edexcel

GCSE (9-1) Biology

Specification

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Biology (1BI0)

First teaching from September 2016

First certification from 2018

Issue 2

Pearson

Summary of Pearson Level 1/Level 2 GCSE (9–1) in Biology (1BI0) specification Issue 2 changes

Summary of changes made between previous issue and this current issue	Page number
Inclusion of calculation information in the assessment overview section	4
Specification statement 1.3 has been amended to include the word 'organelles'	10
Inclusion of B against specification statements 5.5f, 5.5g, 5.6e and 5.6f as these are for Biology only	20
Specification statements 5.24a and 7.17 have been amended to correct the BMI equation from 'weight' to 'mass'	22, 26
Specification statement 6.9 has been amended from 'describe' to 'explain'	23
In *Appendix 4: Practical Science Statement* the statement has been amended	51
Addition of *Appendix 8: Calculators* which contains the rules around calculator use in the examinations	56

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html

Contents

1 Introduction

Why choose Edexcel GCSE in Biology?

Supporting success in science

Science matters. That's why we've built the most inclusive GCSE (9–1) courses, so every student can enjoy science and succeed in their studies.

Every student is different. With the same science and equal number of exams across our tiered qualifications, you can structure the courses in the ways that mean you can best support and stretch your students together.

Our specifications are straightforward, and our selection of core practicals are designed to help bring science learning to life. And when it comes to our assessments, they're shaped to encourage all students to best show what they know and can do.

Supporting you in planning and implementing this qualification

Planning

- Our **Getting Started** guide gives you an overview of the new GCSE qualifications to help you to get to grips with the changes to content and assessment and to help you understand what these changes mean for you and your students.
- We will give you editable **schemes of work** that you can adapt to suit your department.
- **Our mapping documents** highlight key differences between the new and 2011 qualifications.

Teaching and learning

There will be lots of free teaching and learning support to help you deliver the new qualifications, including:

- a free series of teacher, student and technician worksheets will help cover each element of planning and delivering every core practical
- a free **practical** guide to help you prepare for the changes to practical assessment
- a free **maths** guide for scientists to help you embed mathematics in your science teaching.

Preparing for exams

We will also provide a range of resources to help you prepare your students for the assessments, including:

- additional assessment materials to support formative assessments and mock exams
- marked exemplars of student work with examiner commentaries.

ResultsPlus

ResutsPlus provides the most detailed analysis available of your students' exam performance. It can help you identify the topics and skills where further learning would benefit your students.

Get help and support

Our subject advisor service, led by Stephen Nugus and Julius Edwards will ensure you receive help and guidance from us and that you can share ideas and information with other teachers.

Learn more at qualifications.pearson.com

examWizard

examWizard is a free exam preparation tool containing a bank of Edexcel GCSE Science exam questions, mark schemes and examiners' reports. Existing questions will be reviewed and tagged to our new specifications so they can still be used, and question descriptions will be updated.

Qualification at a glance

Content and assessment overview

The Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Biology consists of two externally-examined papers. These are available at foundation tier and higher tier.

Students must complete all assessments in the same tier.

Students must complete all assessment in May/June in any single year.

Paper 1 (*Paper code: 1BI0/1F, 1BI0/1H)
Written examination: 1 hour and 45 minutes ***50% of the qualification*** ***100 marks***
Content overview • Topic 1 – Key concepts in biology • Topic 2 – Cells and control • Topic 3 – Genetics • Topic 4 – Natural selection and genetic modification • Topic 5 – Health, disease and the development of medicines
Assessment overview A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. Information on the use of calculators during the examinations for this qualification can be found in *Appendix 8: Calculators*.

Paper 2 (Paper code: 1BI0/2F, 1BI0/2H)
Written examination: 1 hour and 45 minutes ***50% of the qualification*** ***100 marks***
Content overview • Topic 1 – Key concepts in biology • Topic 6 – Plant structures and their functions • Topic 7 – Animal coordination, control and homeostasis • Topic 8 – Exchange and transport in animals • Topic 9 – Ecosystems and material cycles
Assessment overview A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. Information on the use of calculators during the examinations for this qualification can be found in *Appendix 8: Calculators*.

*See *Appendix 7: Codes* for a description of this code and all other codes relevant to this qualification.

2 Subject content

Qualification aims and objectives

GCSE study in the sciences provides the foundation for understanding the material world. Scientific understanding is changing our lives and is vital to the world's future prosperity. All students should learn essential aspects of the knowledge, methods, processes and uses of science. They should gain appreciation of how the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas that relate to the sciences and that are both inter-linked and of universal application. These key ideas include:

- the use of conceptual models and theories to make sense of the observed diversity of natural phenomena
- the assumption that every effect has one or more cause
- that change is driven by differences between different objects and systems when they interact
- that many such interactions occur over a distance without direct contact
- that science progresses through a cycle of hypothesis, practical experimentation, observation, theory development and review
- that quantitative analysis is a central element both of many theories and of scientific methods of inquiry.

These key ideas are relevant in different ways and with different emphases in the three subjects. Examples of their relevance are given for each subject in the separate sections below for Biology, Chemistry and Physics.

The three GCSE Science qualifications enable students to:

- develop scientific knowledge and conceptual understanding through the specific disciplines of Biology, Chemistry and Physics
- develop understanding of the nature, processes and methods of science, through different types of scientific enquiries that help them to answer scientific questions about the world around them
- develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills in the laboratory, in the field and in 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.

Students should study the sciences in ways that help them to develop curiosity about the natural world, that give them an insight into how science works and that enable them to appreciate its relevance to their everyday lives. The scope and nature of the study should be broad, coherent, practical and satisfying. It should encourage students to be inspired, motivated and challenged by the subject and its achievements.

The key ideas specific to the Biology content include:

- life processes depend on molecules whose structure is related to their function
- the fundamental units of living organisms are cells, which may be part of highly adapted structures, including tissues, organs and organ systems, enabling living processes to be performed effectively
- living organisms may form populations of single species, communities of many species and ecosystems, interacting with each other, with the environment and with humans in many different ways

- living organisms are interdependent and show adaptations to their environment
- life on Earth is dependent on photosynthesis in which green plants and algae trap light from the Sun to fix carbon dioxide and combine it with hydrogen from water to make organic compounds and oxygen
- organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life
- the chemicals in ecosystems are continually cycling through the natural world
- the characteristics of a living organism are influenced by its genome and its interaction with the environment
- evolution occurs by a process of natural selection and accounts both for biodiversity and how organisms are all related to varying degrees.

All of these key ideas will be assessed as part of this qualification, through the subject content.

Working scientifically

The GCSE in Biology requires students to develop the skills, knowledge and understanding of working scientifically. Working scientifically will be assessed through examination and the completion of the eight core practicals.

1 Development of scientific thinking

a Understand how scientific methods and theories develop over time.

b Use a variety of models, such as representational, spatial, descriptive, computational and mathematical, to solve problems, make predictions and to develop scientific explanations and an understanding of familiar and unfamiliar facts.

c Appreciate the power and limitations of science, and consider any ethical issues that may arise.

d Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.

e Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.

f Recognise the importance of peer review of results and of communicating results to a range of audiences.

2 Experimental skills and strategies

a Use scientific theories and explanations to develop hypotheses.

b Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.

c Apply a knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to the experiment.

d Carry out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.

e Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative.

f Make and record observations and measurements using a range of apparatus and methods.

g Evaluate methods and suggest possible improvements and further investigations.

3 Analysis and evaluation

Apply the cycle of collecting, presenting and analysing data, including:

a presenting observations and other data using appropriate methods.

b translating data from one form to another.

c carrying out and representing mathematical and statistical analysis.

d representing distributions of results and making estimations of uncertainty.

e interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.

f presenting reasoned explanations, including relating data to hypotheses.

g being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.

h communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms.

4 Scientific vocabulary, quantities, units, symbols and nomenclature

a Use scientific vocabulary, terminology and definitions.

b Recognise the importance of scientific quantities and understand how they are determined.

c Use SI units (e.g. kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate.

d Use prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano).

e Interconvert units.

f Use an appropriate number of significant figures in calculation.

Practical work

The content includes eight mandatory core practicals, indicated as an entire specification point in italics.

Students must carry out all eight of the mandatory core practicals listed below.

