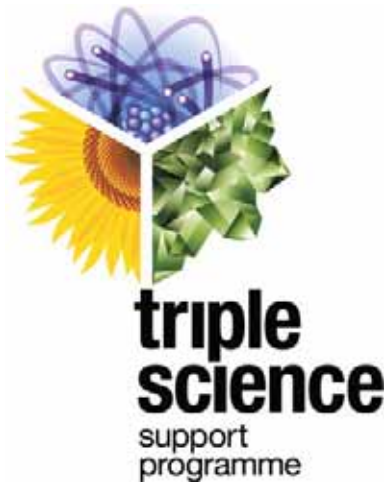




triple science GCSEs: curriculum planning and design

**GCSEs in biology, chemistry
and physics**

This publication will provide managers and others with practical advice on how to plan, develop and model the Triple Science requirement – taking into account all the critical factors that need to be considered.



triple science GCSEs: curriculum planning and design

**GCSEs in biology, chemistry
and physics**

Published by the Learning and Skills Network
www.LSNeducation.org.uk
 Registered with the Charity Commissioners

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 Photographs: John Walmsley Education Photos
 Printer: Blackmore Ltd, Shaftesbury, Dorset
 CIMS 072851GR/09/07/5000
 ISBN 9781845726621

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Acknowledgements

The authors would like to thank the schools and local authority representatives who answered questions and contributed case studies. Thanks are also due to: Carole Stroud, Martin Hollins, Derek Bell of ASE, QCA and the awarding bodies.

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Contents

Preface	V
Executive summary	VII
Section 1: The policy context	1
Section 2: The curriculum context	3
Section 3: The Key stage 4 curriculum	7
Section 4: The science curriculum	11
Section 5: Ways of approaching Triple Science within the curriculum	15
Section 6: Developing e-learning	19
Section 7: The models and case studies	21
Model 1	22
Model 2	26
Model 3	30
Model 4	34
Model 5	38
Model 6	42
Model 7	46
Model 8	50
Model 9	54
Model 10	58
Appendix 1: The specifications for separate science GCSEs	63
Appendix 2: Useful organisations	80
Appendix 3: LSN science publications	82

Preface

The Department for Children, Schools and Families (DCSF) has contracted with the Learning and Skills Network to support awareness and take-up of Triple Science GCSEs through the Triple Science Support Programme.

The programme aims to support the following policy objectives:

- to enable all young people with level 6 in science at Key stage 3 to study Triple Science GCSEs from September 2008
- to help specialist science schools offer Triple Science to their students from September 2008.

The Triple Science Support Programme comprises the following:

- the programme website: www.triplescience.org.uk
- a programme newsletter
- publications on: collaboration and partnership; raising attainment in Triple Science; curriculum modelling, timetabling and Triple Science; and three subject-specific resources on the separate sciences
- Triple Science networks of support for practitioners
- an audit of resources for Triple Science
- an offer of three days' consultancy per targeted school (around the topics above)
- a marketing campaign around Triple Science for schools.

This programme has been funded by the DCSF. All publications, networks and newsletters will be delivered without charge to maintained secondary schools. The training and consultancy will be available to targeted Triple Science schools only.

If you wish to register an interest in the programme, please contact the LSN helpline on 0845 071 0800 or e-mail triplescience@LSNeducation.org.uk

Alan Goulbourne

Executive Manager
Triple Science Support Programme
Learning and Skills Network

Executive summary

Policy context

1

To increase the supply of engineers and scientists, the Government has set out an ambitious plan to encourage more students to take science at A-level and in higher education.

2

This includes:

- introducing for 2008 a statutory entitlement for students achieving at least level 6 at Key stage 3 to study the three separate sciences to GCSE
- encouraging all schools to make Triple Science available to all students who could benefit.

3

The Triple Science Support Programme has been set up to provide guidance, advice and training for schools so that they can meet the entitlement.

4

Triple Science is a combination of three GCSEs in biology, chemistry and physics. It provides the fullest coverage of these three subjects at Key stage 4 and, taken together, the subjects cover the statutory programme of study for science. They are available within the suites of awarding body specifications introduced for first teaching in 2006.

5

The introduction of Triple Science GCSEs should be seen within the context of other changes, some of which will have more direct impact on science provision than others, but all of which will affect the school curriculum as a whole. These include:

- the new curriculum for Key stage 3, and the growing practice of covering this in two years
- the introduction of the Diploma for 14–19 year-olds, for first teaching (in five lines of learning) in 2008 and as a student entitlement across all 14 lines of learning from 2013.

6

This guidance concentrates on curriculum planning and design, including the use of the new (2006) specifications to provide Triple Science at Key stage 4. Its audience is curriculum planners, managers and subject leaders in science. The sections move from the national picture, including forthcoming 11–19 curriculum developments, to the shape of the Key stage 4 curriculum and the place of science in it. Curriculum models of Triple Science delivery are supplemented by case studies that illustrate practice in a range of schools in different circumstances and localities.

The science curriculum

7

The science curriculum offers a range of qualifications, specifications and assessment patterns. Many schools broadened their science curriculum in 2006 and some introduced Triple Science as part of the new offer.

8

Schools not currently offering Triple Science have a range of reasons, from a desire to offer a curriculum intended to maximise breadth to concerns about lack of suitable staff or other resources. Some consider that the nature of their student body is likely to result in small and uneconomic classes.

9

These schools now need to consider how best to introduce Triple Science to their science offer. This guidance should help in that process.

Curriculum models

10

There are a number of different approaches to the inclusion of Triple Science within a curriculum, and variations on most of them.

11

The list below shows the range of **models** within the guidance. Some are models already implemented, others are more speculative and for future development. Each is discussed in terms of its advantages and disadvantages.

Model 1

Teaching two GCSEs within the core curriculum and adding a third science as an option choice, to maximise science take-up and quality of learning experience

Model 2

Teaching Triple Science within a core allocation of around 20% of curriculum time, to allow for breadth and balance across the optional curriculum

Model 3

Teaching a single science GCSE within the core curriculum, and adding two science options, to maximise flexibility and choice

Model 4

Offering lessons or experiences outside the normal school day, to supplement learning and offer further choice

Model 5

Following a condensed Key stage 3 and starting GCSE Science in Year 9, to improve Key stage 3 experience and create time for additional GCSE or other courses

Model 6

Starting GCSE Science after Year 9
National Curriculum assessment tests,
to retain motivation and introduce skills
required for GCSE

Model 7

Teaching Triple Science in around
25% of curriculum time, exploiting
synergies across the three subjects,
to maximise motivation and use of time

Model 8

Operating a different curriculum in
Years 10 and 11, to give opportunity for
further choices in Year 11

Model 9

Organising a top set or sets that
work across more than one subject,
to enable joint planning and/or
teaching to enhance learning and
maximise use of curriculum time

Model 10

Delivering Triple Science in partnership
with other schools or colleges, to
secure the entitlement and benefit
from local links

12

Case studies illustrate each model,
several exemplifying more than one approach.
The case studies also show how schools
are using the science specifications from
the different awarding bodies.

13

Appendix 1 explores the GCSE specifications
offered by the awarding bodies and the
different patterns of external and internal
assessment available. It discusses factors
to consider in choosing a Triple Science
specification that best fits a school's
needs and circumstances.

Section 1

The policy context

Background

The Government believes that the future economic success of the United Kingdom depends on a good supply of skilled scientists and engineers. It aims to secure this supply by creating an education and training environment that delivers the best in science teaching and learning at every stage.

Key priorities for the Government

One of the Government's key priorities for action is to increase provision of the three separate science GCSEs. It is committed to ensuring the following.

- By September 2008, all students achieving at least level 6 at Key stage 3 should be entitled to study Triple Science GCSEs.
- By September 2008, all specialist science schools should offer Triple Science at least to all students achieving level 6+ at the end of Key stage 3.
- All schools are encouraged to make Triple Science available to all students who could benefit.

From September 2007, there will also be a new statutory entitlement for all students to study science courses leading to at least two GCSEs.

Summary of science statutory requirement and entitlement

Statutory requirement (GCSE) – all Key stage 4 students:

- one science GCSE (covering the Key stage 4 programme of study).

Statutory entitlement – all Key stage 4 students:

- two science GCSEs – schools will need to offer access to at least:
 - GCSE Science + GCSE Additional Science or
 - GCSE Physics, GCSE Chemistry and GCSE Biology.

Entitlement – all Key stage 4 students who have reached level 6 in science at Key stage 3:

- three GCSEs: GCSE Physics, GCSE Chemistry and GCSE Biology.

This can be achieved through:

- GCSE Science units + GCSE Additional Science units + TS extension units.

For further details of how the awarding bodies arrange their qualifications, see Appendix 1 (page 63).

Science at Key stage 4

GCSE Science (sometimes called core or single science) is the qualification that covers the statutory programme of study (PoS) for science at Key stage 4.

Most students take, and should continue to take, the equivalent of at least two GCSEs in science. Choices available include Additional Science, Additional Applied Science and Applied Science (double award, DA). These remain a viable route to A-level study in science.

Triple Science (TS) is a combination of three GCSEs in biology, chemistry and physics. It provides the fullest coverage of these three subjects at Key stage 4 and, taken together, the subjects cover the PoS for science. The courses cover an extensive range of subject matter and therefore prepare students well for progression to A-level.

The introduction of the new entitlement to Triple Science for students achieving level 6 or above at the end of Key stage 3 means that all schools will be obliged to make arrangements to meet it. The Triple Science Support Programme (TSSP) aims to provide resources, materials and training that will help schools not currently offering Triple Science to see the possibilities that exist, and make the appropriate decisions and curriculum arrangements for their own circumstances and their own students.

For details of the TSSP see *Preface* (page V).

Aims of this guidance

There are a number of ways that Triple Science can be accommodated within the Key stage 4 curriculum, and different ways of approaching the delivery of the units involved. In researching this publication we have found examples of most of them already being implemented, and several variations on each main theme.

The structure of the publication moves from the national picture, including forthcoming 11–19 curriculum developments, to the shape of the Key stage 4 curriculum and the place of science within it. There is a list of potential ways of providing and timetabling Triple Science, and each of these is further expanded in a more detailed model that includes discussion of its advantages and disadvantages. Case studies illustrate each model, several of them exemplifying more than one approach – as is the reality. Most of the case studies are of current practice, though some are of plans for 2008.

Section 2

The curriculum context

The wider context

There will be significant development of the 11–19 curriculum in all schools and colleges catering for this age group between 2008 and 2013.

The aim is to create a curriculum that enables all young people to become:

- successful learners who enjoy learning, make progress and achieve
- confident individuals who are able to live safe, healthy and fulfilling lives
- active and responsible citizens who make a positive contribution to society.

For further information on the new secondary curriculum and its aims see www.qca.org.uk/qca_5855.aspx/

Curriculum review

The Qualifications and Curriculum Authority (QCA) is encouraging the use of the following questions to support a process of curriculum review and development.

- What are we trying to achieve?
- How do we organise learning? (Designing a curriculum solution)
- How well are we achieving our aims?

In terms of the first question, schools should consider the benefits of meeting the entitlement to Triple Science – for example, challenging able students, personalising the curriculum by adding choice, providing a range of progression pathways and enabling students to develop a specialism that they take through to A-level. Judgements about the success of a curriculum initiative should involve quantitative and qualitative evidence, including the quality of student experience and their progression.

The nature of the new curriculum

The new secondary curriculum is planned to be more flexible and responsive to local need. It can be characterised as personalised, with a local flavour and set within national parameters.

Student entitlements to science learning and qualifications contribute to this in the following ways:

- offering a range of science courses, including combinations of two or more GCSEs, is an aspect of personalisation, meeting the needs and progression plans of students and providing enhanced choice. Selection of assessment methodology and timing will also be based on student needs and preferences
- local flavour is provided by:
 - the way in which science is offered within the curriculum
 - the provision of different types and sizes of qualification, including those that enable teachers to teach to their specialism and enthusiasm
 - approaches to teaching and learning, including e-learning
 - use of local examples to provide depth and detail to topics
 - use of local business and industry, in terms of personnel and visits
- the national parameters are:
 - the programme of study for science
 - aspects of other programmes of study that link with the science curriculum, for example citizenship or personal well-being
 - student entitlements in relation to science.

11–19 curriculum changes

The introduction of Triple Science should be seen within the context of other changes, some of which will have more direct impact on science provision than others, but all of which will affect the school curriculum as a whole. They include:

- new programmes of study for science at Key stage 3 and for other subjects at Key stages 3 and 4, to include the personal, learning and thinking skills (PLTS)
- phased introduction of Diplomas for 14–19 year-olds in 14 lines of sector-related learning, starting in 2008
- many new GCSEs available for first teaching in 2009
- new GCSEs in English, ICT and two new GCSEs in mathematics for first teaching in 2010
- availability of stand-alone functional skills qualifications, and functional skills assessment within new GCSEs in English, mathematics and ICT
- revised AS/A-levels for first teaching in 2008
- a change in focus from coursework to controlled assessment
- expectations of more collaborative working across schools, colleges and other providers.

The Key stage 4 programme of study for science was introduced in 2006, and will not change further when the others do. Schools are in the process of coming to terms with the new programme of study and the specifications they chose to use.

Taken together, these developments indicate an extended period of curriculum review and development, with significant opportunities to tailor the curriculum to the needs and interests of students in individual schools and partnerships.

Key stage 3

The revised Key stage 3 programmes of study will roll out, beginning with Year 7 in 2008 and ending with the first tests relating to the new programme of study in May 2011. Only in 2011, therefore, will students choosing Triple Science have been taught and assessed in the revised Key stage 3 programme of study. And only in 2013 will the first results be available for students who have both studied the new programme of study and taken Triple Science GCSEs.

In the interim, schools need to work with the current Key stage 3 programme of study and the Key stage 4 programme of study and associated specifications introduced in 2006. Schools need to be clear about the progress of the roll-out and how it affects the experience and progression of each of their cohorts. It is also important that they plan the teaching of Key stages 3 and 4 together in the statutory subjects such as science.

Revised A-levels

During 2007, while schools are planning for the introduction of Triple Science, they or their partner colleges will also be planning for the new AS/A-levels. As many students taking Triple Science are likely to want to progress to AS/A-level, progression issues, including recruitment and recognition of pre-16 learning, need to be considered. It is important that all members of partnerships are aware of each other's plans and that they are compatible.

