



Revised GCSE subject criteria for science subjects



Consultation

Consultation document No: 072/2009

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Action required: Responses by 11 September 2009

Revised GCSE subject criteria for science subjects

- Audience** Heads of all secondary schools, principals of further education and tertiary colleges, awarding bodies, disability groups, teachers' unions, Estyn, Fforwm, local education authorities, science advisers, subject associations.
- Overview** This consultation seeks views on revised GCSE subject criteria for science subjects, for first teaching from September 2011.
- Revised GCSEs in the sciences will be introduced for first teaching from September 2011, with first awards in summer 2013.
- The subject criteria at GCSE provide a template against which the qualifications' regulators consider draft specifications submitted by awarding bodies for accreditation. A GCSE qualification will only be accredited by the regulators when it is judged to have met the subject criteria and the GCSE qualification criteria.
- There are subject criteria for GCSE Science, Additional Science, Additional Applied Science, Chemistry, Physics, and Biology.
- There are three separate questionnaires as follows:
1. A questionnaire for those responding for GCSE Science
 2. A questionnaire for those responding for GCSE Additional Science or GCSE Additional Applied Science
 3. A questionnaire for those responding for GCSE Chemistry, Physics, or Biology.
- Action required** The Welsh Assembly Government is consulting nationally with centres, awarding bodies and a range of key stakeholders on revised criteria to govern GCSEs in science subjects.
- The consultation materials, within an Annex to this document, include consultation questionnaires, the GCSE qualification criteria, and the subject criteria for Science, Additional Science, Additional Applied Science, Chemistry, Physics and Biology. These are all available via a link on the Welsh Assembly Government website at www.wales.gov.uk/consultations/education/?lang=en
- The period of consultation will last for 12 weeks and your response should, therefore, be submitted by 11 September 2009. Completed questionnaires should be returned by this date, either by post to the General Qualifications Development Manager, Qualifications and Learning Division, DCELLS, Castle Buildings, Womanby Street, Cardiff CF10 1SX, or by email to infoquals@wales.gsi.gov.uk
- Further information** If you want further information about the consultation, please contact Hugh Griffiths at DCELLS, Castle Buildings, Womanby Street, Cardiff, CF10 1SX, Tel: 029 2037 5433, or by email on infoquals@wales.gsi.gov.uk

Contents

		Page
Introduction		2
Section 1	Draft GCSE subject criteria for Science – June 2009 Consultation version	3
Section 2	Draft GCSE subject criteria for Additional Science - June 2009 Consultation version	8
Section 3	Draft GCSE subject criteria for Additional Applied Science - June 2009 consultation draft version	13
Section 4	Draft GCSE subject criteria for Chemistry - June 2009 Consultation version	17
Section 5	Draft GCSE subject criteria for Physics - June 2009 Consultation version	22
Section 6	Draft GCSE subject criteria for Biology - June 2009 Consultation version	27
Section 7	GCSE qualification criteria	32

Introduction

GCSE subject criteria set out the knowledge, understanding, skills and assessment objectives common to all GCSE specifications in that subject. They provide the framework within which an awarding body creates the detail of the specification.

Specifications must also meet the regulators' general requirements, including the common and GCSE criteria as defined in *The statutory regulation of external qualifications* (AC/GM/0549).

Subject criteria are intended to:

- help ensure consistent and comparable standards in the same subject across the awarding bodies
- ensure that the rigour of GCSE is maintained
- ensure that specifications build on the knowledge, understanding and skills established by the national curricula for England, Northern Ireland and Wales, and support progression to higher level qualifications in science
- help higher education institutions, employers and other stakeholders, such as learners and parents/guardians, know what has been studied and assessed.

Any GCSE specification that contains significant elements of Science / Additional Science / Additional Applied Science / Chemistry / Physics / Biology must be consistent with the relevant parts of the subject criteria for that science subject.

