Advice on how to revise for and approach examinations

Tips for revision

Know the syllabus

The Cambridge International AS and A Level Physics syllabus is divided into **sections**; each section is divided into **Learning outcomes**. The advice here refers to both the AS and A Level examinations. It is useful to familiarise yourself with what you are expected to know for examination. You can access a copy of the syllabus on the Cambridge International Examinations website, and you should always refer to the syllabus for the specific year you are entering the examination. Your class notes may contain extra background information to help you understand topics. Use the syllabus to refer to the Learning outcomes and then extract the relevant points from class notes when you make **learning notes** (see below) and **revision notes**.

When planning your revision, allocate your revision time according to:

- the amount of material you need to learn
- how difficult each section has been for you.

Learn the wording of any Learning outcomes that are definitions of scientific terms, and learn any basic proofs that are required in the Learning outcomes – these could form the basis of some questions. Remember to use 'per' in a definition if a ratio is used; for example, **pressure** is defined as **force per unit area,** and not **force on unit area.** However, it is very important not to simply learn the material by rote, but to be able to apply your learning to usual and unusual situations, as exam questions can present you with a situation in a new context.

Make learning notes

Many students learn by repetition. As you learn, you can reduce your class notes:

class notes → **learning notes** → revision notes

Each time you complete a topic, it's helpful to go back through your class notes and organise them in a way that suits your style of learning, to make your learning notes. Learning notes are personal and individual to you and will emphasise anything that you have found difficult.

You can benefit from rewriting class notes using strategies that work for you – for example, with colours, flow diagrams, bullet points or concept maps, in any way that you find helpful and even humorous. Check your notes against the coursebook and leave out, or reduce to a minimum, any points with which you are thoroughly familiar. Include equations.

To make learning notes:

- produce a shortened version of your class notes
- check your class notes against your coursebook
- leave out background, non-syllabus information
- leave out, or reduce to a minimum, points that you know you will never forget; for example, you know from earlier courses, such as the IGCSE®, the properties of magnets and magnetic fields, but a new formula such as $F = BIL \sin\theta$ needs to be emphasised
- avoid long, flowing sentences that contain many points
- use bullet points or short sentences, each containing one or two points that are likely to gain marks in an exam – 'mark points'

- use scientific terminology correctly and as specifically as you can.

Your teacher may have covered topics in a different order from that in the published syllabus. This may also be a logical order for you. Make your learning notes for each topic on separate pieces of paper to put into your folder in your preferred order.

Making learning notes has benefits:

- repeating and reformatting class notes helps learning
- it is a first stage in revision for the exams
- notes are in your preferred style to optimise learning
- you can assess how well you understand each Learning outcome.

Make revision notes

It is likely that you will be trying to cope with other subjects as the exam time approaches, so you can reduce your notes further to make revision notes:

class notes → learning notes → **revision notes**

Revision notes should contain only the detail necessary to get your very best grade. Think about how you will set out these notes and discuss them with your friends. Make your revision productive by making it interesting and fun. Make notes, revision cards or topic maps. Revision should be an active process, i.e. you should be 'doing things', not just sitting and reading a book. Revise with a friend so that you can test each other, or try explaining the physics of a topic to a friend – as if you were a teacher! Try not to copy directly from the coursebook or syllabus, but put the ideas in your own words, checking them later. At this stage you should incorporate your experience of practice questions and their mark schemes from past papers.

You might try another process. Using the syllabus as your starting point:

1 Write down on a sheet of paper or card each definition, law and equation. Some equations will be given to you on the examination paper, but you must still learn what the letters stand for, and the units.

2 On another sheet or card, write down the title of each important experiment.

3 On a third sheet, write down the title for each important idea that you need to understand (e.g. the difference between AM and FM modulation).

4 On the next sheet, write down any parts of the syllabus you do not understand.

Now, with your sheets or cards labelled 1, 2, 3 or 4, you should:

1 Write out the definitions, laws and equations **from your own memory**. Tick each one off when you are sure you know it and it is the same as in your notes or in the coursebook.

2 Test your knowledge by drawing a clearly labelled diagram, listing the readings taken and explaining the conclusion. Go back to the page in your notes or the coursebook to check.

3 Test your understanding by drawing labelled diagrams and/or brief notes. Go back to the page in your notes or coursebook to check.

4 Seek help! Ask your teacher, or read the coursebook.

Know what to expect for each exam

Before you enter the exam room, you should know what to expect in the exam paper you are facing. Exam papers have different types of questions, including multiple choice questions, structured questions and practical questions. It is important to know how long the exam lasts and how many questions you need to answer. You can find this information in the syllabus.

