edexcel

INTERNATIONAL GCSE Biology

Specification and Sample Assessment Material

Edexcel International GCSE in Biology (4BI0)

First examination June 2013

ALWAYS LEARNING

PEARSON

Pearson Education Ltd is one of the UK's largest awarding organisations, offering academic and vocational qualifications and testing to schools, colleges, employers and other places of learning, both in the UK and internationally. Qualifications offered include GCSE, AS and A Level, NVQ and our BTEC suite of vocational qualifications, ranging from Entry Level to BTEC Higher National Diplomas. Pearson Education Ltd administers Edexcel GCSE examinations.

Through initiatives such as onscreen marking and administration, Pearson is leading the way in using technology to modernise educational assessment, and to support teachers and learners.

Authorised by Martin Stretton
Prepared by Jo Harland
Publications code: UG030030

edexcel

International GCSE

Biology (4BI0)

Specification

First examination June 2013

ALWAYS LEARNING

PEARSON

An internationally recognised option within Edexcel's learning pathways for students

Depending on the learning approach that suits them, and the progression route that they wish to follow, different learning pathways can suit different students. For many, especially those capable of progression to further academic study in science-related subjects, this International GCSE qualification forms an ideal grounding in scientific theory.

Used by many UK independent schools as well as renowned international schools, the content of International GCSE is:

- examined terminally to ensure secure acquisition of knowledge
- examined externally – controlled assessment is not required.
- focused on the key theory that all students need to consider further study in Science.

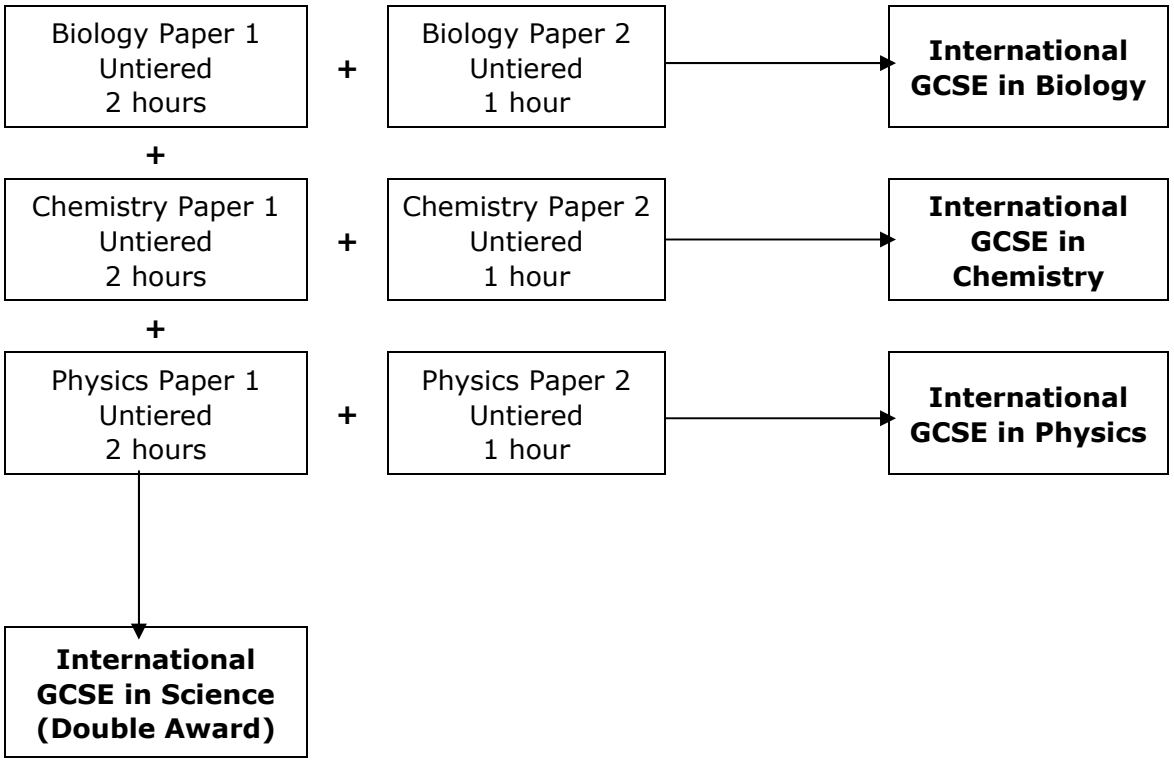
Introduction

The 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 Edexcel.

The course gives students the opportunity to experience biology within the context of their general education. The course design provides a basis for progression to further study in GCE Advanced Subsidiary and Advanced Level Biology.

How assessment relates to the qualifications available is shown below.

- The assessment for this qualification is linear and both papers need to be completed in the same series.



National Qualifications Framework (NQF) criteria

This specification complies with the requirements of the common criteria which are prescribed by the regulatory authorities.

About this specification

Key subject aims

The Edexcel International GCSE in Biology enables students to:

- learn about the unifying patterns and themes of biology
- acquire knowledge and understanding of biological facts, concepts and principles and the skills needed to use them in new and changing situations
- appreciate the practical nature of biology, developing experimental and investigative skills based on correct and safe laboratory techniques
- appreciate the importance of accurate experimental work and reporting as scientific methods
- sustain and develop an enjoyment of, and interest in, the study of living organisms
- evaluate, in terms of their biological knowledge and understanding, the benefits and drawbacks of real-life applications of science, including their everyday, industrial and environmental aspects
- select, organise and present information clearly and logically, using appropriate scientific terms and conventions
- prepare for more advanced courses in biology and for other courses which require them to have a knowledge of biology.

Key features and benefits of the specification

Key features and benefits of the specification are:

- it includes aspects of science appropriate for the 21st century
- straightforward linear assessment
- untiered assessment
- assessment of experimental skills through the examination paper
- it provides a sound foundation for progression to Edexcel GCE Advanced Subsidiary (AS) and Advanced Level in Biology, and other comparable post-16 qualifications.

Contents

Specification at a glance

This Edexcel International GCSE in Biology comprises two externally assessed papers:

- Biology Paper 1
- Biology Paper 2

Biology Paper 1	**Paper code: 4BI0/1B**
• Externally assessed • Availability: January and June series • First assessment: June 2013	**66.7% of the total qualification marks**
Overview of content Assesses only the content **not** in bold • Section 1: The nature and variety of living organisms • Section 2: Structures and functions in living organisms • Section 3: Reproduction and inheritance • Section 4: Ecology and the environment • Section 5: Use of biological resources	
Overview of assessment • The paper is assessed through a 2-hour examination paper set and marked by Edexcel. • The total number of marks is 120. • Grades A*–G are available.	

Biology Paper 2	**Paper code: 4BI0/2B**
• Externally assessed • Availability: January and June series • First assessment: June 2013	**33.3% of the total qualification marks**
Overview of content • Assesses all content including the content in **bold** • Section 1: The nature and variety of living organisms • Section 2: Structures and functions in living organisms • Section 3: Reproduction and inheritance • Section 4: Ecology and the environment • Section 5: Use of biological resources	
Overview of assessment • The paper is assessed through a 1-hour examination paper set and marked by Edexcel. • The total number of marks is 60. • Grades A*–G are available.	

Practicals

The best way to develop practical and investigative skills is to embed practical activities in your teaching of theory. The development of knowledge and skills can then happen together, leading to secure acquisition of knowledge and skills.

There are some practicals in the specification content, which students need to describe. Knowledge of these practicals, and the ability to interpret the resulting data, is required for the examinations.

The teachers' guide materials contain additional suggested practicals.

Appendix 2 also contains some suggestions of practical activities.

Qualification content

Paper 1 assesses only the content that is **not** in bold.

Paper 2 assesses all content including content in **bold.**

This Edexcel International GCSE in Biology requires students to demonstrate an understanding of:

- the nature and variety of living organisms
- structures and functions in living organisms
- reproduction and inheritance
- ecology and the environment
- use of biological resources.