Figure 1
Phasing of 11–16 science developments

Academic year	Development
2007	August – first results from 2006 one-year science GCSEs September – new Key stage 3 programme of study available for planning in schools September – all students are entitled to study two GCSEs in science
2008	August – first results from 2006 two-year science GCSEs, including separate sciences September – Year 7 follows new Key stage 3 programme of study September – entitlement for students achieving level 6 or above to take Triple Science September – all specialist science schools offer Triple Science
2009	September – Years 7 and 8 follow new Key stage 3 programme of study
2010	September – Years 7, 8 and 9 follow new Key stage 3 programme of study
2011	May – first assessment and tests against new Key stage 3 programme of study September – first students who have followed new Key stage 3 programme of study start Triple Science course
2013	August – first results from students who have followed both new Key stage 3 programme of study and Triple Science qualifications

Section 3

The Key stage 4 curriculum

The core curriculum

The statutory curriculum at Key stage 4 remains the same – English, maths, science, ICT, PE, citizenship, careers and work-related learning, sex and relationships education. RE also remains a statutory requirement.

These subjects form the core curriculum in most schools. Depending on the size of the core, students may be able to choose up to 50% of their programme. The decision on the amount of science within the core is a major determinant of its size. Where the core curriculum is around 60% of available time, it will normally include two science GCSEs (perhaps three for some students). Where the core is around 50% it will include the statutory aspect of science, reflected in a single science GCSE.

It is important, and a Government aim, that most students continue to take the equivalent of Double Science ie two GCSEs. However, it may be that the greater flexibility required in the new KS4 curriculum will lead more schools to achieve this by offering a single science GCSE within the core, with one or two additional opportunities within the options system. See Model 3 (page 30).

Options and flexibilities

In addition to sciences, students are entitled to choose a course in each of the following areas of learning: the arts, design and technology, humanities and a modern foreign language (MFL). While these may form the basis of option blocks (see Figure 2, page 9) most schools operate a system that includes other subjects within these blocks to provide choice, including two subjects within the same area, for example history and geography, music and art, or two languages.

Schools can choose how to organise teaching and learning and select from a range of qualifications that can be used for assessment – the range of science qualifications has expanded a great deal in recent years.

Subjects or aspects of learning may be taught in a timetable slot with that name or elsewhere in the curriculum. They may be taught in one place and assessed in another. Where schools are adopting a skills-based curriculum, this may be the norm. The most common example is ICT, which may be taught across the curriculum or within specific ‘host’ subjects, including science, but may be separately assessed for a qualification.

Schools are exploring how best to deliver all the aspects of the core that may be regarded as ‘personal development’ (PD). These can include personal, social and health education (PSHE), citizenship, careers and work-related learning, financial literacy and enterprise and may include RE. Some question whether a regular, often short, session is the best way to promote learning, and are considering the advantages of extended or in-depth learning for these, and other, aspects of their curriculum.

Many schools have occasional focus or themed days that can include science, particularly those aspects most interesting to students. Others have developed a more regular pattern of provision for such days, which can be regarded as part of the time allocation for subjects as well as providing opportunities for useful cross-curricular work and career exploration.

For guidance relating to the new secondary curriculum, see QCA’s *Design for success: shaping your curriculum to incorporate the Diploma*.

Pathways

Beyond statutory provision, the range of pathways through the Key stage 4 curriculum continues to expand and now includes:

- Young Apprenticeships
- vocational courses of the type introduced under the Increased Flexibility Programme
- BTEC and OCR national qualifications
- re-engagement programmes for those in danger of disaffection
- the Foundation Learning Tier at Entry level and level 1.

A significant addition to the choices available is the Diploma, to be introduced in some areas from 2008 and as a student entitlement from 2013. The qualification is available at levels 1–3 and aims to be suitable for students of all abilities. It needs to be placed within the Key stage 4 curriculum so that students can choose it freely – see Figure 2 (opposite).

The Diploma will be available in 14 lines of learning, some of which will include scientific content. This may influence science provision for students taking these Diplomas. A mapping exercise is taking place and its outcomes will be available on the QCA website (www.qca.org.uk).

As the Diploma will be delivered in partnership across schools, colleges and other providers, it may create opportunities for those partnerships to be built on for other purposes. This may include support for the introduction of Triple Science in schools without enough eligible students or suitably qualified and experienced staff. Linked guidance on collaboration is available from the TSSP.

The range of opportunities available to young people, and their nature, means that the provision of impartial information, advice and guidance (IAG) is even more important than it has been in the past. When making choices for Key stage 4, they need to be thinking beyond the age of 16 and making decisions based on the range of progression paths they might follow.

Figure 2 (opposite) shows a typical set of GCSE option choices, based on a 50% core curriculum, including 10% science. It has five option blocks so that each can relate to one of the entitlement areas. It includes Double Science GCSEs, Diplomas and other qualifications. The principles underpinning it are that students should be able to choose:

- a broad programme
- a degree of specialism – for example, Triple Science or a Diploma
- Triple Science and a Diploma (where appropriate)
- a language alongside Triple Science or a Diploma.

This means that the option blocks contain choices beyond the entitlement area.

Conclusion

The introduction of the Triple Science entitlement needs to be seen within the wider context and considered in the round, alongside other aspects of curriculum development.

Figure 2
Key stage 4 options

Option A	Option B	Option C	Option D	Option E
Entitlement area – Science	Entitlement area – Modern foreign languages	Entitlement area – Arts	Entitlement area – Design and technology	Entitlement area – Humanities
Additional science Applied science Environmental science Electronics ASDAN Certificate of personal effectiveness	TS extension units Modern foreign languages ICT Business Applied business PE Graphics	Art and design Drama Music PE Dance History Economics Diploma level 2	Resistant materials Food Graphics Textiles ICT Geography Art and design Diploma level 1 Diploma level 2	Geography History RE Modern foreign languages Applied business ICT Diploma level 1 Diploma level 2

Section 4

The science curriculum

A moving picture

The current process of science curriculum change and development began in 2006. The introduction of the new programme of study and suites of specifications has meant that both teachers and students have had to make choices. These developments are themselves only part way through implementation at the time of researching and writing this publication.

The science curriculum is rich and complex, offering a range of routes, qualifications, specifications, teaching and assessment patterns. Many schools took the opportunity to broaden their science curriculum in 2006 and some to include Triple Science as part of the new offer. Others decided to continue to use the equivalent of Double Science for all or most of their students.

Schools not currently offering Triple Science may have some or all of the following reasons:

- they regard Double Science as an adequate preparation for A-levels in sciences
- they offer a curriculum intended to maximise breadth and balance
- they lack suitably qualified specialist staff
- they have concerns about suitable accommodation and other resources
- the nature of their student body is likely to result in small and uneconomic classes.

These schools now need to consider how best to introduce Triple Science to their science offer. In carrying this out, schools have a range of possibilities for action including:

- evaluating the courses introduced in 2006 and reviewing their choice of qualifications and/or specifications
- considering the issues in detail during 2007
- piloting Triple Science courses in 2007
- implementing the entitlement in full in 2008
- discussing how partnership may help them to meet the entitlement
- investigating online or other electronic delivery methods.

Science within the Key stage 4 curriculum

There are no statutory time allocations for subjects, and schools are free to organise learning to meet the needs of their students in the most appropriate way. The typical Key stage 4 curriculum is likely to have a core of around 60% that includes around 20% science. It allocates a total of around 25% to English and maths together. Options are normally in the 8–10% range. Specialist schools may include their specialism within their core, and consequently offer fewer options.

Schools are increasingly asking questions about the most effective arrangement of learning time. However, at present the most typical timetable patterns are the 30-lesson week, each of 50 minutes, and the 25-lesson week, each of one hour. The latter is often operated as a two-week timetable to provide 2½ hours per week for each option. Many schools regard three hours as too long for a GCSE option, and two hours as too short – though there are others that use these allocations, depending on the nature of their students and the learning required within the option.

Both these common patterns lead to 20% science being easily provided by six 50-minute lessons or five one-hour lessons. This allocation may not be equally suitable for all students, however – in many schools one or more groups take a single GCSE Science in less time, and other provision is fitted within the core for these groups. When offering courses such as Triple Science that may be taught by three different teachers, a pattern that offers three, six or nine slots will obviously be appropriate. This may lead to nine hours within a two-week timetable or 18% of curriculum time.

As the range of science courses expands, and students are offered more choice, different time allocations may be seen as appropriate for different courses.

In the same way, schools may ask whether the large block within the core remains the best way of providing for all, or whether more flexibility would be provided by a smaller core and a wider range of options as represented in Model 4 (page 34).

Where one or more sciences features within the option system, there are consequences for the subjects that are set against them, in numbers and ability of students taking them. This may point to an advantage in students being presented with a free choice of subjects, as opposed to the fixed option blocks exemplified in Figure 2 (page 9), though fixed blocks may be easier to control and timetable.

Figure 3 Science within the Key stage 4 curriculum

Figure 3 (opposite) shows examples of the Key stage 4 curriculum in terms of core and options, and how science can be placed within them.

In the first model (opposite, left column) Citizenship (Cz) is delivered across the curriculum, including the Personal Development curriculum (PD), and by whole-day activities on active citizenship.

In the second model (opposite, right column) ICT is delivered across the curriculum.

Core – 60%	English – 14%
	Maths – 12%
	PE – 8%
	PD/RE – 4%
	ICT – 4%
	Science, Additional Science and Additional Applied Science – 18%
Options – 40%	A – 10% TS extension units
	B – 10%
	C – 10%
	D – 10%

Core – 50%	English – 12%
	Maths – 12%
	PE – 8%
	RE – 4%
	PD/Cz – 4%
	Science or one separate science, Applied Science (DA) – 10%
Options – 50%	A – 10% Additional Science, Additional Applied Science, one separate science or Applied Science (DA)
	B – 10% TS extension units or one separate science
	C – 10%
	D – 10%
	E – 10%

Section 5

Ways of approaching Triple Science within the curriculum

The following list represents a range of ways of organising a curriculum that includes Triple Science. Some of them are tried-and-tested models; others are more speculative and may be possibilities for the future. There are several possible variations on some of them.

Model 1

Teaching two GCSEs within the core curriculum and adding a third science as an option choice, to maximise science take-up and quality of learning experience

Model 2

Teaching Triple Science within a core allocation of around 20% of curriculum time, to allow for breadth and balance across the optional curriculum

Model 3

Teaching a single science GCSE within the core curriculum, and adding two science options, to maximise flexibility and choice

Model 4

Offering lessons or experiences outside the normal school day, to supplement learning and offer further choice

Model 5

Following a condensed Key stage 3 and starting GCSE Science in Year 9, to improve Key stage 3 experience and create time for additional GCSE or other courses

Model 6

Starting GCSE Science after Year 9 National Curriculum assessment tests, to retain motivation and introduce skills required for GCSE

Model 7

Teaching Triple Science in around 25% of curriculum time, exploiting synergies across the three subjects, to maximise motivation and use of time

Model 8

Operating a different curriculum in Years 10 and 11, to give opportunity for further choices in Year 11

Model 9

Organising a top set or sets that work across more than one subject, to enable joint planning and/or teaching to enhance learning and maximise use of curriculum time

Model 10

Delivering Triple Science in partnership with other schools or colleges, to secure the entitlement and benefit from local links

Variables determining or influencing the approach adopted

Time

A key issue is one of time and how it is used:

- the amount of curriculum time that enables students to achieve the best learning and results within the subjects
- the period (of weeks, terms or years) over which the time can be allocated
- how the time is organised
- whether time allocations vary from year to year.

Where students have around 30% of their time devoted to science, and potentially around 15% to maths, there are concerns both about breadth and balance within their programme and about maintaining their enthusiasm across such a large proportion of their time.

The larger the proportion of time allocated to science, the more likely it is that students will have more than one lesson on several days of the week/fortnight, especially if the core is timetabled within three or four days to enable students on other pathways to learn away from the school site. Although it is possible to mitigate the effect of this by creating discrete bands/pathways within the cohort, this has its own disadvantages. An answer may be to offer at least some science within the same option blocks that contain other pathways such as the Diploma.

As the range of science courses expands, and students are offered more choice, different time allocations may be seen as appropriate for different courses. In the same way, schools may ask whether the large science block within the core remains the best way of providing for all, or whether more flexibility would be provided by a smaller core and a wider range of options (see Model 3, page 30).

Students

Decisions about the nature of provision and its timetabling will be influenced by the number of students attaining level 6 or above, and the numbers taking up the entitlement. Numbers choosing Triple Science will in turn be influenced by the alternative options available and the guidance they receive about progression. Where numbers choosing Triple Science form one or more groups of reasonable size, from the point of view of teaching and economics, most schools will be able to make provision for it. Where groups are smaller, schools may wish to investigate out-of-hours learning, partnership working and/or e-learning for some aspects of the course. These approaches may have advantages in themselves and for all schools, in providing different ways of learning.

Staffing and staff expertise

Individual teacher strengths and specialisms, and the relative numbers of specialists in each subject, may influence the choice of Triple Science extension units and assessment methodology (and hence the selection of a GCSE specification). These factors may also determine the arrangement of teaching modules across the term, year and key stage. Ways of arranging teaching modules include:

- a carousel of separate sciences with three specialist teachers
- timetabling Triple Science against another year group as in Case study 1 (page 24)
- pairing teachers with different specialisms for joint planning and/or teaching
- placing separate sciences within the core and an option block so that specialists are available on both occasions
- using scarce specialism to teach after-school sessions to avoid clashes with other teaching.

The specifications for GCSEs introduced in 2006

A range of approaches to teaching and learning is supported by the new specifications, and units can be arranged in different patterns for teaching purposes. Each awarding body offers a range of GCSE specifications in science, including the three separate science GCSEs. Different weightings are given to external examinations and to internally assessed components, and there is a range of assessment styles.

At this early stage in the implementation of the new science specifications, most schools have chosen to teach the new specifications 'in series' – ie completing the GCSE Science units first. This means that students sit the written exams for these components in Year 9 or 10, before proceeding to the Additional Science units in the following year. A few schools have chosen to teach the new specifications 'in parallel', ie combining the topics covered in GCSE Science and Additional Science, with external assessment taking place at the end of the course.

The National Curriculum programme of study for science is based on the knowledge, skills and understanding of how science works:

- data, evidence, theories and explanations
- practical and enquiry skills
- communication skills
- applications and implications of science.