Core practical:

1.6 *Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations*

1.10 *Investigate the effect of pH on enzyme activity*

1.13B *Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*

1.16 *Investigate osmosis in potatoes*

5.18B *Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*

6.5 *Investigate the effect of light intensity on the rate of photosynthesis*

8.11 *Investigate the rate of respiration in living organisms*

9.5 *Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*

Students will need to use their knowledge and understanding of these practical techniques and procedures in the written assessments.

Centres must confirm that each student has completed the eight mandatory core practicals.

Students need to record the work that they have undertaken for the eight mandatory core practicals. The practical record must include the knowledge, skills and understanding they have derived from the practical activities. Centres must complete and submit a Practical Science Statement (see *Appendix 4*) to confirm that all students have completed the eight mandatory core practicals. This must be submitted to Pearson by 15th April in the year that the students will sit their examinations. Any failure by centres to provide this Practical Science Statement will be treated as malpractice and/or maladministration.

Scientific diagrams should be included, where appropriate, to show the set-up and to record the apparatus and procedures used in practical work.

It is important to realise that these core practicals are the minimum number of practicals that should be taken during the course. Suggested additional practicals are given beneath the content at the end of each topic. The eight mandatory core practicals cover all aspects of the apparatus and techniques listed in *Appendix 3: Apparatus and techniques*. This appendix also includes more detailed instructions for each core practical, which must be followed.

Safety is an overriding requirement for all practical work. Centres are responsible for ensuring appropriate safety procedures are followed whenever their students complete practical work.

These core practicals may be reviewed and amended if changes are required to the apparatus and techniques listed by the Department for Education. Pearson may also review and amend the core practicals if necessary. Centres will be told as soon as possible about any changes to core practicals, with an updated specification being published.

Qualification content

The following notation is used in the tables that show the content for this qualification:

- text in **bold** indicates content that is for higher tier only
- entire specification points in italics indicates the core practicals.

Specification statement numbers with a B in them refer to content which is only in the GCSE in Biology and is not found in the GCSE in Combined Science (e.g. 1.13B).

Mathematics

Maths skills that can be assessed in relation to a specification point are referenced in the maths column, next to this specification point. Please see *Appendix 1: Mathematical skills* for full details of each maths skill.

After each topic of content in this specification, there are details relating to the 'Use of mathematics' which contains the Biology specific mathematic skills that are found in each topic of content in the document *Biology, Chemistry and Physics GCSE subject content*, published by the Department for Education (DfE) in June 2014. The reference in brackets after each statement refers to the mathematical skills from *Appendix 1*.

Topics common to Paper 1 and Paper 2

Topic 1 – Key concepts in biology

Students should:		Maths skills
1.1	Explain how the sub-cellular structures of eukaryotic and prokaryotic cells are related to their functions, including: a animal cells – nucleus, cell membrane, mitochondria and ribosomes b plant cells – nucleus, cell membrane, cell wall, chloroplasts, mitochondria, vacuole and ribosomes c bacteria – chromosomal DNA, plasmid DNA, cell membrane, ribosomes and flagella	
1.2	Describe how specialised cells are adapted to their function, including: a sperm cells – acrosome, haploid nucleus, mitochondria and tail b egg cells – nutrients in the cytoplasm, haploid nucleus and changes in the cell membrane after fertilisation c ciliated epithelial cells	
1.3	Explain how changes in microscope technology, including electron microscopy, have enabled us to see cell structures and organelles with more clarity and detail than in the past and increased our understanding of the role of sub-cellular structures	
1.4	Demonstrate an understanding of number, size and scale, including the use of estimations and explain when they should be used	1d 2h
1.5	Demonstrate an understanding of the relationship between quantitative units in relation to cells, including: a milli (10^{-3}) b micro (10^{-6}) c nano (10^{-9}) d pico (10^{-12}) **e calculations with numbers written in standard form**	1b 2a 2h
1.6	*Core Practical: Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations*	1d 2a, 2h 3b
1.7	Explain the mechanism of enzyme action including the active site and enzyme specificity	
1.8	Explain how enzymes can be denatured due to changes in the shape of the active site	
1.9	Explain the effects of temperature, substrate concentration and pH on enzyme activity	2c, 2f 4a, 4c

Students should:		Maths skills
1.10	*Core Practical: Investigate the effect of pH on enzyme activity*	2c, 2f 4a, 4c
1.11	Demonstrate an understanding of rate calculations for enzyme activity	1a, 1c
1.12	Explain the importance of enzymes as biological catalysts in the synthesis of carbohydrates, proteins and lipids and their breakdown into sugars, amino acids and fatty acids and glycerol	
1.13B	*Core Practical: Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*	
1.14B	Explain how the energy contained in food can be measured using calorimetry	1a 2a
1.15	Explain how substances are transported into and out of cells, including by diffusion, osmosis and active transport	
1.16	*Core Practical: Investigate osmosis in potatoes*	1c 2b, 2f 4a, 4c
1.17	Calculate percentage gain and loss of mass in osmosis	1a, 1c 4a, 4c

Use of mathematics

- Demonstrate an understanding of number, size and scale and the quantitative relationship between units (2a and 2h).
- Use estimations and explain when they should be used (1d).
- Carry out rate calculations for chemical reactions (1a and 1c).
- **Calculate with numbers written in standard form (1b).**
- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Translate information between numerical and graphical forms (4a).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Use a scatter diagram to identify a correlation between two variables (2g).
- Understand and use simple compound measures such as the rate of a reaction (1a and 1c).
- Calculate the percentage gain and loss of mass (1c).
- Use fractions and percentages (1c).
- Calculate arithmetic means (2b).
- Carry out rate calculations (1a and 1c).

Suggested practicals

- Investigate the effect of different concentrations of digestive enzymes, using and evaluating models of the alimentary canal.
- Investigate the effect of temperatures and concentration on enzyme activity.
- Investigate plant and animal cells with a light microscope.
- Investigate the effect of concentration on rate of diffusion.

Topics for Paper 1

Topic 2 – Cells and control

Students should:		Maths skills
2.1	Describe mitosis as part of the cell cycle, including the stages interphase, prophase, metaphase, anaphase and telophase and cytokinesis	
2.2	Describe the importance of mitosis in growth, repair and asexual reproduction	
2.3	Describe the division of a cell by mitosis as the production of two daughter cells, each with identical sets of chromosomes in the nucleus to the parent cell, and that this results in the formation of two genetically identical diploid body cells	
2.4	Describe cancer as the result of changes in cells that lead to uncontrolled cell division	
2.5	Describe growth in organisms, including: a cell division and differentiation in animals b cell division, elongation and differentiation in plants	
2.6	Explain the importance of cell differentiation in the development of specialised cells	
2.7	Demonstrate an understanding of the use of percentiles charts to monitor growth	1c 4a
2.8	Describe the function of embryonic stem cells, stem cells in animals and meristems in plants	1d
2.9	Discuss the potential benefits and risks associated with the use of stem cells in medicine	
2.10B	Describe the structures and functions of the brain including the cerebellum, cerebral hemispheres and medulla oblongata	
2.11B	**Explain how the difficulties of accessing brain tissue inside the skull can be overcome by using CT scanning and PET scanning to investigate brain function**	1d 2d
2.12B	**Explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system, including spinal injuries and brain tumours**	
2.13	Explain the structure and function of sensory receptors, sensory neurones, relay neurones in the CNS, motor neurones and synapses in the transmission of electrical impulses, including the axon, dendron, myelin sheath and the role of neurotransmitters	2g 4a, 4c
2.14	Explain the structure and function of a reflex arc including sensory, relay and motor neurones	

Students should:		Maths skills
2.15B	Explain the structure and function of the eye as a sensory receptor including the role of: a the cornea and lens b the iris c rod and cone cells in the retina	2c
2.16B	Describe defects of the eye including cataracts, long-sightedness, short-sightedness and colour blindness	
2.17B	Explain how cataracts, long-sightedness and short-sightedness can be corrected	

Use of mathematics

- Use estimations and explain when they should be used (1d).
- Use percentiles and calculate percentage gain and loss of mass (1c).
- Translate information between numerical and graphical forms (4a).
- Use a scatter diagram to identify a correlation between two variables (2g).
- Extract and interpret information from graphs, charts and tables (2c and 4a).
- Extract and interpret data from graphs, charts, and tables (2c).
- Understand and use percentiles (1c).
- Use fractions and percentages (1c).