Section 1: Draft GCSE subject criteria for Science - June 2009 Consultation version

Aims and learning outcomes

1. GCSE specifications in Science should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should provide insight into how science works, enabling learners to engage with science in their everyday lives; and to make informed choices about further study in science.
2. GCSE specifications in Science must enable learners to:
 - develop their knowledge and understanding of the material, physical and living worlds
 - develop their understanding of the nature of science and the role of science in society
 - develop and apply their knowledge and understanding of scientific theories, concepts, systems and processes
 - develop and apply their practical, problem solving and enquiry skills and understanding in laboratory and other practical activities
 - develop their understanding of the relationships between data, evidence, theories and explanations
 - develop their ability to evaluate claims, scientific methods, evidence and conclusions qualitatively and quantitatively
 - develop their skills in communication, mathematics and the use of technology in scientific contexts

Subject content

3. The content of GCSE specifications in Science must reflect the learning outcomes.

4. GCSE specifications in Science must be consistent with the national curriculum key stage 4 programmes of study requirements in the orders for England and Wales, and the statutory requirements for key stage 4 in Northern Ireland.
5. GCSE specifications in Science must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Science must require learners to demonstrate knowledge and understanding of:
 - the evidence for the origin, structure and continuing evolution of the Universe
 - how the surface of the Earth and its atmosphere have changed since the Earth's origin and are still changing
 - the Earth's crust, sea and atmosphere, and living organisms as the ultimate sources from which all useful materials are obtained or synthesised
 - the production, use and disposal of materials and how an understanding of Chemistry helps to reduce the resulting impacts on the environment
 - how, in chemical reactions, atoms are rearranged to make new products with different properties and no atoms are lost or made
 - the patterns in the chemical reactions between substances
 - the chemical properties of elements related to their atomic structure and their position in the Periodic Table
 - how Chemistry can be used to explain how the properties of materials determine their uses, including elements and compounds
 - energy, its conservation, transfer, dissipation and the associated economic and environmental implications, including the efficiency of energy transfer
 - the generation of electricity, its distribution and uses, including the relationship between power, energy and time

- longitudinal and transverse waves transfer energy and can be used to transfer information
- the interdependence of organisms and their adaptations to their environment
- fieldwork including the use of living and non-living indicators to measure environmental change
- the variety of life, including microorganisms, plants and animals
- variation within species
- how similarities and differences can be used to classify organisms and the importance of classification
- natural selection and how it can lead to evolutionary changes
- how genes determine the structure and function of organisms
- the structure and function of DNA
- how animals and plants respond to external and internal changes
- how organisms regulate internal systems
- how human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatment
- hazard identification and risk assessment
- the importance of working accurately and safely
- ethical implications of science
- science as an evidence-based discipline
- the collaborative nature of science as a subject discipline and the way new scientific knowledge is validated
- how scientific understanding and theories develop and the limitations of science
- how and why decisions about science and technology are made

7. GCSE specifications in Science must require learners to develop the ability to:

- develop and test scientific hypotheses
- plan investigations and devise methods for the collection of numerical and other data

- assess and manage risks when carrying out practical work
- collect, process, analyse and interpret primary and secondary data
- evaluate methods of data collection and consider the validity of investigations and the quality of data
- use models to explain systems and processes
- develop arguments and explanations, and draw conclusions using scientific ideas and evidence
- communicate scientific information or ideas using both qualitative and quantitative approaches, and scientific, technical and mathematical language, conventions and symbols

Assessment objectives

8. All specifications in Science must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding of science	30-40
AO2	Apply skills, knowledge and understanding in practical and other contexts	30-40
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

9. GCSE specifications in Science must allocate a weighting of 75 per cent to external assessment and a weighting of 25 per cent to controlled assessment in the overall scheme of assessment.
10. Question papers in Science must be targeted at either foundation or higher tier.

Grade descriptions

11. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.

12. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 2: Draft GCSE subject criteria for Additional Science - June 2009 Consultation version

Aims and learning outcomes

1. GCSE specifications in Additional Science should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should encourage learners to develop their curiosity about the living, material and physical worlds and provide insight into how science works. They should enable learners to engage with science in their everyday lives, and to make informed decisions about further study in science and related subjects, and about career choices.

2. GCSE specifications in science must enable learners to:
 - develop their knowledge and understanding of science
 - develop their understanding of the impact of science on society
 - develop and apply their knowledge and understanding of scientific theories, concepts, systems and processes
 - develop and apply their practical, problem-solving and enquiry skills and understanding in laboratory and other practical activities
 - develop their understanding of the relationships between data, evidence, theories and explanations
 - develop their ability to evaluate scientific methods, evidence and conclusions and scientific claims, qualitatively and quantitatively
 - develop their skills in communication, mathematics and the use of technology in scientific contexts.

