

**Physics
GCSE****Introduction**

Your physics GCSE course has been designed to be a comprehensive, clear and usable practical course which develops the necessary skills for GCSE, as well as ensuring that you learn and retain the information for your examination. Accordingly, each lesson has a summary, and clear statements of aims and context.

These features will ensure you know exactly how what you are learning fits into the overall plan of the course; what the main learning features of the lesson are; and what you need to revise most! Moreover, almost every lesson includes a self-assessment test, which will help you to monitor your progress, as well as tutor-marked tests; and activity sections which will help you to put your knowledge into practice in the way required by GCSE. In short, the course has been designed to help you learn how to exercise the physicists' skills which GCSE requires, and to learn the information required, but it has been designed to do so in a way which is clear, and suited to correspondence or distance learning.

In this Introduction we will make clear the other requirements of GCSE, and the ways that your Oxford Open Learning Course meets these. We discuss the textbooks which the course uses; the organisation of lessons and test material; the differences between Key Stage Four, GCSE and O level; and suggestions as to the best study methods for using your GCSE course.



Oxford Open Learning

Textbooks

It is essential that you acquire the following textbook.

Jim Breithaupt: *Key Science, Physics* Nelson Thornes
3rd ed., ISBN 0-7487-6243-4

Key Science: Physics is written in a friendly and approachable way. It is this book that we recommend that students purchase to accompany the course.

If you are keen to read further textbooks, then you will find the following is also useful.

1. M. Nelkon: *Principles of Physics* (8th ed) Hart-Davis
ISBN 0-5820-5416-8

This is the latest edition of a much older style textbook, but explains topics in more detail than many more modern books. While it has been altered to reflect modern trends in the teaching of physics, it also contains many topics which are not now studied in the new GCSE syllabuses, and omits a number of the essential topics.

or:

2. T. Duncan: *GCSE Physics* (3rd Ed) Murray
ISBN 0-7195-5301-6

Duncan can be used in conjunction by students who would like further reading. This is an ideal textbook for GCSE students, especially those who find that *Key Science* is too brief. Duncan has been written to match the newer ideas, and in particular places far more emphasis on the relevance of physics to everyday life than do earlier books. It tends to a simple style of presentation, which makes it easy to read, but is sometimes almost too simple.

One easy way to purchase supporting texts is through the OOL website (www.ool.co.uk). You'll find other useful books in your library or bookshop.

The Arrangement of Lessons

All reading references are to Breithaupt.

| Lesson | Subject | Reading |
|--------|--|---------------------------------|
| 1 | Introduction to Physics: Measurement, Scales and Instruments | Introduction |
| 2 | Energy, Sources, Forms and Uses | Topic 1.1, 6.3, 4 |
| 3 | Temperature and Heat; Calorimetry | Topic 3, 5.1, 5.4 |
| 4 | Heat Transfer and the Effects of Heat | Topic 5.1, 5.2 to p 53, 5.5-5.8 |
| 5 | Gases and their Behaviour <i>Test A</i> | Topic 5.2, 7.2, 7.3 |
| 6 | Light: Geometrical Optics | Topic 14.1, 14.2 |
| 7 | Refraction | Topic 14.3 |
| 8 | Diffraction | Topic 11.2 |
| 9 | The Electro-magnetic Spectrum <i>Test B</i> | Topic 5.7, 15.1, 15.2 |
| 10 | Light and Water Waves | Topic 11 |
| 11 | Sound Waves | Topic 12 |
| 12 | General Wave Behaviour <i>Test C</i> <i>Coursework (1)</i> | Topic 11 |

| | | |
|---------------|--|------------------------------|
| 13 | Force | Topic 16, 17.3-17.8 |
| 14 | Motion | Topic 18.1-18.6 |
| 15 | Work, Energy and Power | Topic 19.1-19.2 |
| <i>Test D</i> | | |
| 16 | Kinetic Theory | Topic 7.2, 18.6 |
| 17 | Properties of Liquids, Solids and Gases; Materials and Energy Storage | Topic 3.1-3.4, 6.1, (7.2) |
| <i>Test E</i> | | |
| 18 | Current Electricity | Topic 21 |
| 19 | Electrostatics | Topic 20 |
| 20 | Magnetism and Electricity | Topic 22 |
| 21 | Uses of Electricity | Topic 21.1-21.2, 22.6 |
| <i>Test F</i> | | |
| 22 | Atomic Structure (Extension Material) | Topic 9.1-9.4, T8, T10 |
| 23 | Radiation and its Effects | Topic 8.1, 9 |
| 24 | Electronic Components | Topic 23.1, 23.3- 23.4 |
| 25 | Uses of Electronics | Topic 23.2, 23.5- 23.8 |
| <i>Test G</i> | | |
| 26 | Fluids | (T7.2-7.3), 17.3- 17.6 |
| 27 | Surface Tension (Extension Material) | Topic 17.8 |
| 28 | Fluid Flow (Extension Material) | Topic 17.7, 19.3 |
| <i>Test H</i> | | |

