Pearson Edexcel

International GCSE

Biology (9–1)

Specification

Pearson Edexcel International GCSE in Biology (4BI1)

First teaching September 2017

First examination June 2019

Issue 3

About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to learners, educational institutions, employers, governments and other partners globally. We are committed to helping equip learners with the skills they need to enhance their employability prospects and to succeed in the changing world of work. We believe that wherever learning flourishes so do people.

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All information in this specification is correct at time of publication.

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Summary of Pearson Edexcel International GCSE in Biology (4BI1) specification

Issue 3 changes

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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.

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1 About this specification

The Pearson Edexcel International GCSE in Biology is part of a suite of International GCSE qualifications offered by Pearson.

This qualification is not accredited or regulated by any UK regulatory body.

This specification includes the following key features.

Structure: the Pearson Edexcel International GCSE in Biology is a linear qualification. Two written examinations must be taken in the same series at the end of the course of study.

Content: relevant, engaging, up to date and of equivalent standard to Pearson's regulated GCSE in Biology.

Assessment: untiered, written examinations with questions designed to be accessible to students of all abilities.

Approach: a solid basis for students wishing to progress to the Pearson Edexcel AS and Advanced GCE level or equivalent qualifications, focusing on key biology theory.

Specification updates

This specification is Issue 3 and is valid for the Pearson Edexcel International GCSE in Biology examined from 2019. If there are any significant changes to the specification, Pearson will inform centres. Changes will also be posted on our website.

For more information, please visit qualifications.pearson.com

Using this specification

This specification has been designed to give guidance to teachers and encourage effective delivery of the qualification. The following information will help you get the most out of the content and guidance.

Content: this is arranged as five topics in *2: Biology content*. A summary of sub-topics is included at the start of each topic. As a minimum, all the bullet points in the content must be taught. The word 'including' in the content helps specify the detail of what must be covered.

Examples: throughout the content we have included examples of what could be covered or what might support teaching and learning. It is important to note that examples are for illustrative purposes only and that centres can use other examples. We have included examples that are easily understood and recognised by international centres.

Practical investigations: these are included in *2: Biology content* as specification points in italics. Students will develop knowledge and understanding of experimental skills through the context of the biology they are learning. Experimental skills are assessed through written examinations.

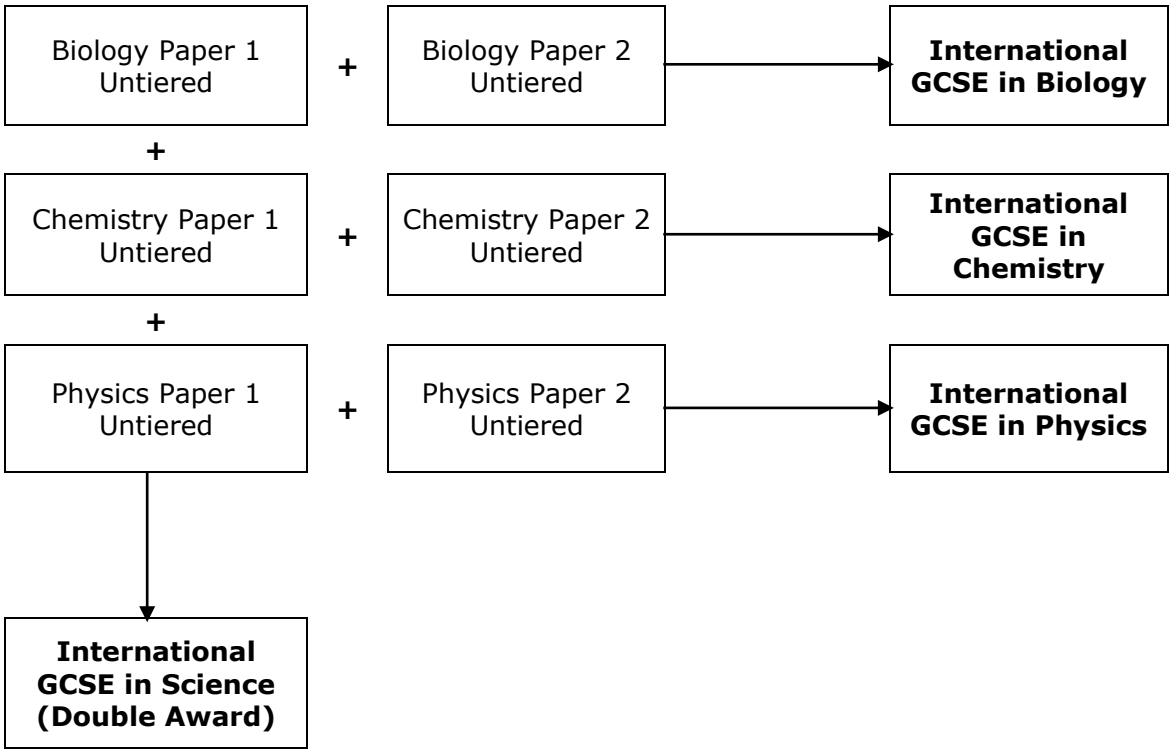
Referencing: specification statements that are in bold with a 'B' reference relate to content that is only in the International GCSE in Biology and is not found in the International GCSE in Science (Double Award).

Course introduction

The Pearson Edexcel International GCSE in Biology is designed for use in schools and colleges. It is part of a suite of International GCSE qualifications offered by Pearson.

The course gives students the opportunity to experience biology within the context of their general education.

How assessment relates to the qualifications available is shown below.



A Pearson Edexcel International GCSE in Science (Single Award) qualification is also available. This will cover approximately 50% of the Pearson Edexcel International GCSE in Science (Double Award) specification, while still having a comparable level of rigour and demand.