Section 1: The nature and variety of living organisms

a) Characteristics of living organisms

b) Variety of living organisms

a) Characteristics of living organisms

Students will be assessed on their ability to:

1.1 Understand that 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 will be assessed on their ability to:

1.2 describe the common features shared by organisms within the following main groups: plants, animals, fungi, bacteria, protoctists and viruses, and for each group describe examples and their features as follows (details of life cycle and economic importance are not required)

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 coordination 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

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

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

Viruses: These 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

1.3 recall the term 'pathogen' and know that pathogens may be fungi, bacteria, protoctists or viruses.

Section 2: Structures and functions in living organisms

a) Levels 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) Coordination and response

a) Levels of organisation

Students will be assessed on their ability to:

2.1 describe the levels of organisation within organisms: organelles, cells, tissues, organs and systems.

b) Cell structure

Students will be assessed on their ability to:

2.2 describe cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, chloroplast and vacuole

2.3 describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, chloroplast and vacuole

2.4 compare the structures of plant and animal cells.

c) Biological molecules

Students will be assessed on their ability to:

2.5 identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils)

2.6 describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugar; protein from amino acids; lipid from fatty acids and glycerol

2.7 describe the tests for glucose and starch

2.8 understand the role of enzymes as biological catalysts in metabolic reactions

2.9 understand how the functioning of enzymes can be affected by changes in temperature, including changes due to change in active site

2.10 understand how the functioning of enzymes can be affected by changes in active site caused by changes in pH

2.11 describe experiments to investigate how enzyme activity can be affected by changes in temperature.

d) Movement of substances into and out of cells

Students will be assessed on their ability to:

2.12 understand definitions of diffusion, osmosis and active transport

2.13 understand that movement of substances into and out of cells can be by diffusion, osmosis and active transport

2.14 understand the importance in plants of turgid cells as a means of support

2.15 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

2.16 describe experiments to investigate diffusion and osmosis using living and non-living systems.

e) Nutrition

Students will be assessed on their ability to:

Flowering plants

2.17 describe the process of photosynthesis and understand its importance in the conversion of light energy to chemical energy

2.18 write the word equation and the balanced chemical symbol equation for photosynthesis

2.19 understand how varying carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis

2.20 describe the structure of the leaf and explain how it is adapted for photosynthesis

2.21 understand that plants require mineral ions for growth and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids

2.22 describe experiments to 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

2.23 understand that a balanced diet should include appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre

2.24 identify sources and describe functions of carbohydrate, protein, lipid (fats and oils), vitamins A, C and D, and the mineral ions calcium and iron, water and dietary fibre as components of the diet

2.25 understand that energy requirements vary with activity levels, age and pregnancy

2.26 describe the structures of the human alimentary canal and describe the functions of the mouth, oesophagus, stomach, small intestine, large intestine and pancreas

2.27 understand the processes of ingestion, digestion, absorption, assimilation and egestion

2.28 explain how and why food is moved through the gut by peristalsis

2.29 understand the role of digestive enzymes, to include 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, and understand the role of bile in neutralising stomach acid and emulsifying lipids

2.31 describe the structure of a villus and explain how this helps absorption of the products of digestion in the small intestine

2.32 describe an experiment to investigate the energy content in a food sample.

f) Respiration

Students will be assessed on their ability to:

2.33 understand that the process of respiration releases energy in living organisms

2.34 describe the differences between aerobic and anaerobic respiration

2.35 write the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms

2.36 write the word equation for anaerobic respiration in plants and in animals

2.37 describe experiments to investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms.

g) Gas exchange

Students will be assessed on their ability to:

2.38 understand the role of diffusion in gas exchange

Flowering plants

2.39 understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis

2.40 understand that respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light

2.41 explain how the structure of the leaf is adapted for gas exchange

2.42 describe the role of stomata in gas exchange

2.43 describe experiments to investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator

Humans

2.44 describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes

2.45 understand the role of the intercostal muscles and the diaphragm in ventilation

2.46 explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries

2.47 understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease

2.48 describe experiments to investigate the effect of exercise on breathing in humans.

h) Transport

Students will be assessed on their ability to:

2.49 understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell

2.50 understand the need for a transport system in multicellular organisms

Flowering plants

2.51 describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant

2.52 describe the role of xylem in transporting water and mineral salts from the roots to other parts of the plant

2.53 explain how water is absorbed by root hair cells

2.54 understand that transpiration is the evaporation of water from the surface of a plant

2.55 explain how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity

2.56 describe experiments to investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot

Humans

2.57 describe the composition of the blood: red blood cells, white blood cells, platelets and plasma

2.58 understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy

2.59 explain how adaptations of red blood cells, including shape, structure and the presence of haemoglobin, make them suitable for the transport of oxygen

2.60 describe how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen

2.61 understand that vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster and in greater quantity

2.62 understand that platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms

2.63 describe the structure of the heart and how it functions

2.64 explain how the heart rate changes during exercise and under the influence of adrenaline

2.65 describe the structure of arteries, veins and capillaries and understand their roles

2.66 understand the general structure of the circulation system to include the blood vessels to and from the heart, the lungs, the liver and the kidneys.

i) Excretion

Students will be assessed on their ability to:

Flowering plants

2.67 understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf

Humans

2.68 recall that the lungs, kidneys and skin are organs of excretion

2.69 understand how the kidney carries out its roles of excretion and osmoregulation

2.70 describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra

2.71 describe the structure of a nephron, to include Bowman's capsule and glomerulus, convoluted tubules, loop of Henlé and collecting duct

2.72 describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate

2.73 understand that water is reabsorbed into the blood from the collecting duct

2.74 understand that selective reabsorption of glucose occurs at the proximal convoluted tubule

2.75 describe the role of ADH in regulating the water content of the blood

2.76 understand that urine contains water, urea and salts.

j) Coordination and response

Students will be assessed on their ability to:

2.77 understand that organisms are able to respond to changes in their environment

2.78 understand that homeostasis is the maintenance of a constant internal environment and that body water content and body temperature are both examples of homeostasis

2.79 understand that a coordinated response requires a stimulus, a receptor and an effector

Flowering plants

2.80 understand that plants respond to stimuli

2.81 describe the geotropic responses of roots and stems

2.82 describe positive phototropism of stems

Humans

2.83 describe how responses can be controlled by nervous or by hormonal communication and understand the differences between the two systems

2.84 understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves

2.85 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

2.86 describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object

2.87 describe the structure and function of the eye as a receptor

2.88 understand the function of the eye in focusing near and distant objects, and in responding to changes in light intensity

2.89 describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation

2.90 understand the sources, roles and effects of the following hormones: ADH, adrenaline, insulin, testosterone, progesterone and oestrogen.

Section 3: Reproduction and inheritance

a) Reproduction

b) Inheritance

a) Reproduction

Students will be assessed on their ability to:

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 understand 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 describe the structure and explain the function of the male and female reproductive systems

3.9 understand the roles of oestrogen and progesterone in the menstrual cycle

3.10 describe the role of the placenta in the nutrition of the developing embryo

3.11 understand how the developing embryo is protected by amniotic fluid

3.12 understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics.

b) Inheritance

Students will be assessed on their ability to:

3.13 understand that the nucleus of a cell contains chromosomes on which genes are located

3.14 understand that a gene is a section of a molecule of DNA and that a gene codes for a specific protein

3.15 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)

3.16 understand that genes exist in alternative forms called alleles which give rise to differences in inherited characteristics

3.17 understand the meaning of the terms: dominant, recessive, homozygous, heterozygous, phenotype, genotype and **codominance**

3.18 describe patterns of monohybrid inheritance using a genetic diagram

3.19 understand how to interpret family pedigrees

3.20 predict probabilities of outcomes from monohybrid crosses

3.21 understand that the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male

3.22 describe the determination of the sex of offspring at fertilisation, using a genetic diagram

3.23 understand that division of a diploid cell by mitosis produces two cells which contain identical sets of chromosomes

3.24 understand that mitosis occurs during growth, repair, cloning and asexual reproduction

3.25 understand that 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

3.26 understand that random fertilisation produces genetic variation of offspring

3.27 know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23

3.28 understand that variation within a species can be genetic, environmental, or a combination of both

3.29 understand that mutation is a rare, random change in genetic material that can be inherited

3.30 describe the process of evolution by means of natural selection

3.31 understand that many mutations are harmful but some are neutral and a few are beneficial

3.32 understand that resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control

3.33 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).