| | | |
|----|---|-----------------------------|
| 29 | Hydraulic Pressure (Extension Material) | Topic 17.2 |
| 30 | Energy Resources and Domestic Energy | Topic 6 |
| 31 | The Solar System | Topic 1.1, 1.3 |
| 32 | Movement in Space | Topic 1.2, 1.3, T2, 18.8 |
| | <i>Test I</i> | |
| | <i>Coursework (2)</i> | |
| 33 | <i>Revision and Specimen Examination (Test J)</i> | |

Extension Material

Several of the lessons include sections of material which, while not strictly required by the syllabus, provides you with opportunities to enhance your knowledge of physics in ways that will help you to deal better with topics that *are* specified in the syllabus. This additional material is called **Extension Material** and each section of it is labelled as such. Extension Material within a lesson can also be identified by the fact that it is printed in italics, *like this*.

A few of the lessons (Lessons 22, 27, 28 and 29) consist **entirely** of Extension Material. These lessons are not printed in italics. Instead they are clearly labelled as Extension Material on the first page of each lesson, and in the Arrangement of Lessons that appears earlier in this Introduction.

Assessment

At the end of each lesson you will find a self-assessment test. You should answer these questions but you should *not* send the answers to your tutor. Specimen answers are provided against which you can check your answers.

You should answer tests A-J as you encounter them. These tests should be sent to your tutor who will mark them and comment on them. Specimen answers will be sent to you after you have attempted the tests.

At the end of the course you should attempt the specimen examination J, and send this to your tutor for assessment.

Preliminary Information

This course is written to match the AQA Physics syllabus 3451.

You should be sure to acquire your own copy of the syllabus, either via the AQA Publications Dept or from the website www.aqa.org.uk.

The syllabus can be purchased from Publications, AQA, Aldon House, 39, Heald Grove, Rusholme, Manchester M14 4NA (tel: 0161-953-1170) or downloaded from www.aqa.org.uk.

This syllabus is broadly similar to those set by other exam boards, but there are one or two things you should bear in mind about GCSE in general.

Firstly, it is related very closely to the everyday use of physics, and places less emphasis on the experiments which led to our current knowledge of physical principles. There is a new section on Earth and Space, allowing the student to learn about some of the more exciting aspects of physics.

Secondly, the ever-expanding area of electronics and electronic devices is given considerable prominence.

The order in which topics are presented in this course does not correspond to the arrangement of topics in any one text-book. This will lead to some overlap of topics. Don't worry if you find that you are asked to study some parts of the text-book more than once. The process of gaining knowledge cannot be represented as progress in a straight line. You will find that some topics become clearer to you only after you have looked at them from several viewpoints.

Our course will prepare you for your examination, and if in answering a question you include reference to material which is not specifically mentioned in the syllabus the examiner will not penalise you. It is more likely that you will gain their goodwill as it will show you have read around your subject. Even with modern, highly structured, examinations there is scope for the really good candidate to get credit for knowledge beyond the minimum required.

As indicated earlier, a certain amount of repetition will occur in your study. This is deliberate and will help to build and reinforce your knowledge.

Inevitably, physics requires some mathematical work. It is assumed that you are studying mathematics at the same time as you study physics. It is not possible to be sure that you will have studied in depth each part of mathematics needed in the physics course, and help will be given in the lesson where it is likely to be necessary. Ideally, you should have studied Maths either to O Level, or to higher tier Key Stage Four/GCSE standard. Students who have not reached these levels will have to work especially hard on some of the more mathematical sections.