Qualification aims and objectives

The aims and objectives of this qualification are to enable students to:

- learn about unifying patterns and themes in biology and use them in new and changing situations
- acquire knowledge and understanding of biological facts, terminology, concepts, principles and practical techniques
- apply the principles and concepts of biology, including those related to the applications of biology, to different contexts
- evaluate biological information, making judgements on the basis of this information
- appreciate the practical nature of biology, developing experimental and investigative skills based on correct and safe laboratory techniques
- analyse, interpret and evaluate data and experimental methods, drawing conclusions that are consistent with evidence from experimental activities and suggesting possible improvements and further investigations
- recognise the importance of accurate experimental work and reporting scientific methods in biology
- select, organise and present relevant information clearly and logically using appropriate vocabulary, definitions and conventions
- develop a logical approach to problem solving in a wider context
- select and apply appropriate areas of mathematics relevant to biology as set out under each topic
- prepare for more advanced courses in biology and for other courses that require knowledge of biology.

Why choose Edexcel qualifications?

Pearson – the world's largest education company

Edexcel academic qualifications are from Pearson, the UK's largest awarding organisation. With over 3.4 million students studying our academic and vocational qualifications worldwide, we offer internationally recognised qualifications to schools, colleges and employers globally.

Pearson is recognised as the world's largest education company, allowing us to drive innovation and provide comprehensive support for Edexcel students to acquire the knowledge and skills they need for progression in study, work and life.

A heritage you can trust

The background to Pearson becoming the UK's largest awarding organisation began in 1836, when a royal charter gave the University of London its first powers to conduct exams and confer degrees on its students. With over 150 years of international education experience, Edexcel qualifications have firm academic foundations, built on the traditions and rigour associated with Britain's education system.

Results you can trust

Pearson's leading online marking technology has been shown to produce exceptionally reliable results, demonstrating that, at every stage, Edexcel qualifications maintain the highest standards.

Developed to Pearson's world class qualifications standards

Pearson's world-class standards mean that all Edexcel qualifications are developed to be rigorous, demanding, inclusive and empowering. We work collaboratively with a panel of education thought leaders and assessment experts to ensure that Edexcel qualifications are globally relevant, represent world-class best practice and maintain a consistent standard.

For more information on the world class qualification process and principles, please go to *Appendix 2: Pearson World Class Qualification design principles* or visit our website: uk.pearson.com/about-us/news-and-policy/reports-and-campaigns/world-class-qualifications/design-principles.html

Why choose Pearson Edexcel International GCSE in Biology?

We've listened to feedback from all parts of the International and UK school subject community, including a large number of teachers. We've made changes that will engage students and give them skills that will support progression to further study in biology and a range of other subjects, in biological sciences and elsewhere. Our content and assessment approach has been designed to meet students' needs and be consistent with our approach across the sciences.

At Pearson we offer separate science qualifications in Biology, Human Biology, Chemistry and Physics, as well as Double Award and Single Award Science qualifications – these have been designed to meet different students' needs. The content and assessment approach in all our science qualifications has been designed to meet students' needs in the following ways.

- Content that is interesting and engaging for students but is also designed to ensure good preparation, both for those continuing to further study and for those wishing to work in a biology-related field.
- There are opportunities to 'localise' the content to make it more relevant for students in their own country.
- Question papers are clear and straightforward – our question papers are clear and accessible for all students of all ability ranges and learning styles. Our mark schemes are straightforward, so that the assessment requirements are clear.
- Students' skills are broadly developed – we have designed the International GCSE to extend students' knowledge by broadening and deepening skills, for example:
  - developing students' practical skills by including a number of practicals in the specification content. These can be supplemented with other suggested practicals. The skills developed will be assessed through questions in written examinations
  - improving students' analytical and logic skills by applying understanding of scientific concepts and principles to a range of situations. This will include some examination questions that are more problem solving in style
  - addressing the need for mathematical skills to complement students' biology skills by covering a range of mathematical areas.

Progression to A Level – International GCSEs enable successful progression to A Level and beyond. Through our World Class Qualification development process we have consulted with International Advanced Level and GCE A Level teachers as well as higher education professors to validate the appropriateness of the qualification, including its content, skills development and assessment structure.

Courses to suit your students' needs and interests – teachers of biology have a choice of International GCSE courses to deliver, each giving different levels of depth to meet students' needs. As well as the Pearson Edexcel International GCSE in Biology, students can also be taught our International GCSE in Science (Double Award) or our International GCSE in Science (Single Award). The latter two courses offer a reduced amount of content, but are assessed to the same standard. Progression routes for these courses may vary slightly from those for the Pearson Edexcel International GCSE in Biology.

More information about all our qualifications can be found on our Edexcel International GCSE pages at qualifications.pearson.com

Supporting you in planning and implementing this qualification

Planning

- We will give you a course planner and editable schemes of work.
- Our mapping documents highlight key differences between the new and the 2011 legacy qualifications.

Teaching and learning

- Our *Getting Started Guide* gives you an overview of the Pearson Edexcel International GCSE in Biology to help you understand the changes to content and assessment, and what these changes mean for you and your students.
- Print and digital learning and teaching resources promote any time, any place learning to improve student motivation and encourage new ways of working.

Preparing for exams

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

- specimen papers to support formative assessments and mock exams
- examiner commentaries following each examination series.

ResultsPlus

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

examWizard

This is a free online data bank of past exam questions designed to support students and teachers with exam preparation and assessment.

Training events

In addition to online training, we host a series of training events each year (both online and face-to-face) that give teachers a deeper understanding of our qualifications.

Get help and support

Our subject advisor service ensures that you receive help and guidance from us. You can sign up to receive the Edexcel newsletter to keep up to date with our qualifications and receive product and service news.

Qualification at a glance

The Pearson Edexcel International GCSE in Biology comprises two externally-assessed papers:

- Biology Paper 1
- Biology Paper 2.