It deals with the broad content areas of:

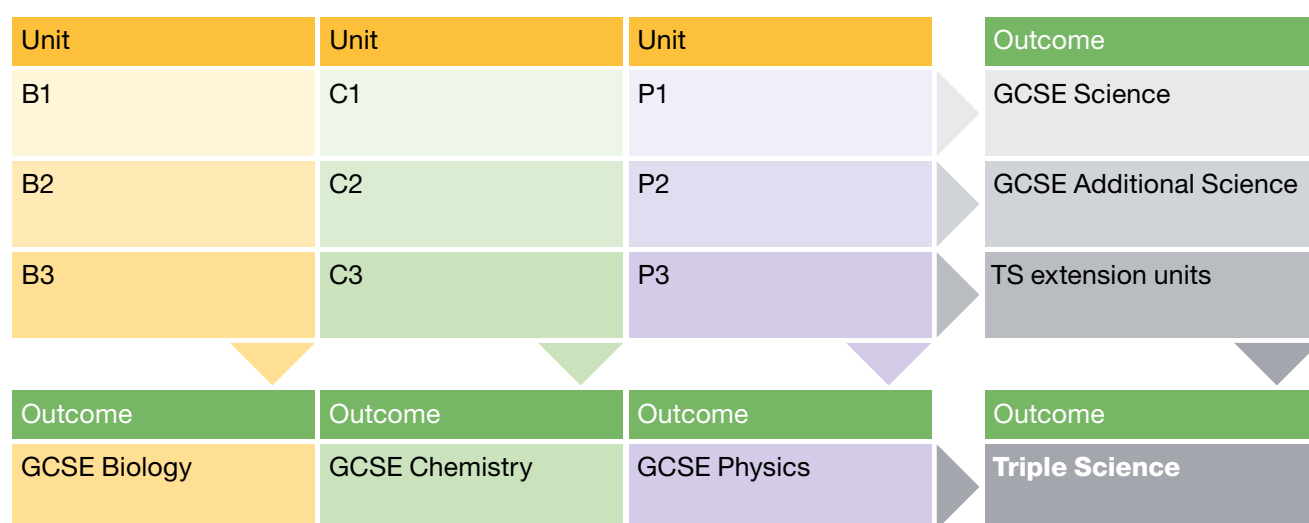
- organisms and health
- chemical and material behaviour
- energy, electricity and radiations
- environment, Earth and universe.

In simple terms, these areas can be characterised as topics in biology (B1), chemistry (C1) and physics (P1), the fourth area being covered across the other three. Awarding bodies have chosen to organise this material differently within their specifications, though all cover each aspect of the statutory requirement within their Science specification.

Units typically build to form Science, Additional Science and the three separate sciences, as shown in Figure 4 (below).

The case studies included in this publication illustrate the ways schools have chosen to structure teaching and assessment. For a more detailed discussion of the different specifications available from AQA, Edexcel, OCR and WJEC, and the assessment pattern within each, see Appendix 1 (page 63).

Figure 4
Simplified diagram to show structure of science GCSEs



Section 6

Developing e-learning

In evolving a technology-rich 21st-century curriculum, schools are interested in developing their use of e-learning, in such forms as:

- a virtual learning environment (VLE) that:
 - operates within school
 - operates across a partnership
 - is accessible to students and teachers within school
 - is accessible to students and their parents at home
- online learning or revision
- online assessment and feedback
- video-conferencing with teachers and/or students in other settings
- using a commercial package to deliver aspects of the curriculum
- informed and ethical use of the internet in the context of the new specifications and controlled assessment.

These developments are supported by those relating to IAG for students, for example independent learning plans, area prospectuses and career planning packages. They also link with initiatives such as Extended Schools and successors to the Increased Flexibility Project, where shared information systems are needed to track student attendance and progress.

While there is more evidence of investigation of these opportunities than of extensive use, there are pilot developments. One school providing a case study aims to have a module of work for each subject available on the VLE during 2007. Students will be able to access it at home, in schools and during an extended school day.

Personalised content and the use of digital resources

‘The way in which content and digital resources are used is crucial to personalised learning’ (Becta review 2006). ICT enables teachers to adapt digital resources to different teaching styles and match the needs of individual students. It also provides the opportunity to share resources within a school using a VLE or school intranet.

Digital resources for teaching and learning are shared beyond the individual school through repositories such as Teacher Resource Exchange – <http://tre.ngfl.gov.uk> – a government-funded database containing over 6000 (800 science) lesson resources produced by teachers. There are many of these repositories, the newest being the resources section of the Science Learning Centres website: www.sciencelearningcentres.org.uk/WebPortal.aspx?page=1/

The advantages of using e-learning include:

- provides a different way of learning – adds variety
- can be used to supplement teaching when specialists are not available
- is personalised, allowing students to work at their own pace and time of choosing
- students can follow up areas of interest
- can help students catch up if they miss lessons
- can be used with small groups or individuals.

Issues that need to be considered include:

- the time needed to develop or investigate and evaluate provision of this type
- can become monotonous if over-used
- not suitable for all aspects of learning, particularly in practical and skills-based subjects and care needs to be taken to ensure that students do not miss the excitement of hands-on experience.

It would appear worthwhile for schools introducing Triple Science and interested in developing e-learning to consider the developments together. They would need to consider the student needs best met by this method of learning, which aspects of the science curriculum could be well served by using e-learning and the extent to which students have access to the appropriate hardware and software.

Section 7

The models and case studies

This section comprises a more detailed discussion of each of the 10 models listed on pages 22–59. The aims, advantages and disadvantages of each are set out, and points for further discussion are raised.

Each model is set out in the same way:

- brief description
- diagram(s)
- advantages and disadvantages of the model
- points for discussion.

None of the models is presented as the ‘right approach’ – schools will decide the most appropriate response in their own situation.

In the models, the relative proportions of time allocated to subjects within the core are indicated by bands of colour. They do not indicate precise time allocations and reality will often include cross-curricular delivery that is difficult to show on these diagrams. The concentration is on the science aspects of the curriculum.

The approaches are not mutually exclusive, and many schools will operate a combination to suit their circumstances and students’ needs. This is fully demonstrated in the case studies.

It is clear that in many schools the curriculum is in a dynamic phase, as they plan provision for 2008, based on only one year’s experience of the new specifications and without yet a detailed knowledge of the demands and opportunities of the new Key stage 3 programme of study.

The case studies are representative of the schools currently delivering Triple Science. They cover a range of:

- geographical areas and urban/rural settings
- age ranges and numbers on roll (NOR)
- specialisms
- specifications taught
- Triple Science delivery models.

Model 1

Teaching two GCSEs within the core curriculum and adding a third science as an option choice, to maximise science take-up and quality of learning experience

In this model, students study Triple Science across the core and within one option block. They may be taught with their peers within the core, or be organised into discrete groups for each science subject. Around 30% of their time is devoted to science. The core curriculum will be around 60% of available time.

Core – 60%	English
	Maths
	PE
	RE
	PD/Cz
	ICT
	Science Science + Additional Science or Science + Additional Applied Science or Applied Science (DA) or Triple Science (two GCSEs)
Options – 40%	A TS extension units or third separate science GCSE
	B
	C
	D

Advantages of this model:

- all students take Double Science as a minimum
- there is flexibility within the 20% core to offer different courses/qualifications
- there is choice for those wishing to take Triple Science
- sufficient time within 30% to cover the course content, master the skills and allow teachers/students to pursue individual interests or topical issues
- can have separate Triple Science group(s) throughout, or teach GCSE Science/ Additional Science within core, separate sciences within the option
- flexible teacher deployment
- easy to timetable.

Disadvantages of this model:

- lack of breadth and balance within a programme comprising 40–45% science and maths
- proportion of time on science means several science lessons on some days
- fewer options available to those taking Triple Science – including other entitlement areas
- impact on other optional subjects – lower take-up of some
- potential impact on ability range taking other options within same block.

Points for discussion:

- which subjects are best placed against science in the option block
- any potential tension between choice and breadth and balance
- how best to maintain student motivation across such a programme.

Case study 1

The Castle School, Taunton, Somerset

11–16 specialist sports college

NOR

1300

Curriculum model

**20% science within core,
plus a 10% option choice**

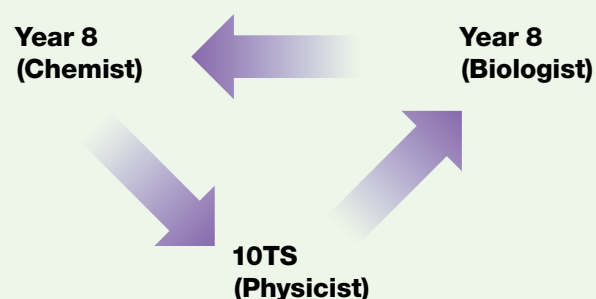
Castle School introduced Triple Science for the first time in September 2006 to coincide with the introduction of the new GCSE Science specifications. The decision was made in response to parental requests and as part of the personalised learning agenda; there was also a perception that students who have studied the three GCSEs are better prepared for A-level science study.

Most students take at least Science and Additional Science GCSEs within the Key stage 4 core curriculum in 20% of time (10 lessons in a 50-lesson fortnightly cycle). They begin their science GCSE courses immediately after the national Key stage 3 science tests in Year 9. Students choosing the Triple Science option have a further five science lessons per fortnight within the options system. No restrictions are placed on students choosing Triple Science but some guidance is given to students for whom Triple Science would be inappropriate.

Twenty-one students (from a cohort of 250) chose the Triple Science option in the first year. They are taught alongside those studying Science and Additional Science in ability groupings and as a discrete set for the extra Triple Science option.

They follow the AQA-A specification, taught in 'series', ie GCSE Science in Year 10 followed by Additional Science in Year 11. Module tests for GCSE Science are taken in November, March and June of Year 10 with any re-sits in November. The school feels the AQA scheme gives flexibility, with students able to leave the decision to opt for the double or triple award until Year 11. From September 2007 they will use the AQA-B specification.

The Triple Science option is timetabled against half the Year 8 science groups. This enables specialist science teachers to teach the Triple Science group for one block of three by 'rotating' twice a year, as shown below.



Case study 2

Finham Park School, Coventry

11–18 maths and IT specialist college

NOR

1300

Curriculum model

**20% science within core,
plus a 10% option choice**

Finham Park has been offering Triple Science GCSEs as an option for the past four years, to provide a suitable challenge for its most able and enthusiastic young scientists.

Almost all students study at least Science and Additional Science GCSEs at Key stage 4 and around 60 students tend to choose the Triple Science option (two groups). Discussions take place during the options procedure between science staff, students and parents, informed by both test marks and attitude to learning (ATL) scores, to ensure that students choosing the Triple Science option are likely to succeed.

The Triple Science groups are taught separately from the rest of the cohort by each of three subject specialists for 3 × 50-minute lessons per week. They follow the AQA-B specification, taking the same written papers as those studying Science and Additional Science (B1, C1, P1) at the end of Year 10. They then sit the Additional Science modules in January of Year 11 and the separate science modules in June of Year 11.

The introduction of Triple Science has had a positive effect on numbers choosing to study one or more A-level sciences and has also made the transition from GCSE to A-level study easier. Several sixth form students from nearby schools attend Finham Park for some, or all, of their science lessons, and this could potentially build to include Triple Science students. However, more students studying more science has put greater pressure on laboratory provision, with some science lessons taking place in normal classrooms.

Model 2

Teaching Triple Science within a core allocation of around 20% of curriculum time, to allow for breadth and balance across the optional curriculum

Many schools offering Triple Science have selected able, well-motivated students whom they regard as capable of working at a faster pace. On this basis, they cover the requirements for the three GCSEs in the core allocation within which other students take two GCSEs. In this model, Triple Science students need to be taught as a separate group within the core.

Some schools using this model have targeted their most able students – those achieving level 7 at the end of Key stage 3. They are considering whether they need to provide more time for students achieving level 6, or to make other changes to their provision.

Schools often supplement this time allocation by some out-of-hours learning – see Model 4 (page 34).

Core – 60%	English
	Maths
	PE
	RE
	PD/Cz
	ICT
	Science Science + Additional Science or Science + Additional Applied Science or Triple Science
Options – 40%	A
	B
	C
	D

Advantages of this model:

- Triple Science students have full choice of other options, including entitlement areas
- does not ask students to choose between Triple Science and other curriculum areas/subjects
- breadth and balance more likely
- able students challenged, may regard this as an opportunity to prove themselves
- content covered economically.

Disadvantages of this model:

- less time for exploration of topics
- potential for 'teaching to the test'
- causes pressure on staff and students to cover content in time allocation
- may be lack of time for practical work.

Points for discussion:

- whether to teach Triple Science students as a discrete group, with potential impact on group sizes within the core
- how to support students who only just achieve level 6 in the National Curriculum tests
- the best time to make this decision, perhaps when teachers are more familiar with the demands of the courses and specifications and can analyse opportunities for coordinated skills teaching.

Case study 3

Gosford Hill School, Kidlington, Oxford

11–18 maths and IT specialist college

NOR

1200

Curriculum model

18% science (core) supplemented by after-school lessons

As part of the school's 'personalised learning' agenda, aiming to provide greater variety and choice for its students and moving towards a 'stage not age' curriculum, the science department is offering Triple Science to a group of Year 10 students for the first time in many years.

The school chose the OCR Twenty First Century Science specification for its new science courses, feeling it reflects the philosophy behind the National Curriculum programme of study. The staff have adopted new teaching methods to better facilitate discussion and group activities and have removed some of the traditional laboratory furniture, replacing it with carpeted floors and normal desks and chairs.

GCSE Science courses start at the beginning of Year 10, with the first module tests taken in January. These are used to identify those students for whom Triple Science would be appropriate. The groups are then adjusted so that all the Triple Science students are in one group. The whole year-group is taught science at the same time, for nine lessons out of 50 per fortnightly cycle (18%).

Students taking Triple Science have a 'top-up' after-school lesson (one hour) each week from January of Year 10 through to the completion of the course. The three subject specialists teaching the group share responsibility for the twilight lessons.

Triple Science students can decide to 'cash-in' their modules for two GCSE awards (Science and Additional Science) instead of three at the end of their studies.

Future plans

The Year 7 cohort starting in September 2008 will be the first to study the Key stage 3 programme of study in two years. They will study GCSE Science in Year 9 and Additional or Additional Applied Science in Year 10. Students will then be able to choose from a range of options in Year 11 including:

- studying the extra modules for Triple Science GCSEs
- stand-alone science GCSEs such as Astronomy and Environmental Science
- starting AS science courses.

