GCSE Subject Criteria for Additional Applied Science

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Contents

The criteria

Introduction

GCSE subject criteria set out the knowledge, understanding, skills and assessment objectives common to all GCSE specifications in a given subject.

They provide the framework within which the awarding organisation creates the detail of the specification.

Aims and learning outcomes

1. GCSE specifications in Additional Applied Science should provide insight into and experience of how science works, encouraging learners' to develop an understanding of science, its applications and its relationship with the world of work. Specifications should prepare learners to make informed decisions about further study and training opportunities in applied science and career opportunities.

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 for industry, the economy and society;
    - develop their understanding of the need for monitoring and regulation of the work of practitioners in science and science-related industries;
    - develop their awareness of risk factors and their ability to assess potential risks and manage them in practical and workplace contexts;
    - develop their understanding of the use of scientific protocols and standard procedures in the laboratory and the work place;
    - develop their understanding of the scientific process;
    - develop their practical, problem-solving, enquiry and scientific modelling skills and understanding in laboratory and work-related contexts;

- develop their understanding of the relationships between data, evidence and explanations and their ability to evaluate scientific methods, evidence and conclusions;
- develop their communication, mathematics and technology skills in scientific contexts.

Subject content

3. GCSE specifications in Additional Applied Science must require learners to demonstrate knowledge and understanding in a range of scientific contexts including biological, chemical and physical:

- the effects of science and its applications on society, industry, the economy and the environment including how scientific applications, technologies and techniques change over time in response to scientific or societal changes;
- the use of science in industry and in the world of work and the contribution of science to the economy;
- the responsibilities of employees, organisations, regulators and governments including health and safety and ethical considerations;
- the role of evidence, theories and hypotheses in the scientific process;
- the importance of following procedures and protocols and managing risks;
- the importance of working accurately and safely;
- the importance of the quality, quantity and accuracy of data collected;
- monitoring and controlling systems and processes;
- the use of electrical or electronic systems for instrumentation and/or communication;
- biotechnology and its applications including the reproduction and cultivation of living organisms;

- how organic resources are processed to produce high quality products including food production and agribusiness;
- human physiology and biomechanics in the context of health and fitness;
- the use of observation, detection and separation techniques in analysis;
- the use of reactions to make new chemicals for economic and industrial purposes;
- the properties of materials and how these determine their uses.

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

- use models to explain scientific observations and processes;
- use scientific ideas, models and evidence to explain applications of science;
- devise methods to solve problems;
- assess risks for the collection of numerical and other data;
- manage risks when using practical techniques, carrying out standard procedures and solving practical problems;
- evaluate methods used to solve practical problems;
- collect primary data;
- process primary and secondary data;
- analyse and interpret primary and secondary data;
- assess the validity and quality of evidence;
- draw evidence-based conclusions;

- use scientific, technical and mathematical language[1], conventions, symbols and techniques.

Assessment objectives

5. All specifications in Additional Applied Science must require learners to demonstrate their ability to:

	Assessment objectives	Weighting
AO1	Recall, select and communicate their knowledge and understanding of science.	25–35%
AO2	Apply skills, knowledge and understanding in applied contexts.	35–45%
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence.	25–35%

Scheme of assessment

6. 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.

7. Question papers must be targeted at either foundation or higher tier.

Grade descriptions

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

[1] See Appendix A.

