Examiner Tips for O Level Physics (5054)

How to Use These Tips
These tips highlight some common mistakes made by students. They are collected under various subheadings to help you when you revise a particular topic.

General Advice
- There is no escaping it; thorough and careful revision is the best way to prepare for a physics examination.
- Make your revision productive by making it interesting and fun. Make notes, revision cards or mind maps. Revision should be an active process, i.e. you should be 'doing things', not just sitting and reading a book.
- Do not try to learn it all in one go! Take regular breaks and review what you have learnt regularly.
- Learning equations is essential; put them on small pieces of paper and stick them on your mirror so you will see them every morning, then revise with a friend so you can test each other.
- Try explaining the physics of a topic to a friend – as if you were a teacher!
- Working through past paper questions is then the best way to complete your revision. This helps you to know the type and style of questions to expect in the examination.
- Try timed questions so you can learn to answer quickly.
- Make sure you get your answers checked so you know you are doing the right things!

Spelling
The spelling of technical terms is important, so make sure your writing is legible as well as spelt correctly. Some words are very similar, such as *reflection* and *refraction*. If the examiner cannot tell which one you have written, then you will lose the mark. Make a list of technical terms and definitions in each section of the syllabus, checking the spellings carefully.

General Tips
In O Level Physics examinations you have to be able to complete a variety of tasks; always read the question carefully to make sure you have understood what you are expected to do.
In descriptive answers, you should:
- check the number of marks available and make sure you give sufficient points.
- plan your answer first so that you don't repeat yourself or contradict yourself.
- read your answer through carefully afterwards to check you have not missed out important words.
- use sketches and diagrams wherever you can to help your explanation.
- add labels when referring to a diagram, e.g. *point X*, so that you can refer to it easily in your explanation. This can save many words and much confusion.

In numerical answers, you should:
- quote any formulae you are going to use.
- show clearly all the steps in your working.
- check the units are consistent, e.g. if the distance is given in *km* and the speed in *m/s*, then you must convert the *km* to *m*.
- be careful when you are converting minutes and seconds: 1 minute 30 seconds is not 1.3 minutes and 150 seconds is not 1.5 minutes. These are common mistakes, so always double check any conversion of units of time.
- state the answer clearly at the end.
- give your answer as a decimal to an appropriate number of significant figures unless specifically asked to give the answer as a fraction.
- check that you have given the unit on your final answer.

- look at your final answer and see if it is reasonable. If you have the cost of using an electrical appliance such as a kettle used for six minutes as more than a few cents, then check the powers of ten in your calculation.

Plotting graphs can be tested in Papers 2, 3 or 4. When drawing graphs, you should:

- remember to label the axes with both quantity (e.g. *distance* or *d*) and unit (e.g. *metres* or *m*). Then write it as *distance / metres* or even just *d / m*.
- make sure the axes are the correct way round. You are usually told, for example, to plot distance on the x-axis, so make sure you know that x is the horizontal axis!
- make the scales go up in sensible amounts, i.e. not 0, 3, 6… or 0, 7, 14 … but 0, 5, 10 … or 0, 2, 4 ….
- make sure that the plotted points fill at least half the graph paper. (This means you cannot double the scale and still plot all the points on the graph.)
- check if you have been told to start the scales from the origin. If not, then think carefully about where to start the axes.
- use a sharp pencil to plot the points and draw the line.
- plot the points carefully. It is best to use small neat crosses. Every point will be checked by the marker, and you will lose the mark if any are wrongly plotted.
- draw either a straight line or a smooth curve. In physics we never join the dots!
- remember that a best fit line (curve or straight) should have some points both above and below the line.

When taking readings from a graph, you should:

- draw a large triangle when measuring the gradient of a line. It must be at least half the length of the line. Examiner's tip – draw a triangle the full size of the graph!
- always use points on the line, not your plotted points, when calculating the gradient.
- draw a tangent to find the gradient of a curve. Make sure it is at the right place on the curve. Again, use a large triangle.
- make sure you read the scales correctly when reading a value from a graph. It may be that they are in *mA* rather than *A* or *km* rather than *m*.

When describing the shape of a graph, remember that:

- directly proportional means a straight line *through the origin***.** In this case, doubling one quantity will cause the other to double.
- if the straight line does not go through the origin, then it is just called a linear graph.
- if doubling one quantity causes the other to halve, then they are inversely proportional.
- if increasing one quantity causes the other to decrease, it is called an inverse relationship.

Paper 1 Tips: Multiple Choice

When reading the question, you should:

- read the question carefully, e.g. if a question refers to a cooling liquid, then it will solidify, not boil. If you know you tend to jump to a quick conclusion, cover up the answers while you read the stem of the question.
- not rush through the questions. Some will be very quick to answer, others take more time.
- check whether a positive or negative answer is being asked for, i.e. does the question say "which of the following *is* or *is not* …?" For example, when looking at ray diagrams it is easy to just spot a correct diagram when you are asked for an incorrect diagram.
- underline or circle important information in the stem of the question.