Suggested practicals

- Investigate human responses to external stimuli.
- Investigate reaction times.
- Investigate the speed of transmission of electrical impulses in the nervous system.

Topic 3 – Genetics

Students should:		Maths skills
3.1B	Explain some of the advantages and disadvantages of asexual reproduction, including the lack of need to find a mate, a rapid reproductive cycle, but no variation in the population	
3.2B	Explain some of the advantages and disadvantages of sexual reproduction, including variation in the population, but the requirement to find a mate	
3.3	Explain the role of meiotic cell division, including the production of four daughter cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes The stages of meiosis are not required	
3.4	Describe DNA as a polymer made up of: a two strands coiled to form a double helix b strands linked by a series of complementary base pairs joined together by weak hydrogen bonds c nucleotides that consist of a sugar and phosphate group with one of the four different bases attached to the sugar	
3.5	Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein	
3.6	Explain how DNA can be extracted from fruit	
3.7B	**Explain how the order of bases in a section of DNA decides the order of amino acids in the protein and that these fold to produce specifically shaped proteins such as enzymes**	
3.8B	**Describe the stages of protein synthesis, including transcription and translation:** **a RNA polymerase binds to non-coding DNA located in front of a gene** **b RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene** **c the attachment of the mRNA to the ribosome** **d the coding by triplets of bases (codons) in the mRNA for specific amino acids** **e the transfer of amino acids to the ribosome by tRNA** **f the linking of amino acids to form polypeptides**	
3.9B	**Describe how genetic variants in the non-coding DNA of a gene can affect phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced**	
3.10B	**Describe how genetic variants in the coding DNA of a gene can affect phenotype by altering the sequence of amino acids and therefore the activity of the protein produced**	

Students should:		Maths skills
3.11B	Describe the work of Mendel in discovering the basis of genetics and recognise the difficulties of understanding inheritance before the mechanism was discovered	1c 2c, 2e
3.12	Explain why there are differences in the inherited characteristics as a result of alleles	
3.13	Explain the terms: chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, gamete and zygote	
3.14	Explain monohybrid inheritance using genetic diagrams, Punnett squares and family pedigrees	1c 2c, 2e 4a
3.15	Describe how the sex of offspring is determined at fertilisation, using genetic diagrams	1c 2c, 2e 4a
3.16	Calculate and analyse outcomes (using probabilities, ratios and percentages) from monohybrid crosses and pedigree analysis for dominant and recessive traits	1c 2c, 2e 4a
3.17B	Describe the inheritance of the ABO blood groups with reference to codominance and multiple alleles	1c 2c, 2e 4a
3.18B	**Explain how sex-linked genetic disorders are inherited**	1c 2c, 2e 4a
3.19	State that most phenotypic features are the result of multiple genes rather than single gene inheritance	
3.20	Describe the causes of variation that influence phenotype, including: a genetic variation – different characteristics as a result of mutation and sexual reproduction b environmental variation – different characteristics caused by an organism's environment (acquired characteristics)	
3.21	Discuss the outcomes of the Human Genome Project and its potential applications within medicine	
3.22	State that there is usually extensive genetic variation within a population of a species and that these arise through mutations	
3.23	State that most genetic mutations have no effect on the phenotype, some mutations have a small effect on the phenotype and, rarely, a single mutation will significantly affect the phenotype	

Use of mathematics

- Use estimations and explain when they should be used (1d).
- Translate information between numerical and graphical forms (4a).
- Extract and interpret information from graphs, charts and tables (2c and 4a).
- Extract and interpret data from graphs, charts, and tables (2c).
- Understand and use direct proportions and simple ratios in genetic crosses (1c).
- Understand and use the concept of probability in predicting the outcome of genetic crosses (2e).
- Calculate arithmetic means (2b).

Suggested practicals

- Investigate the variations within a species to illustrate continuous variation and discontinuous variation.
- Investigate inheritance using suitable organisms or models.

Topic 4 – Natural selection and genetic modification

Students should:		Maths skills
4.1B	Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection and explain the impact of these ideas on modern biology	
4.2	Explain Darwin's theory of evolution by natural selection	
4.3	Explain how the emergence of resistant organisms supports Darwin's theory of evolution including antibiotic resistance in bacteria	2c 4a
4.4	Describe the evidence for human evolution, based on fossils, including: a Ardi from 4.4 million years ago b Lucy from 3.2 million years ago c Leakey's discovery of fossils from 1.6 million years ago	1a, 1b, 1c 4a
4.5	Describe the evidence for human evolution based on stone tools, including: a the development of stone tools over time b how these can be dated from their environment	
4.6B	Describe how the anatomy of the pentadactyl limb provides scientists with evidence for evolution	
4.7	Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method	
4.8	Explain selective breeding and its impact on food plants and domesticated animals	
4.9B	Describe the process of tissue culture and its advantages in medical research and plant breeding programmes	
4.10	Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics	
4.11	**Describe the main stages of genetic engineering including the use of:** **a restriction enzymes** **b ligase** **c sticky ends** **d vectors**	
4.12B	Explain the advantages and disadvantages of genetic engineering to produce GM organisms including the modification of crop plants, including the introduction of genes for insect resistance from *Bacillus thuringiensis* into crop plants	

Students should:		Maths skills
4.13B	Explain the advantages and disadvantages of agricultural solutions to the demands of a growing human population, including use of fertilisers and biological control	2c 4a, 4c
4.14	Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine, including practical and ethical implications	2c 4a, 4c

Use of mathematics

- Translate information between numerical and graphical forms (4a).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Plot and draw appropriate graphs, selecting appropriate scales for axes (4a and 4c).
- Extract and interpret information from graphs, charts and tables (2c and 4a).
- Extract and interpret data from graphs, charts, and tables (2c).
- Understand and use direct proportions and simple ratios in genetic crosses (1c).
- Understand and use the concept of probability in predicting the outcome of genetic crosses (2e).

Topic 5 – Health, disease and the development of medicines

Students should:		Maths skills
5.1	Describe health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, as defined by the World Health Organization (WHO)	
5.2	Describe the difference between communicable and non-communicable diseases	
5.3	Explain why the presence of one disease can lead to a higher susceptibility to other diseases	2c, 2d, 2g 4a, 4c
5.4	Describe a pathogen as a disease-causing organism, including viruses, bacteria, fungi and protists	
5.5	Describe some common infections, including: a cholera (bacteria) causes diarrhoea b tuberculosis (bacteria) causes lung damage c Chalara ash dieback (fungi) causes leaf loss and bark lesions d malaria (protists) causes damage to blood and liver e HIV (virus) destroys white blood cells, leading to the onset of AIDS fB stomach ulcers caused by Helicobacter (bacteria) gB Ebola (virus) causes haemorrhagic fever	
5.6	Explain how pathogens are spread and how this spread can be reduced or prevented, including: a cholera (bacteria) – water b tuberculosis (bacteria) – airborne c Chalara ash dieback (fungi) – airborne d malaria (protists) – animal vectors eB stomach ulcers caused by Helicobacter (bacteria) – oral transmission fB Ebola (virus) – body fluids	
5.7B	Describe the lifecycle of a virus, including lysogenic and lytic pathways	
5.8	Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including: a *Chlamydia* (bacteria) b HIV (virus)	
5.9B	Describe how some plants defend themselves against attack from pests and pathogens by physical barriers, including the leaf cuticle and cell wall	
5.10B	Describe how plants defend themselves against attack from pests and pathogens by producing chemicals, some of which can be used to treat human diseases or relieve symptoms	5c