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

Grade	Description
A	Learners recall, select and communicate precise knowledge and detailed understanding of science and its applications, and of the effects of science and its applications on society, industry, the economy and the environment. They demonstrate a clear understanding of why and how scientific applications, technologies and techniques change over time and the need for regulation and monitoring. They use a wide range of scientific, technical and mathematical terminology and conventions, symbols and techniques appropriately and consistently. They apply appropriate skills, including mathematical skills, knowledge and understanding effectively to a range of practical contexts and to explain applications of science. They apply a comprehensive understanding of practical methods, processes and protocols to plan and justify a range of appropriate methods to solve practical problems. They apply a range of observational, practical enquiry and problem-solving skills to carry out procedures, investigate questions and test hypotheses effectively. They follow procedures and protocols consistently, evaluating and managing risk and working accurately and safely. Learners analyse and interpret critically a broad range of quantitative and qualitative information presented in a variety of forms. They reflect on the limitations of the methods, procedures and protocols they have used and the data they have collected and evaluate information systematically to develop reports and findings. They make reasoned judgements consistent with the evidence to develop substantiated conclusions.
C	Learners recall, select and communicate secure knowledge and understanding of the effects and risks of scientific developments and its applications on society, industry, the economy and the environment. They describe with reasons how scientific applications, technologies and techniques change over time. They use scientific, technical and mathematical terminology and conventions, symbols and techniques appropriately.

	They apply appropriate skills, including communication, mathematical and technological skills, knowledge and understanding in a range of practical and other contexts. They use models and scientific ideas to provide straightforward explanations of scientific applications. They plan and use appropriate methods and apply a variety of skills to address scientific questions and practical problems. They follow procedures, recognising and managing risk, to work safely and competently. Learners analyse, interpret and evaluate a range of quantitative and qualitative data and information. They recognise the limitations of evidence and undertake some evaluation and present reasons for their argument. They draw conclusions consistent with their evidence.
F	Learners recall and communicate their limited knowledge and understanding of effects and risks of scientific developments and its applications on society, industry, the economy and the environment. They recognise simple interrelationships between science and society. They demonstrate a limited understanding of how scientific applications, technologies and techniques change over time. They use a limited range of technical terms. They apply appropriate skills, including communication, mathematical and technological skills, knowledge and understanding in a limited range of practical and other contexts. They apply limited knowledge and ideas in different practical contexts. They identify simple links between evidence and explanations. Using a limited range of skills and techniques, they follow instructions to investigate scientific questions. They recognise a narrow range of risks and work safely. Learners interpret and evaluate some qualitative and quantitative data and information from a limited range of sources. They can draw elementary conclusions having collected limited evidence.

Appendix A: Mathematics requirements

These criteria contain as one of the learning outcomes the requirement for specifications to provide learners with the opportunity to develop their skills in communication, mathematics and the use of technology in scientific contexts. In order to deliver the mathematical element of this outcome, specifications and assessment materials must contain opportunities for learners to demonstrate scientific knowledge using appropriate mathematical skills.

The following represent the areas of mathematics that have been identified as arising naturally from the science content in the subject criteria.

While this is not a checklist for each question paper or assessment, awarding organisations must ensure that their assessment materials properly reflect these mathematical requirements, assessing the full range of mathematical skills over a reasonable period of time.

Learners are permitted to use calculators in all assessments.

Learners are expected to use units appropriately. However, not all questions need to reward the appropriate use of units.

Learners should be able to:

- Understand number size and scale and the quantitative relationship between units.
- Understand when and how to use estimation.
- Carry out calculations involving +, - , x, ÷, either singly or in combination, decimals, fractions, percentages and positive whole number powers.
- Provide answers to calculations to an appropriate number of significant figures.
- Understand and use the symbols =, <, >, ~.
- Understand and use direct proportion and simple ratios.
- Calculate arithmetic means.
- Understand and use common measures and simple compound measures such as speed.
- Plot and draw graphs (line graphs, bar charts, pie charts, scatter graphs, histograms) selecting appropriate scales for the axes.

- Substitute numerical values into simple formulae and equations using appropriate units.
- Translate information between graphical and numeric form.
- Extract and interpret information from charts, graphs and tables.
- Understand the idea of probability.
- Calculate area, perimeters and volumes of simple shapes.

In addition, higher tier learners should be able to:

- Interpret, order and calculate with numbers written in standard form.
- Carry out calculations involving negative powers (only –1 for rate).
- Change the subject of an equation.
- Understand and use inverse proportion.
- Understand and use percentiles and deciles.

Awarding organisations may add to this list to enable them to draw upon other areas of mathematics in their assessments without significantly impacting on the level of demand of the specification.

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