Section 4: Ecology and the environment

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 will be assessed on their ability to:

4.1 understand the terms population, community, habitat and ecosystem

4.2 explain how quadrats can be used to estimate the population size of an organism in two different areas

4.3 explain how quadrats can be used to sample the distribution of organisms in their habitats.

b) Feeding relationships

Students will be assessed on their ability to:

4.4 explain the names given to different trophic levels to include producers, primary, secondary and tertiary consumers and decomposers

4.5 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer

4.6 understand the transfer of substances and of energy along a food chain

4.7 explain why only about 10% of energy is transferred from one trophic level to the next.

c) Cycles within ecosystems

Students will be assessed on their ability to:

4.8 describe the stages in the water cycle, including evaporation, transpiration, condensation and precipitation

4.9 describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion

4.10 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 will be assessed on their ability to:

4.11 understand the biological consequences of pollution of air by sulfur dioxide and by carbon monoxide

4.12 understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases

4.13 understand how human activities contribute to greenhouse gases

4.14 understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences

4.15 understand the biological consequences of pollution of water by sewage, including increases in the number of micro-organisms causing depletion of oxygen

4.16 understand that eutrophication can result from leached minerals from fertiliser

4.17 understand the effects of deforestation, including leaching, soil erosion, disturbance of the water cycle and of the balance in atmospheric oxygen and carbon dioxide.

Section 5: Use of biological resources

a) Food production

b) Selective breeding

c) Genetic modification (genetic engineering)

d) Cloning

a) Food production

Students will be assessed on their ability to:

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 the use of fertiliser to 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 beer

5.6 describe a simple experiment to investigate carbon dioxide production by yeast, in different conditions

5.7 understand the role of bacteria (*Lactobacillus*) in the production of yoghurt

5.8 interpret and label a diagram 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

5.9 explain the methods which are used to farm large numbers of fish to provide a source of protein, including maintenance of water quality, control of intraspecific and interspecific predation, control of disease, removal of waste products, quality and frequency of feeding and the use of selective breeding.

b) Selective breeding

Students will be assessed on their ability to:

5.10 understand that plants with desired characteristics can be developed by selective breeding

5.11 understand that animals with desired characteristics can be developed by selective breeding.

c) Genetic modification (genetic engineering)

Students will be assessed on their ability to:

5.12 describe the use of restriction enzymes to cut DNA at specific sites and ligase enzymes to join pieces of DNA together

5.13 describe how plasmids and viruses can act as vectors, which take up pieces of DNA, then insert this recombinant DNA into other cells

5.14 understand that large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter

5.15 evaluate the potential for using genetically modified plants to improve food production (illustrated by plants with improved resistance to pests)

5.16 understand that the term 'transgenic' means the transfer of genetic material from one species to a different species.

d) Cloning

Students will be assessed on their ability to:

5.17 describe the process of micropropagation (tissue culture) in which small pieces of plants (explants) are grown *in vitro* using nutrient media

5.18 understand how micropropagation can be used to produce commercial quantities of identical plants (clones) with desirable characteristics

5.19 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

5.20 evaluate the potential for using cloned transgenic animals, for example to produce commercial quantities of human antibodies or organs for transplantation.

Assessment

Assessment summary

Paper 1 is externally assessed through an examination paper lasting 2 hours.
Paper 2 is externally assessed through an examination paper lasting 1 hour.

The assessment for this qualification is linear and both papers must be taken in the same series.

There will be a range of compulsory, short-answer structured questions in both papers which are ramped to ensure accessibility for less able students, as well as to stretch more able students.

Students may be required to perform calculations, draw graphs and describe, explain and interpret biological phenomena. Some of the question content will be unfamiliar to students; these questions are designed to assess data-handling skills and the ability to apply biological principles to unfamiliar situations. Questions targeted at grades A*–B will include questions designed to test knowledge, understanding and skills at a higher level, including some requiring longer prose answers.

Summary of table of assessment

Biology Paper 1	**Paper code: 4BI0/1B**
• Externally assessed • Availability: January and June series • First assessment: June 2013 • Assesses all Assessment Objectives • Maximum mark 120 • 2-hour examination • Assesses specification content **not** in bold	
Biology Paper 2	**Paper code: 4BI0/2B**
• Externally assessed • Availability: January and June series • First assessment: June 2013 • Assesses all Assessment Objectives • Maximum mark 60 • 1-hour examination • Assesses all specification content, including that in **bold**	

Assessment Objectives and weightings

In the examination, students will be tested on the following areas:

- **AO1 Knowledge and understanding**
- **AO2 Application of knowledge and understanding, analysis and evaluation**
- **AO3 Experimental skills, analysis and evaluation of data and methods**

Assessment Objectives weightings

	% in International GCSE
AO1: Knowledge and understanding*	45–50%
AO2: Application of knowledge and understanding, analysis and evaluation	27.5–32.5%
AO3: Experimental skills, analysis and evaluation of data and methods	20–25%
TOTAL	**100%**

Relationship of Assessment Objectives to Papers for Certificate

Paper number	Assessment Objectives			
	AO1*	AO2	AO3	Total marks for AO1, AO2 and AO3
Biology Paper 1	54–60 marks	33–39 marks	24–30 marks	120 marks
Biology Paper 2	27–30 marks	16–20 marks	12–15 marks	60 marks
Percentage of Certificate	45–50%	27.5–32.5%	20–25%	100%

* No more than 50% of the AO1 marks **for the International GCSE** will be for recall of knowledge

Entering your students for assessment

Student entry

Details of how to enter students for this qualification can be found in Edexcel's *International Information Manual*, copies of which are sent to all active Edexcel centres. The information can also be found on the Edexcel website.

Forbidden combinations

It is forbidden for students to take this qualification at the same time as the Edexcel Level 1/Level 2 in Biology qualification.

Classification code

Centres should be aware that students who enter for more than one qualification with the same classification code will have only one grade (the highest) counted for the purpose of the school and college performance tables.

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, International GCSE and Entry Level qualifications aims to enhance access to the qualifications for students with disabilities and other difficulties without compromising the assessment of skills, knowledge, understanding or competence.

Please see the Edexcel website (www.edexcel.com) for:

- the Joint Council for Qualifications (JCQ) policy Access Arrangements, Reasonable Adjustments and Special Considerations 2010–2011
- the forms to submit for requests for access arrangements and special considerations
- dates for submission of the forms.

Requests for access arrangements and special considerations must be addressed to:

Special Requirements
Edexcel
One90 High Holborn
London WC1V 7BH

Equality Act 2010

Please see the Edexcel website (www.edexcel.com) for information on the Equality Act 2010.

Health and safety

Students must follow the health and safety rules which normally operate in their laboratories.

Responsibility for safety during practical activities rests with the centre.

With all laboratory practicals it is essential that centres carry out a detailed risk assessment before allowing students to carry out the practical.

For further information on risk assessments and chemical hazards please refer to the CLEAPSS website (www.cleapss.org.uk).

Assessing your students

The first assessment opportunity for Biology Paper 1 and Biology Paper 2 of this qualification will take place in the June 2013 series and in each January and June series thereafter for the lifetime of the specification.

Your student assessment opportunities

	June 2012	Jan 2013	June 2013	Jan 2014
Biology			✓	✓

Awarding and reporting

The grading, awarding and certification of this qualification will comply with the requirements of the current GCSE/GCE Code of Practice, which is published by the Office of Qualifications and Examinations Regulation (Ofqual). The International GCSE will be graded and certificated on an eight-grade scale from A* to G.

The first certification opportunity for the Edexcel International GCSE in Biology will be June 2013.

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

Language of assessment

Assessment of this qualification will be available in English only. Assessment materials will be published in English only and all work submitted for examination and moderation must be produced in English.

Malpractice and plagiarism

For up-to-date advice on malpractice and plagiarism, please refer to the JCQ's *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* document on the JCQ website, www.jcq.org.uk.

Student recruitment

Edexcel's access 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.

Guided learning hours

The number of guided learning hours required for this qualification is 120–140.

