Examiner Tips for AS and A Level Physics (9702)

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

- Don't give up if you think that you have calculated the answer to the first part of a question incorrectly. You can still score marks for your follow on answers in the remaining parts of the question provided that your follow on calculations are correct.
- Always show your working when answering a question. This will allow you to score marks for your method, even if you make a mistake with the final answer.
- When you have calculated an answer always ask yourself if it is sensible and realistic. If it isn't, go back and check your working.
- Ensure that you are fully aware of what data and formulae are given at the front of the question paper. Learn those formulae that are not.
- During the examination you should monitor your rate of progression through the paper and adjust your rate of working accordingly. This will ensure that towards the end of the examination you will have sufficient time to complete the paper. Completing past papers under timed conditions will allow you to develop an appropriate speed of working.
- Be careful with powers of 10 and take deliberate care if you are keying these into your calculator; make sure that you do not neglect the minus sign of any negative powers and check that your final answer is reasonable.
- All answers should have their correct unit. Pay particular attention to questions that ask you to give the units of your answer and so do not give a unit in the answer space.

Tips for Theory Papers

Paper 1 Tips: Multiple Choice

- Attempt all questions – a mark is not deducted for a wrong answer.
- Use the space on the examination paper to write down clear working for each question. If you try to do too much working solely on your calculator or in your head, you will make mistakes – many of the *wrong* answers to a question can be reached by manipulating the data in a plausible, but incorrect, way.
- Carefully consider every one of the four possible answers before making your final decision as to which one is correct – although you may initially think that the first or second option is the right answer you will need to look at all four before the correct answer becomes clear.

Papers 2 and 4 Tips: Structured Questions

- If you are asked to sketch a diagram, this implies that a simple, freehand drawing is acceptable. However, care should be taken over proportions and you should clearly show and label any important details.
- If you are asked to sketch a graph, you should give as much information on your sketch as possible. Label each axis with the appropriate quantity and unit. Then draw on the shape of the graph, ensuring that it is correctly positioned relative to the axes and that the different parts of the graph line are in proportion to each other. Don't forget to put on your sketch graph the value of any applicable intercept, asymptote, discontinuity or end point (if these are known).
- Memorise all definitions - you will need to be as precise as possible when quoting them in the examination. Quantities are defined in terms of quantities. Units are defined in terms of units. Do not neglect to use "per" if a ratio is essential to the

definition; for example, “pressure” should be defined as “force per unit area” (not “force on unit area”).

- A non-numerical answer can sometimes be made clearer by adding a sketch, but remember to ensure that it is clearly labelled and shows all the relevant information.
- Always give your answer to an appropriate number of significant figures. This can be judged from the number of significant figures of the data given in the question.
- Occasionally a question will tell you the number of significant figures that are to be used in your answer and in this case your answer must have exactly the number of significant figures specified.
- Do not prematurely round up figures at an intermediate stage during a calculation – wait until the answer is reached and only then express it to an appropriate number of significant figures.
- When doing algebra ensure that the terms on either side of an “=” sign do in fact equal each other. It is bad practice to write down a string of terms all on the same line and all connected by an “=” sign as any error can result in the first element being of an entirely different nature and/or order to the last.
- Any explanations that you give should be as clear and precise as possible. For example, saying “A increases as B increases” would be insufficient if what is meant is “A is proportional to B”.
- When substituting in the value of “g” use $9.81 ms^{-2}$ (not $10 ms^{-2}$).

Paper 6 Tips: Options

- See the tips listed above for Papers 2 and 4.
- You should answer *all* the questions in any *two* of the Options. If you answer all the questions in more than two of the Options, the examiner will still only award you marks on two of the Options.
- Some questions may require you to give lengthy non-numerical answers. In such cases look at how many marks are allocated to the question as this may help you to decide how much information to put into your answer. For example, if a question is worth 4 marks then you will need to include a minimum of 4 valid points in your answer (but more if you can).
- Ensure that you read the question very carefully to establish exactly what information you are being asked to relate. An explanation of some physics that does not answer the question will not score marks, even if the explanation is correct.
- The Option Booklets clarify much of the syllabus content, but are not designed to be an authoritative guide as to what can and cannot be assessed in the examination. The lessons taught by your teacher are also a vital part of your preparation for the examination.

Tips for Practical Papers

Paper 3 Tips: Practical Test

- Do not panic if the context of the practical experiment appears unfamiliar. Where appropriate the question paper will tell you exactly what to do and how to do it.
- If you find yourself in real difficulty setting up your practical equipment you may ask your supervisor for help, although you may lose one or more marks for this.
- There are a number of things that you can do to save time: Draw a single table for your results in advance of taking any readings and enter your readings in the table as you take them (so that you do not waste time having to copy them up later). This is also important because you must record all your raw readings before you calculate and record any average readings. If the number of readings that you need to take is indicated in the question paper do not waste time by exceeding this number. Repeat your readings, but remember that it is only necessary to repeat them once (so that you have two sets of values) - do not waste time repeating them more than once.