Case study 4

Huish Episcopi School, Langport, Somerset

11–16 specialist science and languages college

NOR
1200

Curriculum model

Triple Science taught within the core, supplemented by after-school lessons in Year 11

Huish Episcopi school has a long tradition of offering separate science GCSEs at Key stage 4. It is seen as providing a genuine challenge for the most able students, many of whom will go on to study A-level sciences at one of the nearby sixth form colleges.

Students start their GCSE Science courses on completion of the Year 9 National Curriculum tests. In Year 10 all students study OCR Twenty First Century Science for 10 lessons out of 50 per fortnight, taking the GCSE Science exam in June of Year 10 except for two sets of lower-attaining students who study GCSE Science over two years. The science department chose this specification because they felt it was fresh and innovative, and would appeal to all abilities.

Students are grouped by ability and the Triple Science students are not taught separately but drawn from the top two sets. These sets are given the option to aim for the separate science GCSEs, providing they are prepared to attend a 1½ hour 'top-up' lesson after school each week in Year 11.

The Triple Science students take the separate science papers at the end of Year 10 (3 × 40 minutes). In Year 11 they follow the Additional Science course with their peers, covering the additional work for the separate science modules in the after-school lessons.

The school will evaluate its current model in the light of the 2006 specifications and may consider including Triple Science in the options at Key stage 4. They are concerned whether the extra lesson each week in Year 11 will prove sufficient to cover the extra work.

Model 3

Teaching a single science GCSE within the core curriculum, and adding two science options, to maximise flexibility and choice

In this model, science within the core is allocated around 10% of time, sufficient to cover GCSE Science or one of the separate sciences, where students are taking all three. Science also appears in two option blocks. A range of science courses can be provided within these, enabling, for example, attainment of GCSE Science and one or two separate sciences, as well as Additional Science, Additional Applied Science and Triple Science.

The model also enables some students to take single science and pursue other options – this may apply particularly to students for whom Double Science may not be appropriate, or who may be following courses within the Foundation Learning Tier.

Numbers taking at least two science GCSEs can be controlled by making option A a constrained option, including mainly science subjects, rather than offering sciences within a completely free choice system.

Core – 50%	English
	Maths
	PE
	RE
	PD/Cz
	ICT
	Science or Chemistry
Options – 50%	A Additional Science or Additional Applied Science or Biology
	B Physics
	C
	D
	E

Advantages of this model:

- flexible offer across science options and other pathways – enables students to take one, two or three science GCSEs
- enables students to take single Science and a Diploma if that is appropriate for their progression and there is scientific content in the Diploma
- core confined to statutory requirements
- creation of another option block expands choice for all
- sufficient time within 30% to cover the course content, master the skills and allow teachers/students to pursue individual interests or topical issues.

Disadvantages of this model:

- some students will choose not to take two science GCSEs, potentially to the detriment of their progression and/or the national interest
- lack of breadth and balance for students that choose a curriculum that has 40–45% science and maths
- fewer options available to those taking Triple Science – including other entitlement areas
- impact on other optional subjects – lower take-up of some
- potential impact on ability range taking other options within same blocks.

Points for discussion:

- how to ensure that most students take two GCSEs in science
- how this model would affect other provision
- which subjects are best placed against science in the option blocks
- whether to operate a free choice or fixed option block system.

Case study 5

Cardinal Wiseman RC School and Language College, Coventry

11–18 specialist language college

NOR

1300

Curriculum model

10% science (core) +

10% science option

The school does not currently offer Triple Science but is exploring ways of doing so.

The school begins teaching the GCSE course immediately after the Year 9 National Curriculum science tests, covering topic B1a of the GCSE Science course.

All students follow the core GCSE Science course (AQA-A) and most choose to study a second science as one of their Key stage 4 options (either Additional Science or Additional Applied Science). The course is taught in 'series', with students taking the GCSE Science module test papers in November, March and June.

One teacher has responsibility for taking a group through the course in six periods of a 30-period week. The biology topics are taught first in the autumn term, followed by the chemistry topics and finishing with the physics topics in the summer term. The department also runs half-day revision workshops before module tests.

Future plans

Each year group is split into two bands (upper and lower). In future the school plans to draw a Triple Science group from the upper band. This group will be taught separately from those following the Science and Additional Science path to cover the course at a faster pace and create time for the extra modules. They will also have an extra after-hours lesson each week to cover the extra material needed for Triple Science.

Case study 6

Bridgemary School, Gosport

11–16 community sports college

NOR

1200

Curriculum model

10% science (core) +

10% options, condensed KS3

Bridgemary School bands its students by ability from the beginning of Year 7 using CAT scores from Year 6. Students who show the potential, confirmed by ongoing assessment, follow a condensed Key stage 3 curriculum for science, taking their National Curriculum science tests at the end of Year 8. (There is a similar programme in Maths and English.)

In Year 9 they study the GCSE Science specification (AQA-A) for seven periods out of 50 in each fortnightly cycle (14%). A recent survey of the students showed that most of them appreciated the chance to take the GCSE early.

In Years 10 and 11 the students in the accelerated groups can choose to take:

- Triple Science GCSEs in 20% of their school timetable (10% core + 10% option): they cover the Additional Science topics in five 1-hour periods per fortnight and the additional units for the separate science qualifications in a 5-hour option block or
- GCSE Additional Science in five periods per fortnight.

Both groups of students are taught together, in ability groupings, for the Additional Science lessons. The aggregation of units and certification as three separate science GCSEs or Science plus Additional Science is not completed until the end of Year 11.

The rest of the cohort can take:

- only GCSE Science over two years in the core allocation, starting at the end of Year 9 with some investigative skills work or
- they can add GCSE Additional Science as an option, taught 'in series'.

The science department organises twilight 'catch-up' sessions before modular exams. The department also holds after-school sessions for students who want to study GCSE Additional Science but could not opt to do it because they had chosen other subjects, together with a drop-in facility for all students after school. All these contribute to the school's ambition to become a '24/7' school.

Model 4

Offering lessons or experiences outside the normal school day, to supplement learning and offer further choice

Many schools are extending their provision beyond the bounds of the normal school day. They do this to offer students supplementary learning, different experiences and/or extra choice.

The diagram below illustrates a week in a school where a range of optional extension programmes is offered at Key stage 4. One of these is Triple Science, for which an after-school session appears to be the most common model of extended provision.

Day 1	Day 2	Day 3	Day 4	Day 5	Triple Science
Extension – Second or third language	Extension – Triple Science extension units	Extension – Art and design endorsement	Extension – Diploma learning at college		

However, there are a number of variations on this basic model for science. The time allocation may be from one hour upwards; it may take place throughout the course, at particular points, on a regular or an ad-hoc basis. It may involve enrichment as well as teaching towards the GCSEs.

Schools have proved very creative in setting up this provision and examples include: breakfast clubs, lunchtime sessions, after-school lessons, drop-in workshops, whole-day events and revision classes during study leave. The case studies illustrate such variety.

One school offering a case study plans to supplement its 20% allocation for Triple Science by using half-term holidays. During this time students will learn in different ways, across a whole day, and will benefit from contact with employers in the scientific field as well as teachers. The school already runs revision courses in holiday times, which are voluntary on the part of students and paid on the part of staff. These have proved popular with both.

Reasons for offering supplementary time vary and include:

- covering all the content of each of the Triple Science units
- organising ‘master classes’, taking aspects of topics covered within core time to a deeper level
- providing time to carry out coursework
- arranging booster sessions on specific topics, for some or all students
- revising work in the period before tests or examinations
- providing guidance on study and exam techniques.

Where the entire content of the Triple Science units is covered in supplementary time, sessions can be organised on a termly or a weekly basis, ie each discipline in turn for a term, or each in turn on a three-week rotation. If some students were working for a separate science GCSEs in one or two, but not all three of the sciences, the pattern chosen would affect them, as well as Triple Science students.

Advantages of this model:

- provides time for a range of activities to engage students
- where it is voluntary, students are likely to be enthusiastic to learn and participate
- work can be covered efficiently and thoroughly with able and motivated students
- provides a challenge for able students
- does not ask students to choose between Triple Science and other curriculum areas/subjects
- may offer a different type of experience from other lessons.

Disadvantages of this model:

- places extra demands on students and staff
- where sessions occur at the end of the school day, it may not be quality learning time
- may require students to choose between Triple Science and other extra-curricular opportunities
- may be difficult where students are dependent on school transport
- would disadvantage any students with caring or other responsibilities after school or part-time work at weekends
- may be inconvenient for teachers with family responsibilities
- is normally voluntary on the part of staff.

Points for discussion:

- whether and how this solution best fits students’ needs and circumstances
- whether attendance should be voluntary or compulsory and how to ensure attendance and continuity of learning
- how staff can be compensated for teaching these sessions
- how to ensure minimum clash with other extra-curricular activities.

Case study 7

The Cooper School, Bicester, Oxon

11–16 specialist science college

NOR

918

Curriculum model

18% science (core) +

4% (from options) +

breakfast club

The Cooper School introduced Triple Science GCSEs in September 2007 in response to both pupil demand and staff wishes. The science department was keen to see more students go on to study A-level sciences, particularly Physics and Chemistry, and this was one way of promoting science in the curriculum.

The school chose the OCR Twenty First Century Science specification, which they regarded as the most relevant and engaging of the new courses. Students wishing to study Triple Science at GCSE are expected to have level 6 in their National Curriculum science tests, and to demonstrate a genuine commitment to the extra work that will be needed to complete the course successfully. Sixty students within the first cohort are working towards the three separate science GCSEs, taught as separate groups from those studying core Science plus Additional Science or Additional Applied Science.

Students begin their courses immediately after the National Curriculum science tests in Year 9. In Key stage 4 they have nine one-hour lessons out of 50 lessons per fortnightly cycle (18%). In addition, students taking Triple Science have a further two hours from within the option system. To enable this, two option blocks contain subjects that have sets in common with the Triple Science groups. In those subjects, the pace of work is faster than for other groups and students undertake more independent study. They also have access to a breakfast club lesson once a fortnight to support their Triple Science study.

In future, the school hopes to increase the number of Triple Science groups and to allow its top sets to start their GCSE courses in Year 9.

Model 5

Following a condensed Key stage 3 and starting GCSE Science in Year 9, to improve Key stage 3 experience and create time for additional GCSE or other courses

Some schools already operate a condensed Key stage 3 to improve teaching and learning in Key stage 3 and to personalise their offer. They complete the Key stage 3 programme of study in some or all subjects at the end of Year 8, whether or not they enter students for National Curriculum assessments at the same point. They may operate this for all or only some of their students, depending on need and attainment on entry.

In science terms, the variations are:

- a two-year Key stage 3 followed by National Curriculum assessment at the end of Year 8, with GCSE beginning in Year 9
- a two-year Key stage 3 followed by GCSE beginning in Year 9, with National Curriculum assessment at the end of Year 9
- a GCSE Science course assessed at the end of Year 9.

Further variations are provided by the by the different assessment patterns and methods available. See Appendix 1 (page 63).

Year 7	Year 8	Year 9	Year 10	Year 11	Outcome	
KS3 PoS	Tests	GCSE			GCSEs	Triple Science
KS3 PoS		GCSE	Tests	GCSE	GCSEs	
KS3 PoS	Tests	GCSE	GCSE	GCSE	GCSEs	

Condensing the KS3 science curriculum has the following effects.

- There is incentive for cooperation between teachers of Year 6 and Year 7 so the transfer from Key stage 2 should be improved. Schools need to work together to ensure that students are well prepared for the transfer and that teachers have the information they need to build on what students already know, understand and can do, avoiding any repetition.
- Teaching and learning may be improved as teachers have to review their schemes of work and their teaching styles, and find new ways of engaging and motivating their students. They have to reconsider the content and order of teaching units and decide how to cover them in a shorter length of time. Students are likely to find the work more challenging because the pace is quicker and there is less repetition.
- Teachers will be aware of individual examples of topics that appear first in their Key stage 3 teaching and are then revisited, perhaps in a different context, at Key stage 4. In some instances it may be unnecessary to revisit the topic, particularly for more able students who have already grasped the fundamental concepts fully. For them it may be appropriate to use the time to cover the additional topics needed for the separate science GCSEs.
- Following a condensed Key stage 3 there are opportunities to provide a broader and more flexible curriculum, starting in Year 9. Students could choose to study Triple Science GCSEs over three years from the beginning of Year 9, or to complete GCSE Science and Additional Science over two years and then complete the requirements for Triple Science in Year 11.

Advantages of the model:

- increases the focus on learning in Year 8, helping to prevent disengagement
- may create more time in Year 9 for a range of subjects/activities
- can be used to supplement time available at Key stage 4
- enables students to progress according to stage rather than age
- motivating for students to be studying and assessed for GCSEs.

Disadvantages of the model:

- Key stage 3 content may not be fully covered/assimilated
- may not suit all students
- where Key stage 3 assessment takes place early, some students may not reach the levels they would attain at the end of Year 9
- learning from Year 9 may need revising later if needed for GCSE
- spreading GCSE over three years could prove demotivating if the teaching is not engaging/inspiring.

Points for discussion:

- whether the pattern across the key stages should be the same for all students
- how much science to include in Year 9, and whether to aim for GCSE assessment at the end of that year
- whether to introduce level 3 study in Year 11
- how to ensure appropriate progression from GCSEs in science, whenever they are taken, to level 3
- maintaining momentum and motivation over a three-year GCSE course – though in Triple Science terms this involves three separate GCSEs.

Case study 8

**Thomas Hardy School,
Dorchester, Dorset**

14–18 specialist science college

**NOR
2300**

Curriculum model

**Triple Science taught from beginning of
Year 9, over three years**

Over the years, Thomas Hardy has offered Triple Science in different ways – within the options programme and, more recently, within Double Science time (20%). Now, by arrangement with its partner middle schools, all students complete the Key stage 3 programme of study and take the science tests at the end of Year 8. They are therefore ready to begin their GCSE Science courses on arrival at Thomas Hardy in Year 9.

In Year 9 all students have eight lessons per 50-lesson fortnight (16%) and in Years 10 and 11 they have nine lessons (18%) – three lessons with each subject specialist.

Students study either Science plus Additional Science or Triple Science depending on ability, with a few students changing from Double to Triple Science at the end of each year. Four groups (115 students) are working towards the Triple Science qualification in the current Year 11.

The department chose AQA-A for its new specification. The Triple Science students take the first module tests (covering units B1, C1 and P1) in November or March of Year 10, the second set of units in January of Year 11 (B2, C2, P2) and the final set (B3, C3, P3) in June of Year 11. The science department feels the course develops fundamental science concepts very well, likes the approach to How Science Works, and considers that it provides a good basis for A-level study.

