included in the following pages. Please read them carefully and talk to your tutor about what you intend to do.

What is an ISA?

An 'ISA' ('Investigative Skills Assessment') is the practical element of your GCSE course. It is made-up of two parts;

Part 1: A Practical Experiment

This is carried out by you, the student. Because you are a private candidate, you should do this practical part of the ISA at home. You should then record the results of your experiment in a table and use them to produce a graph or a chart.

Part 2: A 45-minute Written Test

You must take this at an exam centre of your choice. You will need to contact your chosen centre well in advance to arrange a time when you can take Part 2 of your ISA (the written test) under exam conditions.

This test will be based on the experiment you did in Part 1 (see above). It will contain a section with questions related to your own experiment and results and a second section related to a similar experiment which you will not have seen before. The data obtained from Part 1 (the practical experiment) will be taken into the related written examination with you. You will need to use your data to answer questions (more about the written examination later).

You must *not* take any written explanations, write-ups or methodology into the written test part of your ISA. This is not allowed.

When you have completed both parts of the ISA, your test paper, along with the results from your experiment and any graphs or charts you might have produced, will be sent off to a moderator to be marked.

Risk Assessment

All experiments are undertaken at the student's own risk, so it is essential that you should be aware of (and minimise) the risks associated with your chosen experiment(s). You should therefore read and consider the Risk Assessment sections that precede each experiment.

Drawing up a Table of Results

Before you carry out your practical investigation, you should draw up a table you can use to record your results. You should design your table based on the requirements of the investigation. Guidelines on drawing up a table can be found in Lesson 24 'Gathering and Using Data'.

Labelling your tables, graphs and charts

There are strict rules about what you can and cannot take into the written exam for your ISA. You should label the axes on your graph with the appropriate titles, but the only other writing you may have on your graphs or charts is that of the ISA title (e.g. 'Physics ISA 3.4:'Cantilevers'). N.b. The wording must be **exactly the same** as the title you have chosen to investigate. There must be **no other writing** on tables, graphs or charts, including that which identifies dependent or independent variables.

Writing up your Practical (Optional)

For both the practice ISA and the final ISA, we would advise you to write up your chosen experiment(s) using the lessons on practical work (in particular Lessons 23 onwards, plus the Appendices) to help you. Your tutor will talk to you about what they expect from a write-up.

You *cannot* take your write-up into the written exam part of the ISA. It is to help you understand your experiment, but does not form part of the final assessment.

Practice ISAs (Part 1: Practical Experiment)

You should complete the practice ISA on 'Thermal Insulation' before you attempt your final ISA.

The instructions for practice ISAs are outlined in the pages that follow. It is very important that you carry out a practice ISA in order to familiarise yourself with the processes involved

in carrying out a practical scientific experiment. Doing a practice ISA should mean you are better equipped with the skills of planning, observation arid evaluation which you will be tested on in the actual ISA.

Practice ISAs (Part 2: Written Test)

A past paper relating to your practice ISA on 'Thermal Insulation' is included at the end of this course. Once you have completed your practical experiment and written it up (Part 1), you should complete the past paper under test conditions, as if it were the real thing. You should refer only to your table of results and the graph(s) or chart(s) you produced when you take the practice written test. Look carefully at the mark scheme for the written test (see lesson 26) to see how marks are allocated for each question.

Which ISA should I take?

AQA releases a number of ISA options at regular intervals during the course of the year, which are valid for a certain period only. It is important that you understand which ISAs you can choose from, so that you do not end up submitting an ISA which is no longer accepted.

The tables below show the ISA options for the years 2011 and 2012.

If you are taking your exams in June **2011**, you should choose **one** ISA from **Table 1** to carry out for your coursework.

If you are taking your exams in June **2012**, you should choose the ISA from **Table 2** to carry out for your coursework. A further set of options will be released by AQA in due course, and OOL will update you of any developments. You should also make sure that your student advisor at OOL knows which year you have decided to sit your exams.