Subject content

3. The content of GCSE specifications in Additional Science must reflect the learning outcomes.

4. GCSE specifications in Additional Science must build on the programmes of study at key stage 4.
5. GCSE specifications in Additional Science must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Additional Science must require learners to demonstrate knowledge and understanding of:
 - the chemical properties of elements and compounds in terms of structure and bonding, including metallic, ionic and covalent bonds and bonds between molecules
 - chemical reactions including reduction and oxidation, neutralisation, electrolysis and polymerisation reactions
 - how conditions and quantities can be used to control the rate of chemical reactions
 - chemical analysis using detection and separation techniques
 - the quantitative interpretation of chemical formulae and equations, including percentage yield
 - the energy changes that take place during chemical reactions
 - the relationship between work and energy and changes in kinetic energy and gravitational potential energy
 - electric circuits, including the relationship between power, current and voltage and resistance, current and voltage
 - Newton's three laws of motion, and their uses in calculating changes in the velocity and acceleration of bodies acted on by forces, including momentum
 - radioactivity, sources of background radiation
 - effects of ionising radiations
 - radioactive decay, half life, fission and fusion
 - energy flow through the biosphere and how chemical elements are recycled within it, including carbon and nitrogen
 - the structure of cells, including plant, animal and microbial cells,
 - cell division: mitosis and meiosis

- how chemical reactions essential for life take place inside and outside cells, including the role of enzymes
- photosynthesis and respiration
- protein synthesis
- the different patterns of growth and development in plants and animals
- the collaborative nature of science as a subject discipline, the way new scientific knowledge is validated and the limitations of science
- the uses of modelling, including mathematical modelling to explain aspects of science
- the importance of working accurately and safely
- hazard identification and risk assessment.

7. GCSE specifications in Additional Science must require learners to develop the ability to:

- develop scientific hypotheses
- plan investigations to test scientific hypotheses
- devise methods and assess risks for the collection of numerical and other data
- manage risks when using practical techniques and carrying out investigations
- collect primary data
- process primary and secondary data
- analyse and interpret primary and secondary data
- evaluate methods, and assess the validity of investigations and the quality of evidence
- draw evidence-based conclusions
- use scientific ideas, models and evidence to develop arguments and explanations
- use models to explain systems, processes and abstract ideas
- communicate scientific information using scientific, technical and mathematical language, conventions, symbols and techniques

Assessment objectives

8. All specifications in Additional Science must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding of science	30-40
AO2	Apply skills, knowledge and understanding in practical and other contexts	30-40
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

7. GCSE specifications in Additional Science must allocate a weighting of 75 per cent to external assessment and a weighting of 25 per cent to controlled assessment in the overall scheme of assessment.
8. Question papers in science must be targeted at either foundation or higher tier.

Grade descriptions

9. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.
10. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 3: Draft GCSE subject criteria for Additional Applied Science – June 2009 consultation draft version

Aims and learning outcomes

1. GCSE specifications in Additional Applied Science should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should encourage learners to develop an understanding of science and its applications and implications including the relationship between science and the world of work. Specifications should prepare learners to make informed decisions about further learning and training opportunities and career choices

2. GCSE specifications in Additional Applied Science must enable learners to:
 - develop their knowledge and understanding of science and its applications
 - develop their understanding of the benefits, drawbacks and risks of scientific developments
 - develop their practical, problem solving, enquiry and scientific modeling skills and understanding through laboratory, work related and other practical activities
 - develop their understanding of systems and processes, the use of protocols and standard procedures
 - develop their understanding of the relationships between data, evidence and explanations
 - develop their ability to evaluate scientific methods, evidence and conclusions
 - develop their understanding of the need for monitoring and regulation of science.

- develop their communication, mathematics and technology skills in scientific contexts.

