



London Science Challenge



Guidance notes for Headteachers
and Heads of Science on the new
KS4 Science curriculum

www.londonsciencechallenge.org.uk

London Science Challenge is a partnership between key organisations involved in science education in London including the Association for Science Education, The Institute of Physics, King's College London, National Advisers and Inspectors Group for Science (London & South East Region), The National Strategy (Science), Science Learning Centre London, The Specialist Schools and Academies Trust, the Success for All London Network (Science), the Training and Development Agency for Schools and the Department for Education and Skills.

London Science Challenge is part of London Challenge.

Email

admin@londonchallenge.org.uk
to receive regular email alerts with information to facilitate KS4 curriculum changes in science and other London Science Challenge activities

Section 1: For the Headteacher

Introduction

The new programme of study has brought an opportunity to improve the KS4 curriculum in a way not experienced since the introduction of the National Curriculum fourteen years ago.

The new GCSE specifications will focus on “how science works”. The students will develop a wider range of skills needed to use and understand science than before. Students will also acquire essential science knowledge and understanding for living as a voting citizen in the twenty first century. Students should also enjoy their Key Stage 4 science course. The science curriculum is part of a student’s core education. An understanding of science contributes to the learning of many other subjects including technology, geography, citizenship and PE.

In addition to studying “core” science in line with the statutory orders, students will choose further science courses. The choices made will enable students of differing aptitudes and interests in science to follow a course that best suits their level of ability and will enable them to achieve success.

Managing the change

There are four separate tasks to be accomplished by science teachers:

- selecting new courses;
- informing all those involved in the changes;
- devising and resourcing new schemes of work; and
- training teachers in the different pedagogical methods required by the new courses.

These tasks can overlap and will require two or three years before they are all completed.

Section 2: For the Head of Science

1. Selecting new courses:

There are new specifications from each exam board. Subject leaders will know the detail of these by now, but please note that the content of each board's "core" and "additional" specifications is different in many respects. For example the science content prescribed by the QCA guidance makes up only 50 % of the content for each additional science award.

Course selection is different for each school and it is up to the professional judgement of the science subject leaders and headteacher. They will need to weigh up the needs of the pupils, the skills of the staff members and take into account the constraints of the wider school context (e.g. work experience, work related learning, timetable structure). There is a great deal of discussion about a series (one GCSE in Yr 10, one in Yr 11), parallel (both GCSEs as 2 year courses) or hybrid model (taken in units, some series some parallel) for the delivery of the curriculum.

Reference 1 (the reference pages are at the back of the booklet) gives contact details for the exam boards, and web sites for a summary of the series and parallel issue.

2. Dissemination of information

This is the biggest change in the science curriculum for fourteen years, and without relevant information there will be

misconceptions about the new curriculum. The reduction of emphasis on content does not mean that the new curriculum has been “dumbed down”. It has become more skills based, and now allows important aspects of science knowledge to be studied in greater depth to understand the role of science in people’s lifestyle decisions and in technological developments for society.

One of the reasons that Additional Science specifications should be studied is to complete the preparation of students for further work in science at AS level. Core science is still a broad and balanced qualification, hence does not include sufficient depth of study to prepare for AS level.

If schools are opting to offer applied science in order to meet the aspirations and needs of some students, and to give a work focused curriculum, then departments need to start thinking ahead about progression routes for those students (see QCA guidance booklet, download from <http://www.qca.org.uk/14944.html>)

Reference 2 is a web site for a checklist of who needs what information.

(Go to <http://www.londonsciencechallenge.org.uk/> and click on KS4)

3. Developing schemes of work

Since every 2006 specification is different from those currently in use, science departments should be planning to develop a scheme for each different course.

The medium term planning can be taken from an exam board template (see Reference 1 for contact details). Often outside organisations e.g. publishers or LEA support groups will produce some of the work for short term planning linked to resources. This can be used by science team members who will complete the process by adding additional resources and specifying internal departmental arrangements.