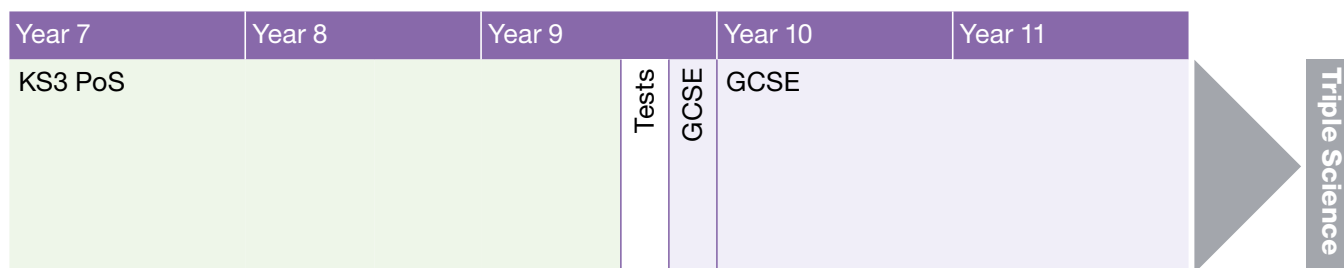
The school has also recently appointed a ‘flying science teacher’ to support the work of science teachers in the middle schools and local 11–16 schools, including support for offering Triple Science in these schools.

Triple Science is viewed as providing a challenge for the most able students and giving them greater confidence in science so that more may choose to progress to further study at A-level. Teaching their specialism is also seen as attractive to staff and therefore helpful in recruiting specialist staff.

Model 6

Starting GCSE Science after Year 9 National Curriculum assessment tests, to retain motivation and introduce skills required for GCSE

The period following the National Curriculum tests in May of Year 9 can be profitably used in a number of ways – including introducing the skills required for GCSE or to starting on a GCSE course. In a survey of schools in one local authority, the majority said that they already follow this model.



Many schools use the opportunity to prepare students for the common components of the GCSE Science specifications. These include:

- mini case studies
- data analysis activities
- measurement and observation skills
- designing and carrying out longer investigations
- teaching aspects of the first unit(s) of the GCSE Science specification.

It is also possible to order the teaching of the Key stage 3 programme of study so that topics that re-appear within Key stage 4 are dealt with in some depth in Year 9, rather than more superficially in Year 7 or 8.

Advantages of this model:

- maintaining momentum after the National Curriculum tests
- preparing students for GCSE
- covering some aspects of the GCSE course
- developing motivation for the GCSE courses
- enabling concentration on GCSE skills.

Disadvantages of this model:

- students may be tired after the tests and not at their highest learning capacity
- students may forget over the summer holidays what they did before
- teaching groups are unlikely to be the same as in Year 10 – limits to what can be covered
- the end of the summer term includes a number of activities that may disrupt the timetable
- potential loss of opportunity to participate in enrichment activities.

Points for discussion:

- the benefits and opportunity costs of using this time to start GCSE learning
- whether to teach in Year 9 or Year 10 groups
- whether to teach skills or content at this stage
- how best to ensure teaching and learning are motivating and build enthusiasm for Key stage 4 courses.

Case study 9

William Ellis School, Camden

11–16 voluntary-aided language college

NOR

640 (boys)

Curriculum model

**Starting GCSEs following the
Key stage 3 tests**

All the science GCSE courses begin immediately after the national Key stage 3 science tests. The second half of the summer term is used to complete a mini ‘case study’ and ‘data analysis’ in preparation for the coursework components at GCSE.

Students are allowed to opt for Triple Science in Year 10 provided they have achieved level 6 or 7 – for 2007/8 there is one group of 29 students. These students have the core allocation for science of 10 lessons in a 50 lesson fortnightly cycle (20%) together with an extra twilight or breakfast time top-up session each week. The precise timing of the extra lessons is decided by when normal science lessons are timetabled. If, for example, there is a science lesson timetabled for the first period of the day, a breakfast session of 40 minutes is added on.

The science department chose the OCR Twenty First Century Science specification for its new GCSE courses as one that would engage the students and offer a course that provided the variety required to match the students’ needs. The Triple Science group is taught by three specialist teachers; each is responsible for all seven modules within their subject. Triple Science students sit their first module papers in June of Year 10. The school forms part of a mixed sixth form consortium of four schools within Camden.

Case study 10

The Blue School, Wells, Somerset

11–18 specialist science college

NOR

1460

Curriculum model

Starting GCSEs following the Key stage 3 tests, 75-minute lessons

The Blue School introduced Triple Science in 2004 when it was designated a specialist science college. They chose Edexcel's 360Science suite of specifications for the courses starting in September 2006 as teachers felt they offered a good balance between How Science Works and the detailed subject knowledge and understanding needed to progress to A-level study. They also liked the range of assessment pathways offered and the quality of the support material.

Year 9 groups started on their GCSE courses immediately after the national Key stage 3 tests, to allow for testing of the first module in November. All students have at least five hours per week of science (20%) in Key stage 4 – four periods of 75 minutes each from a 40-period weekly timetable. Triple Science is offered as a free choice option, though staff give guidance in cases where the choice may be inappropriate.

Forty students in Year 11 are working towards Triple Science, in two groups. They completed the GCSE Science modules in Year 10 in core science time, alongside their peers. In the two lessons forming the option, one teacher covered the first of the separate science modules in physics, chemistry and biology. The same patterns will be repeated in Year 11 to cover the Additional Science modules and the remaining separate science modules.

Teaching the Triple Science students alongside students studying Double Science GCSEs for the Science and Additional Science components of the course has avoided large groups within the core. It also enables students to change from Triple Science to the two science GCSEs relatively easily.

Module tests are taken in November, March and June of Year 10 for the GCSE Science modules most recently completed. The Triple Science students will take the external extension tests in June 2008.

The school has found that offering the separate sciences has encouraged students to make decisions about studying one or more of the A-level sciences at an earlier stage.

Model 7

Teaching Triple Science in around 25% of curriculum time, exploiting synergies across the three subjects, to maximise motivation and use of time

Where students are taking all three separate sciences, there are opportunities to use the synergies across the subjects to reduce repetition of skills’ learning and time allocations, and enhance students’ motivation. Teaching Triple Science in around 25% of curriculum time can provide further choice, leading to broader student programmes.

This can be achieved by allocating:

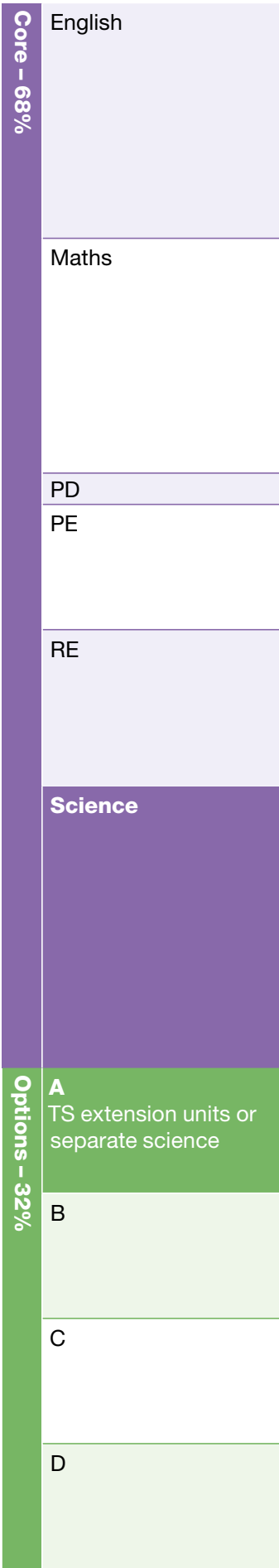
- less than 20% of curriculum time within the core
- less than 10% to options
- different amounts of time across the key stage.

In addition, subjects may deliver aspects of another area of learning within a specific time allocation, for example, ICT or citizenship. In this case the time allocation will be based on the extended delivery, as in the example opposite where the subjects in option block A are responsible for ICT delivery, rather than having ICT within the core. ICT could be taught as separate units within the option block, in addition to the Triple Science units, or it could be taught in the context of science learning.

Some schools have a core larger than the previous models have used, for example because:

- they decide to devote higher than average amounts of time to English and maths
- their status requires additional focus, or qualification outcomes, in core subjects such as RE, ICT or PE.

In such cases, choice can be maintained by allocating a smaller percentage of time to each option.



Current Triple Science provision varies. Those who currently have 30% of curriculum time may regard any less as insufficient time to fully explore and experience the Triple Sciences GCSEs. Those who teach within 20%, whether or not supplemented by twilight sessions, are likely to regard around 25% as a suitable amount of time.

Taking the most common timetable patterns for the core:

- five 50-minute lessons provide 16.6% of curriculum time
- four one-hour lessons provide 16% of curriculum time
- nine one-hour lessons across a two-week timetable provide 18% of curriculum time.

Each of these figures could represent sufficient time for the delivery of two GCSEs in science, particularly for more able students who grasp concepts swiftly and who are taught together. An additional option is likely to add 8–10%.

Where students are taking all three sciences, there are some synergies across the three subjects that can be exploited. Many of the practical skills required for the centre-assessed component of each specification are common to all three sciences so teaching can be coordinated. The following are examples of the practical skills common to many of the revised specifications:

- observation skills – accuracy and precision
- designing an investigation
- making measurements
- presenting data
- identifying patterns and relationships in data
- recognising the limitations of scientific evidence.

Teachers are likely to identify further opportunities to economise on time as they become more familiar with the specification they are teaching, and the demands of revised coursework (controlled assessment).

Advantages of this model:

- may enable students to choose an extra subject, providing a broader programme
- avoids unnecessary repetition of learning
- promotes pace in learning
- is motivating for students
- encourages transferable skills and knowledge.

Disadvantages of this model:

- time allocations may not fit a system requiring each class to be taught by three different teachers
- may not allow for exploration round the topics.

Points for discussion:

- the amount of time needed to maximise motivation and attainment
- the most effective balance of science time across core and options
- how best to exploit the synergies across the subjects
- when to evaluate decisions taken for 2006 and the schemes of work developed to meet the new specifications.

Case study 11

Warneford School, Highworth, Swindon

11–16 specialist technology school

NOR

930

Curriculum model

Teaching Triple Science in 26% of curriculum time

Warneford School has taught Triple Science for some time. In 2006, the science department decided to change its previous practice of teaching it within the time allocation of double science, supplemented by twilight sessions.

The school has a 25-lesson week, with one-hour lessons on a fortnightly timetable. Most students have nine hours per fortnight of science within the core, or 18% of curriculum time.

The specification used is Edexcel 360Science. Most students will take single science GCSE at the end of Year 10 and Additional Science at the end of Year 11. Within the core, students taking Triple Science are taught with those taking Double Science GCSEs, but then separately within the option covering the extension units. Those taking Triple Science do not cash in their single science at the end of Year 10.

Two teachers share the teaching of each group within the core, teaching to their strengths. Wherever possible the extension units are taught by a specialist teacher.

Students opting for Triple Science take an option set against design and technology. While any student can take Triple Science, it tends to be the more able who do so, with consequences for the other options. Forty students opted for Triple Science in 2006 and 60 in 2007. The school teaches these as two and three groups respectively – small classes are a priority throughout the school.

The option adds four hours per fortnight to their science time – making a total of 13 hours per fortnight or 26% of curriculum time.

Case study 12

Chingford Foundation School, Waltham Forest

11–18 foundation school

NOR

1275

Curriculum model

Teaching Triple Science in 24% of curriculum time

Current science provision

Chingford School has a 25-lesson week, and a weekly timetable. It currently teaches OCR's Gateway specification in four one-hour lessons in Year 10. In Year 11 those taking the higher tier papers have an extra science lesson, while students taking foundation papers have their extra lesson in RE. The time comes from changes to the time spent on ICT and PSHE across the two years.

The school has four option blocks, with students having free choice of subjects. Across the key stage, optional subjects have three hours in one year and two in the other.

Plans for 2008

The school plans significant curriculum change for 2008, when a larger Year 10 cohort will coincide with the introduction of the new entitlement.

All students will have four hours of science within the core. Those taking Triple Science will have a further two hours within the option system and they will be taught as a discrete group across the core and option. Teachers feel this will make tracking of student progress more straightforward and build students' sense of being part of a group. Able students will be given individual advice to ensure they are aware of all the progression issues that may be relevant to their choice of science course.

Some students may aim for only GCSE Science within the core, most will take two science GCSEs. Future provision may also include vocational science courses within the core. The curriculum offer will therefore develop to enable greater choice and personalisation.

There will be five option blocks of two hours each. One will be a constrained IT option; aside from that students will have free choice.

Model 8

Operating a different curriculum in Years 10 and 11, to give opportunity for further choices in Year 11

In this model, students would complete some aspect of their Key stage 4 programme at the end of Year 10. This leaves room for extension, enrichment or additional qualifications in Year 11 and provides an opportunity for further, informed choice at that point.

Where subjects are compulsory, but do not always lead to a qualification, additional time in Year 11 can be used to complete qualifications in those subjects, for example, RE, citizenship, PE or ICT. In this example, the compulsory aspects of these subjects are completed in Year 10, apart from in PE. Students then have the opportunity in Year 11 to 'top-up' their learning in a range of subjects, by taking a short optional course, including Triple Science extension units, and to achieve qualifications in these areas where appropriate.

Where schools start Key stage 4 courses in Year 9, some students may complete GCSEs in Year 10 and have the opportunity to take other subjects, such as Triple Science, or to take AS-level units – see Model 5 (page 38) and Case study 13 (page 53).

TS extension units,
ICT, RE, PE, Cz,
Preparing for employment,
Study support

Year 10 core – 60%	English	Year 11 core – 55%	English
	Maths		Maths
	PE		PE
	RE		PD
	PD/Cz		Science Science + Additional Science or Science + Additional Applied Science or Triple Science
	ICT		
Year 10 options – 40%	Science Science + Additional Science or Science + Additional Applied Science	Year 11 options – 45%	A
	A		B
	B		C
	C		D
	D		E

Advantages of this model:

- can be flexible to suit student need
- likely to be motivating for students
- status of some core subjects may be raised as qualifications in them become available in Year 11
- students can decide which science course to take at the end of Year 10
- enables further choice for Year 11
- may fit well with condensed Key stage 3 provision
- supports progression according to stage not age.

