

GCE Subject Criteria for Applied Science

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The criteria

Introduction

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

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

Aims and objectives

1. Subject criteria define the relationship between the AS (3-unit), AS double award (6-unit), the A level (6-unit) and the A level double award (12-unit) qualifications.
2. Any GCE specification that contains significant elements of the subject applied science must be consistent with the relevant parts of these subject criteria. Awarding organisations must ensure that GCE specifications and external assessment approaches are clearly differentiated from other qualifications they offer in this and similar subject(s) at this level.
3. The titles of the qualifications are:
 - Advanced Subsidiary General Certificate of Education in Applied Science;
 - Advanced Subsidiary General Certificate of Education in Applied Science (double award);
 - Advanced General Certificate of Education in Applied Science;
 - Advanced General Certificate of Education in Applied Science (double award).
4. All specifications in Applied Science should:
 - provide learners with the opportunity to develop appropriate skills, knowledge and understanding, and apply these where science is used;
 - enable learners to appreciate and evaluate the social, economic and environmental impact that science has on society, identifying ethical issues that may arise;

- prepare learners for further study on a course in a science or in a science-related subject or for training in a science-related occupation;
 - support and complement other programmes of advanced level study.
5. All specifications in Applied Science should encourage learners to:
- acquire knowledge and understanding of the scientific ideas and skills that scientists need in order to be effective in their work and to apply this in a variety of vocational contexts;
 - become skillful in carrying out practical techniques and following procedures used in vocational contexts;
 - develop knowledge and understanding of the science used by organisations, business and industry;
 - further develop their interest in science and its practical applications through exploring and experiencing science in a vocational context;
 - understand the nature of science-based work and the contribution this use of science makes to society;
 - develop an awareness of the use and importance of information and communication technology (ICT) in scientific work.
6. In addition, A level and A level double award specifications in Applied Science should encourage learners to:
- develop their skills of investigation and problem solving in a vocational context, by applying their knowledge and understanding of scientific ideas and techniques and using skills of primary research, planning and evaluation.

Specification content

7. AS and A level specifications should build on the skills, knowledge and understanding found in level 2 qualifications in science or gained through other relevant experience.
8. The core content, which is common to all awarding organisation specifications, is grouped into areas of study, with amplification. The core content to be included in AS is in normal type, the core content to

be included in A2 is in **bold** type. Areas of study titles do not necessarily constitute unit titles. All areas of study and associated amplification must be covered in awarding organisation specifications.

9. A2 content should further develop higher-level skills and extend beyond AS in terms of depth, complexity and application of knowledge, skills and understanding.
10. The areas of study define:
 - all of the content of AS (three-unit) specifications (areas of study 1–8);
 - one-half of the content of AS double award (six-unit) specifications (areas of study 1–8);
 - two-thirds of the content of A level (six-unit) specifications (areas of study 1–12);
 - one-third of the content of A level double award (12-unit) specifications (areas of study 1–12).
11. Other areas of science, which build on and extend the knowledge, understanding and skills set out in the core content, should make up the remainder of the AS double award (6-unit), the A level (6-unit) and the A level double award (12-unit) specifications listed below:
 - AS: no awarding organisation devised content;
 - AS double award: one-half awarding organisation devised content;
 - A level: one-third awarding organisation devised content;
 - A level double award: two-thirds awarding organisation devised content.
12. The areas included in the awarding organisation devised content must provide the opportunity for study of the major sectors of science.
13. All the content in the specifications should be set in appropriate vocational contexts.

Area of study	Amplification
<p>1. Organisations using science</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Areas of scientific knowledge and understanding involved ■ Roles, responsibilities and skills of scientifically qualified staff ■ Nature of work, e.g. research, production, quality control, safety, education and service provision ■ How processes used by organisations apply scientific principles ■ Examples of commercial, legal, health and safety constraints on organisations
<p>2. Science and the community</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Impact of organisations on the community and environment in terms of contribution to the economy, waste management, energy consumption, need for transport and communication, and employment ■ Benefits to the local, national and global community of the use of science and technology and reasons for constraints ■ Range of services and products dependent on science
<p>3. Health and safety in an organisation using science</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Regulations, laws and their implementation in a scientific organisation ■ Hazards involved in operations carried out by the organisation