The table below, based on the latest syllabus, shows the types of questions in each of the Cambridge International Examinations papers.

Paper	Level	Type of paper and questions it contains
1	AS	written; multiple choice questions
2	AS	written; structured questions
3	AS	practical; testing skills such as manipulation, measurement and observation, presentation of data and observations, analysis, conclusions and evaluation
4	A	written; structured questions
5	A	written; testing the practical skills of planning, analysis and evaluation

Apart from multiple choice questions, it is rare for questions to be worded as straightforward questions with question marks. They generally have **command terms**. A list with explanations of the most common command terms that you should understand is in the syllabus. The most common terms are: **state**, **describe**, **explain** and **calculate**. Make sure you know exactly what is required for each command term. For example, there is no point in writing a long explanation of why something happens if the question merely asks you to state what happens.

Use past papers to help you revise

You will find it helpful to look at or practise past exam papers.

You will also need to learn and practise the practical skills that are tested in the AS practical examination and the A Level paper that concentrates on the skills of planning, analysis and evaluation.

Your teacher may have copies of past papers and mark schemes.

Approaching the examinations

Make sure that you know about the data and formulae given at the front of the question paper. You should be so familiar with this data and these formulae that you almost do not need to look them up, but it is better to refresh your memory each time that you use an equation, to check that you have not made a mistake in writing down a formula or have used a wrong power of ten in a constant.

Suggestions on how to approach multiple choice question papers

Understanding multiple choice questions

Each question may be posed on its own or may be preceded by some information. There are four answer options: **A**, **B**, **C** and **D**. You must choose the one that is the correct answer.

Some questions have a simple construction in which the options **A**, **B**, **C** and **D** appear directly below the question. The options could be one or more sentences long. Other questions have a construction in which each option is a row in a headed table.

During the exam

When tackling questions:

- read questions through more than once
- check whether a positive or negative answer is being asked for, e.g. whether the question says 'which of the following is ...?' or, 'is **not** …?'; for example, when asked for an incorrect ray diagram, be careful not 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 in the space provided near the question) so you can check it later; do not try to do all the working in your head, as you are likely to make mistakes
- if option **A** appears to be correct, read on and check the others before you confirm your choice
- do not look at the pattern of answers on the answer sheet to predict the correct option – you should not expect there to be an equal number of correct option letters in the whole exam; likewise, if the last answer was an **A**, you cannot assume that the next one must be a **B**, **C** or **D**, for example. For questions that assess topics which you find difficult, try to recall the relevant section of your revision notes before looking at the options (**A**, **B**, **C** and **D**) available.

Suggestions on how to approach papers with structured questions

During a 'real' examination is not the time to work out your preferred strategy for coping with structured questions in exam papers. If you can, practise beforehand by using, for example, past papers, and try different exam approaches to see what is best for you.

Exam papers aren't long enough to test your knowledge and understanding of all the Learning outcomes. Ensure that you have revised well and are prepared for your less-favourite topics to turn up in the exam. In both of the structured-question papers, each main question can assess Learning outcomes from **more than one syllabus section**.

Approaching the exam paper

The first question in a structured-question paper is sometimes slightly easier, so it can be completed with relative ease and gives you confidence. However, make sure that you read through all of the questions thoroughly and then decide which question to tackle first. You should monitor the time that you spend on each question throughout any paper and adjust your working accordingly. This will ensure that towards the end of the examination you will have sufficient time to finish. Practise with past papers under timed conditions to develop your timing skills.

Always show your working when answering a question. You must include the method as well as the answer, and show every step in each calculation. It is also true that you should not give up on any question, but should show what you can do, even if you cannot work the question through to the end.

In calculations, it is best to start by writing down the equation that you will use, then substitute the values in another written expression, and finally give the answer. All of these stages should appear. During the calculation do not prematurely round your answer, and always keep and use more significant figures than are given in the question. You can round your answer at the end, but make sure you do so correctly: for example, 1.86 is 1.9 to two significant figures, **not** 1.8. Always use g as $9.81\,\text{m}\,\text{s}^{-2}$ and not $10\,\text{m}\,\text{s}^{-2}$. Check that the units you have used are consistent; for example, if the distance is given in km and the speed is given in $\text{m}\,\text{s}^{-1}$, then you must convert km to m.

When you have obtained the final answer, make sure that:

- it is a sensible and realistic number; for example, if you have worked out the current in a wire to be 3 000 000 A, then this is likely to be wrong and you should look for the mistake
- it has units; look out, in particular, for questions that ask you to give the units of your answer or that do not have the units on the answer line
- it has the correct number of significant figures; this should be the least number of significant figures in the data in the question – this data is often given to two or three significant figures, so if you write your answer down to one or to four or more figures, then you should have a good reason. Think very carefully indeed before you write down all the figures you see on your calculator!