This reflects how centres will use time for practical activities differently.

Progression

This qualification supports progression to:

- Edexcel GCE Advanced Subsidiary and Advanced Level Biology
- Edexcel Level 3 BTEC National Award/Certificate/Diploma in Applied Science.

Grade descriptions

Grade A

Candidates can:

- recall a wide range of knowledge from all areas of the specification
- use detailed scientific knowledge and understanding in many different applications relating to scientific systems or phenomena, for example they can explain how temperature or water content is regulated in humans
- draw together and communicate knowledge from more than one area, routinely use scientific or mathematical conventions in support of arguments, and use a wide range of scientific and technical vocabulary throughout their work
- use scientific knowledge and understanding to describe an appropriate method for a practical task, identifying the key factors to be considered. They can recall or describe a range of apparatus required for the task. They can select a method of presenting data which is appropriate to the task; they can select information from a range of sources where it is appropriate to do so. They can identify and explain anomalous observations and measurements and the salient features of graphs
- use scientific knowledge and understanding to identify and explain patterns and draw conclusions from the evidence by combining data of more than one kind or from more than one source. They can identify shortcomings in evidence, use scientific knowledge and understanding to draw conclusions from their evidence and suggest improvements to methods used that would enable them to collect more reliable evidence.

Grade C

Candidates can:

- recall a range of scientific information from all areas of the specification, for example they explain how the lungs are ventilated
- use and apply scientific knowledge and understanding in some general contexts, for example they describe how a leaf is adapted to its functions
- describe links between related phenomena in different contexts; use diagrams, charts and graphs to support arguments; use appropriate scientific and technical vocabulary in a range of contexts
- use scientific knowledge and understanding to identify an approach to a practical scenario. For example, they can identify key factors to vary and control; they can recall or describe a range of apparatus required for the task; they can present data systematically, in graphs where appropriate, and use lines of best fit; they can identify and explain patterns within data and draw conclusions consistent with the evidence. They can explain these conclusions on the basis of their scientific knowledge and understanding, and evaluate how strongly their evidence supports the conclusions.

Grade F

Candidates can:

- recall a limited range of information, for example they state the main functions of organs of the human body and know that plants need light for photosynthesis
- use and apply knowledge and understanding in some specific everyday contexts, for example describe how the heart rate increases with exercise
- make some use of scientific and technical vocabulary and make simple generalisations from information
- devise fair tests in contexts which involve only a few factors. They can recall or describe simple apparatus appropriate for the task. They can obtain information from simple tables, charts and graphs and identify simple patterns in information and observations. They can offer explanations consistent with the evidence obtained.

Support and training

Edexcel support services

Edexcel has a wide range of support services to help you implement this qualification successfully.

ResultsPlus – ResultsPlus is an application launched by Edexcel to help subject teachers, senior management teams and students by providing detailed analysis of examination performance. Reports that compare performance between subjects, classes, your centre and similar centres can be generated with one click. Skills maps that show performance according to the specification topic being tested are available for some subjects. For further information about which subjects will be analysed through ResultsPlus, and for information on how to access and use the service, please visit www.edexcel.com/resultsplus.

Ask the Expert – to make it easier for you to raise a query with us online, we have merged our **Ask Edexcel** and **Ask the Expert** services.

There is now one easy-to-use web query form that will allow you to ask any question about the delivery or teaching of Edexcel qualifications. You will receive a personal response, from one of our administrative or teaching experts, sent to the email address you provide.

We'll also be doing lots of work to improve the quantity and quality of information in our FAQ database where you will be able to find answers to many questions.

Examzone – the Examzone site is aimed at students sitting external examinations and gives information on revision, advice from examiners and guidance on results, including remarking, resitting and progression opportunities. Further services for students – many of which will also be of interest to parents – will be available in the near future. Links to this site can be found on the main homepage at www.examzone.co.uk.

Training

A programme of professional development and training courses, covering various aspects of the specification and examination, will be arranged by Edexcel. Full details can be obtained from our website: www.edexcel.com.

Appendices

Appendix 1: Wider curriculum

Signposting and development suggestions

Issue	Paper	Opportunities for development
Spiritual	None	
Moral	All	4d, 5
Ethical	All	4d, 5
Social	All	2.23, 2.47, 2.48, 2.67, 3.32, 3.33, 4d, 5
Legislative	All	4d, 5
Economic	All	4d, 5
Cultural	All	3.30, 5
Sustainable	All	2.56, 4d, 5
Health and safety	All	Practical work
European initiatives	All	4d

Appendix 2: Suggested practicals

The following suggestions for practical investigations exemplify the scientific process and can support students' understanding of the subject.

- Investigate human responses to external stimuli
- Investigate reaction times
- Investigate the effects of antiseptics or antibiotics on microbial cultures
- 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 sugar in simulated urine/body fluids
- Investigate the effect of light and/or gravity on plant growth
- Investigate how indicator species can be used to assess levels of pollution in water or the atmosphere
- Investigate the factors that affect enzyme activity
- Investigate the effect of exercise on breathing rate and heart rate
- Investigate how factors, including light intensity, CO_2 concentration or temperature, affect the rate of photosynthesis
- Investigate osmosis
- Investigate the relationship between organisms and their environment using fieldwork techniques
- Investigate the distribution of organisms in an ecosystem, using sampling techniques including:

  a pooters

  b sweep nets/pond nets

  c pitfall traps

  d quadrats

  and measure environmental factors including:

  e temperature

  f light intensity

  g pH
- Investigate the effect of different concentrations of digestive enzymes, using and evaluating models of the alimentary canal
- Investigate plant and animal cells with a light microscope
- Investigate the effect of concentration on rate of diffusion
- 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 how the loss of water vapour from leaves drives transpiration

- Investigate the conditions affecting growth of micro-organisms (using resazurin dye)
- Investigate the effect of different factors on yoghurt making
- Investigate the use of immobilised lactase to produce lactose-free milk
- Investigate the use of enzymes in food production
- Investigate the importance of photoperiodicity in plants
- Investigate different behaviours exhibited by animals
- Investigate the use of chymosin in the manufacture of vegetarian cheese
- Investigate the use of invertase (sucrase) produced by Saccharomyces cerevisiae (yeast) in the manufacture of sweets
- Investigate the use of enzymes in washing powders

Seb201111G:\WORDPROC\LT\PD\INTERNATIONAL GCSES 2012\UG029855 INTL GCSE IN BIOLOGY (4BI0).DOC.1-43/1

edexcel

International GCSE

Biology (4BI0)

Sample Assessment Material

First examination June 2013

ALWAYS LEARNING

PEARSON

Contents

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, ie if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Biology Marking notation:

eq = equivalent

Compare i.e. range of values / variable present or absent
Organism i.e. same species / size / age / sex
Replication i.e. more than one reading
Measure i.e. the time between readings / time delay AND units / what is measured
Same i.e. variables controlled to ensure fair test e.g. temperature / light intensity

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Paper: 1B

Sample Assessment Material
Time: 2 hours

Paper Reference
4BI0/1B

You must have:
Ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S41644A

S 4 1 6 4 4 A 0 1 2 9

PEARSON

Answer ALL questions.

1 Organisms can be classified into groups, depending on some of their features.

(a) Some scientists were working in the rainforest in Indonesia.
They found two organisms living in the water in a pond.

Organism A was visible by eye, had fins for swimming and a mouth for feeding.
Organism B was a single-celled organism. This cell had a nucleus but no chitin cell wall.

animals	bacteria	fungi	plants	protoctists	viruses

Use a word from the box to complete each of the following sentences.

(i) Organism A belongs to the group called .....

(1)

(ii) Organism B belongs to the group called .....

(1)

(b) Give **three** structural differences between plant cells and animal cells.

(3)

.....

.....

.....

(c) Explain how fungi obtain their food.

(3)

.....

.....

