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**BOOK REVIEW**

**Calculations for A-Level Physics, 4th edition**

This welcome updating of Lowe and Rounce’s classic book is a ‘must buy’ for any physics department. For those not familiar with the original, it contains chapters on different topics in physics and then gives worked examples of calculations, followed by examination questions. The book has chapters on all of basic physics, updated to include the 2002 specifications, as well as most of the standard options available, for example medical physics and astronomy.

The book’s great strength is its simplicity. Problems are outlined clearly and solutions are laid out to show every stage of the working. There is even an introductory chapter on general topics, like units, estimating your answer and examination technique. All of this is backed up by a thorough index. Countless students over the 15 years since the first edition have benefited from this comprehensive book and many more will do so from this new edition.

I would recommend that your school should buy one copy of this as a departmental resource and that every A- and AS-level student should have one as well.

Steven Chapman

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**Calculations for A-Level Physics, 4th edition**

*TL Lowe and JF Rounce*

**Rating:** excellent

**Price:** £16.50

Details: Published 2002, Nelson Thornes, Cheltenham, 328pp

ISBN: 0 7487 6748 7

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**BOOK REVIEW**

**The Science of Soccer**

This is a cute little book, written for anyone who enjoys a bit of maths and physics with their football. Written by retired physicist, keen sportsman and football fan John Wesson, this book oozes the sort of enthusiasm for the game that will either seem quite normal or totally pathetic. This is not a book for people with no love for the game, but if you are interested to see how a graph of ‘attendance’ against ‘the rank of a team in the football league’ shows exponential decay —this is your book.

In the first half Wesson sets out the mechanics of the game: the ball, the bounce, the kick…. He deals with everything from first, Newtonian, principles having carried out field research with the Oxford United Youth team. There is useful information here for teachers who want to be able to give their students some interesting numbers to crunch in mechanics classes. Unfortunately the units are yards, miles per hour and inches. But it is still useful to know that a kick takes about 0.1 s while contact with the ball is only for around 0.01 s. “The foot is accelerated to 50 miles per hour over a distance of 3 feet”—calculate the acceleration then! ‘Is Wesson correct to claim that the force on the foot is 30 times its own weight?’ There’s a useful exercise for your students.

The mechanics of throwing, catching and curling the ball are okay, but the real interest for me is in the anecdotes, the history and the back-of-an-envelope calculations.

But this is a book of two halves. There is a change in tempo in chapter 5 as Wesson discusses why the laws of the game have developed as they have, moving on
to game theory, discussion of the league system and the probability of the best team winning, finishing with the economics of the game.

I suppose what I like about this book is that Wesson is so obviously not a marketing/strategy/analyst/professional sports coach. He is just a football fan, finding out about the game he loves, and writing interesting stuff about it. Who but a fan would be interested to see a map showing the birthplaces of the 25 players who played for England over 60 times since 1945? This isn’t science—this is sheer indulgence by scientists who love football! If you are wondering who figures in that list of 25, this is definitely the book for you.

Even if you loathe football, there will undoubtedly be students in your classes who love it, and there is plenty in this book to encourage those students to read some physics, improve their graph-reading skills and apply some maths. (This is a great book for maths teachers too.) It is useful background but not a textbook for sport scientists—there is insufficient depth in any analysis and some very dodgy physiology (ignore the paragraph on muscle power). Wesson’s bibliography traces publications relating to the path of the ball from Galileo to boundary layer theory, but he seems to be unaware of other soccer science publications. In its context, that doesn’t matter. This book is a good starting point for using maths/physics skills to think about football, it is lots of fun, a great resource for a teacher and a must for the school library.

The Science of Soccer
John Wesson
Rating: very good
Price: £14.99 pbk

New Higher Physics, 2nd edition

Here is a textbook for students who are following the Higher Physics course in Scotland. This is a one-year post-16 course broadly equivalent to AS physics. The author, Adrian Watt, with the watchful assistance of Editor Jim Page, brings unparalleled experience of the Higher Physics course to this book and the result reflects this. For a student embarking on the Higher Physics course, this is a must-have textbook. At £16.99 it is about par for the course in terms of value for money.

The book is structured well, following the three main sections of the Higher course, Mechanics and Matter, Electricity and Electronics, Waves and Radiation. Coverage is good with each section including good line illustrations in two colours and black and white photographs to show applications. The style is very businesslike with little space for extended reading about the history of physics, applications in detail or potential challenges to learners struggling for the first time with some key ideas. However, what you do get is a no-nonsense coverage of all that is important in the Higher course. The book is comprehensive rather than innovative. Many of the illustrations are based on the sort of small practical tasks students will be faced with during their course. Apparatus is drawn to look just like it is in the lab. I thought this was a commendable attention to detail. Clear headings in soft font, coupled with the use of shaded boxes, help to offer the reader some sense of structure and a route through.
Some special features are worth noting. At key points throughout the book are worked examples of test ‘consolidation’ questions. These are accompanied by a set of consolidation questions for students with answers at the back of the book. Exam style questions follow, again starting with a worked example. As a guide to the value of this resource I counted more than 50 test questions in the first of the three sections alone. Add to this number the ‘consolidation’ questions and you have an excellent learning resource. I would have preferred a shade more information in the answers section. A glance shows that the vast majority of questions have no more than a single numerical answer. At the end of the book the authors have included a revision summary in the form of behavioural objectives. A short, and far too brief, section on avoiding common mistakes together with a formula index complete the material for students.

