

# INTERNATIONAL GCSE

## Human Biology (9-1)

### SPECIFICATION

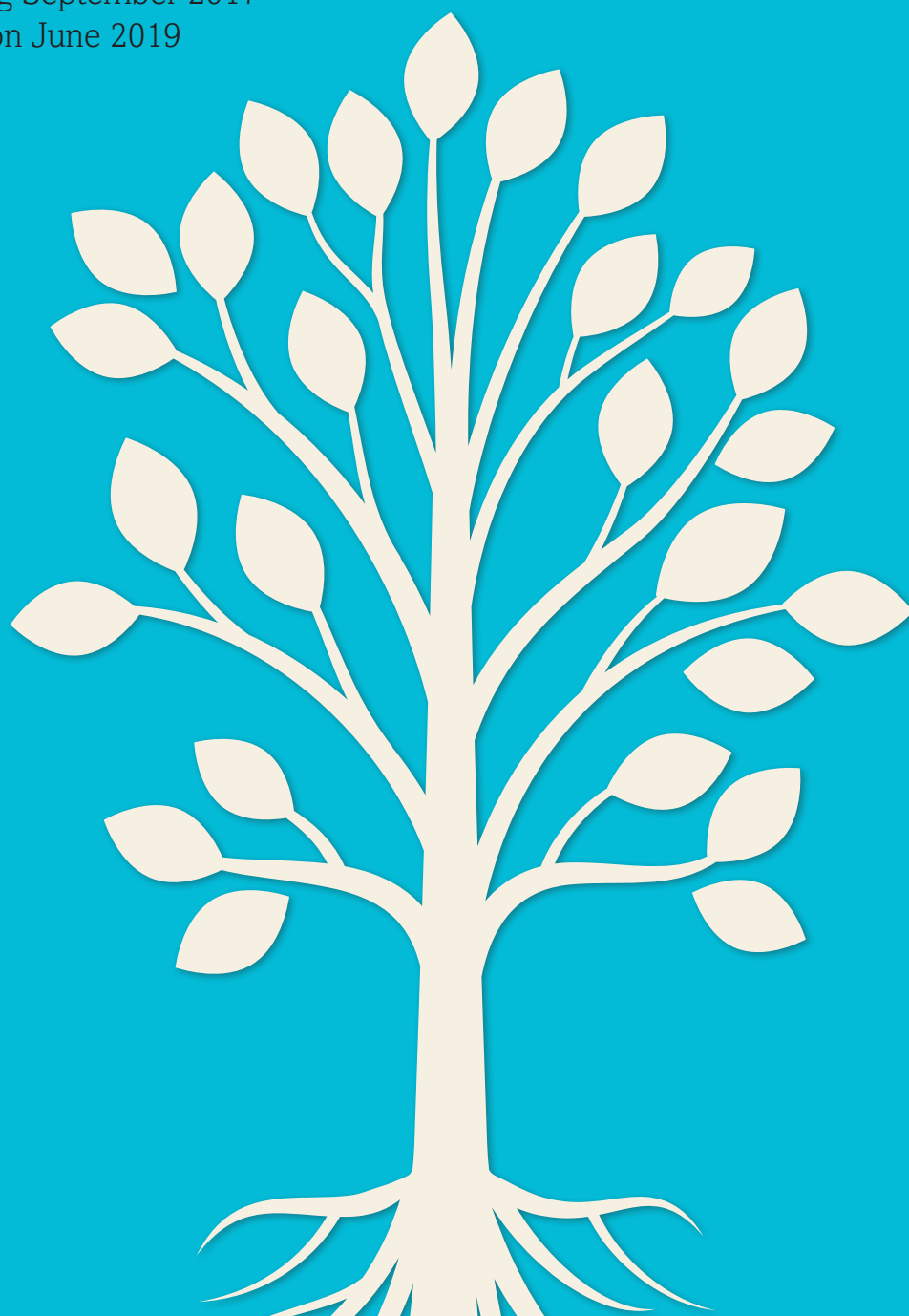
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Pearson Edexcel International GCSE in Human Biology (4HB1)

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For first teaching September 2017

First examination June 2019





## Qualification at a glance

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

- Human Biology Paper 1
- Human Biology Paper 2.