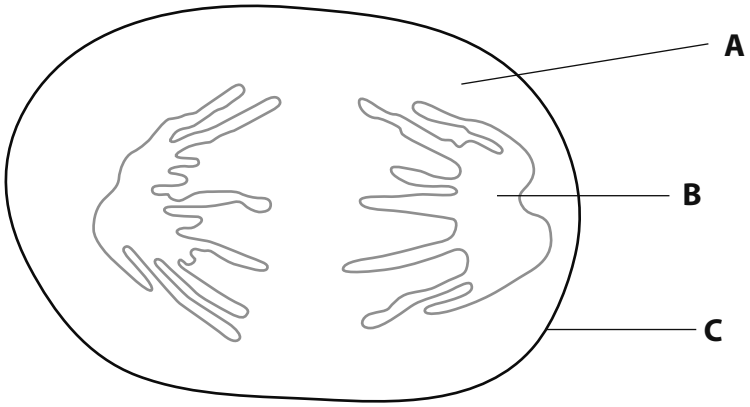
.....

.....

.....

(Total for Question 1 = 8 marks)

2 The animal cell below has a diploid number of eight. The cell is dividing by mitosis.



(a) Name the parts labelled **A**, **B** and **C**.

(3)

A .....

B .....

C .....

(b) A student wrote this passage describing mitosis. There are two mistakes.

> The diploid number of this cell is 8. It will divide into four daughter cells, each with a diploid number of 8. Mitosis is a very important type of cell division for growth, repair, cloning and sexual reproduction.

Identify the **two** mistakes in the passage.

(2)

1 .....

.....

2 .....

.....

(c) What is the diploid number in a human body cell?

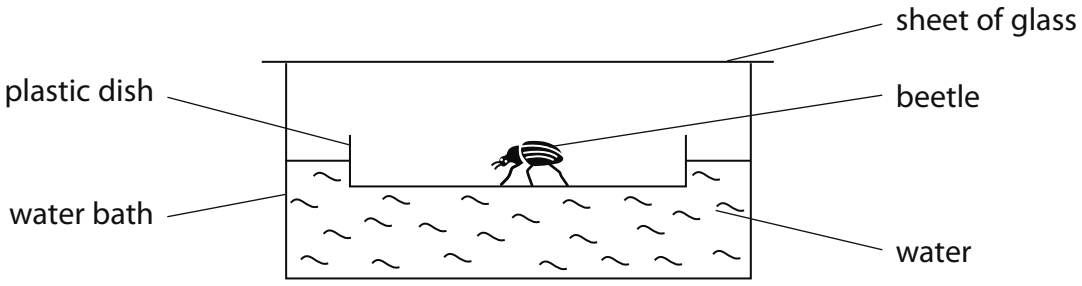
(1)

.....

(Total for Question 2 = 6 marks)

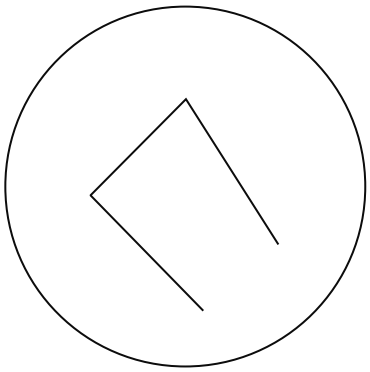
3 A student carried out an investigation to find out how temperature affects movement in beetles. The student placed a beetle in a plastic dish, which was allowed to float on water in a water bath. The water bath was set at a temperature of 15 °C.

The apparatus the student used is shown in the diagram below.

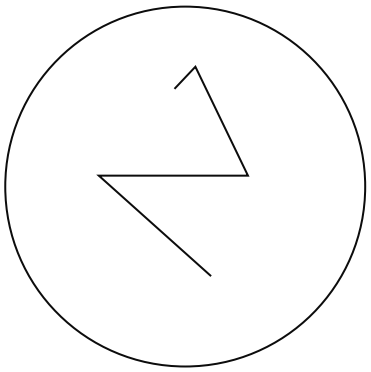


The student wanted to measure the distance moved in cm by the beetle in one minute. To do this, the student looked down from the top and recorded the movement of the beetle on the sheet of glass using a pen. The student did this four times (trials).
The whole procedure was carried out at five different temperatures using the same beetle.

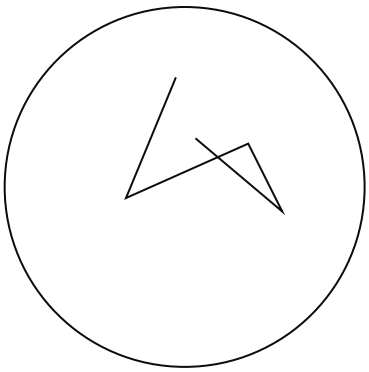
The diagrams show the pen recordings for the beetle's movement during one minute at 25 °C.



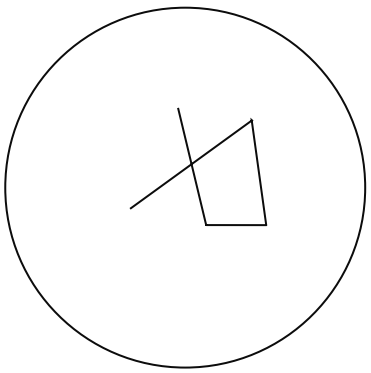
Trial 1



Trial 2



Trial 3



Trial 4

(a) Table 1 shows the results obtained for all trials at 15 °C, 20 °C, 30 °C and 35 °C.

(i) Measure the distance moved in cm by the beetle during trial 4 at 25 °C.
Write your answer in the empty box in Table 1.

(1)

Table 1

Temperature in °C	Distance moved in cm in one minute			
	Trial 1	Trial 2	Trial 3	Trial 4
15	2.4	2.1	1.8	1.7
20	4.3	4.1	4.4	4.0
25	6.2	6.0	6.0	
30	7.0	6.7	6.9	6.6
35	8.3	8.4	8.1	8.0

(ii) Calculate the average distance moved in cm by the beetle at 35 °C.
Show your working.

(2)

Answer ..... cm

(b) Describe and explain the results shown in the table.

(2)

.....

.....

.....

.....

(c) (i) Suggest how you could adapt this apparatus to obtain results at a temperature of 5 °C.

(1)

.....

.....

(ii) Suggest **one** reason why the student should not collect results above 35 °C.

(1)

.....

.....

(d) Suggest **one** way in which the student could modify the investigation to improve the accuracy of the results.

(1)

.....

.....

(Total for Question 3 = 8 marks)

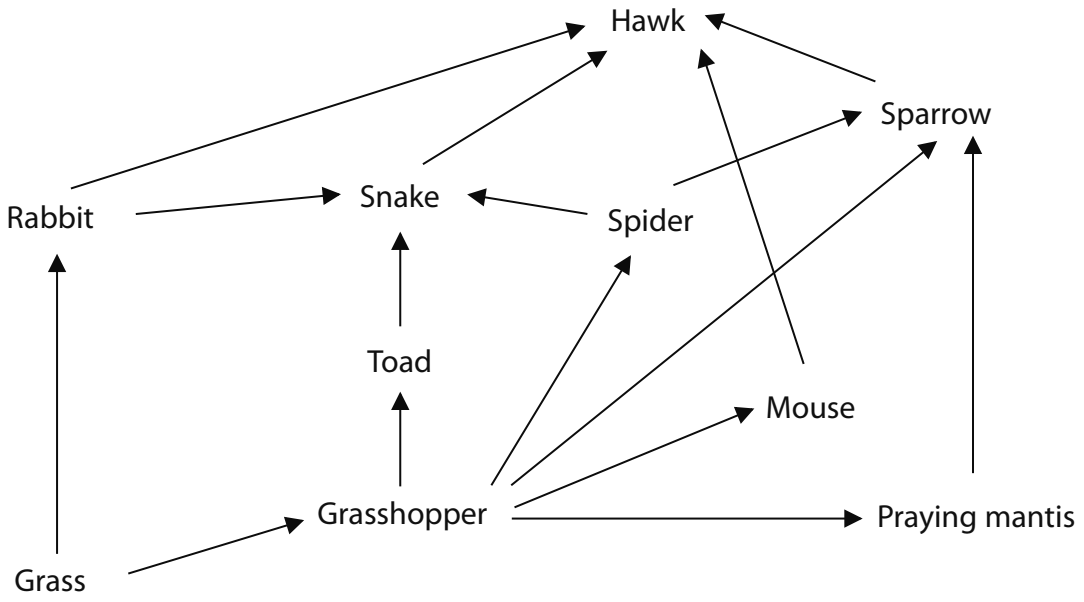
4 Many endurance athletes train at high altitude (height above sea level) before a major sporting event. They do this because they think that training at high altitude changes the number of red blood cells in their body.