Final ISA (Part 1: Practical Experiment)

Table 1 (2011)

Option	June 2011 GCSE Physics Final ISA Options
Option 1	Physics 3.4 Cantilevers, Set 4
Option 2	Physics 2.5 Crumple Zones, Set 5

Table 2 (2012)

Option	June 2012 GCSE Physics Final ISA Options
Option 2	Physics 2.5 Crumple Zones, Set 5

You should discuss which ISA you will choose with your tutor. The instructions for these options are outlined in the pages that follow, and each is labelled as a 'Final ISA'.

Experiments should be all your own work and AQA ask schools not to announce the experiments until they are actually to be attempted (to prevent students from accessing model answers on the internet). Your tutor and the exam board will be on the look out for work that has been copied from elsewhere.

Final ISA (Part 2: Written Test)

This will be sat at an Exam Centre of your choice. It is the student's responsibility to find a centre. For more information, see the 'Oxford Open Learning Guide to finding a Centre'.

Not sure about anything?

You should find further useful information about ISAs in an Appendix at the back of this course. But that is as much as you need to know at the outset.

Practice ISA and Final ISAs

Please note that the following section includes 1 practice ISA and 2 final ISAs. You should carry out the practice ISA first and then choose the final ISA that you are going to submit for assessment. Please ask your tutor if you are not sure how to proceed.

PRACTICE ISA

Thermal Insulation

Risk Assessment

The risks involved with this practical are minimal, but as with all practical work, you should be careful.

- You can scald yourself with hot water – take care when performing this experiment.
- Glass will break if you add very hot water to cold glass.
- Take care with broken glass and dispose of it safely.
- Loft insulating material can be an irritant to the skin. If you are sensitive to this wear disposable gloves or chose an alternative substance.
- If you are using a mercury thermometer do not dispose of it in normal household waste – contact your local authority and ask for advice.
- Keep small children out of the way when performing this experiment.

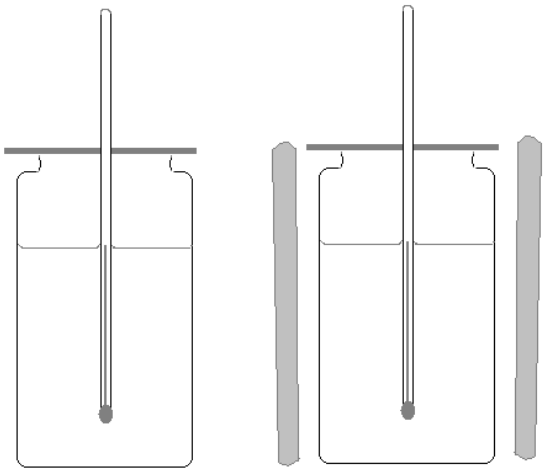
Relevant Lessons

This practical relates to the material provided in **Lesson One: Moving Heat** in your course pack. You should re-read this lesson to re-fresh your memory of the topic.

Part 1: The Practical Work

1. Take a clean jam jar or coffee jar and place a cardboard disk over the top. Make a hole in the disk just large enough to take a thermometer in such a way that the thermometer is supported.
2. Fill the jar with warm water and note the initial temperature. Perform a number of readings at regular intervals. Record all temperatures.
3. Repeat the experiment this time by lagging the jar with any three of the following materials.

- Wool fabric
- Cotton fabric
- Newspaper
- Aluminium foil
- Bubble wrap
- Loft insulating material



Part 2: The Data Processing

You should draw up a table of your results and process the data in an appropriate way, e.g. charts, graphs, diagrams, line of best fit (if appropriate).

Equipment

You can use the stopwatch facility on your wristwatch.

A free stopwatch, which works on your computer screen, can be downloaded from:

www.download.com/XNote-Stopwatch/3000-2350_4-10332723.html

You can buy a very cheap sports stopwatch at:

www.astopwatch.co.uk/products/fastimerange.asp

You can buy a thermometer from a local kitchen equipment shop; check that the range of the thermometer is suitable for your experiment. It will need to cover at least the range 10° to 50°C using a reasonable scale. A thermometer that measures temperature in °F is of no use in this experiment.