- All the raw readings of a particular quantity should be recorded to the same number of decimal places which should in turn be consistent with the uncertainty in the readings.
- The uncertainty in a measurement can sometimes be larger than the smallest interval that can be measured by the measuring equipment. For example, a stopwatch can measure time to a hundredth of a second, but human reaction times will mean that the uncertainty in the reading given by a stopwatch is (typically) 0.1s to 0.4s.
- Each column heading in your table must contain both a quantity and its unit. For instance if you have measured time "t" in seconds, your column heading would be written as "t/s" ("t in s" or "t(s)" would also be acceptable). The quantity or unit or both may also be written in words rather than symbols.
- The number of significant figures used in a derived quantity that you calculate from your raw readings should be equal in number to (or possibly one more than) the number of significant figures in the raw readings. For example, if you measure potential difference and current to 2 and 3 sig figs respectively, then the corresponding value of resistance calculated from them should be given to 2 or 3 sig figs, but not 1 or 4. If both were measured to 3 significant figures, then the resistance could be given to 3 (or 4) sig figs.
- When drawing your graph, do not forget to label each axis with the appropriate quantity and unit, using the same format for expressing column headings in a table. Choose a scale such that the plotted points occupy at least half the graph grid in both the x and y directions. The x-axis scale should increase positively to the right and the y-axis scale should increase positively upwards. Use a convenient scale such as 1, 2 or 5 units to a 2cm square as you will then be less likely to make a mistake with the position of your plotted points and it will be easier for you to read off points from your graph if you are calculating the gradient or finding an intercept.
- All your plotted points should be on the grid; points in the white margin area will be ignored. Plot all your observations and ensure that they are accurate to half a small square. A fine cross (or an encircled dot) drawn with a sharp pencil is acceptable, but be careful not to obscure the position of your points by your line of best fit or other working.
- When drawing your line of best fit, ensure you have an even balance of points about the line along its whole length. If it is a straight line, use a clear plastic rule so that you can see points on both sides of the line as it is being drawn.
- Show all your working when calculating a gradient. It is helpful to draw the triangle used to calculate the gradient on the graph and to clearly label the coordinates of the vertices (accurate to half a small square). These values can then be used in the gradient calculation. The length of the hypotenuse of the triangle should be greater than half the length of the graph line.
- If you are required to give a value for the y-intercept, it may be possible to directly read it off from your graph from an axis where x=0. If this is not possible you can instead calculate the y-intercept by using the equation of a straight line. In this case you should substitute into this equation a pair of x and y values from your line of best fit along with your calculated value of gradient.

Paper 5 Tips: Practical Test

Experiment Question

- See tips for Paper 3.
- Although the experiment question in Paper 5 has a similar structure to the experiment question in Paper 3, the techniques that you will be required to use are more demanding. For example, you may be asked to plot a logarithmic graph and to rearrange an equation into its logarithmic form. Therefore you should ensure that you are fully familiar with the mathematical processes for taking logarithms and dealing with exponential functions as well as the use of logarithmic graphs to test exponential and power law variations.
- When you are producing the column headings of your results table be careful how you write down the units of quantities where the logarithm has been found. For example, the logarithm of a length "l" measured in centimetres using a base of ten should be written as log (l/cm). Note that the unit is inside the bracket with the quantity so that "l/cm" is dimensionless. This is because a logarithm is a power and therefore has no units.

Design Question

- Do not panic if the context of the question appears unfamiliar to you. During your A Level studies you will have used or learnt about suitable apparatus for completing the task. If you are asked to use any unfamiliar apparatus the question will supply you with all the details that you need to know about.
- Read the question very carefully – it may give you guidance on those aspects of your design to which you need to pay particular attention.
- When relating your answer you will need to consider some or all of the following:
    - what apparatus you will use
    - what experimental arrangement will be used
    - what procedure will be followed
    - the independent and dependent variables
    - the means of keeping other variables constant
    - how the raw data readings will be processed to give the desired result, e.g. what derived quantities you might calculate or what graph you might plot
    - what *relevant* safety precautions should be in place
- When writing your answer you must write down all the information clearly and *explicitly* - the examiner cannot give you marks for things that are vaguely implied.
- Many of the marks can often be scored by having a good diagram (even if the accompanying explanation is weak) and so you should spend time making sure that your diagram shows all the relevant details and is fully labelled.
- The equipment and procedures that you describe in your answer should be realistic and workable.
- As part of your preparation for this question you should design some of your own experiments, but this should be done under the close supervision of your teacher. Also practise answering past papers.
- You do not need to write a conclusion to your designed experiment or draw sketch graphs of what the results will be. Since no experiment has been carried out, it is not possible to give marks for this.

About the Examiner

Mark Mercer graduated from Cambridge University in 1987 and qualified as a chartered engineer in 1990. In 1993 he left the engineering profession to train as a Physics teacher and has since taught A Level Physics in both state and private schools.

Mark's examining work includes being a Team Leader for A Level Physics as well as an Assistant Examiner for AS Level Physics. He has also worked as a teacher trainer for A Level Physics and has been involved in the development of computer-based testing.