Describe an investigation to find out if training at high altitude does change the number of red blood cells in the human body.

(6)

(Total for Question 4 = 6 marks)

5 The diagram shows a food web from a grassland ecosystem.



(a) From the food web, name an organism that is

(i) a producer

(1)

.....

(ii) a primary consumer

(1)

.....

(iii) a tertiary consumer

(1)

.....

(b) How many different organisms feed on the grasshopper in the food web?

(1)

.....

(c) From the food web, draw a food chain that contains 5 levels and includes the spider.

(2)

(d) A land owner wanted to reduce the number of rabbits feeding on his grass, so he killed a large number of rabbits.

Suggest an explanation for the effect this would have on the hawk population.

(2)

.....

.....

.....

.....

(Total for Question 5 = 8 marks)

6 As part of an investigation into biological cycles, Ome buried a dead mouse in some soil outside her classroom.

Explain what would happen to the body of the mouse over the next six months.

(5)

(Total for Question 6 = 5 marks)

7 The kidney contains many nephrons and is involved in excretion.

(a) Ultrafiltration occurs at the glomerulus. Describe how the blood leaving the glomerulus will differ from blood entering the glomerulus.

(3)

.....

.....

.....

.....

.....

.....

(b) In part of the nephron, selective reabsorption occurs.

What is meant by the term selective reabsorption?

(2)

.....

.....

.....

.....

(c) The following passage describes part of the role of the kidney. Complete the sentences in the passage by writing a suitable word or words on each dotted line.

(5)

The amount of water returning to the blood is controlled by the hormone

..... which is released from the ..... gland.

The solution containing waste products from the kidney is called

..... and passes down a tube called the ..... .

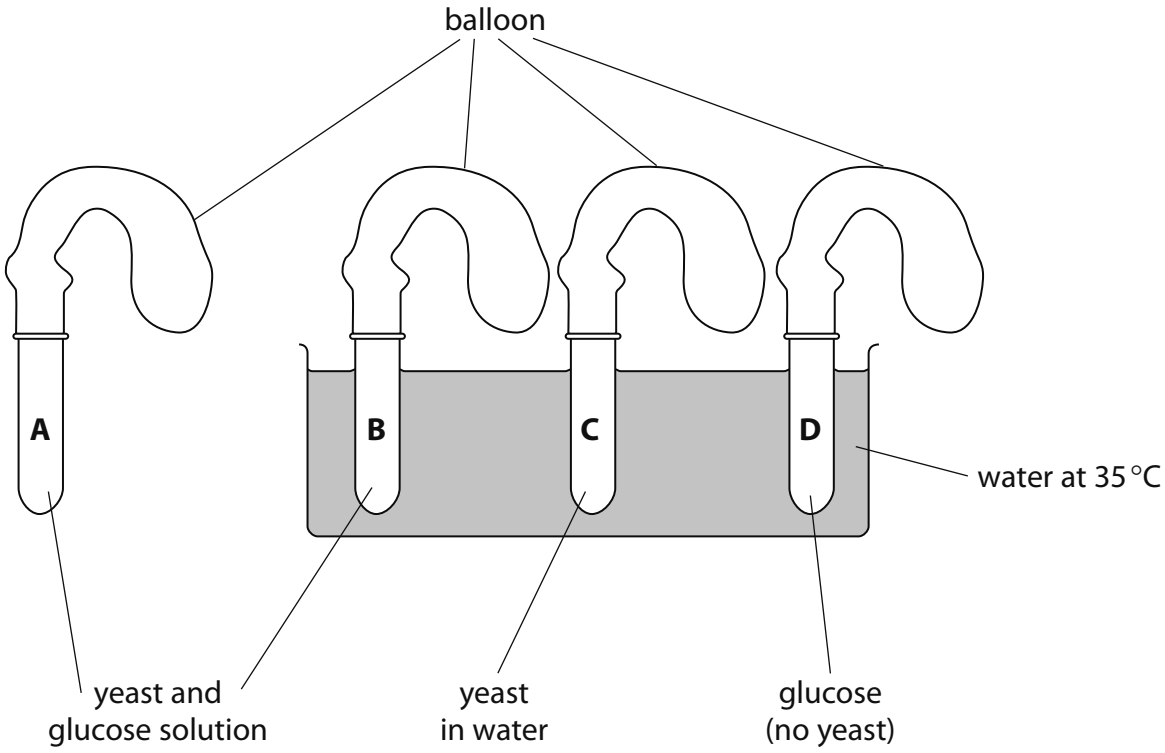
It is stored in the ..... before being passed from the body down the urethra.

(Total for Question 7 = 10 marks)

8 A student investigated how much gas was given off under different conditions in the production of beer. The diagram shows the apparatus she used.

Test tubes A and B each contained the same volume of yeast mixed with glucose solution.
Test tube C contained yeast in water, but no glucose.
Test tube D contained glucose solution, but no yeast.

Test tube A was placed in room temperature at 20 °C. The other test tubes were placed in a warm water bath at 35 °C. A balloon was put over the opening of each tube.



The table describes the appearance of the balloons after 15 minutes.
Some inflate (fill up with gas), others do not.

Tube	Appearance of balloon after 15 minutes
A	slightly inflated
B	very inflated
C	no change
D	

(a) (i) Explain why the balloons on tubes **A** and **B** inflated.

(2)

(ii) Explain why being in a higher temperature caused the balloon on tube **B** to inflate more than the balloon on tube **A**.

(2)

(b) Why did the balloon on tube **C** not show any change?

(1)

(c) Describe the appearance you would expect the balloon on tube **D** to have at the end of the experiment.

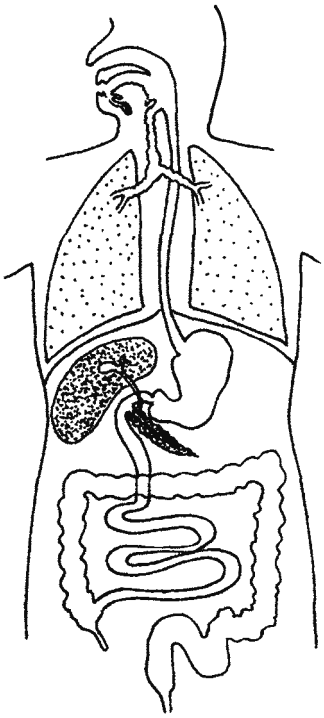
(1)

(Total for Question 8 = 6 marks)

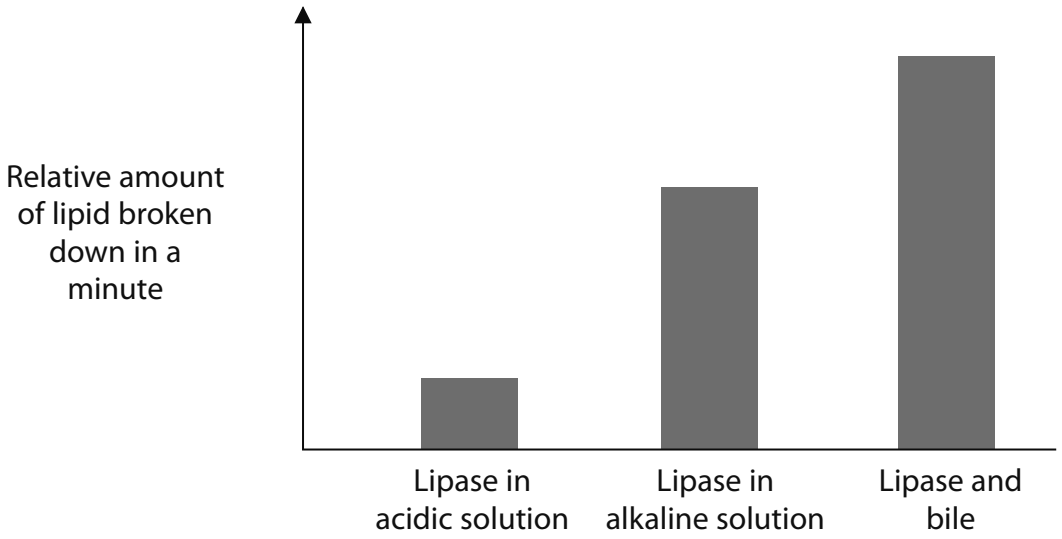
9 Lipase is an enzyme that breaks down lipids (fats) to fatty acids and glycerol. Lipase is produced in the pancreas and acts in the small intestine.