## Paper overview

<b>Human Biology Paper 1</b>	*Paper code 4HB1/01
<ul style="list-style-type: none"> <li>• Externally assessed</li> <li>• Availability: January and June</li> <li>• First assessment: June 2019</li> </ul>	50% of the total International GCSE
<b>Content summary</b> <ol style="list-style-type: none"> <li>1 Cells and tissues</li> <li>2 Biological molecules</li> <li>3 Movement of substances in and out of cells</li> <li>4 Bones, muscles and joints</li> <li>5 Coordination</li> <li>6 Nutrition and energy</li> <li>7 Respiration</li> <li>8 Gas exchange</li> <li>9 Internal transport</li> <li>10 Homeostatic mechanisms</li> <li>11 Reproduction and heredity</li> <li>12 Disease</li> </ol>	
<b>Assessment</b> <ul style="list-style-type: none"> <li>• The paper is assessed through a 1-hour 45-minute written examination paper set and marked by Pearson.</li> <li>• The total number of marks is 90.</li> <li>• A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions.</li> <li>• A calculator may be used in the examinations.</li> </ul>	

<b>Human Biology Paper 2</b>	*Paper code 4HB1/02
<ul style="list-style-type: none"> <li>Externally assessed</li> <li>Availability: January and June</li> <li>First assessment: June 2019</li> </ul>	50% of the total International GCSE
<b>Content summary</b> <ol style="list-style-type: none"> <li>Cells and tissues</li> <li>Biological molecules</li> <li>Movement of substances in and out of cells</li> <li>Bones, muscles and joints</li> <li>Coordination</li> <li>Nutrition and energy</li> <li>Respiration</li> <li>Gas exchange</li> <li>Internal transport</li> <li>Homeostatic mechanisms</li> <li>Reproduction and heredity</li> <li>Disease</li> </ol>	
<b>Assessment</b> <ul style="list-style-type: none"> <li>The paper is assessed through a 1-hour 45-minute written examination paper set and marked by Pearson.</li> <li>The total number of marks is 90.</li> <li>A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations, comprehension and extended open-response questions.</li> <li>A calculator may be used in the examinations.</li> </ul>	

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



## 2 Human Biology content

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# 1 Cells and tissues

Students should:	
1.1	recognise cell structures as seen with a light microscope and electron microscope (TEM images only), including nucleus, chromosomes, cell membrane, mitochondria, endoplasmic reticulum and ribosomes
1.2	<p>describe the functions of the cell structures:</p> <ul style="list-style-type: none"> <li>• nucleus</li> <li>• chromosomes</li> <li>• cell membrane</li> <li>• mitochondria</li> <li>• endoplasmic reticulum</li> <li>• ribosomes.</li> </ul>
1.3	<p>describe the structure of a DNA molecule as:</p> <ul style="list-style-type: none"> <li>• two strands coiled to form a double helix</li> <li>• containing nucleotides</li> <li>• strands linked by complementary bases</li> <li>• complementary bases linked by hydrogen bonds.</li> </ul>
1.4	describe DNA replication as the separation of DNA strands and the formation of a new strand by complementary base pairing of nucleotides, including the role of DNA polymerase
1.5	<p>understand that a gene is a length of DNA containing a sequence of bases that code for a specific protein.</p> <p><i>teaching should be limited to:</i></p> <ul style="list-style-type: none"> <li>• <i>the order of bases in DNA codes for the order of amino acids in a protein</i></li> <li>• <i>3 bases coding for one amino acid.</i></li> </ul>
1.6	<p>know that RNA is a second type of nucleic acid that has the following features:</p> <ul style="list-style-type: none"> <li>• single stranded</li> <li>• contains ribose</li> <li>• contains uracil and that it is used to take information from DNA in the nucleus to the ribosomes for the synthesis of proteins.</li> </ul>
1.7	understand that a DNA mutation involves a change in the sequence of bases that could lead to a change in the amino acid sequence and phenotype of an individual
1.8	<p>describe protein synthesis as:</p> <ul style="list-style-type: none"> <li>• transcription – the formation of mRNA in the nucleus</li> <li>• the transfer of mRNA to ribosomes in the cytoplasm</li> <li>• translation of the genetic code by tRNA from mRNA codons</li> <li>• the formation of a polypeptide chain using amino acids.</li> </ul>