It is strongly recommended that every member of the science team is included in planning and developing the schemes of work. Apart from sharing the work load, those left out of the loop may not feel committed to the schemes.

Schemes should contain learning objectives and differentiated outcomes, and should consolidate the approaches to planning developed as a result of the Secondary Strategy interventions. A suitable template for a scheme of work is available from strategy consultants or from London Science Challenge (admin@london-science-challenge.org.uk).

Sources of other relevant information have been compiled in **Reference 3**, which lists what publishers are producing for new GCSEs and in **Reference 4** which lists additional resources.

4. Pedagogical changes required for the new curriculum

It is clear from the guidance published by QCA (http://www.qca.org.uk/12265_14377.html) and Ofsted (<http://www.ofsted.gov.uk/>) that science teachers will need a bigger repertoire of teaching strategies. Activities that engage students in discussion, debate, evaluation and decision making have not recently been a strong feature of classroom practice in science.

Even when the resources are available for these sorts of activity, many teachers will need CPD to support them in making full use of the lesson scaffolds provided. Planning for and providing this CPD is an essential feature of planning for the curriculum change.

Section 3: For Heads of Science

Comments and advice from consultants, and from science subject leaders in London Schools.

From the Secondary Strategy

Changes to GCSE Science

A number of significant changes are being made to the Key Stage 4 science curriculum which will come into effect from September 2006.

The purpose of the changes is to promote science teaching which is relevant and motivating for all students in the 21st Century, to widen GCSE science choices, and to improve science uptake post-16.

The new science GCSEs will enable greater choice and flexibility in the range and type of courses available to meet students' needs, providing pathways designed to develop scientifically literate citizens as well as provide a sound grounding for those students who wish to continue their study of science beyond 16.

The new statutory programme of study for science defines the content of a single award in science which is suitable for all pupils and from which there is no disapplication. In addition there are further qualifications in science (additional science and additional applied science) as well as the option of GCSEs in the separate sciences (physics, chemistry and biology). The government has signalled its intention to ensure that all pupils have an entitlement to the option of taking at least two GCSEs in science.

Most students will probably take (core) science and an additional science as separate GCSEs, which is the equivalent of the current double award science. Unlike the current double award the two GCSEs will not have linked grades. Entry level qualifications which meet the requirements of the new programme of study are also available as is a double award in applied science (which is seen as one appropriate successor qualification to the current GNVQ in science).

A major part of the new programme of study is entitled “How Science Works”, which is an extension of scientific enquiry and is regarded as an essential way of making science relevant and motivating. This emphasis is common to all the new GCSE science specifications and may require a widening of the teaching and learning approaches used in lessons to include more opportunities for discussion, debate, genuine investigation and personalised writing. There will be a significant need for teacher CPD to support this development. There will also be an increased variety of assessment methods and opportunities.

QCA have distributed a 24 page booklet *Science: Changes to the curriculum from 2006 for Key Stage 4* on the changes and some of their implications for the KS4 science curriculum. This document as well as additional information is available on the QCA website (www.qca.org.uk)

From a London Borough National Strategy consultant

All Change for the 2006 Science GCSE Courses

Background

Why, you might ask, are they changing things yet again, and why should what is on offer be any improvement?

School science has always suffered from a fundamental tension. On the one hand, it is effectively training for the would-be scientist. To achieve this end it requires an emphasis on basic scientific concepts.

Developing any broader or coherent picture of the major explanatory themes of science is something that only emerges with time. It requires commitment and application and, as the figures for A-level show, where 5, 6, and 8 per cent of the post-16 cohort take physics, chemistry and biology respectively, it is far from being everybody's cup of tea.

The other goal of science education, however, is to educate young people about the relevance and place of science in our society. To do this they need more than content knowledge, but also they need to know how science works.

How, for instance, do scientists decide on what is good evidence? What are the mechanisms that the scientific community has for regulating itself to ensure that the claims advanced are reliable? And what are the implications of developments in science and technology for society? In short, how can science education help to make young people critical consumers of science?