Paper overview

Biology Paper 1	*Paper code 4BI1/1B and 4SD0/1B
• Externally assessed • Availability: November and June • First assessment: June 2019	61.1% of the total International GCSE

Content summary

Assesses core content that is **not** in bold and does not have a 'B' reference. Questions may come from any topic area across the specification.

1 The nature and variety of living organisms

2 Structures and functions in living organisms

3 Reproduction and inheritance

4 Ecology and the environment

5 Use of biological resources

Assessment

- The paper is assessed through a 2-hour written examination paper set and marked by Pearson.
- The total number of marks is 110.
- A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions.
- A calculator may be used in the examinations.

Biology Paper 2	*Paper code 4BI1/2B
• Externally assessed • Availability: November and June • First assessment: June 2019	38.9% of the total International GCSE

Content summary

Assesses **all the content**, including content that is in bold and has a 'B' reference.
Questions may come from any topic area across the specification.
Bold statements cover some sub-topics in greater depth.

1 The nature and variety of living organisms

2 Structures and functions in living organisms

3 Reproduction and inheritance

4 Ecology and the environment

5 Use of biological resources

Assessment

- The paper is assessed through a 1-hour and 15-minute written examination paper set and marked by Pearson.
- The total number of marks is 70.
- A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions.
- A calculator may be used in the examinations.

* See *Appendix 1: Codes* for a description of this code and all the other codes relevant to this qualification.

2 Biology content

1 The nature and variety of living organisms

The following sub-topics are covered in this section.

(a) Characteristics of living organisms

(b) Variety of living organisms

(a) Characteristics of living organisms
Students should:
1.1 understand how living organisms share the following characteristics: • they require nutrition • they respire • they excrete their waste • they respond to their surroundings • they move • they control their internal conditions • they reproduce • they grow and develop.

(b) Variety of living organisms
Students should:
1.2 describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists Plants: these are multicellular organisms; their cells contain chloroplasts and are able to carry out photosynthesis; their cells have cellulose cell walls; they store carbohydrates as starch or sucrose. Examples include flowering plants, such as a cereal (for example, maize), and a herbaceous legume (for example, peas or beans). Animals: these are multicellular organisms; their cells do not contain chloroplasts and are not able to carry out photosynthesis; they have no cell walls; they usually have nervous co-ordination and are able to move from one place to another; they often store carbohydrate as glycogen. Examples include mammals (for example, humans) and insects (for example, housefly and mosquito). Fungi: these are organisms that are not able to carry out photosynthesis; their body is usually organised into a mycelium made from thread-like structures called hyphae, which contain many nuclei; some examples are single-celled; their cells have walls made of chitin; they feed by extracellular secretion of digestive enzymes onto food material and absorption of the organic products; this is known as saprotrophic nutrition; they may store carbohydrate as glycogen. Examples include *Mucor*, which has the typical fungal hyphal structure, and yeast, which is single-celled. Protoctists: these are microscopic single-celled organisms. Some, like *Amoeba*, that live in pond water, have features like an animal cell, while others, like *Chlorella*, have chloroplasts and are more like plants. A pathogenic example is *Plasmodium*, responsible for causing malaria.

Students should:	
1.3	describe the common features shown by prokaryotic organisms such as bacteria Bacteria: these are microscopic single-celled organisms; they have a cell wall, cell membrane, cytoplasm and plasmids; they lack a nucleus but contain a circular chromosome of DNA; some bacteria can carry out photosynthesis but most feed off other living or dead organisms. Examples include *Lactobacillus bulgaricus*, a rod-shaped bacterium used in the production of yoghurt from milk, and *Pneumococcus*, a spherical bacterium that acts as the pathogen causing pneumonia.
1.4	understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses Viruses: these are not living organisms. They are small particles, smaller than bacteria; they are parasitic and can reproduce only inside living cells; they infect every type of living organism. They have a wide variety of shapes and sizes; they have no cellular structure but have a protein coat and contain one type of nucleic acid, either DNA or RNA. Examples include the tobacco mosaic virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, the influenza virus that causes 'flu' and the HIV virus that causes AIDS.

2 Structure and functions in living organisms

The following sub-topics are covered in this section.

(a) Level of organisation

(b) Cell structure

(c) Biological molecules

(d) Movement of substances into and out of cells

(e) Nutrition

(f) Respiration

(g) Gas exchange

(h) Transport

(i) Excretion

(j) Co-ordination and response

(a)	**Level of organisation**
Students should:	
2.1	describe the levels of organisation in organisms: organelles, cells, tissues, organs and systems

(b)	**Cell structure**
Students should:	
2.2	describe cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole
2.3	describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole
2.4	know the similarities and differences in the structure of plant and animal cells
2.5B	**explain the importance of cell differentiation in the development of specialised cells**
2.6B	**understand the advantages and disadvantages of using stem cells in medicine**

(c)	**Biological molecules**
Students should:	
2.7	identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils)
2.8	describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugars, protein from amino acids, and lipid from fatty acids and glycerol
2.9	*practical: investigate food samples for the presence of glucose, starch, protein and fat*
2.10	understand the role of enzymes as biological catalysts in metabolic reactions
2.11	understand how temperature changes can affect enzyme function, including changes to the shape of active site
2.12	*practical: investigate how enzyme activity can be affected by changes in temperature*
2.13	understand how enzyme function can be affected by changes in pH altering the active site
2.14B	***practical: investigate how enzyme activity can be affected by changes in pH***

(d)	**Movement of substances into and out of cells**
Students should:	
2.15	understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells
2.16	understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient
2.17	*practical: investigate diffusion and osmosis using living and non-living systems*

