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 somewhere you will see them every morning.
- Revise with a friend so you can test each other or try explaining the physics of a topic to a friend – as if you were a teacher!
- Working through past paper questions is 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.
- Get your answers checked so you know you are correct!

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*, *fission* and *fusion*. 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 and show **clearly all the steps** in your working. It may be tempting to use your calculator and just write down the answer; but if you write down one figure wrongly then you may lose all the marks for the calculation. If the examiner can see the formula and the numbers you have used then you will lose only a little credit. Some questions ask for a formula to be quoted; even if you get the right answer, failure to quote the formula will lose you a mark.
- 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. Don't leave your answer as a fraction unless specifically asked to do so.
- check that you have given the **unit** of your final answer.
- look at your final answer and see that it is reasonable. If you have calculated the cost of using an electrical appliance such as a kettle for a few minutes and found it to be hundreds of dollars, 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 if you can double the scale and still plot all the points then you should double the scale
- 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 above and some points 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! It is best to show the numbers on the sides of the triangle when finding the gradient,
- 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; alternatively if two quantities *F* and *l* are directly proportional then if you find several values of *F/L* they should be the same.
- 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. If you know you tend to jump to a quick conclusion, cover up the answers while you read the stem of the question.
- avoid rushing 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 asked for an incorrect ray diagram it is easy to pick a correct diagram as your answer.
- underline or circle important information in the stem of the question to help you understand the important points.
- 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; for example in moments questions, remember you need to use the perpendicular distance from the force to the pivot.
- draw on the diagram to help you understand what is happening; for example 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; for example 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 $E = \frac{1}{2} mv^2$ (kinetic energy) so make sure you know when to use each one.

Paper 2 Tips - Structured Questions

- Read all the three questions in section B before you make your choice of which two questions to answer. Some students find it better
  - to read through the whole paper before they start writing any answers at all
  - to start answering section B with the question they think they can answer best.

  Whatever you do, you must plan your answers to section B briefly, perhaps writing brief notes – but be sure to **include all the material** you want to be marked in the correct place on your script.
- Read all the parts of a question before you start. It is often tempting to write too much in the first part and then realise you have answered the second and third parts as well but in the wrong place.
- 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 one 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. Practise 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.
- Failure to give enough detail is a common cause of lost marks; for example If the question asks you to describe the movement of electrons, then you must mention electrons; if the direction of the current in a solenoid is reversed, then just saying that the magnetic field changes is not enough - you need to say that the field reverses or changes *direction*. If you describe 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. Collisions between the molecules themselves do not explain the pressure on the walls. To increase the pressure, molecules can hit the walls harder or more often, i.e. at a greater speed or more frequently. Take care to explain this clearly and without contradiction!
- Make sure you know where to put ammeters and voltmeters in a circuit. Ammeters are in series and voltmeters in parallel with other components. 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 state the answer then give a clear explanation. The amount of detail depends upon the number of marks.
- Make sure that you link your answer to the question, rather than just quoting learnt facts. For example, just stating that paper stops alpha is not enough if the question asks why a radioactive tracer emitting alpha particles is not used inside the body.
- If you are asked to draw forces on a diagram, 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. 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.

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*. Use the explanation that there is an infinite supply or renewable energy sources 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 you travel at a constant speed, you cannot be accelerating! When describing uniform acceleration, you can say constant acceleration or accelerating at a constant rate.

General Tips for both Paper 3 & 4 - Practical Test and Alternative to Practical

- 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 unless asked to do so.
- If you are asked to "use your results" to explain something, then quote them, do not just mention the theory you know!
- 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* – not 9 or *9.2* s (and not *09:24 s*).
- Significant figures are important in the practical papers. Do not quote too many – or too few! Give just the right number. 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! There are usually 2 or 3 significant figures in most readings. Think carefully if you ever use more or less.
- In calculated values, you should never give more significant figures then were used in the data, e.g. the average of 27.95, 26.54 and 27.36 is actually 27.28333333 but should be given as either 27.28 to the four significant figures given in the data or 27.3 as the variation of the readings suggests that four significant figures are too many.
- Normally you can measure an instrument to the accuracy shown by the smallest scale division. However
  - If using a liquid in glass thermometer, you should be able to estimate within the degree markings, e.g. to 0.5ºC or even 0.25ºC.
  - If using a ruler you can usually measure to about 0.3-0.5 mm even though the smallest division is a mm.
- Make sure you understand technical terms used in the question; for example *extension* means the *increase in length* of a spring when a load is added; *calibration* means "*to put a scale on a measuring instrument*", which applies to any measuring instrument.
- When measuring vertical heights, a setsquare should always be used to ensure the ruler is vertical. The setsquare can be shown correctly positioned in a diagram.
- 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.
- 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".
- When measuring time or length be careful to explain the meaning clearly; for example "longer" can mean either a longer time or a longer length. There is no confusion if you use the words "a longer time" or "a shorter time".

When recording your readings in a table:

- Write down **all** your readings clearly. Do not do a calculation in your head or on your calculator without writing the readings down first and saying what they are. Then the examiner can see what you have done and give you the credit you deserve.
- 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 which 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 readings that cover the whole range; for example record the temperature for the full time suggested in the question and don't forget to note down the temperature when you start the stopwatch.
- Make sure all the readings of one quantity in a table have the same number of decimal places as these reflect the accuracy of the measuring instrument. Trailing zeros are often missed out.

Paper 3 Tips - Practical Test

- You 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 time to waste, so be sure you do the right thing first time.
- 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.

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!

Paper 4 Tips - Alternative to Practical

This paper asks you questions about how you would perform practicals in the laboratory at your school. So you need experience of actual practicals not just alternative to practical papers.

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.

Answering the examination Paper
- When answering questions about sources of error in an experiment, just writing "more accurate" is usually not enough - more detail is required
- Sometimes the answers appear too obvious, but they are good practical points; .for example when choosing a measuring cylinder of the correct size to measure the volume of some marbles, the measuring cylinder must be large enough to hold all the marbles!
- 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 in the question; do not assume that it is the same as an experiment you have seen before.
    - follow round the circuit or the rays of light to be sure you understand what is happening.