<p>4. Practical techniques and procedures</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Risk assessments for hazardous procedures ■ Regulations governing specific procedures ■ Carrying out risk assessments in the laboratory ■ Practical use of standard procedures ■ Practical techniques for analysing and monitoring
<p>5. Data handling</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Choosing and evaluating sources of data ■ Obtaining and using primary and secondary data ■ Uses and limitations of qualitative and quantitative data ■ Interpretation, explanation and evaluation of data
<p>6. Health science</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Structure and function of the human circulatory and respiratory systems ■ Methods of taking physiological measurements related to the human circulatory and respiratory systems, and uses of these in monitoring health and in diagnosis ■ Examples of imaging methods used in monitoring health and in diagnosis, and principles on which they are based ■ Examples of ethical issues related to the monitoring, diagnosis and treatment of human circulatory and respiratory systems

<p>7. Analysis</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Obtaining pure samples for analysis ■ Quantitative chemical analysis and its uses ■ Chemical tests in qualitative analysis and their uses and limitations ■ Principles of chromatography and its uses ■ Principles of colorimetric analysis and its uses
<p>8. Energy</p> <p>AS content for the AS (three-unit).</p>	<ul style="list-style-type: none"> ■ Energy changes in chemical reactions and relationship to bond making and breaking ■ Application to respiration and burning fuels ■ Applications of energy transfer ■ Controlling temperature and rate of energy transfer in a system ■ Consequences of wasteful energy transfer and methods of reducing this ■ Limits to the efficiency of energy transfer
<p>9. Planning an investigation</p> <p>A2 content for the A level (six-unit).</p>	<p>Production of a plan for an investigation related to a vocational context, which includes:</p> <ul style="list-style-type: none"> ■ identification of sources of information and awareness of the need to check for validity; ■ selection of appropriate techniques and equipment; ■ identification of constraints, including health and safety regulations and risk assessments.

<p>10. Carrying out the investigation</p> <p>A2 content for the A level (six-unit).</p>	<ul style="list-style-type: none"> ■ Implementation and review of the planning ■ Collection of reliable quantitative and/or qualitative data. ■ Recording of data, if numerical, to an appropriate degree of precision ■ Methods of checking the reliability of the data
<p>11. Processing and presenting data in investigation</p> <p>A2 content for the A level (six-unit).</p>	<ul style="list-style-type: none"> ■ Use of appropriate methods to process the data ■ Treatment of any anomalous data collected ■ Presentation of results in a suitable format
<p>12. Evaluation of the investigation</p> <p>A2 content for the A level (six-unit).</p>	<ul style="list-style-type: none"> ■ Interpretation of results and drawing conclusions ■ Evaluation of methods used and, if appropriate, suggestions for improvement ■ Discussion of the significance of conclusions ■ Production of a report suitable for the identified audience. This could be a written report, presentation, poster, video or any other appropriate medium

14. Specifications must present content in a coherent and appropriate manner, fit for teaching, learning and assessment purposes.

15. All specifications must:

- include guidance for teachers on the provision of the vocational context;

- set out for learners the purpose and vocational relevance of the content (skills, knowledge and understanding);
- set out for learners the skills, knowledge and understanding that they will need to demonstrate to achieve the assessment units;
- set out for learners the evidence that they will need to produce for the internally assessed units;
- set out for learners the marking criteria for the internally assessed units against which they will be assessed.

Assessment objectives

16. Awarding organisation specifications must require the learners to demonstrate the following objectives in a range of appropriate vocationally related contexts.
17. The weightings for the assessment objectives must be within the ranges set out below:

Assessment objective		Weighting (%)		
		AS	A2	A level / A level (double award)
AO1	Demonstration of knowledge and understanding Learners demonstrate their knowledge and understanding by: <ul style="list-style-type: none"> ■ recognising and recalling facts, terminology, principles, concepts and practical techniques; ■ selecting, organising and presenting, clearly and logically, information either provided or acquired through systematic research. 	35–50	15–30	25–40
AO2	Application of knowledge, skills and understanding Learners apply their skills,	10–25	20–35	15–30

	<p>knowledge and understanding in appropriate vocational contexts by:</p> <ul style="list-style-type: none"> ■ describing, explaining, interpreting and evaluating information and the impact on society of the work of scientists, including beneficial effects and the need for constraints; ■ carrying out relevant calculations. 			
AO3	<p>Experimentation and investigation Learners:</p> <ul style="list-style-type: none"> ■ carry out, safely and skilfully, practical tasks, making and recording observations and measurements with appropriate precision, processing them appropriately and communicating this information clearly and logically, for example in prose, tables and graphs; ■ plan, carry out and evaluate investigative work. 	25–40	35–50	30–45