Students should:		Maths skills
5.11B	**Describe different ways plant diseases can be detected and identified, in the lab and in the field including the elimination of possible environmental causes, distribution analysis of affected plants, observation of visible symptoms and diagnostic testing to identify pathogens**	2d 4c 5c
5.12	Describe how the physical barriers and chemical defences of the human body provide protection from pathogens, including: a physical barriers, including mucus, cilia and skin b chemical defence, including lysozymes and hydrochloric acid	5c
5.13	Explain the role of the specific immune system of the human body in defence against disease, including: a exposure to pathogen b the antigens trigger an immune response which causes the production of antibodies c the antigens also trigger production of memory lymphocytes d the role of memory lymphocytes in the secondary response to the antigen	
5.14	Explain the body's response to immunisation using an inactive form of a pathogen	2c, 2g 4a, 4c
5.15B	Discuss the advantages and disadvantages of immunisation, including the concept of herd immunity	2d, 2g 4a, 4c
5.16	Explain that antibiotics can only be used to treat bacterial infections because they inhibit cell processes in the bacterium but not the host organism	5c
5.17B	Explain the aseptic techniques used in culturing microorganisms in the laboratory, including the use of an autoclave to prepare sterile growth medium and petri dishes, the use of sterile inoculating loops to transfer microorganisms and the need to keep petri dishes and culture vials covered	
5.18B	*Core Practical: Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*	1a 2c, 2f 5c
5.19B	Calculate cross-sectional areas of bacterial cultures and clear agar jelly using πr^2	1a 2c 5c
5.20	Describe that the process of developing new medicines, including antibiotics, has many stages, including discovery, development, preclinical and clinical testing	5c

Students should:	Maths skills
5.21B **Describe the production of monoclonal antibodies, including:** **a use of lymphocytes which produce desired antibodies but do not divide** **b production of hybridoma cells** **c hybridoma cells produce antibodies as they divide**	
5.22B **Explain the use of monoclonal antibodies, including:** **a in pregnancy testing** **b in diagnosis including locating the position of blood clots and cancer cells and in treatment of diseases including cancer** **c the advantages of using monoclonal antibodies to target specific cells compared to drug and radiotherapy treatments**	
5.23 Describe that many non-communicable human diseases are caused by the interaction of a number of factors, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition	
5.24 Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a exercise and diet on obesity and malnutrition, including BMI and waist : hip calculations, using the BMI equation: $\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$ b alcohol on liver diseases c smoking on cardiovascular diseases	1a, 1c 2c, 2d, 2g 3b 4a, 4c
5.25 Evaluate some different treatments for cardiovascular disease, including: a life-long medication b surgical procedures c lifestyle changes	1c, 1d 2c 4a, 4c

Use of mathematics

- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Understand the principles of sampling as applied to scientific data (2d).
- Use a scatter diagram to identify a correlation between two variables (2g).
- Calculate cross-sectional areas of bacterial cultures and clear agar jelly using πr^2 (5c).

Suggested practicals

- Investigate antimicrobial properties of plants.
- Investigate the conditions affecting growth of microorganisms (using resazurin dye).

Topics for Paper 2

Topic 6 – Plant structures and their functions

Students should:		Maths skills
6.1	Describe photosynthetic organisms as the main producers of food and therefore biomass	
6.2	Describe photosynthesis in plants and algae as an endothermic reaction that uses light energy to react carbon dioxide and water to produce glucose and oxygen	
6.3	Explain the effect of temperature, light intensity and carbon dioxide concentration as limiting factors on the rate of photosynthesis	2c, 2d, 2g 4a, 4c
6.4	**Explain the interactions of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis**	4b, 4c, 4d
6.5	*Core Practical: Investigate the effect of light intensity on the rate of photosynthesis*	2c, 2f, 2g 4a, 4c
6.6	**Explain how the rate of photosynthesis is directly proportional to light intensity and inversely proportional to the distance from a light source, including the use of the inverse square law calculation**	2g 3a, 3b 4a, 4b, 4c, 4d
6.7	Explain how the structure of the root hair cells is adapted to absorb water and mineral ions	
6.8	Explain how the structures of the xylem and phloem are adapted to their function in the plant, including: a lignified dead cells in xylem transporting water and minerals through the plant b living cells in phloem using energy to transport sucrose around the plant	
6.9	Explain how water and mineral ions are transported through the plant by transpiration, including the structure and function of the stomata	
6.10	Describe how sucrose is transported around the plant by translocation	
6.11B	Explain how the structure of a leaf is adapted for photosynthesis and gas exchange	2d 5c
6.12	Explain the effect of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement and temperature	1a, 1c 2b, 2c 4a, 4b, 4c, 4d
6.13	Demonstrate an understanding of rate calculations for transpiration	1a, 1c 2b, 2c 4a, 4b, 4c, 4d

Students should:		Maths skills
6.14B	Explain how plants are adapted to survive in extreme environments including the effect of leaf size and shape, the cuticle and stomata	2d 5c
6.15B	Explain how plant hormones control and coordinate plant growth and development, including the role of auxins in phototropisms and gravitropisms	5a
6.16B	**Describe the commercial uses of auxins, gibberellins and ethene in plants, including:** **a auxins in weedkillers and rooting powders** **b gibberellins in germination, fruit and flower formation and the production of seedless fruit** **c ethene in fruit ripening**	4a, 4c

Use of mathematics

- Carry out rate calculations for chemical reactions (1a and 1c).
- Use simple compound measures such as rate (1a, 1c)
- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Understand the principles of sampling as applied to scientific data (2d).
- Use a scatter diagram to identify a correlation between two variables (2g).
- Understand and use simple compound measures such as the rate of a reaction (1a and 1c).
- Understand and use inverse proportion – the inverse square law and light intensity in the context of factors affecting photosynthesis.
- Use percentiles and calculate the percentage gain and loss of mass (1c).
- Use fractions and percentages (1c).
- Calculate arithmetic means (2b).
- Calculate cross-sectional areas of bacterial cultures and clear agar jelly using πr^2 (5c).
- Carry out rate calculations (1a and 1c).

Suggested practicals

- Investigate the effect of pollutants on plant germination and plant growth.
- Investigate tropic responses.
- Investigate the effect of CO_2 concentration or temperature on the rate of photosynthesis.
- Investigate how the structure of the leaf is adapted for photosynthesis.
- Investigate how the loss of water vapour from leaves drives transpiration.
- Investigate the importance of photoperiodicity in plants.

Topic 7 – Animal coordination, control and homeostasis

Students should:		Maths skills
7.1	Describe where hormones are produced and how they are transported from endocrine glands to their target organs, including the pituitary gland, thyroid gland, pancreas, adrenal glands, ovaries and testes	
7.2	**Explain that adrenalin is produced by the adrenal glands to prepare the body for fight or flight, including:** **a increased heart rate** **b increased blood pressure** **c increased blood flow to the muscles** **d raised blood sugar levels by stimulating the liver to change glycogen into glucose**	2c 4a, 4c
7.3	**Explain how thyroxine controls metabolic rate as an example of negative feedback, including:** **a low levels of thyroxine stimulates production of TRH in hypothalamus** **b this causes release of TSH from the pituitary gland** **c TSH acts on the thyroid to produce thyroxine** **d when thyroxine levels are normal thyroxine inhibits the release of TRH and the production of TSH**	2c 4a, 4c
7.4	Describe the stages of the menstrual cycle, including the roles of the hormones oestrogen and progesterone, in the control of the menstrual cycle	4a
7.5	**Explain the interactions of oestrogen, progesterone, FSH and LH in the control of the menstrual cycle, including the repair and maintenance of the uterus wall, ovulation and menstruation**	4a, 4c
7.6	Explain how hormonal contraception influences the menstrual cycle and prevents pregnancy	
7.7	Evaluate hormonal and barrier methods of contraception	2c, 2d 4a
7.8	**Explain the use of hormones in Assisted Reproductive Technology (ART) including IVF and clomifene therapy**	
7.9	Explain the importance of maintaining a constant internal environment in response to internal and external change	
7.10B	Explain the importance of homeostasis, including: a thermoregulation – the effect on enzyme activity b osmoregulation – the effect on animal cells	

Students should:		Maths skills
7.11B	Explain how thermoregulation takes place, with reference to the function of the skin, including: a the role of the dermis b the role of the epidermis c the role of the hypothalamus	
7.12B	Explain how thermoregulation takes place, with reference to: a shivering **b vasoconstriction** **c vasodilation**	
7.13	Explain how the hormone insulin controls blood glucose concentration	
7.14	**Explain how blood glucose concentration is regulated by glucagon**	
7.15	Explain the cause of type 1 diabetes and how it is controlled	
7.16	Explain the cause of type 2 diabetes and how it is controlled	
7.17	Evaluate the correlation between body mass and type 2 diabetes including waist:hip calculations and BMI, using the BMI equation: $\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$	1a, 1c, 2c 2e, 3a
7.18B	Describe the structure of the urinary system	
7.19B	Explain how the structure of the nephron is related to its function in filtering the blood and forming urine including: a filtration in the glomerulus and Bowman's capsule b selective reabsorption of glucose c reabsorption of water	
7.20B	**Explain the effect of ADH on the permeability of the collecting duct in regulating the water content of the blood**	
7.21B	Describe the treatments for kidney failure, including kidney dialysis and organ donation	
7.22B	State that urea is produced from the breakdown of excess amino acids in the liver	

Use of mathematics

- Use simple compound measures such as rate (1a, 1c).
- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Translate information between numerical and graphical forms (4a).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Understand and use percentiles (1c).
- Extract and interpret data from graphs, charts and tables (1c).