In summary I find that I can recommend this book. It will be a valuable resource for teachers and students engaged in the Higher Physics course. The authors have moved this second edition on and it deserves to be given the ‘new’ label.

Bob Kibble

New Higher Physics, 2nd edition
Adrian Watt
Rating: very good
Price: £16.99
Details: Published 2002, Hodder & Stoughton Educational, London, 272pp
ISBN: 0 340 84776 X
www.hodderheadline.co.uk

BOOK REVIEW

Standard Grade Physics, 2nd edition

This is a course book written to support all students following Standard Grade Physics in Scotland. Already a popular choice among Scottish schools, the second edition offers a complete overhaul of its predecessor. It has embraced all recent Arrangements changes and has been given the full-colour makeover. The result is an attractive and accessible book that will be seen as interesting to dip into as well as a valuable support for learning.

As expected, the seven key topics in the Standard Grade course form the body of the text. Unlike some physics courses, Standard Grade has been developed deliberately around an applications-based philosophy. The book might not find much of a market beyond Scotland for this reason. However, an enlightened teacher would be advised to have a copy in the lab or the library regardless of which course he or she follows. It is simply an appealing book.

The full-colour photographs and excellent illustrations help to bring the ideas alive and would certainly engage the reader. The snippets called ‘fascinating physics’, peppered throughout the book, provide added interest. Each section includes worked examples of key development questions as well as concluding with a summary and questions. Learning outcomes are listed in each section and are colour coded to distinguish general level from credit level outcomes. Exam style questions are found throughout the book. There is a formula summary page at the end which uses the triangle notation for simple relationships—much loved by some but loathed by others. A minimal ‘revision’ notes page attempts to guide readers before the exam. I’d like to see a more thoughtful and structured space allocated to this area, increasingly common in course books but rarely that helpful. The final
pages include answers to all questions. I was encouraged by the author’s attempts to offer far more than single-number answers. Many of the questions require more than a calculation and the answers reflect this.

So here is a book with a captive market but one that should certainly be on the agenda for students embarking on the Standard Grade course as well as departments wanting to provide students with a lively, engaging course book. It marks a significant step forward in the quality of material that has hitherto been available in Scotland and would not be out of place in any school library across the world. Recommended.  

Bob Kibble

**Standard Grade Physics, 2nd edition**  
D McCormick and A Bailie  
Rating: very good  
Price: £12.99  
www.hodderheadline.co.uk

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**BOOK REVIEW**

**Particle Physics**

*Particle Physics* is one in a new series called ‘Advanced Physics Readers’, aimed at year 13 students taking option papers at A-level. It is supported by a website at [www.ph.surrey.ac.uk/starbase/pp](http://www.ph.surrey.ac.uk/starbase/pp) which contains an abridged version of the book and will keep the reader updated as the subject evolves. According to the author, “It would be all too easy to write a book that simply listed particles and their discoveries together with physical formula (sic), all quoted in rote fashion”. He’s right. It was. The book abounds with examples of ‘tell not show’ and the result is a dense narrative with little to inspire the reader to move on.

Bishop feels he cannot explain particle physics if the reader does not know relativity, so he attempts to cover it in 16 pages. Inevitably, just as things are getting interesting he has to sign off as there is no time or space to finish the job properly. The result is a book that would be more useful to a teacher than a student, especially to answer factual questions rather than conceptual ones—but then, at A-level, how can particle physics be anything other than a jumble of facts? The book is very up to date and contains much useful data on the main accelerators—data that could be harvested from the web these days. However, it does suffer from a number of errors and confusing statements. It is cruel to pick out errors in a review but one made me laugh out, so I feel obliged to share it. In the very first chapter, Bishop tells us that the philosopher Democritus has democracy named after him! Later on we are told “Since the total momentum of the e− and the e+ is zero, the momentum of the quark–antiquark pair…must be zero, which means that the velocities of the quarks must also be zero”. How misleading to a student!

In summary: up to date, many useful facts, and a much wider coverage than the standard books, but too many errors and too dense for students.

Ken Zetie

**Particle Physics**

Christopher Bishop  
Rating: fair  
Price: £12.99 pbk  
Details: Published 2002, John Murray, London, 312pp  
ISBN: 0 7195 8589 9
“Fly me to the Moon ...”

Where to start? Not only do I have this universe and possibly untold parallel universes to choose from, although the laws of physics must still apply, but now I have fictional universes to choose from as well. Of course, I’m unlikely to want to start in a place where the laws of physics, as I know them, don’t apply (spoils the CV). However, there have often been times when I’ve thought “get me off this planet please!” I’ve always rather fancied Barnard’s Star. But how do I get there?