<b>Students should:</b>	
1.9	outline principles of genetic engineering, including: <ul style="list-style-type: none"> <li>the production of genetically modified bacteria to produce human insulin</li> <li>the production of genetically modified plants to produce vaccines (e.g. hepatitis B) and to improve health (e.g. Golden Rice to increase Vitamin A in the diet)</li> </ul>
1.10	understand that mitosis occurs during growth, repair, cloning and asexual reproduction
1.11	know the four main stages of mitosis; prophase, metaphase, anaphase and telophase, which results in the production of two genetically identical diploid daughter cells
1.12	know that there are different types of stem cells, including embryonic and adult stem cells that have the ability to develop into other body cells
1.13	describe the advantages, disadvantages and ethics in the research and use of embryonic and adult stem cells
1.14	understand that cells are grouped into tissues and that tissues are organised into organs
1.15	describe the structure of bone, muscle (voluntary, involuntary and cardiac, as observed under a light microscope), blood, nervous tissue and epithelium (squamous and ciliated, with reference to cells lining the cheek and trachea)
1.16	describe the structure of cells specialised for reproduction, e.g. egg (ovum) and sperm and relate their structure to function

## 2 Biological molecules

<b>Students should:</b>	
2.1	know the chemical elements present in carbohydrates, proteins and lipids (fats and oils)
2.2	understand the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: <ul style="list-style-type: none"> <li>starch and glycogen from simple sugars</li> <li>protein from amino acids</li> <li>lipids from fatty acids and glycerol.</li> </ul>
2.3	describe the tests for glucose (a reducing sugar), starch, lipid and protein
2.4	<i>practical: investigate the qualitative and quantitative content of vitamin C in food</i>
2.5	<i>practical: investigate the energy content of food</i>
2.6	explain the role of enzymes as biological catalysts in metabolic reactions
2.7	explain the action of enzymes and how their activity is affected by: <ul style="list-style-type: none"> <li>temperature</li> <li>pH</li> <li>substrate concentration</li> <li>competitive and non-competitive inhibitors.</li> </ul>



<b>Students should:</b>	
2.8	<i>practical: investigate the effect of temperature and pH on enzyme activity</i>
2.9	describe the advantages of using immobilised enzymes in: <ul style="list-style-type: none"> <li>the production of lactose-free milk</li> <li>the conversion of sucrose into glucose and fructose</li> <li>glucose testing strips for diabetics.</li> </ul>
2.10	<i>practical: investigate the action of immobilised enzymes including the preparation of alginate beads</i>

### 3 Movement of substances into and out of cells

<b>Students should:</b>	
3.1	know simple definitions of diffusion, osmosis and active transport
3.2	understand that movement of substances into and out of cells can be by diffusion, osmosis (understanding of water potential is required) and active transport
3.3	understand the factors that affect the rate of movement of substances into and out of cells to include the effects of surface area to volume ratio, temperature and concentration gradient

### 4 Bones, muscles and joints

<b>Students should:</b>	
4.1	describe the structure and function of the main parts of the skeleton: <ul style="list-style-type: none"> <li>axial skeleton (vertebral column, ribcage and skull)</li> <li>appendicular skeleton (scapula, clavicle, pelvis and limbs)</li> <li>the structure of a long bone to include the distribution of spongy bone, compact bone and epiphysis.</li> </ul>
4.2	explain the functions of joints using the elbow, shoulder and a cartilaginous intervertebral joint as examples
4.3	describe the structure of a synovial joint
4.4	explain the relationship between voluntary muscles and bones to bring about movement illustrated by the biceps and triceps muscles and associated bones in the arm and shoulder
4.5	understand the dietary factors controlling the healthy development of muscle and bone
4.6	understand the causes and symptoms of osteoporosis