- never leave a question unanswered; marks are not deducted for incorrect answers.
- try to eliminate some of the possible answers if you are not sure of the answer.
- write out your working to numerical questions clearly (on the question paper, near the question) so you can check it later.
- be aware of the topics which occur frequently, such as *potential difference* and *potential dividers*. The theory here just has to be learnt!

When taking readings from a diagram, you should:

- check you are using the correct distance, e.g. in moments questions, remember you need to use the perpendicular distance from the force to the axis of rotation.
- draw on the diagram to help you understand what is happening, e.g. in a travelling wave moving to the right, draw in the new wave outline after a short time, or in deciding the direction of the magnetic field at a point near a bar magnet, draw in the shape of the field.

Choosing the right response:

- When several answers seem correct, re-read the stem of the question. You must choose the answer that is not only a correct statement, but also answers the question, e.g. swapping the live and neutral wires in a plug is a fault, but will not cause the fuse to blow. The live wire touching the metal case of a kettle is a fault which will cause the fuse to blow!

Choosing the right equation:

- Many equations are very similar, e.g. $E = mc^2$ (energy equivalence of mass) and $E = ½\, m\, v^2$ (kinetic energy of a moving object) so make sure you know when to use each one.

Paper 2 Tips: Structured Questions

- Read the stem of the question to check which topic in physics is being tested. Then read all the parts of the question. It is often tempting to write too much in the first part of the question and then realise you have answered parts two and three as well.
- Only answer the question asked. Don't be tempted to give more detail than is required. This wastes time and gains you no extra marks!
- If you are asked for two points (e.g. *name two materials that are magnetic* ….) then don't give three. If you give three and the second is incorrect, you will only get one mark out of two.
- Your answer should fit the space available. If it doesn't, you are writing too much! The number of lines given is a clue as to how much to write. Think about the size of your writing: if it is too big, it will not fit in the space; if it is too small, then the examiner will not be able to read it. Practice writing a size that is in between the extremes!
- If the question asks you to describe the movement of electrons, then not mentioning electrons and only referring to the movement of charged particles in the answer cannot gain full marks. Failure to give sufficient detail is a common cause of lost marks
- If describing the motion of molecules in a liquid then linking the temperature to the average *kinetic* energy of the molecules is important. Molecules of a gas exert a pressure on the walls of a container by colliding with the walls. To increase the pressure, they must collide at a greater rate, i.e. more frequently or with a higher speed. Take care to explain this clearly and without contradiction!
- Electrical circuits are common questions. Make sure you know where to put ammeters and voltmeters in a circuit. Then, if you need to vary the current, make sure you include a variable resistor or use a variable power supply.
- If the question asks you to"state and explain" you need to give a clear explanation.

The amount of detail depends upon the number of marks for the question, e.g. if the direction of the current in a solenoid is reversed, then just saying that the magnetic field changes is not enough. This could mean increases or decreases in strength. You need to state that the field reverses or changes *direction*.

- Make sure you link your answer to the question, rather than just quote learnt facts, such as the penetration of radioactive radiation. Just stating what stops alpha, beta or gamma will not gain all the marks.
- If you are asked to draw forces on a diagram, be sure to draw them through the point where they act. Do not draw them floating in mid-air to the side of a diagram! Remember to label them. Make sure you add an arrow to show the direction, e.g. if the question asks for “the force exerted by the Sun on the Earth”, then since it is a force of attraction, the force arrow must go from the Earth towards the Sun.
- If you are asked to draw a forces diagram, make sure the diagram is large enough, and that all the forces are drawn with arrows and labelled.
- Where a question asks for a formula to be quoted, there will be one mark specifically for this. Even if you get the right answer, failure to quote the formula will lose you a mark.

Some incorrect physics statements will lose a mark even if followed or accompanied by a correct statement. Examples of such statements are:

- *Renewable energy sources can be used again and again*. Please use the explanation that there is an infinite supply or it will not run out.
- *Heat rises*. Note that it is either hot air or hot liquids that rise, carrying the heat energy with them.
- *Acceleration at a constant speed*. This is a contradiction as if travelling at a constant speed, you cannot be accelerating! When describing a uniform acceleration, you can say constant acceleration or that it is accelerating at a constant rate.

Paper 3 Tips: Practical Test

- You will have three short experiments (20 minutes each) and one longer experiment (1 hour).
- Read the instructions carefully. Make absolutely sure you know exactly what you are asked to do each time.
- You do not have any time to waste, so you need to be sure you are doing the right thing first time.
- Write down all your readings clearly in the answer booklet.
- When asked to take a single reading, make sure you include the unit.
- Do not write anything you are not asked for – you are not expected to write an account of the experiment.
- If you are asked to “use your results” to explain something, then quote them, not just use the theory you know!
- Think about the experiment as you do it – you are often asked for sources of error or difficulties you met while doing the experiment. Make sure you give sufficient detail, e.g. don’t just say "to avoid parallax error” but say how this is avoided. This can be done by drawing a suitable diagram showing the position of the observer relative to the scale.
- Significant figures are important in the practical papers. Do not quote too many – or too few! Just right is important.
- If you are reading a measuring instrument, give all the values on the scale, e.g. on a hundredth of a second stopwatch, write *9.24 s* (but not *09:24 s*).
- Many marks are lost by giving too few significant figures. This usually occurs when reading a scale where the value is on a major mark, e.g. *6 V*. If the scale measures to *0.1 V*, then the reading is *6.0 V*, and you must include the point zero!
- In calculated values, you should give the same number of significant figures as in the values used, e.g. the average of 27.95, 26.54 and 27.36 is 27.28333333 and should

be given as 27.28.