Method of Study

Each set of lesson notes contains a number of activities, a set of key-words and a chart indicating how the subjects studied are related. You should use these notes as follows.

1. Read the lesson notes thoroughly until you feel you have a clear idea of what they have to say. Sometimes information will be given which is not in the text-books, sometimes the lesson notes will tell you how to use the text-book.
2. When you come to an activity, try to carry it out, or make a note to carry it out as soon as you can. The GCSE syllabus expects you to take an active interest in the subject.
3. Read the recommended chapters or pages in your text-book(s). If necessary, re-read until you are confident you understand the material. In most cases there will be some exercises in the text-book. Have a try at these, especially numerical questions — you cannot have too much practice.
4. When you have mastered the material in the notes and text-book(s), look at the key-words given. Check that you can write a brief, clear explanation or definition of each one.
5. Look at the summary chart, and see how it relates to what you have read.
6. Answer the self-assessment test without reference to the notes or text-books. When you have finished check your answer against the specimen answers.
7. If you cannot understand any part of the study, it should be possible to discuss it with your tutor. Give a brief and specific statement of your problem. If it is a question in a text-book, write the questions out for your tutor (it has been known for students to have a different edition!)
8. At the end of a section, when a lettered test is due, do it under strict examination conditions. There is no point in referring to your notes or a text-book. Let your tutor see what you have understood and they will be better able to help you.
9. When your lettered test is returned, check any comments and corrections. If you are not absolutely certain of your tutor's comments, don't be afraid to ask for clarification.

Practical Work

Physics is an observational science. The GCSE syllabus assumes a large amount of experimental work. The type of experiments a student studying in a school or college would undertake are described in the text-books. Even if you have only limited access to a laboratory, you must try to complete as many experiments as possible. If you are unable to undertake all the experiments prescribed by the syllabus, you must be able to describe the experiments at least. It would be a mistake to start this course unless you have some access to a laboratory.

To help students without automatic access to a laboratory, a number of activities are described which should be possible with the help of domestic equipment or easily obtained objects. Don't ignore these activities. You must give the examiner the impression that your knowledge is based on practical *and* theoretical study.

This course concentrates on the theoretical rather than the practical side of the subject because it is not possible for a textbook to act as a substitute for real practical experience.

The AQA Syllabus

This course is designed to meet the needs of the AQA syllabus 3451. This syllabus, like the GCSE physics syllabuses set by other examination boards, is based on the requirements for National Curriculum Key Stage 4. Key Stage 4 is the stage that schoolchildren reach round about the age of 16. They would normally be expected to combine physics with other science subjects but post-16 students may take physics by itself.

Written Papers with Different Levels of Difficulty

AQA, like other GCSE boards, sets written papers with different levels of difficulty. When you enter for the exam, you nominate a "tier" (a level of difficulty) and you take the written paper(s) set for that tier. In 2003 and later years, there are two tiers, Foundation (grades C-G) and Higher (A*-D). If you opt for the Foundation level, you cannot do better than a grade C. *You do not need to decide at this stage which papers you will be taking.*

Grade Descriptions

There are eight possible grades at GCSE: A* (“A starred”), A, B, C, D, E, F and G. The bottom two grades indicate a very poor performance and you should expect to aim much higher than that.

It is generally agreed that a grade B at GCSE is equivalent to a good pass in the old O level examination and a grade C is the absolute minimum if you want to go on to ‘A’ level. This course is designed for students aiming for grades A*-D.

- How do you know which tier you are aiming for?

The short answer is that it is very difficult. If you follow your studies diligently, you should reach Grade D, at least. The Oxford Open Learning course assumes that you are aiming to take the Higher Tier exams. But you don’t have to decide at this stage. Much will depend on how well you cope with the course.

- What if I aim for the Higher Tier, but don’t do well enough?

Don’t worry. Even if you have a disaster in the examination, it should still be good enough to earn you a grade D, and you are permitted to achieve this result.

The Examination Structure

AQA students take one written paper and submit coursework, as follows:

Written Paper (80%) 2¼ hours long

The examination will consist of structured questions, some of which will require extended writing. It can be taken at either foundation level (3451F) or higher level (3451H).

Coursework (20%)

The coursework component is the same for all candidates, whatever tier they are entered for. It tests the ability to plan and carry out scientific investigations in a physics context. Centres (e.g. a school or college) may devise their own investigations. Coursework is normally marked by the tutor.