(a) On the diagram, label the pancreas and the small intestine.

(2)



(b) The graph shows the relative amount of lipid broken down by lipase under different conditions.



(i) Describe and explain the results shown by the graph.

(4)

(ii) Name the **three** chemical elements present in lipids.

(1)

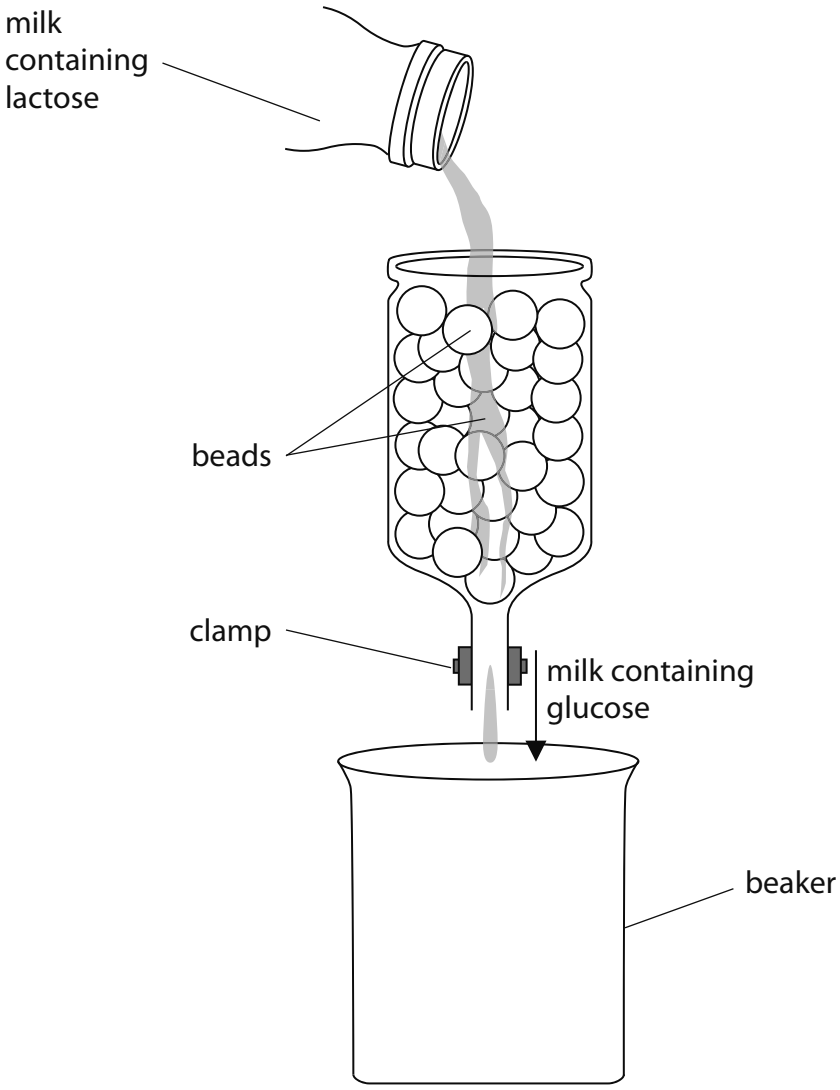
(c) Describe how the structure of the small intestine is adapted for the efficient absorption of the products of digestion.

(5)

(Total for Question 9 = 12 marks)

10 Nicola investigated the digestion of lactose, a substance found in milk.

The diagram shows the apparatus she used.

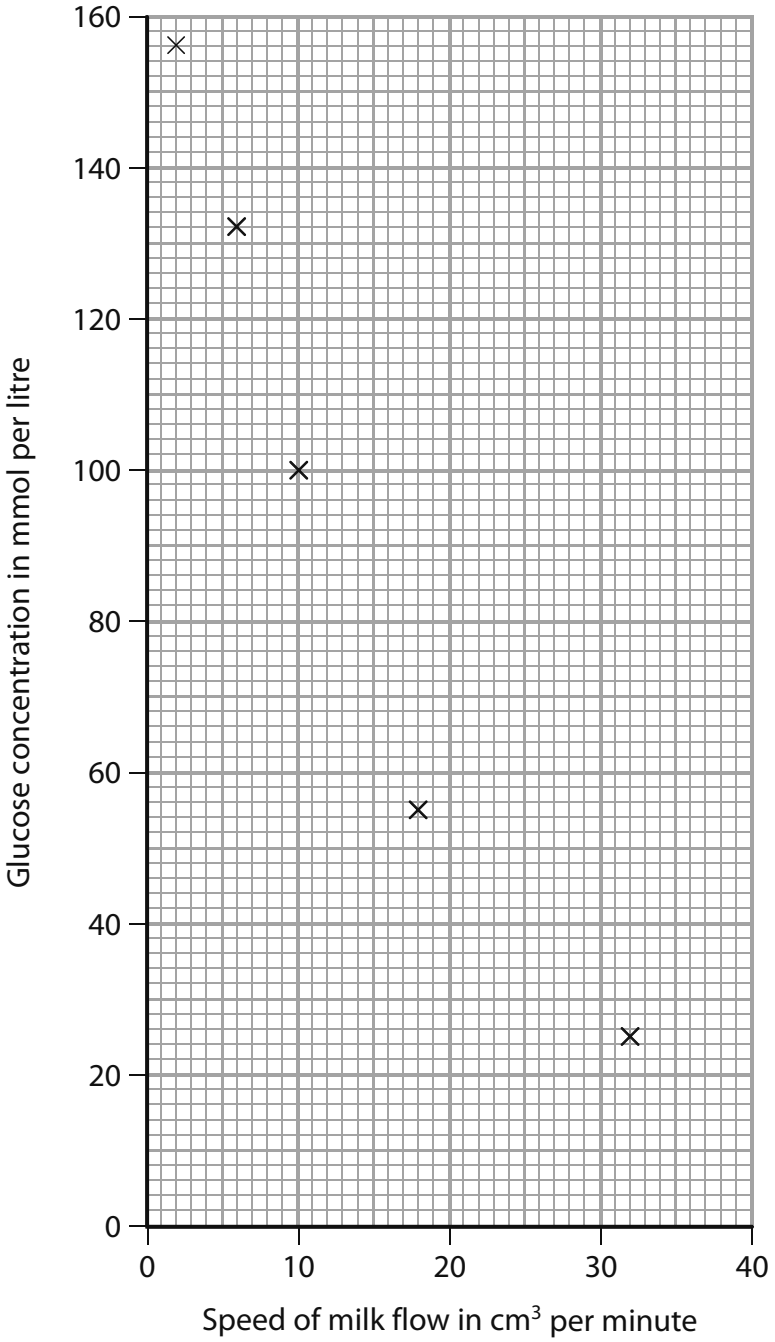


The beads contained an enzyme called lactase. This enzyme digests lactose into two sugars called glucose and galactose.

The outer coat of the beads allows milk to enter and sugars to leave. The outer coat also prevents the enzyme from leaving.

An experiment was carried out in which milk was allowed to flow through the apparatus at different speeds. The speed of flow was changed using the clamp on the exit tube.

The milk collected in the beaker was tested for the concentration of glucose it contained at each flow speed. The graph shows the results.



Speed of milk flow through apparatus in cm^3 per minute	Glucose concentration in beaker milk in mmol per litre
4	156
6	132
10	100
18	55
32	25

(a) (i) Describe the relationship between the speed of flow and the concentration of glucose.

(1)

.....

.....

(ii) Suggest an explanation for the relationship between the speed of flow and the concentration of glucose.

(2)

.....

.....

.....

.....

(b) The investigation was carried out at 20 °C.

(i) Name **two** variables, apart from temperature, that need to be kept the same during this investigation.