- Make sure you understand the technical terms used in the question, e.g. extension means the *increase in length* of a spring when a load is added.
- When measuring vertical heights, a setsquare should always be used to ensure the ruler is vertical. The setsquare should be shown correctly positioned in the diagram.

When you have completed an experiment, go back over your answers and:

- check that you have answered all the parts of the question. Read the instructions again. You may be asked to draw a diagram after a calculation and this can easily be missed.
- check that you have read scales to the correct power of ten, e.g. when reading an ammeter should it be *0.012A*, *0.12A* or *1.2A*?
- check that you have the correct number of significant figures.
- check that you have added a unit to all your measurements and any calculated values, and then check that it is the correct unit!

In the Section B question, you will be asked to take a set of readings to plot a graph.

When recording your readings in a table:

- Write both the quantity and unit in the heading. Note that the quantity means current, not "reading on the ammeter". Don't write the unit after every reading in the table. This just clutters up the table and makes it difficult to see the values clearly; a heading should say *current / ampere* or just I */ A*.
- You do not need a column labelled"reading number" which just goes *1, 2, 3* etc. If you are given a table outline in which to record your results, this will use one of them and you will not have enough columns for your results.
- Make sure you have taken sufficient readings, e.g. if you are asked to measure the temperature of a cooling liquid for five minutes, then a reading every minute gives you too few readings. Every 30 seconds is acceptable.
- Make sure you record the temperature for the full time.
- Don't forget to note the initial temperature when you start the stopwatch.
- If using a liquid in glass thermometer, you should be able to estimate within a degree, e.g. to 0.5^{o}C or even 0.25^{o}C.

Paper 4 Tips: Alternative to Practical

- This paper asks you questions about how you would perform practicals in the laboratory at school.

When you *observe your teacher* demonstrating experiments, you should:

- watch closely how the apparatus is set up.
- think about any problems with the apparatus that occur during the experiment.
- think about any sources of error in taking the readings.

When *you* do practical work at school, you should:

- handle the apparatus carefully.
- think about how the apparatus is set up.
- ask your teacher for help if you are not sure.
- think about how you take down the readings in a clear table – never just write numbers on a page, as you may well forget what they were later!
- think about the number of significant figures in your readings.

- Significant figures are important in the practical papers. Do not quote too many – or too few! Just right is important.
- If you are reading a measuring instrument, give all the values on the scale, e.g. on a hundredth of a second stopwatch, write *9.24 s* (but not *09:24 s*).

- Many marks are lost by giving too few significant figures. This usually occurs when reading a scale where the value is on a major mark, e.g. *6 V*. If the scale measures to *0.1 V*, then the reading is *6.0 V*, and you must include the point zero!
- In calculated values, you should give the same number of significant figures as in the values used, e.g. the average of 27.95, 26.54 and 27.36 is 27.28333333 and should be given as 27.28.

- Be careful when calculating values for a table. These are usually straightforward and do not involve complex calculations!

- When answering questions about sources of error in an experiment, just writing "more accurate" is usually not enough and more detail is required, e.g. when choosing the correct size measuring cylinder to use in order to measure the volume of some marbles, the measuring cylinder must be large enough to hold all the marbles! Sometimes the answers appear too obvious, but they are good practical points.
- Make sure you can explain the difference between the source of error and what you could do to reduce it, e.g. in transferring a hot object from one place to another: the source of error is the heat it loses during the transfer and you could reduce this error by reducing the distance it has to be moved.
- When substituting values into a given equation, always check your calculation twice. Check that you have included all the quantities, e.g. if the equation contains an l for length, do not confuse it with a 1. Then check that the units are consistent, and do not change them if you don't need to!
- When measuring a time or a length be careful with the phrase "how long" as it can mean either. Make sure there is no confusion here by using the words "a longer time" or "a shorter time".
- If a question asks for the effect of changing something such as "the length of the wings" then make sure your answer shows a comparison, e.g. "the long*er* the wings, the long*er* the time to fall".
- Technical terms such as *calibration* need to be understood. This means, "to put a scale on a measuring instrument". Although you may have met this only with reference to thermometers, it applies to any measuring instrument.

If a question involves familiar equipment used in a novel way, e.g. circuits or ray diagrams:

- take time to look at the equipment used.
- do not assume that it is the same as an experiment you have done or seen before.
- follow round the circuit or the rays of light to be sure you understand what is happening.

You should then be able to work out how to answer the question.

About the Examiner

Marianne Devereux has been an examiner for GCSE Physics (5054) for many years. At present she is Principal Examiner for Paper 4, the Alternative to Practical, and also works as an examiner on Paper 2. She has recently retired from teaching as Head of Physics at an independent girls' boarding school.