## 5 Coordination

Students should:	
5.1	know the structure of neurones: sensory, motor and relay
5.2	know the basic plan of the central nervous system
5.3	know the main areas of the brain and their functions including the cerebral hemispheres, cerebellum, mid brain, pituitary gland and hypothalamus
5.4	know the structure and functions of the spinal cord and the structure of a reflex arc
5.5	understand that the body contains receptors that can detect the stimuli for light, temperature, pressure/pain and taste
5.6	describe the pathway taken by a nerve impulse to cause a response to a stimulus
5.7	<i>practical: investigate the number and position of sensory receptors, such as touch and temperature receptors in the skin</i>
5.8	understand how nerve impulses are initiated, the direction of movement of an impulse along a neurone and transmission across a synapse
5.9	understand the action of hormones from the pituitary (ADH and gonadotrophic hormones), adrenal (adrenaline) and thyroid glands, the islets of Langerhans in the pancreas (insulin and glucagon) and the gonads, and know the role of hormones in growth and development
5.10	understand between the nervous and hormonal systems
5.11	explain the structure and function of the eye in: <ul style="list-style-type: none"> <li>• focusing on near and distant objects</li> <li>• responding to changes in light intensity</li> <li>• stereoscopic vision allowing better judgment of distance.</li> </ul>
5.12	understand eye defects and their treatment, i.e. long sight, short sight, astigmatism, and cataracts, and the use of corneal transplants
5.13	explain the structure and function of the ear in balance and hearing
5.14	understand how prolonged exposure to high noise levels affects the functioning of the ear and hearing
5.15	<i>practical: investigate the range of frequency audible to the human ear</i>
5.16	understand the meaning of the term 'drug' and distinguish between legal and illegal drugs, including: <ul style="list-style-type: none"> <li>• the dangers of heroin, cannabis and cocaine</li> <li>• the action of common painkillers such as paracetamol on the nervous system.</li> </ul>
5.17	describe the damaging effects of alcohol on the nervous system and liver and the behavioural consequences of excessive and long-term drinking
5.18	describe the causes, symptoms and treatments of mental illness, including schizophrenia and depression
5.19	describe the causes, symptoms and treatments of Alzheimer's disease, vascular dementia and Parkinson's disease

## 6 Nutrition and energy

Students should:	
6.1	explain the importance of a balanced diet including the recommended dietary intake of carbohydrates, fats, proteins, vitamins A and C, calcium, iron and fibre
6.2	understand variations in diet related to age, pregnancy, climate and occupation
6.3	know the sources and functions of carbohydrates, proteins, lipids (fats and oils), vitamins A, C and D, and the mineral ions, calcium and iron
6.4	describe the causes and symptoms of deficiency diseases limited to scurvy (lack of vitamin C), anaemia (lack of iron), blindness (lack of vitamin A) and Kwashiorkor (lack of protein)
6.5	know the structures of the human alimentary canal and describe the functions of the mouth, oesophagus, stomach, small intestine, large intestine and pancreas in digestion
6.6	explain how food is moved through the gut by peristalsis including the role of dietary fibre in the process
6.7	understand the role of digestive enzymes including: <ul style="list-style-type: none"> <li>• their site of production and action</li> <li>• the digestion of starch to glucose by amylase and maltase</li> <li>• the digestion of proteins to amino acids by proteases (pepsin, trypsin)</li> <li>• the digestion of lipids to fatty acids and glycerol by lipases.</li> </ul>
6.8	know that bile is produced by the liver and stored in the gall bladder and understand the role of bile in neutralising stomach acid and emulsifying lipids
6.9	understand how the structure of the villus helps absorption of the products of digestion in the small intestine
6.10	know the types, structure and functions of teeth, the factors that affect their growth and how to care for teeth and gums
6.11	understand BMI, including the calculation of BMI, and the role of obesity as a risk factor in early onset of diabetes and the significance of high cholesterol levels in atherosclerosis
6.12	explain the importance of hygienic methods of food preparation, cooking, storage and preservation

## 7 Respiration

Students should:	
7.1	know that the process of respiration releases energy in living organisms
7.2	<i>practical: investigate the difference between inspired and expired air for carbon dioxide concentration</i>
7.3	know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms
7.4	know the word equation for anaerobic respiration
7.5	explain the differences between aerobic and anaerobic respiration
7.6	understand the role of ATP in energy transfer (addition and removal of a phosphate group and associated energy requirement and release)

## 8 Gas exchange

Students should:	
8.1	know the structure of the thorax including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes
8.2	explain the role of the intercostal muscles and the diaphragm in ventilation
8.3	explain how the lungs are adapted for gas exchange by diffusion
8.4	understand the terms lung capacity, vital capacity, tidal volume and interpret spirometer traces showing breathing movement
8.5	<i>practical: investigate the effect of exercise on the rate of breathing and measure lung capacity</i>
8.6	describe the regulation of carbon dioxide content in the blood including the role of chemoreceptors in the aorta and carotid arteries
8.7	understand the term aerobic exercise
8.8	understand the long-term benefits of exercise on the cardiovascular system
8.9	understand the pulse rate as a measure of heart rate and explain why resting pulse can be used as a measure of physical fitness
8.10	explain why the heart rate changes during exercise and the influence of adrenaline
8.11	<i>practical: investigate the effect of exercise on the pulse rate</i>
8.12	understand how an oxygen debt arises and how it is repaid after exercise
8.13	understand the damage to the respiratory and cardiovascular system caused by smoking

