GCSE Subject Criteria for Biology

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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 Biology should encourage learners to develop their curiosity about the living world and provide insight into and experience of how science works. They should enable learners to engage with biology in their everyday lives and to make informed choices about further study in biology-related disciplines and about career choices.

2. GCSE specifications in Biology must enable learners to:

    - develop their knowledge and understanding of biology;
    - develop their understanding of the effects of biology on society;
    - develop an understanding of the importance of scale in biology;
    - develop and apply their knowledge and understanding of the nature of science and of the scientific process;
    - develop their understanding of the relationships between hypotheses, evidence, theories and explanations;
    - develop their awareness of risk and the ability to assess potential risk in the context of potential benefits;
    - develop and apply their observational, practical, modelling, enquiry and problem-solving skills and understanding in laboratory, field and other learning environments;
    - develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions both qualitatively and quantitatively;
    - develop their skills in communication, mathematics and the use of technology in scientific contexts.

Subject content

3. GCSE specifications in Biology must require learners to demonstrate knowledge and understanding of:

- 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;
- the importance of working accurately and safely;
- hazard identification and risk assessment;
- risk factors and risk assessment in the context of potential benefit;
- the use of use modelling, including mathematical modelling, to explain aspects of biology;
- the importance of scale in terms of time, size and space in biology;
- the variety of life, including microorganisms, plants and animals, variation within species including the effects of genotype and environment;
- how similarities and differences can be used to classify organisms and the importance of classification;
- how organisms have changed through time;
- natural selection and how it can lead to evolutionary changes, and how genes determine the structure and function of organisms;
- the need for, and development and functions of, specialised organ systems;
- the interdependence of organisms and their adaptations to their environment;

- fieldwork techniques to explore the relationships between communities of organisms and their environments;
- how environmental change is measured including using living and non-living indicators;
- energy flow through the biosphere;
- cycling and recycling of nutrients including the roles of micro-organisms;
- the production, use and disposal of materials and how an understanding of biology helps to reduce the resulting impacts on the environment;
- the structure of cells including plant, animal and microbial cells;
- mitosis and meiosis;
- how chemical reactions that are essential for life take place inside and outside cells;
- photosynthesis and respiration;
- the structure and function of DNA and its role in protein synthesis;
- the structure and functions of proteins including enzyme action;
- the different patterns of growth and development in plants and animals.

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

- develop hypotheses and plan practical ways to test them including risk assessment; manage risks when carrying out practical work; collect, process, analyse and interpret primary and secondary data including the use of appropriate technology to draw evidence-based conclusions; review methodology to assess fitness for purpose, and review hypotheses in light of outcomes;
- use scientific theories, models and evidence to develop hypotheses, arguments and explanations; develop and use models to explain systems, processes and abstract ideas;

- communicate scientific information using scientific, technical and mathematical language[1], conventions, and symbols.

Assessment objectives

5. All specifications in Biology must require learners 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 of biology in practical and other contexts.	30–40%
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence.	25–35%

Scheme of assessment

6. 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.

7. Question papers in Biology 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

[1] See Appendix A.

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

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 biology. They demonstrate a comprehensive understanding of the nature of biology, its principles and applications, and the relationship between biology and society. They understand the relationships between scientific advances, their ethical implications, and the benefits and risks associated with them. They use scientific and technical knowledge, terminology and conventions appropriately and consistently showing a detailed understanding of scale in terms of time, size and space. They apply appropriate skills, including communication, mathematical, technical and observational skills, knowledge and understanding effectively in a wide range of practical and other contexts. They show a comprehensive understanding of the relationships between hypotheses, evidence, theories and explanations and make effective use of models, including mathematical models, to explain abstract ideas, phenomena, events and processes. They use a wide range of appropriate methods, sources of information and data consistently, applying relevant skills to address scientific questions, solve problems and test hypotheses. Learners analyse, interpret and critically evaluate a broad range of quantitative and qualitative data and information. They evaluate information systematically to develop arguments and explanations taking account of the limitations of the available evidence. They make reasoned judgments consistently and draw detailed, evidence-based conclusions.
C	Learners recall, select and communicate secure knowledge and understanding of biology. They demonstrate understanding of the nature of biology and its principles and applications and the relationship between biology and society. They understand that scientific advances may have ethical implications, benefits and risks.

	They use scientific and technical knowledge, terminology and conventions appropriately, showing understanding of scale in terms of time, size and space. They apply appropriate skills, including communication, mathematical, technical and observational skills, knowledge and understanding in a range of practical and other contexts. They show understanding of the relationships between hypotheses, evidence, theories and explanations and use models, including mathematical models, to describe abstract ideas, phenomena, events and processes. They use a range of appropriate methods, sources of information and data, applying their skills to address scientific questions, solve problems and test hypotheses. Learners analyse, interpret and evaluate a range of quantitative and qualitative data and information. They understand the limitations of evidence and use evidence and information to develop arguments with supporting explanations. They draw conclusions based on the available evidence.
F	Learners recall, select and communicate limited knowledge and understanding of biology. They recognise simple interrelationships between biology and society. They show a limited understanding that scientific advances may have ethical implications, benefits and risks. They use limited scientific and technical knowledge, terminology and conventions, showing some understanding of scale in terms of time, size and space. They apply skills, including limited communication, mathematical, technical and observational skills, knowledge and understanding in practical and some other contexts. They recognise and use hypotheses, evidence and explanations and can explain straightforward models of phenomena, events and processes. They use a limited range of methods, sources of information and data to address straightforward scientific questions, problems and hypotheses. Learners interpret and evaluate limited quantitative and qualitative data and information from a narrow 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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