My first means of travel may well be Celestia (figure 1)—a free piece of software that lets you travel the universe, available from www.shatters.net/celestia/. Not only can you visit stars, some with extra-solar planets, and Sol and its planets, but you can record a movie of your travels. You can then analyse said movie using Vidshell, a free video analysis package from web-physics.tec.nh.us/vidshell/vidshell.html. There are others of a similar nature, e.g. OpenUniverse—virtual spaceships that let you roam just as you may dream; see www.openuniverse.org/.

Orbit Xplorer (figures 2 and 3), available at www.ottisoft.com/orbit_x.htm, is a piece of software that lets you control a variety of gravitational simulations of astronomical bodies, and at $89 for a site licence I think it is good value. You would probably be looking at using this with 16+ year-old pupils, as it seems pretty powerful.

Voyages: Stories with good science, at www.hbcollege.com/astro/fraknoi/stories/stories.html, is a website giving details of books and stories related to aspects of science and you can select categories. For instance, the category ‘The Sun—A Garden Variety Star’ lists five entries and gives a brief description of
each. There are 29 categories altogether, useful for finding a cool-sounding quote for the start of a lesson.

Have a look at Introducing The International Tesla Electric Company page at www.jeffry.com/technology/bwt/free_electricity/free_electricity.htm. This is a bit of a crank-sounding site (well I did find it by following a link from www.crank.net/contents.html, so it’s not just my opinion) but it will make for interesting discussion at many levels. Crank Dot Net has some excellent links with a crankiness rating system. Categories such as ‘tired light’, ‘Einstein was wrong’ and ‘antigravity’ could make an interesting ‘What’s wrong with this?’ homework.

There’s a good set of lecture notes and slides at members.optushome.com.au/guests/PhysicsinSF.html by Andrew Love Jr, all about Physics in Science Fiction but it is aimed more at university level. It does a detailed treatment of the existence of a ‘ring’ world amongst other things like teleportation.

Warp Drive, When? (figure 4) at www.grc.nasa.gov/WWW/PAO/warp.htm discusses the reality of travelling long distances across space. To get the feeling of relativistic effects try Warp (figure 5) from www.adamauton.com/warp/—there are even some lesson notes. The idea of this free software is to show the student what happens at relativistic speeds. There are all sorts of models you can fly past including an X-wing fighter and Santa Claus.

SciFlicks.com at www.sciflicks.com/ is a useful source of pictures, movies and sound files as well as interesting facts. As the name suggests, it’s all about science fiction movies and generally the more modern and better quality ones. I didn’t see much physics but I did see some fantastic photos—you could make a really juicy PowerPoint presentation with some of them. Strangely they don’t mention The Day the Earth Stood Still.
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There are a lot of sound clips including one that says:

Bobby: “Mr Carpenter, what does inertia mean?”

Klaatu: “Inertia is the property of matter by which it remains in uniform motion unless acted upon by external force.”

For something more or less down to Earth, depending on your interpretation, try spaceflight.nasa.gov/living/spacefun/ (figure 7). It has a link to a page full of movies of astronauts doing strange things such as somersaulting, dancing and using a string telephone, though not all at the same time. The quality isn’t great but pupils will enjoy watching them bounce around in microgravity.

The BBC (figure 8) have a nice site at www.bbc.co.uk/science/space/playspace/index.shtml: anything with the Clangers on can’t be far wrong. There’s also a multimedia presentation on the history of cosmology as well as games and a link at www.bbc.co.uk/science/space/scifi/index.shtml to some pages about Science Fiction. There’s a ‘Fantastic Voyages’ game which I thought good as well as more about the possibility of spaceflight as it appears in sci-fi books. The home page for the two sites above is at www.bbc.co.uk/science/space/index.shtml and certainly worth a look for anything astronomical.

You can explore the International Space Station (figure 9) at www.hq.nasa.gov/pao/iss/home.html. I have no idea how they do this, but it really is like being in control of a web-cam in the ISS. It is quite amazing. You have to download a viewer first but then you get 3D views of the inside of the space station in pretty good detail.

No article about astronomy and the internet can fail to mention CLEA (figure 10) at www.gettysburg.edu/
There are simulations of real astronomical data-gathering techniques for you to download and run. I used the spectroscopy one and found the students enjoyed some of the finer detail such as having to open the observatory doors before you start.

One thing you might like to try with a science club, say, is building model rockets and satellites. There are lots of these available on the web. www.spacestation42.com/pt-space.html is a good starting point, with paper and card models that you cut out and glue together. However, be warned—many of these are real detailed models, not easily constructed by a 13 year-old pupil with a glue stick and a pair of scissors. My own favourite (figure 11) is www.groeg.de/puzzles/rocket.html. It has a plan for an air-powered rocket that you make out of card. I've built one and, by golly, it works!

You may also recall that there was a Web Watch on astronomy and cosmology in the July 2001 issue of Physics Education.

Gary Williams