Scheme of assessment

18. Assessment units must be either internally or externally assessed.
19. AS content and A2 content must be separately assessed.
20. In each AS specification, at least one assessment unit must be externally assessed.
21. In each AS double award specification, at least two assessment units must be externally assessed.
22. In each A level specification, at least two assessment units must be externally assessed, one of which must be in A2.
23. In each A level double award specification, at least four assessment units must be externally assessed, two of which must be in A2.
24. The scheme of assessment must include assessment of quality of written communication.¹
25. The chosen assessment instruments for both internal and external assessments must be suitable for testing learners on how they apply skills, knowledge and understanding in vocational contexts.
26. All A level and A level double award specifications must include synoptic assessment in A2. Synoptic assessment will involve the learner bringing together and making connections between the areas of skills, knowledge and understanding covered within the specification, and applying this when carrying out the substantive investigation.
27. All specifications must include external assessment that is externally set, timed and includes some part completed under 'controlled' conditions. The assessed outcome(s) should be marked by either:
 - the awarding organisation; or
 - the centre and moderated by the awarding organisation.

¹ Any reference to 'writing' or 'written communication' should be interpreted as the production of text by any means, for example pen, word processor and so on.

Grade descriptions

28. The following grade descriptions give a general indication of the required advanced level standard at each specified grade. The description should be interpreted in relation to the content and assessment evidence requirements set out in the specification; they are not expected to define these. 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 the assessment may be balanced by better performance in others.

Grade	Description
A	<p>Learners demonstrate their knowledge and understanding of science with few significant omissions. They use scientific terminology and conventions accurately in all their work. They select relevant information, present it clearly and logically, and then evaluate and justify it.</p> <p>Learners describe, interpret and explain phenomena and effects using scientific principles, and apply scientific facts and principles to familiar and unfamiliar situations. They describe, interpret and evaluate quantitative and qualitative data. They identify and explain issues arising from scientific activities which impact on society. They carry out complex calculations, obtaining correct solutions to an appropriate degree of accuracy.</p> <p>In all practical tasks, learners produce risk assessments, consistent with COSHH guidelines, and use them to carry out tasks safely, using a range of techniques and equipment with an appropriate degree of accuracy. They make and record relevant observations and measurements with appropriate precision, and process these accurately. They interpret their results and draw conclusions, discussing their significance.</p> <p>In the synoptic investigation, learners independently make a realistic and achievable plan for an investigation, linked to other areas of the AS/A level specification. They critically evaluate their investigation, incorporating amendments into the plan where appropriate, and produce a logical and well-structured report, showing a detailed scientific understanding of their work.</p>

C	<p>Learners demonstrate their knowledge and understanding of science from a range of areas of the specification. They use appropriate scientific terminology and conventions in their work. They select relevant information and present it clearly and logically.</p> <p>Learners describe and explain phenomena and effects using scientific principles, and apply scientific facts and principles competently to familiar situations and with some success to unfamiliar situations. They describe and interpret quantitative and qualitative data. They identify and describe issues arising from scientific activities which impact on society. They carry out complex calculations with partial success.</p> <p>In all practical tasks, learners use risk assessments to carry out tasks safely, using a range of techniques and equipment. They make and record relevant observations and measurements, and process these accurately. They interpret their results and draw conclusions, discussing their significance.</p> <p>In the synoptic investigation, learners independently make a realistic and achievable plan for an investigation, linked to other areas of the AS/A level specification. They evaluate their investigation, suggesting amendments where appropriate, and produce a logical and well-structured report, showing a scientific understanding of their work.</p>
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E	<p>Learners demonstrate some knowledge and understanding of science. They use some scientific terminology and conventions in their work. They select and clearly present information. They describe phenomena and effects using scientific principles and apply scientific facts and principles to familiar situations. Learners describe and give limited interpretations of quantitative and qualitative scientific data and describe issues arising from scientific activities which impact on society. They carry out straightforward calculations, generally obtaining correct solutions.</p> <p>In all practical tasks, learners use risk assessments to carry out the tasks safely, using a range of techniques and equipment. They make and record some relevant observations and measurements and, with guidance, provide some interpretation of their results in terms of their scientific knowledge and understanding.</p> <p>In the synoptic investigation, learners make a plan for an investigation, linked to other areas of the AS/A level specification, make an appropriate evaluation, and produce a clear and accurate report.</p>
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