Cheap, digital read-out thermometers suitable for this experiment can be obtained from:

www.toolstation.com/search.html?searchstr=thermometer

Remember:

You must decide:

1. How you will make this investigation a 'fair test'.
2. Which variable will be your independent variable.
3 The number of tests. (Each test with a different value for the independent variable.)
4. How many repeats of each test you should carry out so that you can calculate the average value of the dependent variable for each test.
5 The type of graph/chart to plot.

Before you start the practical work you must draw up a table ready to record your results.

When you have finished your investigation:

1. Make sure that you have produced a clear table of results as close to the standard table layout as possible.

2. Process your results to produce what you think is the most appropriate **graph** or **chart**.

The written ISA Test which matches this Practice ISA can be found in Lesson 26.

FINAL *ISA*

Option 1 (Valid for June 2011)

Physics 3 ISA 3.4.-. Cantilevers

This ISA relates to Unit P3: Physics (4451) Section 13.1.

Risk Assessment

It is the responsibility of the candidate (and any relevant parent or guardian) to ensure that a risk assessment is carried out. This ISA has been chosen, in part, because the risks are small.

Your attention is drawn in particular to the dangers associated with falling weights and rebounding or splitting wood.

Area of investigation

This work relates to the section of your course which investigates:

How do forces have a turning effect?

Related Lessons

You should re-visit **Lesson 15 on 'Turning Effects'** in your course pack before you carry out this ISA, to refresh your memory of the topic.

Equipment

- A metre rule (or similar length of wood)
- A mass, or masses, that can be hung from the rule and will deflect it.
- A device to clamp one end of the rule firmly to the edge of a bench or table.
- A way of measuring the deflection of the rule from the horizontal.

The Practical Work

You will need your table of results and the graph/chart to answer questions in your ISA written exam. Therefore keep as close as possible to the task that follows.

You should aim to carry out an investigation concerning the deflection of the cantilever (the rule) from the horizontal when a load is suspended from it.

Choose only one of the following to investigate:

How the deflection depends on the position of the suspended mass along the cantilever,

Or,

How the deflection depends on the magnitude of the load.

Practical suggestions:

The cantilever: Use any approximately 1m long piece of wood that will bend enough to give a range of deflections. Or you can purchase a metre rule online, for example from The Ruler Company at www.rulerco.co.uk Item GW200 should be suitable.

The clamp: Use any way of holding the cantilever firmly at one end. Or you can purchase a G clamp from a DIY store or online, for example from Toolstation at www.Toolstation.com Item 17212 G clamp 150mm should be suitable.

Measuring the deflection: You require a vertical ruler and a pointer on the cantilever. For example, a darning needle taped to the cantilever and a piece of graph paper/or ruler taped onto a nearby wall.

The load: If you require only one mass to act as the load throughout your investigation you can use anything suitable, for example a tin of beans. If you require different masses you can use kitchen scales to measure them.

The Data Processing

Each candidate must draw up his or her own table for the results and should process the data in an appropriate way, e.g. charts, graphs, diagrams, line of best fit.

Candidates' work must **not** be annotated with additional information, by either the tutor or the candidate, which would give an unfair advantage during the written ISA exam, e.g. do not write the words independent variable or dependent variable on your results table or graph/chart.

Remember:

You must decide:

1. How you will make this investigation a 'fair test'.
2. Which variable will be your independent variable.
3 The number of tests. (Each test with a different value for the independent variable.)
4. How many repeats of each test you should carry out so that you can calculate the average value of the dependent variable for each test.
5 The type of graph/chart to plot.

Before you start the practical work you must draw up a table ready to record your results.

When you have finished your investigation:

1. Make sure that you have produced a clear table of results as close to the standard table layout as possible.

2. Process your results to produce what you think is the most appropriate **graph** or **chart**.

FINAL ISA

Option 2 (Valid for June 2011 and June 2012)

Physics 2.5 - Crumple Zones

This ISA relates to Unit P2: Additional Science (4463) and to Physics (4451) Section 12.3.