Disadvantages of this model:

- students wanting to progress in areas they do not study in Year 11 may be at a disadvantage
- subjects not within the core may be seen as devalued
- may result in little choice for students in Year 11 or in uneconomic groups if wide options offered
- may not be easy to timetable as it uses staff from a range of departments.

Points for discussion:

- the benefits of such a model
- which opportunities could usefully be offered
- any implications for progression in learning or from the key stage
- whether to offer level 3 courses in Year 11.

Case study 13

Collingwood College, Camberley, Surrey

11–18 technology college

NOR

2200

Curriculum model

**Condensed Key stage 3,
followed by Triple Science in two years
and Year 11 choices**

Collingwood College has offered the opportunity to study the three separate science GCSEs for many years. In science, there is a programme of accelerated learning for all students, including teaching a condensed form of the Key stage 3 programme of study in Years 7 and 8.

In Year 9, most students follow a programme of science enrichment, and preparation for the national Key stage 3 science tests, taken at the end of that year.

The top four groups start their GCSE Science in Year 9. The school is planning for two of these groups to aim for the Triple Science qualification, with one twilight lesson each week in Years 9 and 10 to cover the extra modules in the separate science courses.

The school chose AQA-B from the new specifications – they like the Investigative Skills Assessments (ISAs) and consider the course good preparation for A-level study. The Science/Additional Science groups follow the course in ‘series’, completing the Science course at the end of Year 9 and the Additional Science course in Year 10.

Those aiming for Triple Science follow a blend of Science and Additional Science content over the two years. In Year 9 they have two 1¼ hour lessons in each subject per fortnightly cycle (15%) and in Year 10 three lessons in each subject per fortnight (22.5%). The three science teachers taking one of the top groups will share the teaching of the after-school lessons.

Students completing their GCSE Science courses by the end of Year 10 then have the opportunity to start an AS science course or follow a different option such as a course in media or IT.

The accelerated learning programme is seen as a way of enhancing motivation and providing an authentic challenge for the most able students. It is hoped more of them will consider A-level sciences in the future.

Model 9

Organising a top set or sets that work across more than one subject, to enable joint planning and/or teaching to enhance learning and maximise use of curriculum time

In this model, year groups are set or banded at Key stage 4 in such a way that students are taught within that grouping for some of their subjects. Given the target group for the Triple Science GCSE entitlement, they are likely to constitute a top set or sets.

The model below relates to the core curriculum, including science. It assumes that the optional subjects are arranged on a different basis.

There may be improved learning as well as economies of time when a skill or technique is taught once and then applied across the subjects. This approach fits well with the new science programme of study for Key stage 4. In the model below, links are made across the skills aspects of the programme of study, the personal, learning and thinking skills (PLTS) and the moral and ethical aspects of science.

English	Maths	Science	ICT	Other aspects of core	Example of opportunity for combined learning
	Maths/Science common groups				Common mathematical skills and content
	Maths/Science/ICT common groups				Data, Evidence, Theories and Explanations from science PoS
English/Maths/Science/ICT common groups					Communication Skills' aspects of How Science Works and PLTS
Common groups across the core					Citizenship, careers education, work-related learning, Applications and Implications of Science from science PoS

There are examples of work to map the links between the programmes of study in maths and science and teach them as a coherent whole. Schools may find it useful to undertake such an exercise using the new programmes of study, given the presentation of the new secondary curriculum as integrated, flexible and focused on skill development. There are also examples of links between skills developed in English and used in science – particularly appropriate to the current emphasis on discussion and group-work skills. The personal, learning and thinking skills should be developed across the whole curriculum and will be referenced in the new GCSEs.

Advantages of this model:

- groups across two or more subjects are consistent
- coordination of skills and topics can be achieved, improving quality of learning
- time can be used flexibly
- work can be planned across the subjects
- only the teachers of those groups need be involved.

Disadvantages of this model:

- students are not necessarily equally able across the subject disciplines
- students also develop at different rates and this model may lack flexibility to enable them to move groups
- these students may be seen as an elite group, separated from their peers
- need to ensure cooperation/coordination between different teachers and different departments.

The advantages could also apply on a larger scale, across a year group, though the scale means that it needs more central organisation and coordination. The disadvantages can be mitigated to some extent by organising the cohort into bands rather than sets, though some of the advantages then disappear as the tight grouping is broken.

Points for discussion:

- the costs and benefits of such an approach within any given school
- how the new GCSE mathematics courses would fit within such a model.

In the case studies that follow, students are placed in bands or chose pathways according to their interests and ability.

Case study 14

Barnwell Community School, Stevenage, Herts

11–18 business and enterprise college

NOR

1600

Curriculum model

Separate bands at Key stage 4

In Key stage 4, students are taught in three bands, each band following a different curriculum. Where appropriate, students are grouped into sets within each band.

- Band 1 comprises around 100 students, usually with level 6 or above. They follow a curriculum that includes 16% science within the core and up to two further science choices within the options, set against languages and humanities. There are two additional GCSE options, in common with Band 2.
- Band 2 includes around 120 students with attainment around level 5. Their curriculum includes 20% science in the core, leading to Science and Additional Applied Science. Their options include a range of BTEC Certificates and vocational GCSEs.
- Band 3 has around 30 students. Their curriculum includes 16% science within the core, leading to GCSE Science, and a choice of level 1 BTEC Diplomas.

The specification introduced in 2006 was OCR Gateway. The school wanted a pattern of continuous assessment to maintain motivation. They also appreciated the online support that promoted personalised learning and has proved popular with students.

In Key stage 4, Band 1 students have four one-hour periods each week (16%) within the core to cover the Science and Additional Science modules they have not covered in Key stage 3. They are taught by specialist teachers in each of the three sciences in rotation.

Beyond the core they have choices that enable them to top up their science qualifications to Triple Science or to add one or two separate sciences. Each option block has two hours or 8% of curriculum time, so students in Band 1 will have 24% or 32% of their time devoted to science.

The school has mapped the Key stage 3 programmes of study against the modules within the Science specification. They plan to teach Band 1 students during Key stage 3 in such a way that some of the content of the GCSE is covered during Year 9 – amounting to around two of the six modules. They will continue to take National Curriculum science tests at the end of Year 9.

Case study 15

Birley Community College, Sheffield

11–16 specialist technology college

NOR

1200

Curriculum model

Pathways at Key stage 4 and aspects of e-learning

Since September 2002, KS4 students at Birley have been able to choose between four 'pathways'.

Pathway 1	Choice of 10 or 11 GCSEs, including Triple Science	
Pathway 2 and 2a	5 or 6 GCSEs	BTEC or OCR level 2 Diplomas in IT, Manufacturing, Health and Social Care
		Pathway 2a – ASDAN and college-based NVQ level 1 qualifications
Pathway 3 (small numbers)	Basic skills qualifications	One day in vocational training at Sheffield College and two days on work placements

All students begin their science GCSEs courses after the completion of the Year 9 national Key stage 3 science tests, though decisions about which Key stage 4 courses individual students will follow are not taken until the beginning of Year 10. All the courses follow the AQA-A specification.

Science provision

Pathway 1

The Triple Science students follow this pathway. They have science for six lessons per week out of 25 (24%) – two lessons in each of the separate sciences taught by specialist teachers. There are 65 students in the current Year 11 following this route out of a cohort of 230 students.

Pathway 2

Students study science for five lessons per week (20%) leading to the GCSE Science and Additional Science qualifications and follow a rota of biology, chemistry and physics lessons.

Pathway 2a

Students study science for three lessons per week (10%) – one biology, one chemistry and one physics lesson – leading to the GCSE Science qualification.

E-learning

Art and Design, Travel and Tourism, Health and Social Care and ICT are 'online' courses. The students following Pathway 2a are piloting online assessment.

The science department is also very keen to use all aspects of IT in its teaching. They introduced a web-based provider of test practice and revision for national Key stage 3 tests, GCSE and A-level, initially for Year 11 revision at lunchtimes. They found that their students were motivated into taking responsibility for their own learning through the material and valued the feedback it gave them; in particular, the fact that the software tracks their progress individually and allows them to try again to improve their performance. Many students said using it helped to improve their exam results.

Model 10

Delivering Triple Science in partnership with other schools or colleges, to secure the entitlement and benefit from local links

Where there are schools that will find it difficult to offer Triple Science entirely on their own, there may be opportunities to develop 14–19 partnerships further to include science. Such schools might include those with few specialist staff, or with small numbers opting for Triple Science. There may also be partnerships within which take-up is uneven from year to year, or where the number of students opting does not divide into economic teaching groups. In these circumstances some or all of the delivery could be shared.

Within the Increased Flexibility Programme, 14–19 partnerships have developed, and will become even more important with the introduction of the Diploma. They have structures that include senior managers and protocols that cover common practices and quality assurance. Increasingly, they will have timetables with compatible elements so students can be taught offsite for two or more of their options. They will also have transport networks to move students between sites.

The diagram below shows a Year 10 curriculum for a school with partnership provision for that year group on one day per week (which is shaded). On that day there are lessons only in the optional subjects so students working offsite do not miss core lessons. There is a 30-period, weekly timetable, with a 50% core including 10% science. Each option has three lessons or 10% of time.

GSCE Science is taught within the core, Additional Science in option A and Triple Science extension units in option B. Students taking Triple Science could travel to another site for those lessons, but would need supported self study or some other provision for the remaining lesson. Alternatively, all three lessons could be timetabled in one day, meaning that teachers and students would need to develop new approaches to learning across longer blocks of time.

Partnership delivery could also use after-school or other extended provision as in Model 4 (page 34).

Day 1	Day 2	Day 3	Day 4	Day 5
Core	Core	Core	Core	Core
English – 1 Maths – 1 Science – 1 PE – 1	English – 2 RE – 1 Maths – 1 Science – 1	English – 1 Maths – 1 Science – 1 ICT – 1		PE – 1 PD/Cz – 1
Options	Options	Options	Options	Options
Option A Additional Science – 1 Option E – 1	Option A Additional Science – 1	Option E – 2	Option B TS extension units – 2 Option C – 2 Option D – 2	Option A Additional Science – 1 Option B TS extension units – 1 Option C – 1 Option D – 1
6 lessons	6 lessons	6 lessons	6 lessons	6 lessons

Local partnerships that relate to science teaching currently concentrate on:

- teacher networks to share experience and resources
- in-service training for teachers teaching outside their specialism
- special events that involve students in out-of school activities
- specific, funded projects such as the Independent/State School Partnerships (ISSPs – see examples in the case studies on pages 60–61) or those arranged as part of Aimhigher initiatives
- opportunities for students to attend FE colleges to follow vocational courses such as BTEC in science.

These are all applicable to supporting teaching and learning in Triple Science and could be extended to explicitly include it. Where there are examples of shared delivery of a course, they tend to be at sixth form level.

Advantages of this model:

- may secure the entitlement when students would otherwise be disadvantaged
- could include Applied Science provision (eg across core and option B)
- may strengthen local delivery by sharing expertise
- could result in more economic groups
- could build on developing practice in other curriculum areas
- binds partnerships closer together.

Disadvantages of this model:

- teachers may lose ownership of their students
- travelling may be costly in time and money
- timetables may be arranged in large blocks of time that may not be appropriate for science teaching
- students may be reluctant to travel to another institution and opt instead not to take Triple Science
- need to develop systems for monitoring attendance and progress across sites.

Points for discussion:

- where Triple Science delivery will be enabled or enhanced by collaborative working
- the most appropriate form of collaboration for Triple Science
- what already exists in the way of partnership infrastructure that can be built on
- whether any agreed blocks of time across a partnership are appropriate to science teaching, or could be made so
- how best to communicate the advantages to students and their parents.

For more detailed discussion of the issues and processes involved in partnership delivery, see the TSSP publication *Triple Science GCSEs: collaborative approaches*.

Case study 16

St Cuthbert's High School, Newcastle

11–18 voluntary-aided specialist science school

NOR

1100 (boys)

Curriculum model

Triple Science within core and aspects of partnership

St Cuthbert's High School offers Triple Science to 70 students in three of the four classes in its upper ability band – the fourth takes Double Science GCSEs. Triple Science is taught in the same time as double science (24%), and has been for several years. Science subjects at Key stages 3 and 4 are taught by specialist teachers. The course is taught as three separate sciences. Twilight sessions begin after mock exams in November of Year 11 and are devoted to exam skills and revision, rather than teaching of content.

Following the new programme of study, teachers find that it takes longer to cover the content than previously, though students are better at understanding scientific terminology and language use, and at expressing concepts.

The school adopted the AQA-A specification in 2006. The school prefers terminal examination to modular tests, considering that depth of understanding is promoted by learning that is integrated and continuous – that 'creates the story'. To achieve this, the material from the B1/2/3, C1/2/3 and P1/2/3 units has been analysed and re-packaged so that topics from both are taught together, in an order and a combination that the school finds coherent.

For example:

- atoms, symbols, structures and chemical bonding (C1)
- ions, covalency and electron reactivity (C2)
- trends in reactivity, loss and gain of electrons (C3).

Students will be able to enter for a first set of tests in January of Year 11. The school will evaluate this integrated approach in the light of the results in 2008.

Partnership

St Cuthbert's High School is part of an Independent/State School Partnership of 10 schools. Year 10 students participate in enrichment activity on three occasions during the year. In September, they investigate solar power, in January the hardness of water and in May the effects of temperature on washing powders. Activities take place at the Royal Grammar School (independent) and each is led by an industrial mentor, who assesses students' reports and presentations for CREST Awards.

Other partnership activities include:

- a Year 9 masterclass on plant physiology: this is run in conjunction with the university and deals with aspects of the Key stage 4 biology curriculum
- a Year 12 specialist week in the independent school, during its holiday period.

As part of its obligation as a specialist school, St Cuthbert's science staff also visit other local schools to give talks about specialised aspects of the curriculum and provide curriculum materials for them. As the other schools do not currently offer Triple Science, it is likely that St Cuthbert's will support them in planning for and delivering Triple Science courses to meet the new entitlement.

Case study 17

A local authority ISSP partnership in York

The City of York Local Authority has gained financial support from the ISSP to set up collaborative arrangements across the city's 13 schools (state and independent) and York College. Initiatives such as these could be used to promote teaching and take-up of Triple Science.

The aims are to:

- increase engagement with science post-16 and into higher education
- enable teachers to pursue their discipline at a high level
- form collaborative relationships of mutual respect between sectors
- improve social cohesion in the city.

The objective is to build sustainable relationships that can support both students taking the sciences and other developments, which could include Triple Science delivery in the future if the need arises.