The new Programme of Study (PoS) set out by QCA (<http://www.qca.org.uk/10340.html>) aims to deal with this tension by creating a less content-led course, focusing instead on the way science and scientists work within society.

Possible Choices

It is important to realise that there will be no disapplication for science and that all students must follow the programme of study for the single GCSE in science. In addition the government is committed to ensuring that all schools offer the entitlement to at least two GCSE courses with the expectation that the same proportion of students (around 80%) will take up this entitlement as do currently.

The overwhelming majority will then go on to take another GCSE from many choices such as:

Additional Science, Additional Applied Science, Astronomy, Chemistry, Electronics, Environmental Science, Geology, Human Biology, Physics, Psychology, Rural and Agricultural Science.

Students can also follow the Double award course of GCSE Applied Science. Triple science is also possible with the usual timetabling and staffing constraints.

Some Consequences of the Changes

Science will feature significantly in the option choices of year 9 pupils. Science teachers will have to step outside the 'one course for all' approach and justify the existence of their courses to students and management teams. The variety of choices mentioned above are likely to be constrained by timetabling, teachers' skills and physical resources, but the chance to offer students pathways that are suited to their individual needs will encourage schools to be more creative in what they offer.

Those holding the purse strings need to be aware that there could be considerable teacher and technician training required and the possible purchase of new resources.

Advice from Heads of Science

Support

- The Local Authority (LA) Science Consultants should be used to facilitate the dissemination of effective practice, for example, how courses were chosen and schemes of work written.
- Negotiate with strategy managers to block time while preparing timetables for 2006 and for science team planning during the first year of the new courses.
- Heads of department from Specialist Schools and ASTs in the Borough may be able to support other schools.
- You could organise clusters for those schools that have chosen the same courses.
- Use all the contacts you can in order to get as fully informed as possible and remain informed e.g. about exam board developments.
- The timetable will need to include a programme of professional development for which the summer term will be the key time.
- Make the most of what the awarding bodies are offering. Details are on their websites (listed in **Reference 1**) and include that:
 - OCR intend to facilitate cluster groups of schools;
 - AQA intend to provide consultant visits for the vocational courses, and will provide a scheme of

work and teacher's guide. These should be available electronically; and

- Edexcel are running a large number of meetings designed to highlight the changes in terms of content and the assessment model.

Pedagogy

- With the new GCSE there is an increased focus on contexts that enable students to relate their understanding of science to their own and others' lifestyle and to make decisions on the basis of this.
- This is an opportunity for establishing a real change in culture for teaching science in a more relevant and motivating manner.
- The Pedagogy and Practice pack from the Secondary Strategy will be a useful basis for planning additions to teacher repertoire.
- Other departments in a school, such as Humanities, may already have these unfamiliar pedagogical skills embedded into their teaching.

Specifications

- You should prepare for several 'new' contexts in the specifications e.g. obesity, biogenesis, stem cells, nanotechnology and different types of telescope.
- You could set up a staff development reading box and a school intranet area for 'new information' which people

can add to or take from so that flyers/web sites/ professional publications can easily be shared.

- Consider the needs of lower attaining and EAL pupils who may find the terminology used in science extremely difficult. One school's solution is to offer one group Core Science over two years and one group the Entry Level Specification over two years.
- Before you rush out and purchase new expensive sets of textbooks, carry out an audit of what you currently have in your department. Take your time to decide; you can always start by teaching the parts of the curriculum that are familiar and use your current resources for the time being.
- Bear in mind that there are many good free resources and information about the new teaching approaches and science content.
- You will need to consider what training technicians need in order to support the delivery and development of the new curriculum.
- Take the opportunity to evaluate new ICT programmes, worksheets and other similar resources to see how they can enhance teaching and learning.