## 9 Internal transport

Students should:	
9.1	know the composition of the blood: red blood cells (erythrocytes), white blood cells (phagocytes and lymphocytes), platelets and plasma
9.2	understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy
9.3	know the role of tissue fluid and explain how this arises as a result of pressure differences and its subsequent drainage into the lymphatic system
9.4	explain how red blood cells are adapted for oxygen transport
9.5	understand the role of ABO blood groups and their importance in blood transfusions
9.6	understand the role of white blood cells including phagocytosis and antibody production (details of plasma cells are not required)
9.7	describe the importance of blood clotting and the role of enzymes in causing the conversion of fibrinogen into fibrin (the names of other intermediates and enzyme names are not required)
9.8	compare the structures of arteries, veins and capillaries, and understand their roles including the pulse
9.9	know the general plan of the circulatory system to include the blood vessels to and from the heart, the lungs, the liver and the kidneys
9.10	know the structure of the heart and how it functions
9.11	describe the causes, prevention and treatment of heart disease including: <ul style="list-style-type: none"> <li>the effect of diet and exercise</li> <li>the use of stents, artificial hearts and transplants.</li> </ul>
9.12	understand the problems associated with heart transplants
9.13	describe the use of statins and plant stanol esters in the treatment and prevention of circulatory disorders
9.14	understand the role of beta-blockers in the treatment of circulatory disorders, e.g. heart failure and angina
9.15	explain the terms systolic and diastolic blood pressure
9.16	describe the causes, prevention and treatment of hypertension
9.17	understand the role of ACE inhibitors in the treatment of high blood pressure
9.18	describe how monoclonal antibodies are produced
9.19	understand how monoclonal antibodies work to detect and treat diseases such as cancer

## 10 Homeostatic mechanisms

Students should:	
10.1	know the structure and functions of the skin and explain the role of sweat glands, vasoconstriction, vasodilation and shivering in temperature regulation
10.2	know the definition of excretion; the removal of metabolic waste, including urea, carbon dioxide and water
10.3	know the structure and functions of the renal system
10.4	explain why the composition of urine may vary
10.5	describe the role of the hypothalamus and pituitary gland in osmoregulation
10.6	explain the role of ADH in regulating the water content of the blood
10.7	understand the roles of insulin and glucagon in maintaining blood glucose levels
10.8	understand the concept of homeostasis and the role of negative feedback, with particular reference to temperature control and blood glucose concentration
10.9	describe the advantages and disadvantages of: <ul style="list-style-type: none"><li>• kidney transplants</li><li>• kidney dialysis.</li></ul>
10.10	<i>practical: investigate diffusion using a partially-permeable membrane such as Visking tubing</i>
10.11	describe the functions of the liver in bile production, regulation of blood sugar, urea formation and detoxification including the breakdown of alcohol