Suggested practical

- Investigate the presence of sugar in simulated urine/body fluids.

Topic 8 – Exchange and transport in animals

Students should:		Maths skills
8.1	Describe the need to transport substances into and out of a range of organisms, including oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea	
8.2	Explain the need for exchange surfaces and a transport system in multicellular organisms including the calculation of surface area : volume ratio	1a, 1c 5c
8.3	Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries	
8.4B	Describe the factors affecting the rate of diffusion, including surface area, concentration gradient and diffusion distance	
8.5B	Calculate the rate of diffusion using Fick's law: $\text{rate of diffusion} \propto \frac{\text{surface area} \times \text{concentration difference}}{\text{thickness of membrane}}$	1a 3a, 3b, 3d
8.6	Explain how the structure of the blood is related to its function: a red blood cells (erythrocytes) b white blood cells (phagocytes and lymphocytes) c plasma d platelets	1b 2h
8.7	Explain how the structure of the blood vessels is related to their function	1a
8.8	Explain how the structure of the heart and circulatory system is related to its function, including the role of the major blood vessels, the valves and the relative thickness of chamber walls	
8.9	Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration	
8.10	Compare the process of aerobic respiration with the process of anaerobic respiration	
8.11	*Core Practical: Investigate the rate of respiration in living organisms*	1a 2a, 2c, 2f 4a, 4c
8.12	Calculate heart rate, stroke volume and cardiac output, using the equation cardiac output = stroke volume × heart rate	1a 2a, 2c 3a, 3b 4a, 4c

Use of mathematics

- Demonstrate an understanding of number, size and scale and the quantitative relationship between units (2a and 2h).
- **Calculate with numbers written in standard form (1b).**
- Calculate surface area : volume ratios (1c).
- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Translate information between numerical and graphical forms (4a).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Extract and interpret information from graphs, charts and tables (2c and 4a).
- Extract and interpret data from graphs, charts, and tables (2c).
- Use percentiles and calculate percentage gain and loss of mass (1c).

Suggested practicals

- Investigate the effect of glucose concentration on the rate of anaerobic respiration in yeast.
- Investigate the short-term effects of exercise on breathing rate and heart rate.

Topic 9 – Ecosystems and material cycles

Students should:		Maths skills
9.1	Describe the different levels of organisation from individual organisms, populations, communities, to the whole ecosystem	
9.2	Explain how communities can be affected by abiotic and biotic factors, including: a temperature, light, water, pollutants b competition, predation	4a, 4c
9.3	Describe the importance of interdependence in a community	
9.4	Describe how the survival of some organisms is dependent on other species, including parasitism and mutualism	
9.5	*Core Practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*	1c, 1d, 2b, 2c, 2d, 2f, 2g, 4a, 4c
9.6	Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects	1c, 1d 2b, 2c, 2d, 2g 4a, 4c
9.7B	Explain how some energy is transferred to less useful forms at each trophic level and that this affects the number of organisms at each trophic level, limits the length of a food chain and determines the shape of a pyramid of biomass in an ecosystem	
9.8B	Calculate the efficiency of energy transfers between trophic levels and percentage calculations of biomass	1a, 1b, 1c 2c 4a
9.9	Explain the positive and negative human interactions within ecosystems and their impacts on biodiversity, including: a fish farming b introduction of non-indigenous species c eutrophication	2c, 2g 4a, 4c
9.10	Explain the benefits of maintaining local and global biodiversity, including the conservation of animal species and the impact of reforestation	

Students should:		Maths skills
9.11B	Describe the biological factors affecting levels of food security, including: a increasing human population b increasing animal farming and the increased meat and fish consumption c the impact of new pests and pathogens d environmental change caused by human activity e sustainability issues, e.g. use of land for biofuel production and the cost of agricultural inputs	2c 4a, 4c
9.12	Describe how different materials cycle through the abiotic and biotic components of an ecosystem	
9.13	Explain the importance of the carbon cycle, including the processes involved and the role of microorganisms as decomposers	
9.14	Explain the importance of the water cycle, including the processes involved and the production of potable water in areas of drought including desalination	
9.15	Explain how nitrates are made available for plant uptake, including the use of fertilisers, crop rotation and the role of bacteria in the nitrogen cycle	
9.16B	**Evaluate the use of indicator species as evidence to assess the level of pollution, including:** **a polluted water – bloodworm, sludgeworm** **b clean water – freshwater shrimps, stonefly** **c air quality – different species of lichen, blackspot fungus on roses**	2c, 2g 4a, 4c
9.17B	Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in food preservation	
9.18B	Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in composting	2c 4a, 4c
9.19B	Calculate rate changes in the decay of biological material	1c 2c, 2f 4a, 4c

Use of mathematics

- Calculate surface area : volume ratios (1c).
- Plot, draw and interpret appropriate graphs (4a, 4b, 4c and 4d).
- Understand and use percentiles and calculate percentage gain and loss of mass (1c).
- Translate information between numerical and graphical forms (4a).
- Construct and interpret frequency tables and diagrams, bar charts and histograms (2c).
- Understand the principles of sampling as applied to scientific data (2d).
- Use a scatter diagram to identify a correlation between two variables (2g).
- Calculate the percentage of mass (1c).
- Use fractions and percentages (1c).
- Calculate arithmetic means (2b).
- Calculate the rate changes in the decay of biological material (1c).
- Extract and interpret information from charts, graphs and tables (2c, 4a).

Suggested practicals

- Investigate tropic responses.
- Investigate how indicator species can be used to assess levels of pollution in water or the atmosphere.
- Investigate animal behaviour using choice chambers.

3 Assessment information

Paper 1 (Paper code: 1BI0/1F, 1BI0/1H)

- First assessment: May/June 2018.
- The assessment is 1 hour and 45 minutes.
- The assessment is out of 100 marks.
- The assessment consists of ten questions.
- Students must answer all questions.
- The paper will include multiple-choice, short answer questions, calculations and extended open-response questions.
- Calculators may be used in the examination.
- Available at foundation tier and higher tier.
- Students must complete all assessments for this qualification in the same tier.
- The foundation tier paper will target grades 1–5.
- The higher tier paper will target grades 4–9.
- 27 marks of the paper will be overlap questions that appear in both the foundation and higher tier papers.

Content assessed

- Topic 1 – Key concepts in biology
- Topic 2 – Cells and control
- Topic 3 – Genetics
- Topic 4 – Natural selection and genetic modification
- Topic 5 – Health, disease and the development of medicines

Paper 2 (Paper code: 1BI0/2F, 1BI0/2H)

- First assessment: May/June 2018.
- The assessment is 1 hour and 45 minutes.
- The assessment is out of 100 marks.
- The assessment consists of ten questions.
- Students must answer all questions.
- The paper will include multiple-choice, short answer questions, calculations and extended open-response questions.
- Calculators may be used in the examination.
- Available at foundation tier and higher tier.
- Students must complete all assessments for this qualification in the same tier.
- The foundation tier paper will target grades 1–5.
- The higher tier paper will target grades 4–9.
- 27 marks of the paper will be overlap questions that appear in both the foundation and higher tier papers.