Subject content

3. The content of GCSE specifications in Additional Applied Science must reflect the learning outcomes.
4. GCSE specifications in Additional Applied Science must build on the programmes of study at key stage 4.
5. GCSE specifications in Additional Applied Science must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Additional Applied Science must require learners to demonstrate knowledge and understanding in biological, chemical and/or physical contexts of:
 - the impact of science and its applications on industry, the economy and the environment
 - the responsibilities of employees, organisations, regulators and governments including health and safety and ethical considerations
 - monitoring and controlling systems and processes
 - the importance of following procedures and protocols and managing risks
 - energy generation, transfer and transport
 - biotechnology and its applications including food production and DNA analysis
 - the use of detection and separation techniques in chemical analysis
 - the chemical properties of elements and compounds
 - patterns in chemical reactions
 - the properties of materials and how these determine their uses
 - how applications, technologies and/or techniques change over time as scientific knowledge develops

- the importance of working accurately and safely
7. GCSE specifications in Additional Applied Science must require learners to develop the ability to:
- use scientific ideas, models and evidence to develop arguments and explanations
 - model systems and processes
 - devise methods and assess risks for the collection of numerical and other data to solve problems
 - manage risks when using practical techniques and carrying out standard procedures and investigations
 - collect primary data
 - process primary and secondary data
 - analyse and interpret primary and secondary data
 - evaluate methods, and assess the validity of investigations and the quality of evidence
 - draw evidence-based conclusions
 - use scientific, technical and mathematical language, conventions, symbols and techniques.

Assessment objectives

8. All specifications in Additional Applied Science must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding	25-35
AO2	Apply skills, knowledge and understanding in applied contexts	35-45
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

9. GCSE specifications in Additional Applied Science must allocate a weighting of 40 per cent to external assessment and a weighting of 60 per cent to controlled assessment in the overall scheme of assessment.
10. Question papers must be targeted at either foundation or higher tier.

Grade descriptions

11. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.
12. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 4: Draft GCSE subject criteria for Chemistry - June 2009 Consultation version

Aims and learning outcomes

1. GCSE specifications in Chemistry should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should encourage learners to develop their curiosity about the material and physical worlds and provide insight into how science works. They should enable learners to engage with Chemistry in their everyday lives; and to make informed choices about further study in Chemistry and related disciplines, and about career choices.

2. GCSE specifications in Chemistry must enable learners to:
 - develop their knowledge and understanding of Chemistry
 - develop their understanding of the impact of Chemistry on society
 - develop and apply their knowledge and understanding of scientific theories, concepts, systems and processes
 - develop and apply their practical, problem solving and enquiry skills and understanding through laboratory and other practical activities
 - develop their understanding of the relationships between data, evidence, theories and explanations
 - develop their ability to evaluate scientific methods, evidence and conclusions, and scientific claims, qualitatively and quantitatively
 - develop their skills in communication, mathematics and the use of technology in scientific contexts

Subject content

3. The content of GCSE specifications in Chemistry must reflect the learning outcomes.

4. GCSE specifications in Chemistry must be consistent with the national curriculum key stage 4 programmes of study requirements for science in the orders for England and Wales, and the statutory requirements for key stage 4 in Northern Ireland.
5. GCSE specifications in Chemistry must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Chemistry must require learners to demonstrate knowledge and understanding of:
 - the chemical properties of elements related to their atomic structure and their position in the Periodic Table
 - the properties of elements and compounds in terms of structure and bonding, including metallic, ionic and covalent bonds and forces between molecules
 - how Chemistry can be used to explain how the properties of materials determine their uses, including elements and compounds
 - how, in chemical reactions, atoms are rearranged to make new products with different properties and no atoms are lost or made
 - the patterns in the chemical reactions between substances
 - chemical reactions including, reduction and oxidation, neutralisation, electrolysis and polymerisation reactions
 - how conditions and quantities can be used to control the rate of chemical reactions
 - how reactions are reversible and may reach equilibrium
 - the energy changes that take place during chemical reactions
 - chemical analysis using detection and separation techniques
 - the quantitative interpretation of chemical formulae and equations including percentage yield
 - the importance of the chemical industry to the UK and global economies

- how the Earth's atmosphere has changed since its origin and is still changing
- the Earth's crust, sea and atmosphere, and living organisms, as the ultimate sources from which all useful materials are obtained or synthesised
- the production, use and disposal of materials and how Chemistry can help to reduce the resulting impact on the environment
- hazard identification and risk assessment
- the importance of working accurately and safely
- the use of modelling, including mathematical modelling, to explain aspects of Chemistry
- Chemistry as an evidence-based discipline
- the collaborative nature of science as a subject discipline and the way new scientific knowledge is validated
- how scientific understanding and theories develop and the limitations of science
- how and why decisions about science and technology are made
- ethical implications of Chemistry and its applications