(e)	**Nutrition**
Students should:	
Flowering plants	
2.18	understand the process of photosynthesis and its importance in the conversion of light energy to chemical energy
2.19	know the word equation and the balanced chemical symbol equation for photosynthesis
2.20	understand how varying carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis
2.21	describe the structure of the leaf and explain how it is adapted for photosynthesis
2.22	understand that plants require mineral ions for growth, and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids
2.23	*practical: investigate photosynthesis, showing the evolution of oxygen from a water plant, the production of starch and the requirements of light, carbon dioxide and chlorophyll*
Humans	
2.24	understand that a balanced diet should include appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre
2.25	identify the sources and describe the functions of carbohydrate, protein, lipid (fats and oils), vitamins A, C and D, the mineral ions calcium and iron, water and dietary fibre as components of the diet
2.26	understand how energy requirements vary with activity levels, age and pregnancy
2.27	describe the structure and function of the human alimentary canal, including the mouth, oesophagus, stomach, small intestine (duodenum and ileum), large intestine (colon and rectum) and pancreas
2.28	understand how food is moved through the gut by peristalsis
2.29	understand the role of digestive enzymes, including the digestion of starch to glucose by amylase and maltase, the digestion of proteins to amino acids by proteases and the digestion of lipids to fatty acids and glycerol by lipases
2.30	understand that bile is produced by the liver and stored in the gall bladder
2.31	understand the role of bile in neutralising stomach acid and emulsifying lipids
2.32	understand how the small intestine is adapted for absorption, including the structure of a villus
2.33B practical: investigate the energy content in a food sample	

(f)	Respiration
Students should:	
2.34	understand how the process of respiration produces ATP in living organisms
2.35	know that ATP provides energy for cells
2.36	describe the differences between aerobic and anaerobic respiration
2.37	know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms
2.38	know the word equation for anaerobic respiration in plants and in animals
2.39	*practical: investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms*

(g)	Gas exchange
Students should:	
Flowering plants	
2.40B	**understand the role of diffusion in gas exchange**
2.41B	**understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis**
2.42B	**understand how the structure of the leaf is adapted for gas exchange**
2.43B	**describe the role of stomata in gas exchange**
2.44B	**understand how respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light**
2.45B	***practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator***
Humans	
2.46	describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes
2.47	understand the role of the intercostal muscles and the diaphragm in ventilation
2.48	explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries
2.49	understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease
2.50	*practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise*

(h)	**Transport**
Students should:	
2.51	understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell
2.52	understand the need for a transport system in multicellular organisms
Flowering plants	
2.53	describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant
2.54	describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant
2.55B	**understand how water is absorbed by root hair cells**
2.56B	**understand that transpiration is the evaporation of water from the surface of a plant**
2.57B	**understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity**
2.58B	***practical: investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot***
Humans	
2.59	describe the composition of the blood: red blood cells, white blood cells, platelets and plasma
2.60	understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy
2.61	understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin
2.62	understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen
2.63B	**understand how vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster and in greater quantity**
2.64B	**understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms**
2.65	describe the structure of the heart and how it functions
2.66	explain how the heart rate changes during exercise and under the influence of adrenaline
2.67	understand how factors may increase the risk of developing coronary heart disease
2.68	understand how the structure of arteries, veins and capillaries relate to their function
2.69	understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys

(i)	Excretion
Students should:	
Flowering plants	
2.70	understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf
Humans	
2.71	know the excretory products of the lungs, kidneys and skin (organs of excretion)
2.72B	**understand how the kidney carries out its roles of excretion and osmoregulation**
2.73B	**describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra**
2.74B	**describe the structure of a nephron, including the Bowman's capsule and glomerulus, convoluted tubules, loop of Henle and collecting duct**
2.75B	**describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate**
2.76B	**understand how water is reabsorbed into the blood from the collecting duct**
2.77B	**understand why selective reabsorption of glucose occurs at the proximal convoluted tubule**
2.78B	**describe the role of ADH in regulating the water content of the blood**
2.79B	**understand that urine contains water, urea and ions**

(j)	Co-ordination and response
Students should:	
2.80	understand how organisms are able to respond to changes in their environment
2.81	understand that homeostasis is the maintenance of a constant internal environment, and that body water content and body temperature are both examples of homeostasis
2.82	understand that a co-ordinated response requires a stimulus, a receptor and an effector
Flowering plants	
2.83	understand that plants respond to stimuli
2.84	describe the geotropic and phototropic responses of roots and stems
2.85	understand the role of auxin in the phototropic response of stems

Students should:	
Humans	
2.86	describe how nervous and hormonal communication control responses and understand the differences between the two systems
2.87	understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves
2.88	understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses
2.89	understand the role of neurotransmitters at synapses
2.90	describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object
2.91	describe the structure and function of the eye as a receptor
2.92	understand the function of the eye in focusing on near and distant objects, and in responding to changes in light intensity
2.93	describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation
2.94	understand the sources, roles and effects of the following hormones: adrenaline, insulin, testosterone, progesterone and oestrogen
2.95B	**understand the sources, roles and effects of the following hormones: ADH, FSH and LH**

3 Reproduction and inheritance

The following sub-topics are covered in this section.