Content assessed

- Topic 1 – Key concepts in biology
- Topic 6 – Plant structures and their functions
- Topic 7 – Animal coordination, control and homeostasis
- Topic 8 – Exchange and transport in animals
- Topic 9 – Ecosystems and material cycles

Assessment Objectives

Students must:		% in GCSE
AO1	Demonstrate knowledge and understanding of: • scientific ideas • scientific techniques and procedures.	40
AO2	Apply knowledge and understanding of: • scientific ideas • scientific enquiry, techniques and procedures.	40
AO3	Analyse information and ideas to: • interpret and evaluate • make judgements and draw conclusions • develop and improve experimental procedures.	20
	Total	**100%**

Breakdown of Assessment Objectives

Paper	Assessment Objectives			Total for all Assessment Objectives
	AO1 %	AO2 %	AO3 %	
Paper 1 (F/H)	20	20	10	50%
Paper 2 (F/H)	20	20	10	50%
Total for GCSE	**40% ±3**	**40% ±3**	**20% ±3**	**100%**

Synoptic assessment

Synoptic assessment requires students to work across different parts of a qualification and to show their accumulated knowledge and understanding of a topic or subject area.

Synoptic assessment enables students to show their ability to combine their skills, knowledge and understanding with breadth and depth of the subject.

Questions that naturally draw together different aspects of biology will assess synopticity.

Sample assessment materials

Sample papers and mark schemes can be found in the *Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Biology Sample Assessment Materials* (SAMs) document.

4 Administration and general information

Entries

Details of how to enter students for the examinations for this qualification can be found in our *UK Information Manual*. A copy is made available to all examinations officers and is available on our website: qualifications.pearson.com

Discount code and performance tables

Centres should be aware that students who enter for more than one GCSE, or other Level 2 qualifications with the same discount code, will have only the grade for their 'first entry' counted for the purpose of the school and college performance tables (please see *Appendix 7: Codes*). For further information about what constitutes 'first entry' and full details of how this policy is applied, please refer to the DfE website: www.gov.uk/government/organisations/department-for-education

Students should be advised that if they take two GCSEs with the same discount code, schools and colleges they wish to progress to are likely to take the view that this achievement is equivalent to only one GCSE. The same view may be taken if students take two GCSEs or other Level 2 qualifications that have different discount codes but have significant overlap of content. Students or their advisers who have any doubts about their subject combinations should check with the institution they wish to progress to before embarking on their programmes.

Access arrangements, reasonable adjustments, special consideration and malpractice

Equality and fairness are central to our work. Our equality policy requires all students to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every student.

We are committed to making sure that:

- students with a protected characteristic (as defined by the Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic
- all students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Language of assessment

Assessment of this qualification will be available in English. All student work must be in English.

Access arrangements

Access arrangements are agreed before an assessment. They allow students with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual student with a disability, without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the Equality Act 2010 to make 'reasonable adjustments'.

Access arrangements should always be processed at the start of the course. Students will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a person with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular person may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, which will include:

- the needs of the student with the disability
- the effectiveness of the adjustment
- the cost of the adjustment; and
- the likely impact of the adjustment on the student with the disability and other students.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation, timeframes or affects the security or integrity of the assessment. This is because the adjustment is not 'reasonable'.

Special consideration

Special consideration is a post-examination adjustment to a student's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/ assessment, which has had, or is reasonably likely to have had, a material effect on a candidate's ability to take an assessment or demonstrate their level of attainment in an assessment.

Private candidates

Private candidates can complete this qualification only if they carry-out the mandatory core practicals with the centre in which they are sitting the exams, as long as the centre is willing to accept the candidate. These candidates need to fulfil the same requirements as all other candidates.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration, please refer to the JCQ website: www.jcq.org.uk.

Malpractice

Candidate malpractice

Candidate malpractice refers to any act by a candidate that compromises or seeks to compromise the process of assessment or which undermines the integrity of the qualifications or the validity of results/certificates.

Candidate malpractice in examinations **must** be reported to Pearson using a *JCQ M1 Form* (available at www.jcq.org.uk/exams-office/malpractice). The form can be emailed to pqsmalpractice@pearson.com or posted to Investigations Team, Pearson, 190 High Holborn, London, WC1V 7BH. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with candidate malpractice, staff and centre malpractice is any act that compromises or seeks to compromise the process of assessment or which undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ M2(a) Form* (available at www.jcq.org.uk/exams-office/malpractice). The form, supporting documentation and as much information as possible can be emailed to pqsmalpractice@pearson.com or posted to Investigations Team, Pearson, 190 High Holborn, London, WC1V 7BH. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More-detailed guidance on malpractice can be found in the latest version of the document *JCQ General and Vocational Qualifications Suspected Malpractice in Examinations and Assessments,* available at www.jcq.org.uk/exams-office/malpractice.

Awarding and reporting

This qualification will be graded, awarded and certificated to comply with the requirements of Ofqual's General Conditions of Recognition.

This GCSE qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total subject mark where 9 is the highest grade. Individual papers are not graded. For foundation tier, grades 1–5 are available and for higher tier, grades 4–9 are available, however if the mark achieved is a smaller number of marks below the 4/3 grade boundary, then a grade 3 may be awarded.

Students whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

The first certification opportunity for this qualification will be 2018.

Student recruitment and progression

Pearson follows the JCQ policy concerning recruitment to our qualifications in that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Prior learning and other requirements

This qualification is based on the subject content, published by the DfE. The DfE designed the subject content to reflect or build on Key Stage 3. Consequently, students taking this qualification will benefit from previously studying Biology at Key Stage 3.

Progression

Students can progress from this qualification to:

- GCEs, for example in Biology
- Level 3 vocational qualifications in science, for example BTEC Level 3 in Applied Science
- employment, for example in a science-based industry where an Apprenticeship may be available.

The content and skills for these qualifications are set by the DfE to be suitable to allow these progression routes.

Appendices

Appendix 1: Mathematical skills

This appendix is taken from the document *Biology, Chemistry and Physics GCSE subject content* published by the Department for Education (DfE) in June 2014.

The mathematical skills and use of mathematics statements listed will be assessed through the content of this qualification in the examinations. The minimum level of mathematics in the foundation tier examination papers will be equivalent to Key Stage 3 mathematics. The minimum level of mathematics in the higher tier examination papers will be equivalent to foundation tier GCSE in Mathematics.

Mathematical skills

Details of the mathematical skills in other science subjects are given for reference.

		Biology	Chemistry	Physics
1	**Arithmetic and numerical computation**			
a	Recognise and use expressions in decimal form	✓	✓	✓
b	Recognise and use expressions in standard form	✓	✓	✓
c	Use ratios, fractions and percentages	✓	✓	✓
d	Make estimates of the results of simple calculations	✓	✓	✓
2	**Handling data**			
a	Use an appropriate number of significant figures	✓	✓	✓
b	Find arithmetic means	✓	✓	✓
c	Construct and interpret frequency tables and diagrams, bar charts and histograms	✓	✓	✓
d	Understand the principles of sampling as applied to scientific data	✓		
e	Understand simple probability	✓		
f	Understand the terms mean, mode and median	✓		✓
g	Use a scatter diagram to identify a correlation between two variables	✓		✓
h	Make order of magnitude calculations	✓	✓	✓
3	**Algebra**			
a	Understand and use the symbols: =, <, <<, >>, >, ∝, ~	✓	✓	✓
b	Change the subject of an equation		✓	✓
c	Substitute numerical values into algebraic equations using appropriate units for physical quantities		✓	✓
d	Solve simple algebraic equations	✓		✓

		Biology	Chemistry	Physics
4	**Graphs**			
a	Translate information between graphical and numeric form	✓	✓	✓
b	Understand that $y = mx + c$ represents a linear relationship	✓	✓	✓
c	Plot two variables from experimental or other data	✓	✓	✓
d	Determine the slope and intercept of a linear graph	✓	✓	✓
e	Draw and use the slope of a tangent to a curve as a measure of rate of change		✓	✓
f	Understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate			✓
5	**Geometry and trigonometry**			
a	Use angular measures in degrees			✓
b	Visualise and represent 2D and 3D forms, including two dimensional representations of 3D objects		✓	✓
c	Calculate areas of triangles and rectangles, surface areas and volumes of cubes	✓	✓	✓

Appendix 2: Taxonomy

The following table lists the command words used in the external assessments.