7. GCSE specifications in Chemistry must require learners to develop the ability to:

- develop scientific hypotheses
- plan investigations to test scientific hypotheses
- devise methods and assess risks for the collection of numerical and other data
- manage risks when using practical techniques and carrying out investigations
- collect primary data
- process primary and secondary data
- use knowledge and understanding of Chemistry to analyse and interpret primary and secondary data

- evaluate methods, and assess the validity of investigations and the quality of evidence
- draw evidence-based conclusions
- use scientific ideas, models and evidence to develop arguments and explanations
- use models to explain systems, processes and abstract ideas
- communicate scientific information using scientific, technical and mathematical language, conventions, symbols and techniques

Assessment objectives

8. All specifications in Chemistry must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding of Chemistry	30-40
AO2	Apply skills, knowledge and understanding in practical and other contexts	30-40
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

9. GCSE specifications in Chemistry must allocate a weighting of 75 per cent to external assessment and a weighting of 25 per cent to controlled assessment in the overall scheme of assessment.
10. Question papers in Chemistry must be targeted at either foundation or higher tier.

Grade descriptions

11. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.
12. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 5: Draft GCSE subject criteria for Physics - June 2009

Consultation version

Aims and learning outcomes

1. GCSE specifications in Physics should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should encourage learners to develop their curiosity about the physical world and provide insight into how science works. They should enable learners to engage with Physics in their everyday lives; and to make informed choices about further study in Physics and related disciplines, and about career choices.

2. GCSE specifications in Physics must enable learners to:
 - develop their knowledge and understanding of Physics
 - develop their understanding of the impact of Physics on society
 - develop and apply their knowledge and understanding of scientific theories, concepts, systems and processes
 - develop and apply their practical, problem solving and enquiry skills and understanding in laboratory and other practical activities
 - develop their understanding of the relationships between data, evidence, theories and explanations
 - develop their ability to evaluate scientific methods, evidence and conclusions, and scientific claims, qualitatively and quantitatively
 - develop their skills in communication, mathematics and the use of technology in scientific contexts

Subject content

3. The content of GCSE specifications in Physics must reflect the learning outcomes.

4. GCSE specifications in Physics must be consistent with the national curriculum key stage 4 programmes of study requirements for science in the orders for England and Wales, and the statutory requirements for key stage 4 in Northern Ireland.
5. GCSE specifications in Physics must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Physics must require learners to demonstrate knowledge and understanding of:
 - energy its conservation, transfer, transformation, and dissipation and the associated economic and environmental implications, including the efficiency of energy transfer
 - energy transfers, work done, kinetic energy and gravitational potential energy, including the relationship between work and energy
 - the use of kinetic theory and atomic structure as models to explain physical phenomena
 - one dimensional treatment of Newton's three laws of motion, including momentum
 - the generation of electricity and its distribution and uses
 - the relationship between energy, power and time
 - electrical circuits, including the relationships between current and charge; potential difference and energy transfer; power, current and voltage; resistance, current and voltage
 - longitudinal and transverse waves transfer energy and can be used to transfer information
 - the properties of waves and the relationship between frequency and wavelength
 - evidence for the structure of the Earth and the changes in the outer layer of the Earth resulting from the movement of tectonic plates
 - radioactivity, sources of background radiation

- effects of ionising radiations
- radioactive decay, half life, fission and fusion
- the evidence for the origin, structure and continuing evolution of the Universe
- hazard identification and risk assessment
- the importance of working accurately and safely
- the use of modelling, including mathematical modelling, to explain aspects of Physics
- Physics as an evidence-based discipline
- the collaborative nature of science as a subject discipline and the way new scientific knowledge is validated
- how scientific understanding and theories develop and the limitations of science
- how and why decisions about science and technology are made
- ethical implications of Physics and its applications

7. GCSE specifications in Physics must require learners to develop the ability to:

- develop scientific hypotheses
- plan investigations to test scientific hypotheses
- devise methods and assess risks for the collection of numerical and other data
- manage risks when using practical techniques and carrying out investigations
- collect primary data
- process primary and secondary data
- use physical knowledge and understanding to analyse and interpret primary and secondary data
- evaluate methods, and assess the validity of investigations and the quality of evidenced
- draw evidence-based conclusions
- use scientific ideas, models and evidence to develop arguments and explanations
- use models to explain systems, processes and abstract ideas

- communicate scientific information using scientific, technical and mathematical language, conventions, symbols and techniques.