Coursework

Coursework is perhaps the biggest problem for learners who are studying at home or on an open learning programme. You will need to discuss with your tutor how much practical work is possible, if any, and how you can show familiarity with the necessary skills.

The syllabus splits these skills into four different strands:

- (a) **planning** (predicting, planning and doing preliminary work)
- (b) **obtaining evidence** (using a procedure to collect data)
- (c) **analysing and considering evidence** (make and explain conclusions)
- (d) **evaluating** (considering the experiment critically)

Your coursework projects will need to contain some detail on each of these different aspects.

It is essential that your practical work should demonstrate your abilities in all of these areas, as it is for these skills that you will be awarded marks.

Within these four areas, your tutor will also be looking for you to have achieved various “statements of attainment”. These are laid out clearly in your syllabus. Whenever you are producing a piece of coursework, it is important to make sure that as many of these statements as possible are included.

This course contains as much help with practical work as it is possible for such a course to include, but it is difficult to give you extended guidance without face to face tuition.

You will be expected to plan, tackle and write up an investigation (or number of investigations) in the field of physics. Your tutor will advise you on suitable projects which match the level of attainment you are aiming for. The syllabus contains some detailed guidance on this, so you would be well-advised to study it.

Your tutor will eventually give you a mark out of 30 for your investigation(s). They will also collect suitable work from you for moderation by the examiners, together with information about how the investigations were set up and why a particular mark was awarded.

It is not necessary to worry too much about your coursework at this stage. You should not think about attempting these

until you have a good grounding in basic physics. However, you should at an early stage discuss a timetable of coursework with your tutor.

You should be considering doing several pieces of coursework, as this will increase your chances of a good overall mark. This is possible, as your tutor will send in the best mark that you have achieved for each skill area, so that it does not matter if you do not do particularly well in one.

You will need to give your tutor a great deal of information about any practical work that they do not supervise. You also need to verify that all the work is your own, except for any specific areas where you have had help from someone other than your tutor. Here you will need to state the nature of the help that you received on the forms provided for this purpose.

The important thing to remember is that the coursework is not there to make the course more difficult for you. It is an opportunity for you to display your skills under non-exam conditions, and also your practical abilities. It gives you the chance to notch up some good marks before you take your exams.

AQA's Suggestions for Investigations

With any science coursework, there are four skills you need to demonstrate: planning, obtaining evidence, analysing evidence and evaluating evidence.

If you are unable to obtain access to laboratory facilities at a school or college, AQA make the following suggestions for simple investigations:

| Title | Equipment that may be used | Notes |
|--|---|--|
| Factors affecting the time period of a pendulum | A simple pendulum may be made by tying a mass onto the end of a piece of string; stopwatch (wristwatch) | Initial amplitude, mass and length may all be tried |
| Does a rubber band obey Hooke's Law? | Rubber bands, ruler, masses whose weight is known | Can be expanded to bands in series and parallel |
| How does distance affect the height of lettering that we can read? | Tape measure; graph paper is ideal for putting the letters on | Can also investigate the effect of using different colours |

| | | |
|---|---|---|
| The bending of a cantilever | Metre rule or long lath; string; weights; C-clamp | Investigate the amount of deflection for various loads |
| What is the best material for thermal insulation? | Empty, clean pet-food cans to contain hot water; thermometer; bubble-wrap, newspaper, etc | Difficult to make “fair test”, as materials vary greatly in thickness |

Here are some investigations you could try if you have access to laboratory equipment:

- Resistance of a wire
- Extension of a spring
- Electromagnets
- Pendulums
- Bouncing balls
- Inclined planes
- Parachutes
- Radioactive emissions from a wristwatch
- Ball bearings running down a slope

Most of these investigations are covered in the OOL course and there are many other alternatives. Help will also be given with planning, recording results, drawing conclusions and evaluating your own work.

Using the Internet

All students would benefit from access to the Internet. You will find a wealth of information on all the topics in your course. As well as the AQA website (www.aqa.org.uk), you should get into the habit of checking the Oxford Open Learning site (www.ool.co.uk) where you may find news, additional resources and interactive features as time goes by. If you have not already done so, you may register for your free copy of *How to Study at Home*, our 200-page guide to home learning, or enrol on further courses. Put it on your Favourites list now!

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