The focus is on the application of science, and its relevance to other disciplines such as the creative industries, health and humanities. Up to 800 able students will have the opportunity to take part in master classes led by teachers who are expert in their topic and keen to communicate their enthusiasm.

Each master class has three sessions. Each input is followed by tasks for students to undertake before the next class – independent or group follow-up research or investigation. The classes take place in extended school time – after school, in the evening, on Saturdays or during the holidays.

The project comprises:

- a training day for the 30+ tutors from across the schools and other organisations involved (for example, HE, public services, the heritage sector, business)
- planning teams that are mixed across disciplines and sectors
- preparation time for the teachers, working in pairs or small groups during the autumn term
- delivery by pairs of tutors from different institutions, in the spring term to Key stage 4 and post-16 students, and in the summer term to Key stage 3.

Information on the Independent/ State Schools Partnership projects can be found at www.teachernet.gov.uk/wholeschool/buildingbridges/

Appendix 1

The specifications for separate science GCSEs

The awarding bodies offer a range of GCSE Science specifications, including Science, Additional Science, Biology, Chemistry and Physics, where the subjects have a relation to each other.* The separate subject specifications, taken together, include all the topics covered in GCSE Science with its emphasis on How Science Works, together with the more traditional topics in GCSE Additional Science. Triple Science extension units cover the extra content required for the separate science qualifications. (See simplified diagram on page 65.)

Schools can select different specifications and/or awarding bodies for GCSE Science and Additional Science if they wish. They can also choose a different awarding body for each of the three separate sciences. The flexibility of this range of choice needs to be weighed against other factors in spreading provision across awarding bodies – for example, any potential increase in administration or constraint on student flexibility.

This appendix is intended to support schools in making their choices by providing discussion of the issues and a synopsis of the range of relevant specifications offered by each awarding body. Further details are available on each awarding body's website.

What factors could influence choice?

1

Familiarity with the awarding body/ specification suite

There may be some administrative convenience in staying with the same awarding body, but most of the work involved is similar for all awarding bodies.

The content of GCSE Science and Additional Science is also present within the three separate science GCSEs so it is straightforward to offer all variants from the same suite. It makes organisation of teaching and assessment simpler and permits students to change from Triple Science to GCSE Science plus Additional Science part way through the GCSE courses.

The new specifications are structured so that, in most cases, students can postpone decisions about final qualifications (separate science GCSEs or GCSE Science plus Additional Science) until the units are 'cashed in'. Cashing in is the process of applying to the awarding body for certification. There are, however, some restrictions for students studying for one or more of the OCR qualifications (see overleaf for aggregation, certification and cashing-in of units).

*

Other specifications include Additional Applied Science and Applied Science (double award). These qualifications do not have a relationship with the three separate sciences, ie their units are not linked.

2 Choice of content

The content of GCSE Science and Additional Science is specified in some detail by the National Curriculum and the GCSE Science criteria.

It is mainly in the extension units that the specifications vary as awarding bodies are free to select the additional content for these units. Here are some examples.

Biology:

- micro-organisms (AQA, OCR Gateway, WJEC)
- biotechnology (Edexcel, OCR C21, WJEC)
- behaviour (Edexcel)
- transport in plants and animals (AQA, WJEC)
- human physiology (OCR C21).

Chemistry:

- analysis (most specifications)
- chemical production (Edexcel, OCR Gateway, WJEC)
- energy changes (AQA, OCR C21)
- organic chemistry (OCR C21, WJEC).

Physics:

- electromagnetic induction (AQA, WJEC)
- motion (AQA, WJEC)
- particle and nuclear physics (Edexcel, WJEC)
- astronomy (AQA, OCR C21)
- satellite technology (OCR Gateway)
- medical physics (Edexcel)
- electronics (OCR Gateway).

Such variations may be significant in selecting a specification to draw on teachers' strengths and interests, or to promote students' interests and career intentions.

3 Choice of assessment methods

Different weightings are placed on external examinations and internally assessed components and there are a variety of assessment styles to choose from. When the separate science GCSEs are added to the Science and Additional Science offer, there will be much similarity of assessment methods across the qualifications.

4 Timing of assessments

Students can be entered for unit-based external assessment at various times during the course (typically January and June each year), or entered for terminal assessment. These arrangements are the same for Triple Science as for GCSE Science and Additional Science, so this is unlikely to be a significant factor in selecting specifications.

5 Aggregation, certification and cashing-in of units

For most specifications, students may take any unit at any session in which it is available, at either tier. Schools do not need to specify what qualification individuals are aiming for until they actually apply to the awarding body for aggregation and certification.

Students can defer the choice between taking either Additional Science or one or more of the separate sciences until the science units have been completed. The common units within the qualifications also facilitate common teaching of students progressing to Additional Science and to the separate sciences.

Completed internal assessment tasks can be 'bundled' as GCSE Science and Additional Science, or as GCSE Biology, Chemistry and Physics, and submitted accordingly.

The exception is the OCR Gateway Suite, where it is not possible to carry over exam results from the separate sciences when switching to Science and Additional Science part way through a course. The Science and Additional Science exams would have to be taken.

With OCR Twenty First Century Science (OCR C21), however, it is possible to carry over exam results from the separate sciences if a student decides to switch part way through.

Available suites of examinations

	AQA	Edexcel	OCR	WJEC
GCSE Biology/ Chemistry/ Physics	Suite A Suite B	360Science	Suite A – Twenty First Century Science Suite B – Gateway Science	One suite of examinations available

Assessment weightings for the different separate science GCSE specifications

	AQA	Edexcel	OCR	WJEC
External	75%	70–30%	66.7%	75%
Internal	25%	30–70%	33.3%	25%

Science GCSE specifications

The following information provides a synopsis of the relevant science qualifications offered by each awarding body. It shows how the units that comprise GCSE Science, Additional Science and the separate sciences relate to each other and how the separate science qualifications can be constructed from them. It does not explore the other science qualifications that are available, for example, Additional Applied Science, Applied Science (double award), Rural and Environmental Science, Psychology or Astronomy.

AQA

GCSE Biology, GCSE Chemistry and GCSE Physics are single GCSE awards that, taken together, cover the Key stage 4 programme of study for science. The first unit in each of the three separate science GCSEs is the same as that in the single award GCSE Science course. The units are designed to encourage students to develop a critical approach to scientific evidence and to explore the implications of science for scientists and society as a whole. They are assessed by either two short multiple-choice question papers (specification A) or a written paper containing structured questions (specification B).

The second units in each of the separate sciences are the same as those in the single-award GCSE Additional Science course. These units focus on the explanations, theories and models that underpin science. Each unit is assessed through a written paper of structured questions. The final units cover further topics in each of the three sciences and are assessed in the same way.

There are two components to the centre-assessed unit, which are common across the GCSEs in separate sciences, Science and Additional Science:

- a holistic practical skills assessment
- an Investigative Skills Assignment (ISA): this is a written paper that follows up a laboratory practical investigation during which students collect experimental data (some of the questions are based on this). The papers are set by AQA but taken at a time chosen by schools. Students can complete any number of ISAs and select the best.

Further information is available from the AQA website at www.aqa.org.uk

AQA

(Specifications A and B)

**Separate science GCSEs,
GCSE Science and
GCSE Additional Science**

	GCSE Biology	GCSE Chemistry	GCSE Physics	
GCSE Science	Biology 1 Either (A) 2 multiple-choice test papers (B1a, B1b), 2 × 30 minutes or (B) Written paper 45 minutes 25%	Chemistry 1 Either (A) 2 multiple-choice test papers (C1a, C1b), 2 × 30 minutes or (B) Written paper 45 minutes 25%	Physics 1 Either (A) 2 multiple-choice test papers (P1a, P1b), 2 × 30 minutes or (B) Written paper 45 minutes 25%	Science centre-assessed unit (based on B1, C1 or P1) ● ISA (Investigative Skills Assignment) – an externally set, internally assessed test taking 45 minutes ● practical skills assessment (a holistic skills assessment) 25%
GCSE Additional Science	Biology 2 Written paper lasting 45 minutes 25%	Chemistry 2 Written paper lasting 45 minutes 25%	Physics 2 Written paper lasting 45 minutes 25%	Additional science centre-assessed unit (based on B2, C2 or P2) ● ISA ● practical skills assessment 25%
	Biology 3 Written paper lasting 45 minutes 25%	Chemistry 3 Written paper lasting 45 minutes 25%	Physics 3 Written paper lasting 45 minutes 25%	
	Biology Centre-Assessed Unit (based on B1, B2 or B3) ● practical skills ● ISA 25%	Chemistry Centre-Assessed Unit (based on C1, C2 or C3) ● practical skills ● ISA 25%	Physics Centre-Assessed Unit (based on P1, P2 or P3) ● practical skills ● ISA 25%	

Edexcel

GCSE Biology, GCSE Chemistry and GCSE Physics are single GCSE awards that, taken together, cover the Key stage 4 programme of study for science. Each award comprises the relevant content from GCSE Science (units B1, C1 and P1), GCSE Additional Science (units B2, C2 and P2), and specialist extension units for each subject. Each extension unit for biology, chemistry and physics consists of two topics.

The courses are designed to help students develop their questioning, analytical and evaluative skills, alongside core practical skills. The course structures are flexible, with a range of assessment pathways that can be adapted to suit individual teaching approaches and students' needs.

Students can choose different assessment methods for B2, C2 and P2. The flexible assessment model allows students to follow any route between maximum external assessment of 60% and maximum internal assessment of 70%.

Further information is available from the Edexcel 360Science website at <http://360science.edexcel.org.uk/home/>

Assessment

Each separate science GCSE consists of three units of biology, chemistry or physics.

Compulsory assessment for B1, C1 or P1 and parts of B2, C2 or P2

External assessment (20% of GCSE):

- two multiple-choice tiered tests based on B1 or C1 or P1 (available January and June).

Internal assessment (30% of GCSE):

- assessment activities (20%) – two activities based on B1 and B2 or C1 and C2 or P1 and P2
- practical skills assessment (10%) – assessed by teachers and not moderated.

A choice of assessment routes for assessing B2 or C2 or P2 (20% of GCSE)

Schools choose **two** of the following assessment routes:

- multiple-choice tiered test (available January and June)
- structured tiered examination paper (available January and June)
- centre-devised internal assessment.

A choice of assessment routes for assessing B3 or C3 or P3 (30% of GCSE)

Schools choose:

- either a structured single-tiered examination paper (available June only)
- or a centre-devised internal assessment.

Edexcel

Separate science GCSEs

GCSE Biology	GCSE Chemistry	GCSE Physics
2 multiple-choice tiered test papers on Biology unit 1 20% Assessment activities (20%): one activity based on B1 one activity based on B2 Practical skills assessment (10%) assessed by the teacher and not moderated 30%	2 multiple-choice tiered test papers on Chemistry unit 1 20% Assessment activities (20%): one activity based on C1 one activity based on C2 Practical skills assessment (10%) assessed by the teacher and not moderated 30%	2 multiple-choice tiered test papers on Physics unit 1 20% Assessment activities (20%): one activity based on P1 one activity based on P2 Practical skills assessment (10%) assessed by the teacher and not moderated 30%
Choice of two assessments of unit B2 from three below: ● multiple-choice test ● structured written paper ● centre-devised internal assessment 20%	Choice of two assessments of unit C2 from three below: ● multiple-choice test ● structured written paper ● centre-devised internal assessment 20%	Choice of two assessments of unit C2 from three below: ● multiple-choice test ● structured written paper ● centre-devised internal assessment 20%
Choice of assessments of unit B3: either: structured single-tiered examination paper or: centre-devised internal assessment 30%	Choice of assessments of unit C3: either: structured single-tiered examination paper or: centre-devised internal assessment 30%	Choice of assessments of unit P3: either: structured single-tiered examination paper or: centre-devised internal assessment 30%

Edexcel

GCSE Science and GCSE Additional Science

GCSE Science	6 multiple-choice tiered test papers (2 each on B1, C1 and P1) 60%	One assessment activity from each of B1, C1 and P1 – total 30% Practical skills assessment (10%) assessed by teachers and not moderated 40%
GCSE Additional Science	GCSE Additional Science Choice of two assessments from three for each of B2 or C2 or P2: ● multiple-choice tiered test (available January and June) ● structured tiered examination paper (available January and June) ● centre-devised internal assessment 60%	One assessment activity from each of B2, C2 and P2 – total 30% Practical skills assessment (10%) assessed by teachers and not moderated 40%

OCR

GCSE Biology, GCSE Chemistry and GCSE Physics are single GCSE awards that, taken together, cover the Key stage 4 programme of study for science.

Alternatively, students can achieve GCSE Science by taking Unit 1 from each of GCSE Biology, Chemistry and Physics, plus Units 4 and 5 from the GCSE Science specification. They can also achieve GCSE Additional Science by taking Unit 2 from each of GCSE Biology, Chemistry and Physics plus Units 4 and 5 from the GCSE Additional Science specification.

It is not possible to carry over test results from the separate science GCSEs if a student decides to switch to GCSE Science and Additional Science part way through. They would have to take Science and Additional Science unit tests in place of any tests already taken for the other qualification.

Further information is available from the OCR website at www.ocr.org.uk/GCSEscience/

Separate science GCSEs – suite A (Twenty First Century Science)

This is based on a project devised by the University of York Science Education Group. The separate science specifications draw on the teaching modules from GCSE Science (with its emphasis on scientific literacy) and Additional Science (focusing on scientific explanations and models) together with a further section of content specific to each subject.

In each specification there are three externally set and marked unit examinations and one internally assessed coursework unit.

Assessment

Each subject follows the same pattern:

GCSE Biology students sit three written exams:

- Unit 1 (B1, B2, B3) 16.7%
- Unit 2 (B4, B5, B6) 16.7%
- Unit 3 (Ideas in context plus B7) 33.3%
- **plus** internally assessed skills 33.3%.

GCSE Chemistry students sit three written exams:

- Unit 1 (C1, C2, C3) 16.7%
- Unit 2 (C4, C5, C6) 16.7%
- Unit 3 (Ideas in context plus C7) 33.3%
- **plus** internally assessed skills 33.3%.

GCSE Physics students sit three written exams:

- Unit 1 (P1, P2, P3) 16.7%
- Unit 2 (P4, P5, P6) 16.7%
- Unit 3 (Ideas in context plus P7) 33.3%
- **plus** internally assessed skills 33.3%.

Internally assessed skills

In GCSE Biology, GCSE Chemistry and GCSE Physics, students can be assessed for *either* GCSE Science skills *or* GCSE Additional Science skills.