Risk Assessment

It is the responsibility of the candidate (and any relevant parent or guardian) to ensure that a risk assessment is carried out. This ISA has been chosen, in part, because the risks are small.

Area of investigation

This work relates to the section of your course which investigates:

When a force causes a body to move through a distance, energy is transferred and work is done.

Related Lessons

Lesson 8 on **Movement** in the Physics (4451) course pack and Section P2 3.5 in the recommended textbook.

Equipment

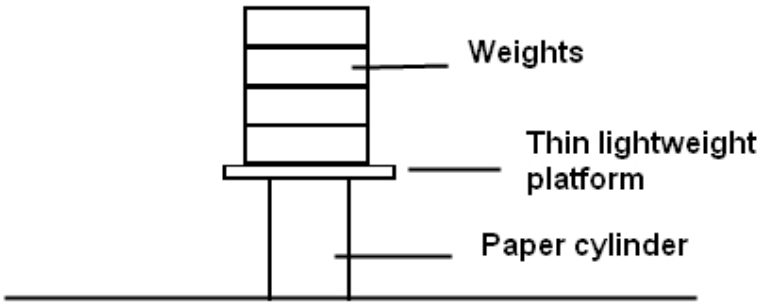
- Paper cylinders
- Weights
- A platform

The Practical Work

You will need your table of results and graph/chart to answer questions in your ISA written exam. Therefore keep as close as possible to the task that follows.

You are to put loads (weights) onto paper cylinders until the cylinders crumple.

Make each paper cylinder by cutting a rectangle out of paper and rolling it into a cylinder and then gluing or taping the two edges together. Use the minimum amount of tape otherwise the cylinder will be given artificial strength. A small platform of, for example hardboard, is then placed on top of the cylinder and weights added until the cylinder is crushed. A suitable size for the platform is about 10cm by 10cm.



Choose <u>only one</u> of the following to investigate:

How the **height** of the cylinder affects the load (weight) needed to crumple the cylinder.

Or how the **diameter** of the of the cylinder affects the load needed to crumple the cylinder.

Or how the **thickness** of the paper affects the load needed to crumple the cylinder.

Practical suggestions:

The paper cylinder: If you use sticky tape to hold the edges of your cylinder, trim off as much tape as you can before attaching the second edge. Try to attach edge to edge rather than overlapping.

The platform: You can use a square 'coaster' (small mat used to protect table top) instead of cutting a piece of hardboard.

The weights: If you do not have a suitable 'set of weights' you can use a container, for example a plastic milk bottle, and pour in sand

(or similar). Find the weight of the sand using kitchen scales. Most kitchen scales give a measurement in grams. The weight of 100grams of material is 1newton.

If you do not have kitchen scales you could use water in the container instead of sand. The water may spill when the cylinder crumples – so work on a tray. You measure the volume of water used to crumple the cylinder and work out the weight of the water. 100cc of water has a mass of 100g and a weight of 1newton.

If you use other objects to provide the load, for example a number of nails, then make sure they are evenly distributed on the platform.

The paper: Paper cylinders can be very strong. Find a type of paper that will crumple reasonably easily for a suitable range of your independent variable.

The Data Processing

Each candidate must draw up his or her own table for the results and should process the data in an appropriate way, e.g. charts, graphs with line of best fit.

Candidates' work must **not** be annotated with additional information, by either the tutor or the candidate, which would give an unfair advantage during the written ISA exam, e.g. do not write the words independent variable or dependent variable on your results table or graph/chart.

Remember:

You must decide:

1. How you will make this investigation a 'fair test'.
2. Which variable will be your independent variable.
3 The number of tests. (Each test with a different value for the independent variable.)
4. How many repeats of each test you should carry out. So that you can calculate the average value of the dependent variable for each test.
5 The type of graph/chart to plot.

Before you start the practical work you must draw up a table ready to record your results.

When you have finished your investigation:

1. Make sure that you have produced a clear **table of results**, as close to the standard table layout as possible.
2. Process your results to produce what you think is the most appropriate **graph** or **chart**.