Assessment objectives

8. All specifications in Physics must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding of Physics	30-40
AO2	Apply skills, knowledge and understanding of Physics in practical and other contexts	30-40
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

9. GCSE specifications in Physics must allocate a weighting of 75 per cent to external assessment and a weighting of 25 per cent to controlled assessment in the overall scheme of assessment.
10. Question papers in Physics must be targeted at either foundation or higher tier.

Grade descriptions

11. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.

12. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 6: Draft GCSE subject criteria for Biology - June 2009

Consultation version

Aims and learning outcomes

1. GCSE specifications in Biology should encourage learners to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. They should encourage learners to develop their curiosity about the living world. They should provide insight into how science works and enable learners to engage with Biology in their everyday lives and to make informed choices about further study in Biology related disciplines, and support career choices.

2. GCSE specifications in Biology must enable learners to:
 - develop their knowledge and understanding of Biology
 - develop their understanding of how organisms function from molecular to whole organism level and the inter-relationships between organisms
 - develop their understanding of the impact of Biology on society
 - develop and apply their knowledge and understanding of scientific theories, concepts, systems and processes
 - develop and apply their practical, problem solving and enquiry skills and understanding in laboratory and other practical activities
 - develop their understanding of the relationships between data, evidence, theories and explanations
 - develop their ability to evaluate scientific methods, evidence, conclusions, and scientific claims qualitatively and quantitatively
 - develop their skills in communication, mathematics and the use of technology in scientific contexts

Subject content

3. The content of GCSE specifications in Biology must reflect the learning outcomes.
4. GCSE specifications in Biology must be consistent with the national curriculum key stage 4 programmes of study requirements for science in the orders for England and Wales, and the statutory requirements for key stage 4 in Northern Ireland.
5. GCSE specifications in Biology must require learners to develop the knowledge, skills and understanding specified below.
6. GCSE specifications in Biology must require learners to demonstrate knowledge and understanding of:
 - the variety of life, including microorganisms, plants and animals
 - how similarities and differences can be used to classify organisms and the importance of classification
 - variation within species
 - natural selection and how it can lead to evolutionary changes
 - the interdependence of organisms and their adaptations to their environment
 - fieldwork including the use of living and non-living indicators to measure environmental change
 - the effects of human activity on the environment
 - energy flow through the biosphere and how chemical elements are recycled within it, including carbon and nitrogen
 - the structure of cells including plant, animal and microbial cells
 - cell division: mitosis and meiosis
 - how chemical reactions essential for life take place inside and outside cells, including the role of enzymes
 - photosynthesis and respiration
 - the structure and function of DNA; protein synthesis
 - how genes determine the structure and function of organisms
 - how organisms function from molecular to whole organism level

- the different patterns of growth and development in plants and animals
- how animals and plants respond to external and internal changes
- how internal systems are regulated, including the circulatory, endocrine and nervous systems, and the skin
- how human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatment
- the importance of working accurately and safely
- hazard identification and risk assessment
- the use of modelling in Biology, including mathematical modelling, to explain aspects of Biology
- Biology as an evidence-based discipline
- the collaborative nature of science as a subject discipline and the way new scientific knowledge is validated
- how scientific understanding and theories develop and the limitations of science
- how and why decisions about science and technology are made
- ethical implications of Biology and its applications

7. GCSE specifications in Biology must require learners to develop the ability to:

- analyse and interpret primary and secondary data
- develop arguments and explanations using scientific ideas and evidence
- develop scientific hypotheses and plan biological investigations to test them; devise methods and assess risks for the collection of numerical and other data; manage risks in using practical techniques to collect primary data; process, analyse and interpret primary and secondary data using appropriate biological knowledge and understanding; evaluate methods, assess the validity of the investigation and the quality of the

evidence; develop explanations using scientific ideas and evidence; and draw evidence-based conclusions

- use models to explain systems, processes and abstract ideas
- use scientific, technical and mathematical language, conventions, symbols and techniques

Assessment objectives

8. All specifications in Biology must require candidates to demonstrate their ability to:

Assessment objectives		Weighting (%)
AO1	Recall, select and communicate their knowledge and understanding of Biology	30-40
AO2	Apply skills, knowledge and understanding in practical and other contexts	30-40
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions	25-35

Scheme of assessment

9. GCSE specifications in Biology must allocate a weighting of 75 per cent to external assessment and a weighting of 25 per cent to controlled assessment in the overall scheme of assessment.
10. Question papers in Biology must be targeted at either foundation or higher tier.