(a) Reproduction

(b) Inheritance

(a)	**Reproduction**
Students should:	
3.1	understand the differences between sexual and asexual reproduction
3.2	understand that fertilisation involves the fusion of a male and female gamete to produce a zygote that undergoes cell division and develops into an embryo
Flowering plants	
3.3	describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination
3.4	understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation
3.5	*practical: investigate the conditions needed for seed germination*
3.6	understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis
3.7	understand that plants can reproduce asexually by natural methods (illustrated by runners) and by artificial methods (illustrated by cuttings)
Humans	
3.8	understand how the structure of the male and female reproductive systems are adapted for their functions
3.9	understand the roles of oestrogen and progesterone in the menstrual cycle
3.10B	**understand the roles of FSH and LH in the menstrual cycle**
3.11	describe the role of the placenta in the nutrition of the developing embryo
3.12	understand how the developing embryo is protected by amniotic fluid
3.13	understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics

(b)	**Inheritance**
Students should:	
3.14	understand that the genome is the entire DNA of an organism and that a gene is a section of a molecule of DNA that codes for a specific protein
3.15	understand that the nucleus of a cell contains chromosomes on which genes are located
3.16B	**describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A) with thymine (T), and cytosine (C) with guanine (G)**
3.17B	**understand that an RNA molecule is single stranded and contains uracil (U) instead of thymine (T)**
3.18B	**describe the stages of protein synthesis including transcription and translation, including the role of mRNA, ribosomes, tRNA, codons and anticodons**
3.19	understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics
3.20	understand the meaning of the terms: dominant, recessive, homozygous, heterozygous, phenotype, and genotype
3.21B	**understand the meaning of the term codominance**
3.22	understand that most phenotypic features are the result of polygenic inheritance rather than single genes
3.23	describe patterns of monohybrid inheritance using a genetic diagram
3.24	understand how to interpret family pedigrees
3.25	predict probabilities of outcomes from monohybrid crosses
3.26	understand how the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male
3.27	describe the determination of the sex of offspring at fertilisation, using a genetic diagram
3.28	understand how division of a diploid cell by mitosis produces two cells that contain identical sets of chromosomes
3.29	understand that mitosis occurs during growth, repair, cloning and asexual reproduction
3.30	understand how division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes
3.31	understand how random fertilisation produces genetic variation of offspring
3.32	know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23
3.33	understand that variation within a species can be genetic, environmental, or a combination of both
3.34	understand that mutation is a rare, random change in genetic material that can be inherited

Students should:	
3.35B	**understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein**
3.36B	**understand how most genetic mutations have no effect on the phenotype, some have a small effect and rarely do they have a significant effect**
3.37B	**understand that the incidence of mutations can be increased by exposure to ionising radiation (for example, gamma rays, x-rays and ultraviolet rays) and some chemical mutagens (for example, chemicals in tobacco)**
3.38	explain Darwin's theory of evolution by natural selection
3.39	understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control

4 Ecology and the environment

The following sub-topics are covered in this section.

(a) The organism in the environment

(b) Feeding relationships

(c) Cycles within ecosystems

(d) Human influences on the environment

(a)	**The organism in the environment**
Students should:	
4.1	understand the terms population, community, habitat and ecosystem
4.2	*practical: investigate the population size of an organism in two different areas using quadrats*
4.3B	**understand the term biodiversity**
4.4B	***practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats***
4.5	understand how abiotic and biotic factors affect the population size and distribution of organisms

(b)	**Feeding relationships**
Students should:	
4.6	understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers
4.7	understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer
4.8	understand the transfer of substances and energy along a food chain
4.9	understand why only about 10% of energy is transferred from one trophic level to the next

(c)	**Cycles within ecosystems**
Students should:	
4.10	describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion
4.11B	**describe the stages in the nitrogen cycle, including the roles of nitrogen fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required)**

(d)	**Human influences on the environment**
Students should:	
4.12	understand the biological consequences of pollution of air by sulfur dioxide and carbon monoxide
4.13	understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases
4.14	understand how human activities contribute to greenhouse gases
4.15	understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences
4.16	understand the biological consequences of pollution of water by sewage
4.17	understand the biological consequences of eutrophication caused by leached minerals from fertiliser
4.18B	**understand the effects of deforestation, including leaching, soil erosion, disturbance of evapotranspiration and the carbon cycle, and the balance of atmospheric gases**

5 Use of biological resources

The following sub-topics are covered in this section.

(a) Food production

(b) Selective breeding

(c) Genetic modification (genetic engineering)

(d) Cloning

(a)	**Food production**
Students should:	
Crop plants	
5.1	describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops
5.2	understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses
5.3	understand how the use of fertiliser can increase crop yield
5.4	understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants
Micro-organisms	
5.5	understand the role of yeast in the production of food including bread
5.6	*practical: investigate the role of anaerobic respiration by yeast in different conditions*
5.7	understand the role of bacteria (*Lactobacillus*) in the production of yoghurt
5.8	understand the use of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of micro-organisms
Fish farming	
5.9B	**understand the methods used to farm large numbers of fish to provide a source of protein, including maintaining water quality, controlling intraspecific and interspecific predation, controlling disease, removing waste products, controlling the quality and frequency of feeding, and selective breeding**

(b)	**Selective breeding**
Students should:	
5.10	understand how selective breeding can develop plants with desired characteristics
5.11	understand how selective breeding can develop animals with desired characteristics

(c)	Genetic modification (genetic engineering)
Students should:	
5.12	understand how restriction enzymes are used to cut DNA at specific sites and ligase enzymes are used to join pieces of DNA together
5.13	understand how plasmids and viruses can act as vectors, which take up pieces of DNA, and then insert this recombinant DNA into other cells
5.14	understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter
5.15	understand how genetically modified plants can be used to improve food production
5.16	understand that the term transgenic means the transfer of genetic material from one species to a different species

(d)	Cloning
Students should:	
5.17B	**describe the process of micropropagation (tissue culture) in which explants are grown *in vitro***
5.18B	**understand how micropropagation can be used to produce commercial quantities of genetically identical plants with desirable characteristics**
5.19B	**describe the stages in the production of cloned mammals involving the introduction of a diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep**
5.20B	**understand how cloned transgenic animals can be used to produce human proteins**

3 Assessment information

Assessment requirements

Paper number	Level	Assessment information	Number of marks allocated in the paper
Paper 1B	1/2	Assessed through a 2-hour written examination set and marked by Pearson. The paper is weighted at 61.1% of the qualification. A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Assesses the content that is **not** in bold and does not have a 'B' reference. Questions may come from any topic area across the specification.	110
Paper 2B	1/2	Assessed through a 1-hour and 15-minute written examination set and marked by Pearson. The paper is weighted at 38.9% of the qualification. A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Assesses **all the content**, including content that is in bold and has a 'B' reference. Questions may come from any topic area across the specification. Bold statements cover some sub-topics in greater depth.	70

The total number of marks for this qualification is 180. This total is obtained by adding the mark for Paper 1B (out of 110 marks) to the mark for Paper 2B (out of 70 marks). The marks for the papers are not scaled.