Reference Section

1 – Examination board contact details

AQA

Tel: 01483 506506

http://www.aqa.org.uk/qual/gcse/new_science.html

OCR

Tel 0870 240 9800

<http://www.gcse-science.com/>

or

<http://www.ocr.org.uk>

Edexcel

Tel: 0870 240913

<http://360science.edexcel.org.uk/home/>

or

<http://www.edexcel.org.uk/quals/gcse/science>

WJEC

Tel: 029 2026 5000

http://www.wjec.co.uk/gcse-new_science.html

Timetable models – go to www.londonsciencechallenge.org.uk and click on KS4

2 – Further Information for KS4 changes – checklist – go to www.londonsciencechallenge.org.uk and click on KS4

3 – Publishers information

Publisher /contacts	Specifications	Release dates
Cambridge http://www.cambridge.org/uk/education/secondary/science/default.htm	AQA Science Additional Science Biology, Chemistry, Physics OCR B (Gateway) Science Additional Science	Evaluation packs Jan 06, free Resources released May 06 for Science, Additional. Triple Sept 06
CGP www.cgpbooks.co.uk	OCR B (Gateway) Science Additional Science Edexcel Science Additional Science AQA Science Additional Science	Evaluation packs available in March, cost not known
Collins www.collinseducation.com/gcscscience	AQA A+B Science Additional Science Biology, Chemistry, Physics Additional Applied Edexcel360 Science, Additional Science, Biology, Chemistry, Physics OCR B (Gateway) Science, Additional Science, Biology, Chemistry, Physics	Evaluation packs are now available Publications Jan-May for Science and Additional Science. September for Triple
Heinemann www.scienceuncovered.co.uk	AQA A+B Science, Additional Science, Additional Applied, Triple OCR B (Gateway) Science, Additional Science, Additional Applied, Triple	Evaluation packs released March Publications: April April for Science June for Additional, September for Triple

Publisher /contacts	Specifications	Release dates
<p>Hodder Murray (endorsed by Edexcel) www.gcscscience06.co.uk www.hoddereducation.co.uk</p>	<p>AQA Science, Additional Science, Additional Applied, Biology, Chemistry, Physics, Double Applied. Foundation and Higher books</p> <p>Edexcel Science, Additional Science for Internal and external assessment, Biology, Chemistry, Physics. Foundation and Higher books</p> <p>WJEC Science, Additional Science</p> <p>CCEA Science</p>	<p>Sample packs are free</p> <p>Evaluation packs are available from Mar 06 onwards</p>
<p>Longman www.longman.co.uk</p>	<p>Edexcel360 Science, Additional Science (no Triple)</p> <p>AQA Science, Additional Science (no Triple)</p> <p>OCR 21stC Science, Additional Science (no Triple)</p>	<p>Evaluation packs in March</p> <p>Publications: Spring 06 for Science, Spring 07 for Additional</p>
<p>Nelson Thornes (endorsed by AQA) http://www.nelsonthornes.com/aqa/index_science.htm</p>	<p>AQA A+B Science, Additional Science, Additional Applied, Triple, Double Applied</p>	<p>Evaluation packs Apr-Sept 06</p> <p>Publication Science in Apr, Additional Science in May, Triple in May, Additional Applied in Sept, Double Applied in Jun</p>
<p>Oxford (endorsed by OCR 21st Century) http://www.oup.co.uk/oxed/secondary/science/</p>	<p>OCR 21st C Science, Additional Science, Triple, Additional Applied, Entry level</p>	<p>Evaluation packs available now</p>

4 – Additional resources

National Strategy

seek advice through your local LA science consultant and at www.standards.dfes.gov.uk/keystage3/

King's College London

<http://www.kcl.ac.uk/depsta/education/ideas.html> IDEAS pack 'Ideas Evidence and Argument in Science education' is a resource for teacher CPD and inspiration. It is low cost and provides a framework for school based training in the educational theory underpinning "how science works". It contains 6 half day inset sessions, 15 lesson activities and a DVD.

Science Enhancement Project (SEP)

www.londongt.org Some excellent new work on designer babies which is aimed at KS3, is well suited to the more able and the approach is very much in the new style we will all be striving to achieve. There is some very useful support on offer from SEP through the "Learning Skills for Science" (LSS) project – Courses currently on offer at the SLC London.