Grade descriptions

11. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in

relation to the content in the specification; they are not designed to define that content.

12. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	
C	
F	

Section 7: GCSE qualification criteria

Content

1. The titles of GCSEs must:
 - where relevant subject criteria exist, correspond to the titles used in the relevant subject criteria published by the regulators.
 - where relevant subject criteria do not exist, be sufficiently broad to cover different specifications in the same subject area
 - use the word GCSE (short course), if based on a short course specification
 - use the words GCSE (double award), if equivalent to two separate GCSEs.
2. GCSE specifications must state how they contribute to overarching aims for the curriculum in England, Wales and Northern Ireland respectively.
3. GCSE specifications and associated assessment and support materials must:
 - anticipate the needs of disabled learners
 - encourage the promotion of positive images and representation of disabled people.
4. The subject matter of GCSEs must:
 - where relevant subject criteria exist, meet the GCSE subject criteria published by the regulators for the subject title.
 - where relevant subject criteria do not exist, compare in substance and range to the GCSE subject criteria published by the regulators for other subjects

- be consistent with the statutory programmes of study within the national curriculum where they exist
- state which aspects/options must be taken by candidates to meet the requirements of their respective countries, when statutory requirements differ in England, Wales and Northern Ireland
- for short course specifications, include half of the content of a single award GCSE and cover the full range of grades
- for double award specifications, include content equivalent to two separate GCSEs
- require candidates to make effective use of technology as appropriate to the subject.

Assessment in GCSEs

5. The assessment arrangements for GCSE must:
 - set out the relationship between the assessment objectives and the assessment components
 - show the proportion of marks allocated to each assessment objective (or group of assessment objectives) and to each assessment component
 - include question papers targeted at either a single tier covering grades A* to G or two tiers of grades: A* to D, with an allowed grade E, and C to G
 - require, across the assessment components/units, a variety of question types and tasks, including extended writing
 - assess the candidates' quality of written communication in accordance with the guidance documentation produced by the regulators

- where relevant criteria exist, comply with subject criteria relating to the balance between external and controlled assessment
 - where relevant subject criteria do not exist, be agreed individually with the regulators as to the balance between external and controlled assessment
6. Where controlled assessment is required, specifications must be developed in accordance with the guidance documentation produced by the regulators. Specifications must make clear how reliability and fairness are secured, by setting out requirements that ensure the robustness of each stage of the controlled assessment. They must cover:
- the specific skills to be assessed
 - the setting of tasks
 - the extent of supervision in carrying out of tasks
 - the conditions under which assessment takes place
 - the marking of the assessment and internal standardising procedures
 - any moderation process.
7. Unitised specifications must:
- allow only one re-sit of an assessment unit with the better result counting towards the qualification
 - allocate a weighting of at least 40% to terminal assessment
 - ensure results for a unit have a shelf-life limited only by the shelf-life of the relevant specification

Reporting of GCSEs

8. There must be arrangements for grading and reporting of GCSEs so that:

- attainment that is sufficient to lead to the award of a certificate is reported on an eight-grade scale from A* to G, where A* is the highest
- attainment that is insufficient to lead to the award of a certificate is reported as Unclassified or U
- where relevant subject criteria exist, the grades awarded match the grade descriptions in the subject criteria published by the regulators
where relevant subject criteria do not exist, the grades awarded match descriptions for grades A, C and F submitted by the awarding body and approved by the regulators
- the grade for double award GCSEs is reported in the format A*A*, A*A, AA, AB, BB, BC, CC, CD, DD, DE, EE, EF, FF, FG, GG
- the grade/s on short course and double award GCSE certificates are accompanied by explanatory notes on the nature of these types of GCSE.