Based on the overall mark, students will be awarded a grade. The grades available range from 9 to 1, where 9 is the highest grade.

Sample assessment materials

Sample papers and mark schemes can be found in the *Pearson Edexcel International GCSE in Biology Sample Assessment Materials (SAMs)* document.

Experimental skills

The best way to develop experimental skills is to embed practical investigations in teaching or theory. The development of knowledge and experimental skills can then happen together, leading to secure acquisition of both knowledge and skills.

Our practical investigations are embedded within *2: Biology content* as specification points in italics. The skills developed through these and other practicals will be assessed through written examinations.

In the assessment of experimental skills, students may be tested on their ability to:

- solve problems set in a practical context
- apply scientific knowledge and understanding in questions with a practical context
- devise and plan investigations, using scientific knowledge and understanding when selecting appropriate techniques
- demonstrate or describe appropriate experimental and investigative methods, including safe and skilful practical techniques
- make observations and measurements with appropriate precision, record these methodically and present them in appropriate ways
- identify independent, dependent and control variables
- use scientific knowledge and understanding to analyse and interpret data to draw conclusions from experimental activities that are consistent with the evidence
- communicate the findings from experimental activities, using appropriate technical language, relevant calculations and graphs
- assess the reliability of an experimental activity
- evaluate data and methods taking into account factors that affect accuracy and validity.

Calculators

Students will be expected to have access to a suitable electronic calculator for all examination papers. Calculators that allow for the retrieval of text or formulae or QWERTY keyboards will not be allowed for use in examinations.

Assessment objectives and weightings

		International GCSE
AO1	Knowledge and understanding of biology	38–42%
AO2	Application of knowledge and understanding, analysis and evaluation of biology	38–42%
AO3	Experimental skills, analysis and evaluation of data and methods in biology	19–21%
		100%

Relationship of assessment objectives to units

Unit number	Assessment objective		
	AO1	AO2	AO3
Biology Paper 1	23.2–25.7%	23.2–25.7%	11.6–12.8%
Biology Paper 2	14.8–16.3%	14.8–16.3%	7.4–8.2%
Total for International GCSE	38–42%	38–42%	19–21%

All components will be available for assessment from June 2019.

4 Administration and general information

Entries

Details of how to enter students for the examinations for this qualification can be found in our *International information manual*. A copy is made available to all examinations officers and is also available on our website.

Students should be advised that if they take two qualifications in the same subject, colleges, universities and employers are very likely to take the view that they have achieved only one of the two GCSEs/International GCSEs. Students or their advisers, who have any doubts about subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

Students may take the Pearson Edexcel International GCSE in Biology alongside the Pearson Edexcel International GCSE in Human Biology.

Forbidden combinations

This qualification may not be taken alongside:

- Pearson Edexcel International GCSE in Science (Double Award) (Linear) (4SD0)
- Pearson Edexcel International GCSE in Biology (Modular) (4XBI1)
- Pearson Edexcel International GCSE in Science (Double Award) (Modular) (4XSD1)

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 UK 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 only be available in English. All student work must be in English.

We recommend that students are able to read and write in English at Level B2 of the Common European Framework of Reference for Languages.

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 UK 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 UK Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a student 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 student 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, including:

- the needs of the student with the disability
- the effectiveness of the adjustment
- the cost of the adjustment
- 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 or unreasonable timeframes or if it 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.

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

Candidate malpractice

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

Candidate malpractice in examinations **must** be reported to Pearson using a *JCQ Form M1* (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 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 Form M2* (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 *General and Vocational Qualifications Suspected Malpractice in Examinations and Assessments,* available at www.jcq.org.uk/exams-office/malpractice

Awarding and reporting

The International 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. The first certification opportunity for the Pearson Edexcel International GCSE in Biology will be in June 2019. 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.

Student recruitment and progression

Pearson's policy concerning recruitment to our qualifications is 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

The qualification builds on the content, knowledge and skills developed in the Key Stage 3 Programme of Study (ages 11–14) or international equivalences for science.

Progression

Students can progress from this qualification to:

- International Advanced Subsidiary, for example in Biology
- International Advanced Level, for example in Biology
- GCE Advanced Subsidiary, for example in Biology
- GCE Advanced Level, for example in Biology
- Level 3 vocational qualifications in science, for example BTEC Level 3 in Applied Science
- other comparable, Level 3 qualifications, such as the International Baccalaureate
- employment, for example in a science-based industry where an apprenticeship may be available.