This means they do *either* a case study and data analysis, *or* an investigation.

Schools offering students all three separate science GCSEs can provide a safety net by requiring students to complete at least one assessment of each type.

In this way, some students could be entered in June of Year 11 for two awards: GCSE Science and GCSE Additional Science, rather than for Triple Science.

OCR

Separate science GCSEs – suite A (Twenty First Century Science)

GCSE Biology	GCSE Chemistry	GCSE Physics
Unit 1: modules B1, B2, B3 40 minutes 16.7%	Unit 1: modules C1, C2, C3 40 minutes 16.7%	Unit 1: modules P1, P2, P3 40 minutes 16.7%
Unit 2: modules B4, B5, B6 40 minutes 16.7%	Unit 2: modules C4, C5, C6 40 minutes 16.7%	Unit 2: modules P4, P5, P6 40 minutes 16.7%
Unit 3: Ideas in context + B7 60 minutes 33.3%	Unit 3: Ideas in context + C7 60 minutes 33.3%	Unit 3: Ideas in context + P7 60 minutes 33.3%
Either: Unit 4: Practical data analysis and case study (as in GCSE Science) 33.3% or: Unit 5: Practical investigation (as in GCSE Additional Science) 33.3%	Either: Unit 4: Practical data analysis and case study (as in GCSE Science) 33.3% or: Unit 5: Practical investigation (as in GCSE Additional Science) 33.3%	Either: Unit 4: Practical data analysis and case study (as in GCSE Science) 33.3% or: Unit 5: Practical investigation (as in GCSE Additional Science) 33.3%

Notes

- Students initially aiming for awards in Triple Science can choose to cash in their unit tests towards the GCSE Science and Additional Science qualifications instead of the Triple Science awards, but they must complete the appropriate coursework for both GCSE Science and Additional Science.
- Students starting with Science and Additional Science cannot use their unit test results towards the Triple Science qualifications.
- It may be advisable for students on a Triple Science course to complete at least one assessment for each of units 4 and 5. If they decide instead to enter for Science and Additional Science, they will then have completed the appropriate assessment for each.

OCR

GCSE Science and GCSE Additional Science – suite A (Twenty First Century Science)

GCSE Science	Unit 1: modules B1, C1, P1 40 minutes 16.7%	Unit 2: modules B2, C2, P2 40 minutes 16.7%	Unit 3: modules B3, C3, P3 40 minutes 16.7%	Unit 4: Ideas in context 45 minutes 16.7%	Unit 5: Practical data analysis and case study 33.3%
GCSE Additional Science	Unit 1: modules B4, C4, P4 40 minutes 16.7%	Unit 2: modules B5, C5, P5 40 minutes 16.7%	Unit 3: modules B6, C6, P6 40 minutes 16.7%	Unit 4: Ideas in context 45 minutes 16.7%	Unit 5: Practical investigation 33.3%

OCR

Separate science GCSEs – suite B (Gateway Science)

The three separate science GCSEs aim to give students opportunities to extend their interest in, and enthusiasm for, the three sciences and to develop a critical approach to scientific evidence and methods. They acquire and apply skills, knowledge and understanding of how science works and its essential role in society. They also gain the scientific skills, knowledge and understanding necessary for progression to further learning.

Assessment

There are three units of assessment: two externally set and marked unit examinations, each testing three teaching modules, and one skills assessment unit:

- external unit exam to test the first three modules: 60 minutes – 33.3%
- external unit exam to test the second three modules: 60 minutes – 33.3%.

The skills assessment unit can be taken from GCSE Science or Additional Science:

- either
 - ‘Can-do’ tasks – 13.3% +
 - ‘Science in the news’ – 20%
 - or
- science research topic – 13.3% +
 - data task – 16.6% +
 - practical skills – 3.4%.

OCR

Separate science GCSEs – suite B (Gateway Science)

GCSE Biology	GCSE Chemistry	GCSE Physics
Unit 1: modules B1, B2, B3 1 hour 33.3%	Unit 1: modules C1, C2, C3 1 hour 33.3%	Unit 1: modules P1, P2, P3 1 hour 33.3%
Unit 2: modules B4, B5, B6 1 hour 33.3%	Unit 2: modules C4, C5, C6 1 hour 33.3%	Unit 2: modules P4, P5, P6 1 hour 33.3%
Either: Unit 3: 'Can-do' tasks and report on 'Science in the news' or: Unit 4: Research study, data task and practical skills 33.3%	Either: Unit 3: 'Can-do' tasks and report on 'Science in the news' or: Unit 4: Research study, data task and practical skills 33.3%	Either: Unit 3: 'Can-do' tasks and report on 'Science in the news' or: Unit 4: Research study, data task and practical skills 33.3%

OCR

GCSE Science and GCSE Additional Science – suite B (Gateway Science)

GCSE Science	Unit 1: modules B1, C1, P1 1 hour 33.3%	Unit 2: modules B2, C2, P2 1 hour 33.3%	Unit 3: 'Can-do' tasks and report on 'Science in the news' 33.3%
GCSE Additional Science	Unit 1: modules B3, C3, P3 1 hour 33.3%	Unit 2: modules B4, C4, P4 1 hour 33.3%	Unit 3: Research study, data task and practical skills 33.3%

WJEC

Separate science GCSEs

GCSE Biology, GCSE Chemistry and GCSE Physics are single GCSE awards that, taken together, cover the Key stage 4 programme of study for science.

GCSE Biology, Chemistry and Physics each consist of the relevant subject units from the GCSE Science and GCSE Additional Science qualifications, plus a further unit for each separate science, externally assessed (45 minutes for both Foundation and Higher Tier). The internal assessment for each separate science GCSE comprises three tasks, two of which are available for Science and Additional Science, and one extra subject-specific task.

In each of GCSE Biology, Chemistry and Physics, students undertake **three** tasks. Of these, **at least one** must be a practical task, **one** may be an extended report and **one** may be a planning task. All three tasks can be Board-supplied practical tasks.

All three types of internal assessment task are marked out of 25 and are untiered, producing a maximum raw internal assessment mark for each specification of 75.

Internal assessment

1

Practical task

In the assessment of the practical task, the student is guided through a practical activity, which could be laboratory- or field-based and which arises from the relevant subject content of the specification. The Board provides a range of such activities for each of the specifications.

2

Extended report

A second aspect of the internal assessment scheme, common to all specifications, is the extended report. This may take a variety of forms including written reports, PowerPoint presentations and poster presentations, and the assessment could include ephemeral evidence, assessed by the teacher against awarding body criteria, for example planning, collecting, and presenting information in the form of a talk.

No more than *one* of the pieces of internal assessment work for any student in any specification may be an extended report.

3

Investigatory planning exercise

This takes the form of a paper exercise in which students plan an experimental activity, involving either an investigation into the relationship between variables or a forensic-style investigation.

No more than *one* of the pieces of internal assessment work for any student in any specification may be a planning task.

WJEC

Separate science GCSEs

GCSE Biology	GCSE Chemistry	GCSE Physics
Biology 1 Written paper: 45 minutes 25%	Chemistry 1 Written paper: 45 minutes 25%	Physics 1 Written paper: 45 minutes 25%
Biology 2 Written paper: 45 minutes 25%	Chemistry 2 Written paper: 45 minutes 25%	Physics 2 Written paper: 45 minutes 25%
Biology 3 Written paper: 45 minutes 25%	Chemistry 3 Written paper: 45 minutes 25%	Physics 3 Written paper: 45 minutes 25%
Internally-assessed unit Practical task(s) Extended report (optional) Planning task (optional) 25%	Internally-assessed unit Practical task(s) Extended report (optional) Planning task (optional) 25%	Internally-assessed unit Practical task(s) Extended report (optional) Planning task (optional) 25%

WJEC

GCSE Science and GCSE Additional Science

	GCSE Biology	GCSE Chemistry	GCSE Physics	
GCSE Science	Biology 1 Written paper: 45 minutes 25%	Chemistry 1 Written paper: 45 minutes 25%	Physics 1 Written paper: 45 minutes 25%	Internally-assessed unit Practical task(s) Extended report (optional) Planning task (optional) 25%
GCSE Additional Science	Biology 2 Written paper: 45 minutes 25%	Chemistry 2 Written paper: 45 minutes 25%	Physics 2 Written paper: 45 minutes 25%	Internally-assessed unit Practical task(s) Extended report (optional) Planning task (optional) 25%

Appendix 2

Useful organisations

Note

Three new departments were set up by the Prime Minister on 28 June 2007. They replace the Department for Education and Skills (DfES) and the Department of Trade and Industry (DTI). The Department for Children, Schools and Families (DCSF) is responsible for improving the focus on all aspects of policy affecting children and young people, as part of the Government's aim to deliver educational excellence. The DfES publications and resources listed below can now be found through the DCSF website.

Curriculum planning

For details of the secondary curriculum review and the new secondary curriculum, see www.qca.org.uk/qca_11717.aspx/

The QCA 14–19 learning website – www.qca.org.uk/14-19/ – includes discussion and case-study examples of many aspects of curriculum planning.

See www.qca.org.uk/14-19/6th-form-schools/68_239.htm/ for the advantages and disadvantages of organising a Key stage 4 curriculum into different pathways.

For various aspects of collaboration see www.qca.org.uk/14-19/6th-form-schools/68_91.htm/

For guidance on the Personal Development curriculum see www.qca.org.uk/14-19/6th-form-schools/68_1191.htm/

The Secondary National Strategies are available at www.standards.dfes.gov.uk/keystage3/subjects/science/

Collaboration

For details of programmes and initiatives involving collaboration along with case studies, evaluations and helpful checklists of good practice, try:

www.DCSF.gov.uk

www.innovation-unit.co.uk/collaboration/

www.ofsted.org.uk

www.QCA.org.uk

www.vocationallearning.org.uk

Information on the Independent State Schools Partnership projects can be found on www.teachernet.gov.uk/wholeschool/buildingbridges/

Professional associations

For general information relating to the changes to Key stage 4 sciences try looking at the websites of professional associations and subject associations. They may also be able to provide additional support, resources and continuing professional development.

Association for Science Education
www.ase.org.uk

Association for Science Education/
Sheffield Hallam's Centre for Science Learning
www.upd8.org.uk

Association of British
Pharmaceutical Industries
www.abpischools.org.uk

BBC science and nature news
www.bbc.co.uk/sn/

Becta
www.becta.org.uk

British Association for Advancement
of Science
www.the-ba.net

Earth Science Teachers' Association
www.esta-uk.org

Guardian Unlimited
www.guardian.co.uk

Institute of Biology
www.iob.org

Institute of Physics
www.iop.org

Learning and Skills Network
 (vocational learning)
www.vocationallearning.org.uk

National Science Learning Centre (The)
www.sciencelearningcentres.org.uk

New Scientist
www.newscientist.com

Royal Institution of Great Britain
www.rigb.org

Royal Society (The)
www.royalsoc.ac.uk

Royal Society of Chemistry
www.rsc.org

SciDevNet
www.scidev.net

Science and Technology
 in Society (SATIS) from ASE
www.ase.org.uk

Science Learning Centres
www.sciencelearningcentres.org.uk

Secondary National Strategies
[www.standards.dfes.gov.uk/
 keystage3/subjects/science/](http://www.standards.dfes.gov.uk/keystage3/subjects/science/)

SEMTA (useful for applied science)
www.semta.org.uk

Specialist Schools and Academies Trust
www.schoolsnetwork.org.uk

Teachers' TV
www.teachers.tv

Twenty-first Century Science website, run
 by the Nuffield Curriculum Centre and the
 University of York Science Education Group
www.21stcenturyscience.org

Awarding bodies

The awarding bodies' approved specifications and sample assessment materials can be found on their websites, together with information about the guidance and training they will offer to support their specifications.

AQA
www.aqa.org.uk

CCEA
www.ccea.org.uk

Edexcel
www.edexcel.org.uk

OCR
www.ocr.org.uk

WJEC
www.wjec.co.uk

Change-management tools

Find examples at [www.tda.gov.uk/
 remodelling/managingchange/tools.aspx/](http://www.tda.gov.uk/remodelling/managingchange/tools.aspx/)

Teachers' groups

www.cambridgebiologists.org

University of Cambridge Science Festival
www.cambridgescience.org

researchersinresidence@ed.ac.uk
 or

www.researchersinresidence.ac.uk

www.sanger.ac.uk/Teams/Team104/
 or

www.yourgenome.org

Details on regulations, definitions
 and examples of good practice
 in developing federations

www.standards.dfes.gov.uk/federations/
 and www.innovation-unit.co.uk/collaboration/

Appendix 3

LSN science publications

Resources for your Triple Science courses: GCSEs in biology, chemistry and physics

This resources guide lists many of the currently available resources, and for each listing there is a short description including suggestions on recommended usage.

Learning and Skills Network, 2007

ISBN 9781845726472

Free

Tel 0845 071 0800

www.triplescience.org.uk

Triple Science GCSEs: collaborative approaches

Many schools that are preparing to introduce Triple Science GCSEs may find it helpful to collaborate. This publication looks at some of the issues, the benefits of collaboration, partnership models, and hints and guidance on setting up a successful partnership.

Learning and Skills Network, 2007

ISBN 9781845726638

Free

Tel 0845 071 0800

www.triplescience.org.uk

Triple Science GCSEs: strategies for raising attainment

LSN's raising attainment publication is designed for practitioners. It will cover:

- teaching and learning for motivation and understanding
- assessment and use of data
- examination techniques for students
- underpinning school policies and strategies
- advice on examinations and assessment for teachers.

Learning and Skills Network, 2007

ISBN 9781845726515

Free

Tel 0845 071 0800

www.triplescience.org.uk

Teaching Triple Science: GCSE Biology Teaching Triple Science: GCSE Chemistry Teaching Triple Science: GCSE Physics

LSN has commissioned three subject-specific publications aimed at helping practitioners tackle some of the main issues in delivering the separate sciences.

Written by acknowledged experts in these subject areas, the books will provide practitioners with up-to-date and useful guidance on:

- the major differences between Double and Triple Science
- teaching and learning modules, particularly focusing on areas known to be delivered poorly in schools
- teaching resources and assignments to promote student-centred problem-solving activities.

Learning and Skills Network, 2007

Teaching Triple Science: GCSE Biology

ISBN 9781845726485

Teaching Triple Science: GCSE Chemistry

ISBN 9781845726492

Teaching Triple Science: GCSE Physics

ISBN 9781845726508

Free

Tel 0845 071 0800

www.triplescience.org.uk