Command word	Definition
Add/Label	Requires the addition or labelling to a stimulus material given in the question, for example labelling a diagram or adding units to a table.
Assess	Give careful consideration to all the factors or events that apply and identify which are the most important or relevant. Make a judgement on the importance of something, and come to a conclusion where needed.
Calculate	Obtain a numerical answer, showing relevant working. If the answer has a unit, this must be included. This can include using an equation to calculate a numerical answer.
Comment on	Requires the synthesis of a number of variables from data/information to form a judgement.
Compare	Looking for the similarities **or** differences of two (or more) things. Should not require the drawing of a conclusion. Answer must relate to both (or all) things mentioned in the question.
Compare and contrast	Looking for the similarities **and** differences of two (or more) things. Should not require the drawing of a conclusion. Answer must relate to both (or all) things mentioned in the question. The answer must include at least one similarity and one difference.
Complete	Requires the completion of a table/diagram.
Deduce	Draw/reach conclusion(s) from the information provided.
Describe	To give an account of something. Statements in the response need to be developed as they are often linked but do not need to include a justification or reason.
Determine	The answer must have an element which is quantitative from the stimulus provided, or must show how the answer can be reached quantitatively. To gain maximum marks there must be a quantitative element to the answer.
Devise	Plan or invent a procedure from existing principles/ideas.
Discuss	Identify the issue/situation/problem/argument that is being assessed within the question. Explore all aspects of an issue/situation/problem/argument. Investigate the issue/situation etc. by reasoning or argument.
Draw	Produce a diagram either using a ruler or using freehand.
Estimate	Find an approximate value, number, or quantity from a diagram/given data or through a calculation.

Command word	Definition
Evaluate	Review information (e.g. data, methods) then bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's qualities and relation to its context.
Explain	An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification, this can include mathematical explanations.
Give/State/Name	All of these command words are really synonyms. They generally all require recall of one or more pieces of information.
Give a reason/reasons	When a statement has been made and the requirement is only to give the reasons why.
Identify	Usually requires some key information to be selected from a given stimulus/resource.
Justify	Give evidence to support (either the statement given in the question or an earlier answer).
Measure	To determine the dimensions or angle from a diagram using an instrument such as a ruler or protractor.
Plot	Produce a graph by marking points accurately on a grid from data that is provided and then drawing a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question.
Predict	Give an expected result.
Show that	Verify the statement given in the question.
Sketch	Produce a freehand drawing. For a graph this would need a line and labelled axis with important features indicated, the axis are not scaled.
State and explain	Make a point and link ideas to justify that point. An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification, this can include mathematical explanations.
State what is meant by	When the meaning of a term is expected but there are different ways of how these can be described.
Write	When the questions ask for an equation.

Verbs preceding a command word	
Suggest a …	Suggest an explanation or suggest a description.

Appendix 3: Apparatus and techniques

The apparatus and techniques listed in the table below are taken from the document *Biology, Chemistry and Physics GCSE subject content* published by the Department for Education (DfE) in June 2014.

Use and coverage of the apparatus and techniques listed are mandatory. The eight mandatory core practicals cover all aspects of the listed apparatus and techniques and are referenced in the table.

Safety is an overriding requirement for all practical work. Centres are responsible for ensuring that whenever their students complete practical work appropriate safety procedures are followed.

Scientific diagrams should be included, where appropriate, to show the set-up and to record the apparatus and procedures used in practical work.

Apparatus and techniques		Core practical (specification reference)	
1	Use of appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, temperature, volume of liquids and gases, and pH	1.6	*Investigate biological specimens using microscopes including magnification calculations and labelled scientific drawings from observations*
		1.10	*Investigate the effect of pH on enzyme activity*
		1.16	*Investigate osmosis in potatoes*
		5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*
		6.5	*Investigate the effect of light intensity on the rate of photosynthesis*
		8.11	*Investigate the rate of respiration in living organisms*
		9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*
2	Safe use of appropriate heating devices and techniques, including use of a Bunsen burner and a water bath or electric heater	1.10	*Investigate the effect of pH on enzyme activity*
		1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*
		5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*
		6.5	*Investigate the effect of light intensity on the rate of photosynthesis*
		8.11	*Investigate the rate of respiration in living organisms*

Apparatus and techniques		Core practical (specification reference)	
3	Use of appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes	1.6	*Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations*
		1.10	*Investigate the effect of pH on enzyme activity*
		1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*
		1.16	*Investigate osmosis in potatoes*
		5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*
		6.5	*Investigate the effect of light intensity on the rate of photosynthesis*
		8.11	*Investigate the rate of respiration in living organisms*
4	Safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment	6.5	*Investigate the effect of light intensity on the rate of photosynthesis*
		8.11	*Investigate the rate of respiration in living organisms*
		9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*
5	Measurement of rates of reaction by a variety of methods, including production of gas, uptake of water and colour change of indicator	1.10	*Investigate the effect of pH on enzyme activity*
		1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*
		1.16	*Investigate osmosis in potatoes*
		6.5	*Investigate the effect of light intensity on the rate of photosynthesis*
		8.11	*Investigate the rate of respiration in living organisms*
6	Application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field	9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*

Apparatus and techniques		Core practical (specification reference)	
7	Use of appropriate apparatus, techniques and magnification, including microscopes, to make observations of biological specimens and produce labelled scientific drawings	1.6	*Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations*
		5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*
		9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*
8	Use of appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem-solving contexts, including continuous sampling in an investigation.	1.10	*Investigate the effect of pH on enzyme activity*
		1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*

These core practicals may be reviewed and amended if changes are required to the apparatus and techniques listed by the Department for Education. Pearson may also review and amend the core practicals if necessary. Centres will be told about any changes as soon as possible.

You must follow the instructions in the table below for each core practical.

Core practical		Description
1.6	*Investigate biological specimens using microscopes including magnification calculations and labelled scientific drawings from observations*	This practical allows students to develop their skills in using a light microscope, preparing slides, and producing labelled scientific drawings. Students need to be familiar with the set-up and use of a light microscope, as well as to be able to identify structures that they see. Magnification calculations will also be required.
1.10	*Investigate the effect of pH on enzyme activity*	For this core practical students will investigate the effect of pH, however other variables can also be investigated to enhance practical work in this area. This method uses amylase (in solutions of different pH) to break down starch. The reaction can be monitored by using iodine to test the presence of starch in the solution with a continuous sampling method. To maintain the temperature of the solution, a Bunsen burner and water beaker must be used.

Core practical		Description
1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*	Carry out food tests shown below: 1. identify starch by using iodine solution 2. identify reducing sugars using Benedict's solution (and a water bath) 3. identify protein using the Biuret test (adding potassium hydroxide to a solution of the food, followed by copper sulfate) 4. identify fats and oils (lipids) using the emulsion test.
1.16	*Investigate osmosis in potatoes*	A known mass of potato must be added to sucrose solution, left for some time, and the final mass recorded to obtain the percentage change in mass. This investigation looks at the exchange of water between the potato and solution and allows the concentration of sucrose in the potato to be determined. The practical provides an opportunity for the appreciation of the need to control variables.
5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*	This practical provides the opportunity for learners to carry out aseptic techniques (Biology statement 5.17). Petri dishes pre-poured with agar must be inoculated with bacteria and discs of antiseptic/antibiotics/plant extracts can be used to determine their effect on bacterial growth. Sterile aseptic technique must include the use of a Bunsen burner.
6.5	*Investigate the effect of light intensity on the rate of photosynthesis*	Algal balls (or similar) must be set up and placed at varying distances from a light source to investigate the effect of light intensity on the rate of photosynthesis. The rate must be measured and compared to the distance away from the light source.
8.11	*Investigate the rate of respiration in living organisms*	Use of a simple respirometer to measure the effect of temperature on the oxygen consumption of some small organisms. A simple respirometer can be made using a tube with soda lime, cotton wool and organisms with a capillary tube to coloured liquid. Students can then track the progress of the liquid up the capillary tube over a set time. This experiment must be carried out using a water bath set at different temperatures. Safety and ethical considerations must also be covered.
9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*	This investigation involves the use of a belt transect along a gradient (e.g. shaded area to an area with no shade). It involves students thinking about how to sample their chosen area, including the identification and observation of plants/organisms.

Appendix 4: Practical Science Statement

Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Biology/Chemistry/Physics/Combined Science

Head Teacher Declaration Form

Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Biology/Chemistry/Physics/Combined Science	
Centre number:	Centre name:
Subject(s): *Please tick as appropriate* ☐ Biology (1BI0) ☐ Chemistry (1CH0) ☐ Physics (1PH0) ☐ Combined Science (1SC0)	
Biology (1BI0) – students must carry out all eight of the mandatory core practicals listed on page 8 of the specification. Chemistry (1CH0) – students must carry out all eight of the mandatory core practicals listed on page 8 of the specification. Physics (1PH0) – students must carry out all eight of the mandatory core practicals listed on page 9 of the specification.	