If you have difficulty in giving an answer in writing, then provide a sketch or diagram; this is sometimes much easier than using many words. Diagrams or sketches should always be labelled with as much detail as you can. Try to make your explanations as clear as possible and use technical terms correctly; for example, it is better to say 'resistance is inversely proportional to area' than 'as area increases resistance decreases'. Sketch graphs should have their axes labelled, and the values of any important points on the axes should be shown, particularly the origin.

Some questions require longer written answers. Before you start these questions, look at the number of marks that they are worth. This will help you decide how many important points you should include in your answer. Then it is best to briefly plan the structure of your answer before starting to write. If there are three marks for the question, then include **at least** three different and valid points if you can. You do not need to start your answer by rewriting the question itself because then there may be too little space left for your answer.

Suggestions on how to approach practical papers

Practical examination papers

Read through each question carefully before you start to take any readings. Do not worry if you have never met the experiment before or if it contains unusual apparatus. The question paper itself should tell you what to do, and you must follow the instructions that you are given.

If there is a problem with your apparatus, for example the power supply does not work, then you can ask the supervisor for help. You may lose some marks if the supervisor has to set the apparatus up for you, but not if there was a genuine failure in the apparatus.

The syllabus gives a lot of information on the skills that you will need. Many of these skills are straightforward but may not be clear from the instructions for the examination. For example, you should choose values for the independent variable that:

- cover the largest possible range of readings that can be obtained using the apparatus, or that are consistent with the instructions given
- give, ideally, an even spread of readings across the range.

For example, if you are asked to measure the resistance of a wire for five different lengths and the wire is stretched along a metre rule, you would not choose to measure lengths of 1, 2, 3, 4 and 5 cm or 10, 20, 30, 40 and 100 cm, but you might suggest 20, 40, 60, 80 and 100 cm.

You may be asked to make a table of your readings. It is best to plan this and to draw the columns and headings **before** you take any readings. Then, as you take each reading you can enter it directly into the table. This will save time.

Before you start:

- look through the question to see whether you need a column for a derived quantity as well the columns for the readings themselves
- think about which readings you will repeat.

For example, if you are measuring the resistance of different lengths of wire, you may record the value of current and voltage twice and calculate the resistance for each length twice. This means that the column for resistance has to have three small sections, two for the values of resistance and one for the average. Do not waste time taking readings more than once unless you are asked to do so. Thus the column headings and first row of your table might be:

Length / cm	Reading 1		Reading 2		Resistance / Ω		
	Current / A	Voltage / V	Current / A	Voltage / V	Reading 1	Reading 2	Average
10.0	1.20	3.45	1.22	3.50	2.88	2.87	2.87

Make sure that each column has a quantity and a unit.

All the readings in a particular column should be recorded to the same number of decimal places, corresponding to the precision of the instrument that you are using. In the example above, every current recorded should be to the nearest 0.01 A if that is the smallest division on the instrument. If the current happens to be 1.20, do not just write down 1.2, as there will be other currents such as 1.51 that have a different number of decimal places.

In the example above, notice that the length was written as 10.0 cm, as it is possible to measure to 1 mm on a rule. Of course the uncertainty in a reading can be larger than the smallest division on the instrument and the ammeter readings may be fluctuating by more than 0.01 A. It is usually best to write down what you see on the instrument. Sometimes the readings will differ when repeated, due to random error.

The number of significant figures in any derived quantity (the resistance in the example above) should be equal to the smallest number of significant figures in the data. If your measurements permit, you may also give one more figure than this. In the example above, the resistance could be given to three or four significant figures.

In most practical examinations you will be required to draw a graph to represent the data you have collected. Make sure before the examination that you have a sharp pencil and a long, clear plastic ruler to draw the graph. You should be thoroughly familiar with the details about drawing graphs, in the section on analysing results in Chapter P1 of the coursebook. To summarise:

- each axis must be labelled with the appropriate quantity and unit
- the plotted points should occupy at least half the grid in both the *x* and *y* directions
- the *x*-axis scale should increase positively to the right
- the *y*-axis scale should increase positively upwards
- the scale should have 1, 2 or 5 units to a 2 cm square
- all plotted points should appear on the grid itself and none should be outside of it
- check that your points are plotted accurately
- when drawing a line of best fit, make sure there is a balance of points on either side of the line along all of its length
- when finding a gradient, draw a triangle that covers more than half of the actual graph line
- show all your working when calculating a gradient
- if you are asked for an intercept, you can read it from the graph; if this is not possible, you can take the equation of the straight line and a point on the line to calculate the intercept.