# 11 Reproduction and heredity

Students should:	
11.1	know that the process of fertilisation involves the fusion of a male and female gamete to produce a zygote
11.2	describe how a zygote divides to form an embryo
11.3	know the stages of meiosis allowing the production of haploid gametes and its significance in bringing about variation in a species
11.4	know the structure and function of the male and female reproductive systems
11.5	understand the roles of oestrogen, progesterone, FSH and LH in the menstrual cycle
11.6	explain the role in pregnancy of the: <ul style="list-style-type: none"> <li>• hormone progesterone</li> <li>• placenta</li> <li>• amniotic fluid</li> <li>• umbilical cord.</li> </ul>
11.7	know the roles of oestrogen and testosterone in the development of secondary sexual characteristics
11.8	describe the birth process and explain the advantages of breast feeding
11.9	describe an outline of growth and development to maturity, to include growth curves for humans
11.10	describe the methods of contraception by hormonal, barrier and natural methods, intra-uterine devices and sterilisation
11.11	describe the advantages and disadvantages of each contraceptive method
11.12	describe the process of IVF and how it can improve the chances of pregnancy
11.13	know that genes exist in alternative forms called alleles which give rise to differences in inherited characteristics
11.14	know the meaning of the terms dominant, recessive, homozygous, heterozygous, phenotype, genotype, co-dominance, diploid and haploid
11.15	know that the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male
11.16	explain how the sex of offspring is determined at fertilisation using a genetic diagram
11.17	understand that random fertilisation produces genetic variation of offspring
11.18	understand the role of multiple alleles in the inheritance of ABO blood groups
11.19	understand patterns of monohybrid inheritance using a genetic diagram and the probabilities of outcomes
11.20	understand how to interpret family pedigrees
11.21	describe the causes and effects of inherited conditions such as haemophilia and red-green colour blindness (sex-linked inheritance), polydactyly (dominant allele) and cystic fibrosis (recessive allele)
11.22	describe how gene therapy with viruses can be used to treat cystic fibrosis
11.23	understand that random fertilisation produces genetic variation of offspring
11.24	understand that variation within a species can be genetic, environmental or a combination of both

## 12 Disease

Students should:	
12.1	understand the general course of a disease as: infection, incubation and symptoms
12.2	know that diseases are caused by pathogenic microorganisms
12.3	describe the structure and reproduction of viruses
12.4	describe methods of transmission, treatment and prevention of the spread of Ebola and HIV (human immuno-deficiency virus), the virus that causes AIDS
12.5	describe the structure, nutrition and reproduction of bacteria including the interpretation of bacterial growth curves
12.6	investigate the effects of antibacterial agents and antibiotics on the growth of bacterial culture
12.7	know the methods of transmission, treatment and prevention of the spread of cholera and gonorrhoea
12.8	explain the importance of oral rehydration therapy
12.9	know the methods of transmission, treatment and prevention of the spread of athlete's foot
12.10	explain the role of the mosquito (malaria) and housefly (typhoid) in transmitting causative agents of disease
12.11	describe the treatment and prevention of the spread of malaria and typhoid
12.12	understand the antibody-antigen reaction
12.13	explain how vaccines work to prevent the spread of disease
12.14	understand the differences between natural and artificial immunity and active and passive immunity
12.15	know the sources and role of antibiotics
12.16	explain how resistant pathogens such as MRSA arise and why they are a cause for concern
12.17	understand the role of non-pathogenic bacteria and fungi (decomposers) useful to humans in the decomposition of organic matter <i>details of other bacteria in the nitrogen and carbon cycles are not required</i>
12.18	know the processes of sewage treatment in modern sewage works and a pit latrine including the role of aerobic and anaerobic microorganisms in sewage breakdown



## 3 Assessment information

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### Assessment requirements

Paper number	Level	Assessment information	Number of marks allocated in the paper
Paper 1	1/2	Assessed through a 1-hour and 45-minute written examination set and marked by Pearson.  The paper is weighted at 50% of the qualification.  A mixture of different question styles, including calculations multiple-choice, short-answer, and extended open-response questions.	90
Paper 2	1/2	Assessed through a 1-hour and 45-minute written examination set and marked by Pearson.  The paper is weighted at 50% of the qualification.  A mixture of different question styles, including calculations, multiple-choice, short-answer, comprehension and extended open-response questions.	90

The final mark for the Pearson Edexcel International GCSE in Human Biology is obtained by adding together the marks scored in Paper 1 and Paper 2. The raw marks are added together, with no scaling, to achieve a total mark for the qualification of 180 marks.

Grades are then awarded for the qualification, based on the overall mark. The grades available range from 1 (at the lower end of the ability range) up to 9.

## 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 in *2: Human 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
<b>A01</b>	Knowledge and understanding of human biology	38–42%
<b>A02</b>	Application of knowledge and understanding, analysis and evaluation of human biology	38–42%
<b>A03</b>	Experimental skills, analysis and evaluation of data and methods in human biology	19–21%
		100%

## Relationship of assessment objectives to units

Unit number	Assessment objective		
	A01	A02	A03
Human Biology Paper 1	19–21%	19–21%	9.5–10.5%
Human Biology Paper 2	19–21%	19–21%	9.5–10.5%
<b>Total for International GCSE</b>	38–42%	38–42%	19–21%

All components will be available for assessment from June 2019.

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