Head teacher declaration

I declare that reasonable steps have been taken to ensure each candidate has completed the practical activities set out above in accordance with Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Biology/Chemistry/Physics/Combined Science practical science work requirements.

Each candidate has made a contemporaneous record of:

i the work that they have undertaken during these practical activities, and

ii the knowledge, skills and understanding which that learner has derived from those practical activities.

Head teacher name:			
Head teacher signature:		**Date:**	

Please send this completed form by email to **science2011@pearson.com** by 15th May. Failure to complete the form may lead to a malpractice investigation.

Appendix 5: The context for the development of this qualification

All our qualifications are designed to meet our World Class Qualification Principles[1] and our ambition to put the student at the heart of everything we do.

We have developed and designed this qualification by:

- reviewing other curricula and qualifications to ensure that it is comparable with those taken in high-performing jurisdictions overseas
- consulting with key stakeholders on content and assessment, including learned bodies, subject associations, higher education academics and teachers to ensure this qualification is suitable for a UK context
- reviewing the legacy qualification and building on its positive attributes.

This qualification has also been developed to meet criteria stipulated by Ofqual in their documents *GCSE (9 to 1)/GCE Qualification Level Conditions and Requirements* and *GCSE/GCE Subject Level Conditions and Requirements for Single Science (Biology, Chemistry, Physics)*, published in May 2015.

[1] Pearson's World Class Qualification Principles ensure that our qualifications are:

- **demanding**, through internationally benchmarked standards, encouraging deep learning and measuring higher-order skills
- **rigorous**, through setting and maintaining standards over time, developing reliable and valid assessment tasks and processes, and generating confidence in end users of the knowledge, skills and competencies of certified students
- **inclusive**, through conceptualising learning as continuous, recognising that students develop at different rates and have different learning needs, and focusing on progression
- **empowering**, through promoting the development of transferable skills, see *Appendix 6*.

From Pearson's Expert Panel for World Class Qualifications

May 2014

"The reform of the qualifications system in England is a profoundly important change to the education system. Teachers need to know that the new qualifications will assist them in helping their learners make progress in their lives.

When these changes were first proposed we were approached by Pearson to join an 'Expert Panel' that would advise them on the development of the new qualifications.

We were chosen, either because of our expertise in the UK education system, or because of our experience in reforming qualifications in other systems around the world as diverse as Singapore, Hong Kong, Australia and a number of countries across Europe.

We have guided Pearson through what we judge to be a rigorous qualification development process that has included:

- extensive international comparability of subject content against the highest-performing jurisdictions in the world
- benchmarking assessments against UK and overseas providers to ensure that they are at the right level of demand
- establishing External Subject Advisory Groups, drawing on independent subject-specific expertise to challenge and validate our qualifications
- subjecting the final qualifications to scrutiny against the DfE content and Ofqual accreditation criteria in advance of submission.

Importantly, we have worked to ensure that the content and learning is future oriented. The design has been guided by what is called an 'Efficacy Framework', meaning learner outcomes have been at the heart of this development throughout.

We understand that ultimately it is excellent teaching that is the key factor to a learner's success in education. As a result of our work as a panel we are confident that we have supported the development of qualifications that are outstanding for their coherence, thoroughness and attention to detail and can be regarded as representing world-class best practice."

Sir Michael Barber (Chair)

Chief Education Advisor, Pearson plc

Professor Lee Sing Kong

Director, National Institute of Education, Singapore

Bahram Bekhradnia

President, Higher Education Policy Institute

Professor Jonathan Osborne

Stanford University

Dame Sally Coates

Principal, Burlington Danes Academy

Professor Dr Ursula Renold

Federal Institute of Technology, Switzerland

Professor Robin Coningham

Pro-Vice Chancellor, University of Durham

Professor Bob Schwartz

Harvard Graduate School of Education

Dr Peter Hill

Former Chief Executive ACARA

All titles correct as at May 2014

Appendix 6: Transferable skills

The need for transferable skills

In recent years, higher education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.' [1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework as the most evidence-based and robust skills framework. We adapted the framework slightly to include the Program for International Student Assessment (PISA) ICT Literacy and Collaborative Problem Solving (CPS) Skills.

The adapted National Research Council's framework of skills involves: [2]

Cognitive skills

- **Non-routine problem solving** – expert thinking, metacognition, creativity.
- **Systems thinking** – decision making and reasoning.
- **Critical thinking** – definitions of critical thinking are broad and usually involve general cognitive skills such as analysing, synthesising and reasoning skills.
- **ICT literacy** – access, manage, integrate, evaluate, construct and communicate. [3]

Interpersonal skills

- **Communication** – active listening, oral communication, written communication, assertive communication and non-verbal communication.
- **Relationship-building skills** – teamwork, trust, intercultural sensitivity, service orientation, self-presentation, social influence, conflict resolution and negotiation.
- **Collaborative problem solving** – establishing and maintaining shared understanding, taking appropriate action, establishing and maintaining team organisation.

Intrapersonal skills

- **Adaptability** – ability and willingness to cope with the uncertain, handling work stress, adapting to different personalities, communication styles and cultures, and physical adaptability to various indoor and outdoor work environments.
- **Self-management and self-development** – ability to work remotely in virtual teams, work autonomously, be self-motivating and self-monitoring, willing and able to acquire new information and skills related to work.

Transferable skills enable young people to face the demands of further and higher education, as well as the demands of the workplace, and are important in the teaching and learning of this qualification. We will provide teaching and learning materials, developed with stakeholders, to support our qualifications.

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[1] OECD – *Better Skills, Better Jobs, Better Lives* (OECD Publishing, 2012)

[2] Koenig J A, National Research Council – *Assessing 21st Century Skills: Summary of a Workshop* (National Academies Press, 2011)

[3] PISA – *The PISA Framework for Assessment of ICT Literacy* (2011)

Appendix 7: Codes

Type of code	Use of code	Code
Discount codes	Every qualification eligible for performance tables is assigned a discount code that indicates the subject area to which it belongs. Discount codes are published by the DfE.	Please see the GOV.UK website*
Regulated Qualifications Framework (RQF) codes	Each qualification title is allocated an Ofqual Regulated Qualifications Framework (RQF) code. The RQF code is known as a Qualification Number (QN). This is the code that features in the DfE Section 96 and on the LARA as being eligible for 16–18 and 19+ funding, and is to be used for all qualification funding purposes. The QN will appear on students' final certification documentation.	The QN for this qualification is: 601/8610/0
Subject codes	The subject code is used by centres to enter students for a qualification. Centres will need to use the entry codes only when claiming students' qualifications.	GCSE in Biology – 1BI0
Paper codes	These codes are provided for reference purposes. Students need to be entered for individual papers at the same tier.	Paper 1: 1BI0/1F, 1BI0/1H Paper 2: 1BI0/2F, 1BI0/2H

*www.gov.uk/government/publications/2018-performance-tables-discount-code

Appendix 8: Calculators

Candidates may use a calculator in assessments for this qualification. Centres are responsible for making sure that calculators used by their students meet the requirements highlighted in the table below.

Candidates must be familiar with the requirements before their assessments for this qualification.

<table>
<tr>
<td>Calculators must be:
of a size suitable for use on a desk
either battery or solar powered
free of lids, cases and covers that have printed instructions or formulae.</td>
<td rowspan="2">Calculators must not:
be designed or adapted to offer any of these facilities:
language translators
symbolic algebraic manipulation
symbolic differentiation or integration
communication with other machines or the internet
be borrowed from another candidate during an examination for any reason*
have retrievable information stored in them, and this includes:
databanks
dictionaries
mathematical formulae
text.</td>
</tr>
<tr>
<td>The candidate is responsible for the following:
the calculator’s power supply
the calculator’s working condition
clearing anything stored in the calculator.</td>
</tr>
</table>

*An invigilator may give a candidate a replacement calculator

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This specification is Issue 2. Key changes are sidelined. We will inform centres of any changes to this issue. The latest issue can be found on the Pearson website: qualifications.pearson.com

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