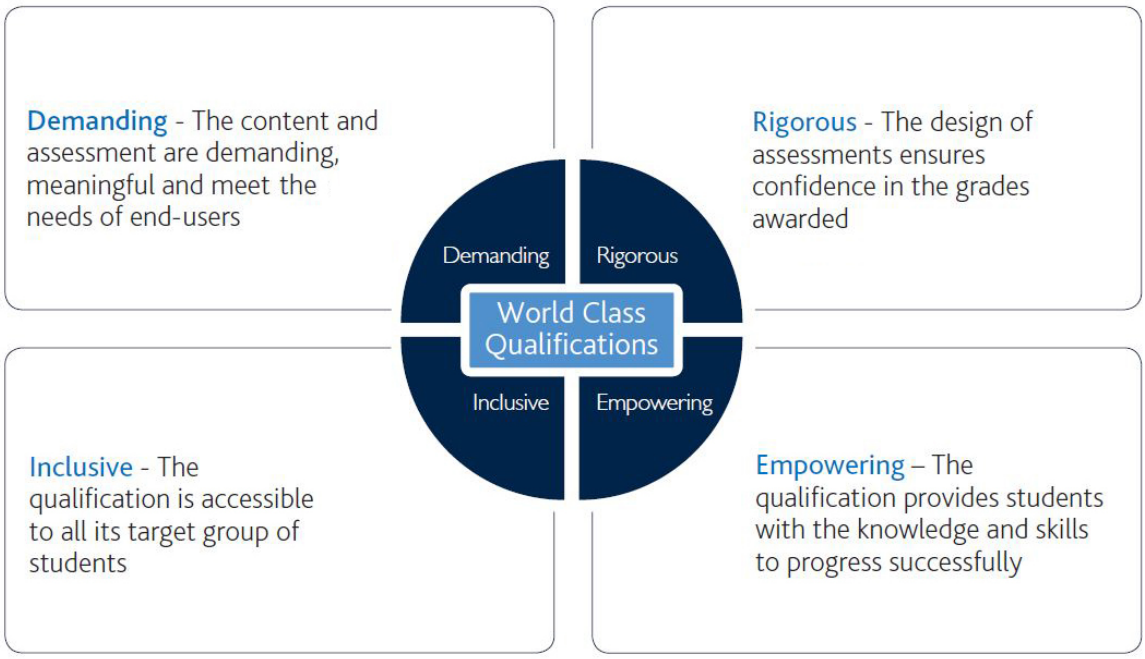
Appendices

Appendix 1: Codes

Type of code	Use of code	Code
Subject codes	The subject code is used by centres to enter students for a qualification.	Pearson Edexcel International GCSE in Biology – 4BI1 Pearson Edexcel International GCSE in Science (Double Award) – 4SD0
Paper codes	These codes are provided for information. Students may need to be entered for individual papers.	Biology Paper 1: 4BI1/1B, 4SD0/1B Biology Paper 2: 4BI1/2B

Appendix 2: Pearson World Class Qualification design principles

Pearson's World Class Qualification design principles mean that all Edexcel qualifications are developed to be **rigorous, demanding, inclusive and empowering**.



We work collaboratively to gain approval from an external panel of educational thought leaders and assessment experts from across the globe. This is to ensure that Edexcel qualifications are globally relevant, represent world-class best practice in qualification and assessment design, maintain a consistent standard and support learner progression in today's fast-changing world.

Pearson's Expert Panel for World-class Qualifications is chaired by Sir Michael Barber, a leading authority on education systems and reform. He is joined by a wide range of key influencers with expertise in education and employability.

'I'm excited to be in a position to work with the global leaders in curriculum and assessment to take a fresh look at what young people need to know and be able to do in the 21st century, and to consider how we can give them the opportunity to access that sort of education.' Sir Michael Barber.

Endorsement from Pearson's Expert Panel for World Class Qualifications for the International GCSE development process

December 2015

"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 world class qualification development process that has included, where appropriate:

- 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.

Importantly, we have worked to ensure that the content and learning is future oriented, and that the design has been guided by Pearson's Efficacy Framework. This is a structured, evidenced process which means that 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 but as a result of our work as a panel we are confident that we have supported the development of Edexcel International GCSE 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
Dean and Managing Director, National Institute of Education International, Singapore

Dr Peter Hill
Former Chief Executive ACARA

Bahram Bekhradnia
President, Higher Education Policy Institute

Professor Jonathan Osborne
Stanford University

Dame Sally Coates
Director of Academies (South), United Learning Trust

Professor Dr Ursula Renold
Federal Institute of Technology, Switzerland

Professor Bob Schwartz
Harvard Graduate School of Education

Professor Janice Kay
Provost, University of Exeter

Jane Beine
Head of Partner Development, John Lewis Partnership

Jason Holt
CEO, Holts Group

All titles correct as at December 2015

Appendix 3: Transferable skills

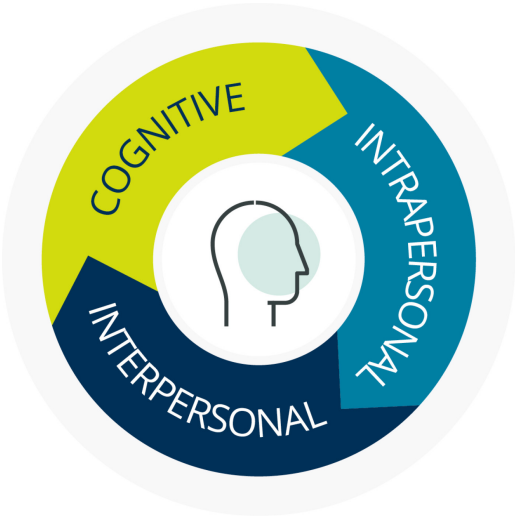
The need for transferable skills

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 [2] as the most evidence-based and robust skills framework, and have used this as a basis for our adapted skills framework.

The framework includes cognitive, intrapersonal skills and interpersonal skills.



The skills have been interpreted for this specification to ensure they are appropriate for the subject. All of the skills listed are evident or accessible in the teaching, learning and/or assessment of the qualification. Some skills are directly assessed. Pearson materials will support you in identifying these skills and developing these skills in students.