A practical examination will also ask you to calculate uncertainties and suggest improvements. It is important that these improvements relate to the actual experiment and are possible to carry out, although you will not have to alter the apparatus yourself or take further readings.

Written examination of practical skills

The best preparation for a written examination of practical skills is to have practised the skills you need to answer the examination questions on many occasions, by:

- planning a number of experiments yourself
- taking readings according to your own plan
- evaluating the results.

It may help for you to swap plans with a fellow student and for each to try to follow the other's plan. You will see how difficult it is to describe in detail what is to be done.

As the examination time draws closer, practise by, for example, looking at past papers and their mark schemes under the supervision of your teacher. Remember, you need to have developed and practised the skills you need in 'real' experiments. You need the ability to think for yourself, to know what apparatus is available in a physics laboratory and to know how it is used, so that you can take the correct approach to the questions in the exam paper.

There are three main types of question you will face in an examination of this type.

1 Planning question

First read the question through several times and identify the dependent and independent variables. You may have to consider a number of other issues, which may involve:

- choosing what apparatus you will use to solve the problem set in the question
- describing the experimental arrangement
- describing a sequence of instructions to take the readings
- stating and describing how you will keep other variables constant (remember to include sufficient detail)
- describing how the data is processed, often in the form of a graph (remember to state the axes on the graph and the form you expect the graph to take; if you sketch the graph, make sure the sketch is consistent with your description)
- describing relevant safety precautions; give detail and reasons; do not just say, for example, 'do not touch the resistor' but explain that the resistor may be hot.

The question will suggest a structure, and it is sensible to make sure that your answer follows this structure and includes as much detail as you can about each point as you go along. Marks for additional detail are likely to be offered, so you should answer each section with a wealth of detail and supporting material. For example, you could suggest how additional variables are kept constant, give circuit diagrams or describe additional safety precautions.

The diagram of your apparatus is important:

- it should be labelled with as much detail as you can provide
- you should check that it is possible to take the measurements and alter the independent variable with the actual apparatus that you draw
- you should re-check your diagram, imagining that you are another person who is not familiar with the experiment – could they actually take the necessary readings for the experiment?

2 Analysis and evaluation question

Refresh your memory on the important points in the practical examination paper section guidance above concerning significant figures, graphs, gradients and intercepts; they also apply to a written examination of practical skills.

You should also practise using expressions that involve the exponential function and rearranging them to plot an appropriate graph. More help is given on this topic in Chapter P2 of the coursebook.

Remember that the unit for a logarithmic quantity is written slightly strangely, for example ln (d / cm). The logarithm itself does not have a unit.

You will need plenty of practice in using calculated uncertainties to draw error bars and in using these error bars to draw a 'worst acceptable' line as well as a line of best fit. You should draw your 'worst acceptable' line as a broken line or, preferably, clearly label each line as 'best-fit line' or 'worst acceptable line'.

The skills of data analysis involved in this question are ones that you can practise again and again, for example by using past papers, until you are sure that you can:

- complete tables of results using the right headings
- rearrange equations such as: $y = mx + c$, $y = ax^n$ and $y = ae^{kx}$
- plot ordinary and log graphs, knowing how logarithms are taken of each side in the above equations
- show error bars on graphs
- calculate gradients
- use the correct number of significant figures
- draw curved trend lines and tangents when required to do so
- write sensible conclusions.

If you practise using past papers, ask your teacher for the mark scheme or sample answers, or swap with a friend and discuss your answers, to make sure that you have understood all of the points. If you do this, then the examination itself will not be a great surprise and you will show that you have the determination to succeed.

Finally

Some questions in examination papers are likely to seem strange, and you may be unsure of the answer. There is no need to panic, as this is likely to be the same for every student. If you are in doubt, first make sure that you have understood the question, and then make sure that you are describing when the question says 'describe' or applying physics principles when the question says 'explain'. Try to think carefully to yourself about what physics principle is actually involved, and perhaps roughly plan your approach before starting to write the answer. Avoid repeating the question or writing out pages from your notes or from the coursebook, but make it your aim to relate the principle to the question itself. An examination is trying to discover what you really know and can do. If all has gone well during your course and when using the coursebook, you will have ensured that you not only understand these principles but can apply them to a range of questions. If that is the case, then you can be confident of giving a good performance.

The questions, example answers, marks and comments that appear in the Coursebook and this accompanying CD-ROM were written by the authors. In examination, the way in which marks would be awarded to answers may be different.