Aspire

www.aspire-ma.com Not free but worth a look and not expensive for a site licence, aimed at the more able and will inspire staff to be more creative in their approach. If you can't get the full package try 'to inspire' which gives you two resources.

Particle Physics and Astronomy Research Council (PPARC) – www.pparc.ac.uk Excellent for an immense amount of resources. CD ROM ‘extremely large telescopes’ will give you extensive information on where support can be found.

GlaxoSmithKline (GSK) – www.gsk.com/education Lots of resources. CD ROM ‘The science behind medicine’ is quite informative and displayed simply.

Wellcome Trust www.wellcome.ac.uk

‘Wellcome Science’

(<http://www.wellcome.ac.uk/node5060.html>) published three times per year. October issue covers avian flu – great for professional development. ‘Big picture’ – some recent issues on obesity (issue 1 January 2005), nanoscience (issue 2 June 2005).

Class sets can be ordered: though you have to pay for these the price is reasonable. ‘Labnotes’ – past topics include stem cells (January 2003) and beyond the genome (July 2004).

These are photocopyable, and online supplementary material is available for some. Contact the marketing department to check if these copies of Labnotes are still available.

Interesting resource ‘genetics and citizenship lesson plans’: pilot done in conjunction with Highwire City Learning Centre, Hackney. www.highwire.org.uk/genetics

For further info contact vivi@highwire.org.uk

Institute of Biology

a range of resources from www.iob.org

Society for General Microbiology

www.microbiologyonline.org.uk Free material available on diseases and the role of micro-organisms in infectious diseases.

Compassion in World Farming

www.ciwf.org Lots of resources on genetic engineering and farm animals. Great for ethical debates. Video and teacher's notes are invaluable for inner city children being able to visualise some of the issues.

Animal Aid

www.animalaid.org.uk Lots of resources to fuel ethical debates on farm animals and the meat industry. Deals with topics in an interesting and informative way, good for cross curricular themes especially with PSHE/citizenship.

Planet Science

www.planetscience.com 'Digital science' for nanotechnology and other ethical issues. Contact Sparry@wellcome.ac.uk

Institute of Physics

www.iop.org CD ROM 'Our planet our future' useful for new technology in general and its application to saving the planet. Good for fuelling debates as an information starter; good as a resource to inspire staff for group projects.

London Ideas

www.londonideas.org

g.a.davis@imperial.ac.uk

Can come to London schools and do a workshop on genetics using games and practical activities to engage pupils.

National Schools Observatory

rsh@astro.livjm.ac.uk Amongst other resources pupils can use their telescope to make own observations on line.

University of Bradford

www.telescope.org is another telescope. You can order your own observation on line.

Royal Society of Chemistry (RSC)

www.rsc.org Good for resources – try ‘Chemistry at the Races’ to inspire teaching drugs in a different context.

Royal Society

www.royalsoc.ac.uk can also be a good starting point for resources e.g. Genetics and health, Stem cells and cloning.

Association of Science Education (ASE)

www.ase.org.uk or for more help Rebecca@ase.org.uk, can provide a list of educational organisations and associations which can also give you the contacts and information (e.g. Frequently Asked Questions and presentations from recent conferences) that your staff need to stay informed and ahead.

Teachers' TV

www.teachers.tv in partnership with the Wellcome Foundation has recently launched six programmes on issues in bio-medical science.

British National Space Centre

www.bnc.gov.uk Subscribe to space:uk to keep informed.

Upd8

www.upd8.org.uk

Upd8, a contemporary science resources project from ASE and Centre for Science Education, will be producing material targeted at exciting contexts for KS4. The material will be published weekly on the upd8 web site, but there will probably be a subscription charge like for primary upd8. The activities will be targeted at teaching "how science works" objectives through contemporary contexts in the media.

Science Learning Centre – London

Tel: 0207 612 6325

<http://www.sciencelearningcentres.org.uk/?page=5> for programme of CPD opportunities.

QCA

<http://www.qca.org.uk>

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