The table on the next page sets out the framework and gives an indication of the skills that can be found in biology and indicates the interpretation of the skill in this area. A full subject interpretation of each skill, with mapping to show opportunities for students' development is provided on the subject pages of our website: qualifications.pearson.com

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1 OECD – *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies* (OECD Publishing, 2012)

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

Cognitive skills	Cognitive processes and strategies	• Critical thinking • Problem solving • Analysis • Reasoning • Interpretation • Decision making • Adaptive learning • Executive function
	Creativity	• Creativity • Innovation
Intrapersonal skills	Intellectual openness	• Adaptability • Personal and social responsibility • Continuous learning • Intellectual interest and curiosity
	Work ethic/ conscientiousness	• Initiative • Self-direction • Responsibility • Perseverance • Productivity • Self-regulation (metacognition, forethought, reflection) • Ethics • Integrity
	Positive core self-evaluation	• Self-monitoring/self-evaluation/self-reinforcement
Interpersonal skills	Teamwork and collaboration	• Communication • Collaboration • Teamwork • Cooperation • Interpersonal skills
	Leadership	• Leadership • Responsibility • Assertive communication • Self-presentation

Problem solving in the application of unifying patterns and themes in biology and using them in new and changing situations.

Initiative when using knowledge of biology, independently (without guided learning), to further own understanding.

Communication to convey a biological process or technique (verbally or written) to peers and teachers and answer questions from others.

Appendix 4: Mathematical skills

The table below identifies the mathematical skills that will be developed and assessed throughout this qualification. These are not explicitly referenced in the content. Details of the mathematical skills in other science subjects are given for reference.

		B	C	P
1	**Arithmetic and numerical computation**			
A	Recognise and use numbers in decimal form	✓	✓	✓
B	Recognise and use numbers in standard form	✓	✓	✓
C	Use ratios, fractions, percentages, powers and roots	✓	✓	✓
D	Make estimates of the results of simple calculations, without using a calculator	✓		✓
E	Use calculators to handle sin x and $\sin^{-1} x$, where x is expressed in degrees			✓
2	**Handling data**			
A	Use an appropriate number of significant figures	✓	✓	✓
B	Understand and find the arithmetic mean (average)	✓	✓	✓
C	Construct and interpret bar charts	✓	✓	✓
D	Construct and interpret frequency tables, diagrams and histograms	✓		✓
E	Understand the principles of sampling as applied to scientific data	✓		
F	Understand simple probability	✓	✓	✓
G	Understand the terms mode and median	✓		
H	Use a scatter diagram to identify a pattern or trend between two variables	✓	✓	✓
I	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	✓	✓	✓
4	**Graphs**			
A	Translate information between graphical and numerical form	✓	✓	✓
B	Understand that $y = mx + c$ represents a linear relationship		✓	✓
C	Plot two variables (discrete and continuous) from experimental or other data	✓	✓	✓
D	Determine the slope and intercept of a linear graph	✓	✓	✓
E	Understand, 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			✓

		B	C	P
5	**Geometry and trigonometry**			
A	Use angular measures in degrees			✓
B	Visualise and represent 2D and 3D objects, including two dimensional representations of 3D objects			✓
C	Calculate areas of triangles and rectangles, surface areas and volumes of cubes	✓		✓

Appendix 5: Command word taxonomy

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

Command word	Definition
Add/Label	Requires the addition or labelling of a stimulus material given in the question, for example labelling a diagram or adding units to a table.
Calculate	Obtain a numerical answer, showing relevant working.
Comment on	Requires the synthesis of a number of variables from data/information to form a judgement.
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 that 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.
Design	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 freehand.
Estimate	Find an approximate value, number or quantity from a diagram/given data or through a calculation.
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 quality and relate it 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 reason(s) why.
Identify	Usually requires some key information to be selected from a given stimulus/resource.

Command word	Definition
Justify	Give evidence to support (either the statement given in the question or an earlier answer).
Plot	Produce a graph by marking points accurately on a grid from data that is provided and then draw 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 axes with important features indicated. The axes are not scaled.
State what is meant by	When the meaning of a term is expected but there are different ways for how these can be described.
Suggest	Use your knowledge to propose a solution to a problem in a novel context.
Verb preceding a command word	
Analyse the data/graph to explain	Examine the data/graph in detail to provide an explanation.
Multiple choice questions	
What, Why, Which	Direct command words used for multiple-choice questions.

Appendix 6: Suggested practical investigations

The following suggestions are *additional* practical investigations that exemplify the scientific process. They can be used to supplement students' understanding of biology in addition to the practical investigations found within the main body of the content.

- Investigate human responses to external stimuli.
- Investigate reaction times.
- Investigate the effect of pollutants on plant germination and plant growth.
- Investigate inheritance using suitable organisms or models.
- Investigate the speed of transmission of electrical impulses in the nervous system.
- Investigate the presence of glucose in simulated urine/body fluids.
- Investigate the effect of light and/or gravity on plant growth.
- Investigate the effect of exercise on heart rate.
- Investigate the relationship between organisms and their environment using fieldwork techniques.
- Investigate the distribution of organisms in an ecosystem, using sampling techniques including:
  - pooters
  - sweep nets/pond nets
  - pitfall traps and measure environmental factors including:
    - temperature
    - light intensity
    - pH.
- Investigate plant and animal cells with a light microscope.
- Investigate the effect of glucose concentration on rate of anaerobic respiration in yeast.
- Investigate how the structure of the leaf is adapted for photosynthesis.
- Investigate the effect of different factors on yoghurt making.
- Investigate the use of enzymes in washing powders.
- Investigate temperature loss in beakers of hot water of different sizes.

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.

Appendix 7: Glossary

Term	Definition
Assessment objectives	The requirements that students need to meet to succeed in the qualification. Each assessment objective has a unique focus, which is then targeted in examinations or coursework. Assessment objectives may be assessed individually or in combination.
External assessment	An examination that is held at the same time and place in a global region.
JCQ	Joint Council for Qualifications. This is a group of UK exam boards that develop policy related to the administration of examinations.
Linear	Linear qualifications have all assessments at the end of a course of study. It is not possible to take one assessment earlier in the course of study.

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