(2)

1 .....

2 .....

(ii) Suggest how the results would be different if the investigations had been carried out at 25 °C.

Explain your answer.

(2)

.....

.....

.....

.....

(c) How would the concentration of glucose in the beaker be different if the beads used were bigger in size?

(1)

.....

.....

(d) Give **one** way in which the results in this investigation could be made more reliable.

(1)

.....

.....

(Total for Question 10 = 9 marks)

11 Angela carried out an experiment to investigate how breathing rate changes during exercise.

She worked with a partner who counted the number of breaths she took during

- three periods of 20 seconds at rest
- three periods of 20 seconds immediately after 5 minutes of exercise
- three periods of 20 seconds immediately after 10 minutes of exercise.

The results that Angela collected from her experiment are given in the table.

Situation when breaths counted	Number of breaths in 20 seconds 1st period	Number of breaths in 20 seconds 2nd period	Number of breaths in 20 seconds 3rd period	Average breathing rate in breaths per minute
At rest	5	6	5	16
After 5 minutes of exercise	15	16	14	45
After 10 minutes of exercise	18	20	18	56

(a) Give **two** variables that Angela should have controlled in her experiment. For each variable describe how she could control it.

(4)

Variable 1 .....

.....

.....

.....

Variable 2 .....

.....

.....

.....

(b) (i) State how Angela's breathing rate changed with exercise.

(1)

.....

.....

(ii) Explain why Angela's breathing rate changed during exercise.

(4)

(Total for Question 11 = 9 marks)

12 The oil seed plant is an important crop plant grown by farmers.

(a) The stages below are used to insert a gene for herbicide resistance into crops such as oil seed plant.

Place the stages in the correct order by writing the order (1, 2, 3, 4 and 5) in the table.

(4)

Stage	Order
Recombinant DNA inserted into the crop plant cell using a vector.	
Desired gene for herbicide resistance inserted into recipient DNA using an enzyme.	
Desired gene for herbicide resistance removed from donor cell using an enzyme.	
The plant is herbicide resistant.	
Desired gene for herbicide resistance identified.	

(b) Give **one** example of a vector used in genetic modification.

(1)

(c) State the role of restriction enzymes and ligase enzymes in genetic modification.

(2)

restriction enzymes .....

ligase enzymes .....

(d) (i) What is meant by the term **herbicide**?

(1)

(ii) Give a reason why a farmer would want his crop plants to be resistant to a herbicide.

(1)

(e) Suggest why some people are concerned about genetically modified (GM) crops.

(2)

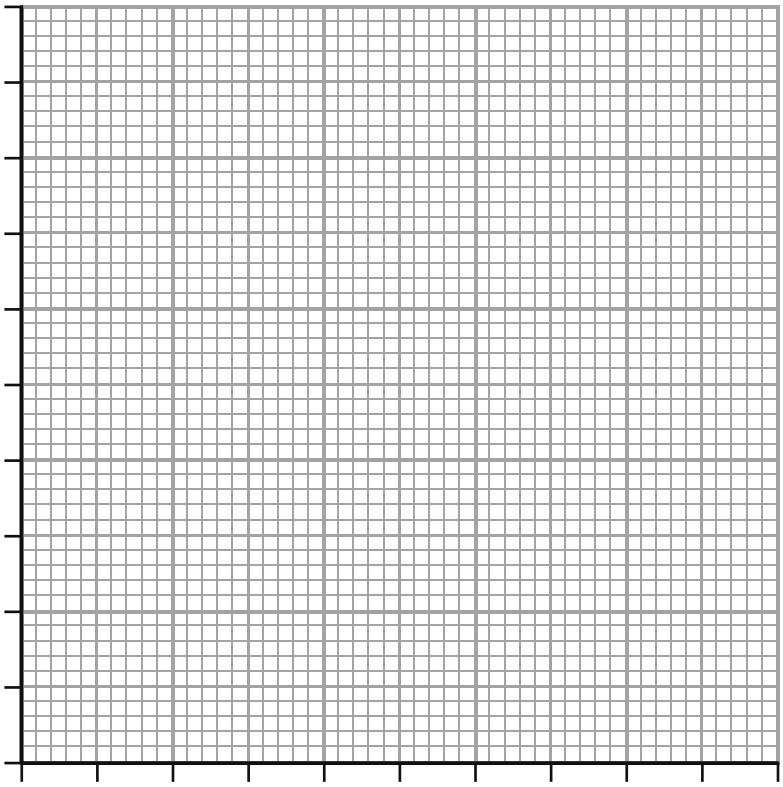
(Total for Question 12 = 11 marks)

13 The table shows data taken from dairy farms in the UK. It shows changes in milk yield and dairy herd size (number of cows) between the years 2000 and 2008.

Year	Average milk yield in dm^3 per cow per year	Average size of dairy herd in thousands
2000	6,048	2,330
2001	6,449	2,229
2002	6,450	2,224
2003	6,631	2,185
2004	6,886	2,060
2005	6,999	2,003
2006	6,963	1,989
2007	6,924	1,961
2008	6,945	1,902

(a) On the grid, plot the data to show how average milk yield changed during the years 2000 to 2008. Join your points using straight lines.

(5)



(b) Describe how the average milk yield per cow changes over the time period.

(2)

(c) Suggest why the average size of dairy herds changed between 2000 and 2008.

(1)

(d) Describe how a selective breeding programme could be used to produce an improvement in milk yield.

(3)

(e) Improvement in milk yield can be affected by factors other than selective breeding.

Suggest **two** factors that a farmer may change that could lead to an improvement in milk yield. For **each factor**, give a reason why it would improve milk yield.

(4)

Factor 1 .....

.....

Reason .....

.....

.....

.....

Factor 2 .....

.....

Reason .....

.....

.....

.....

(Total for Question 13 = 15 marks)

14 Batten's disease is caused by a recessive allele. Symptoms include loss of vision, epilepsy and difficulty in walking and talking.

The mutation causes lipofuscins to build-up in the body's tissues. Lipofuscins consist of fats and proteins and form distinctive deposits that cause the symptoms.

(a) Name **one** system in the body affected by Batten's disease.

(1)

.....

(b) Two adults who had never shown any symptoms married and had a child who developed Batten's disease.

Deduce the genotypes of the parents and show how the gametes formed by these parents can give rise to a child who has the genotype and phenotype for Batten's disease.

Use **B** to show the normal allele and **b** to show the recessive allele responsible for Batten's disease.

(4)

(c) Recessive conditions, like Batten's disease, are usually very rare in populations.

However, if someone who comes from a family with a history of the disease marries a cousin then the likelihood of inheriting the condition changes.

Suggest why this is the case.

(2)

.....

.....

.....

.....

.....

(Total for Question 14 = 7 marks)

TOTAL FOR PAPER = 120 MARKS

Sample Mark Scheme

Paper 1B

Question number	Answer	Notes	Marks
1 (a) (i)	animals	ACCEPT fish	1
(i)	protoctists		1
(b)	Any three of the following statements about plant cells: • plant cells have a (cellulose) cell wall • plants cells contain chloroplasts • plant cells store carbohydrate as starch (or sucrose) • plant cells contain a vacuole	ACCEPT converse statements about the animal cell	3
(c)	An explanation linking three of the following points: • mycelium / hyphae • feed on dead material / saprophytic • secrete extracellular enzymes onto food / eq • which breaks it down / digest • so that breakdown products can be absorbed by fungus		3
			Total: 8

Question number	Answer	Notes	Marks
2 (a)	**A** = cytoplasm **B** = chromosome / DNA **C** = cell membrane		3
(b)	not four cells / two daughter cells not sexual / asexual	ACCEPT either a correction **or** an identification of a wrong statement	2
(c)	46		1
			Total: 6

Question number	Answer	Notes	Marks
3 (a) (i)	5.8	ALLOW ±1 mm	1
(ii)	(8.3 + 8.4 + 8.1 + 8.0) ÷ 4 = 8.2	ALLOW 1 in working for division by 4	2
(b)	increase in temperature leads to an increase in distance moved enzymes work better / more energy / more respiration		2
(c) (i)	ice	IGNORE fridge	1
(ii)	cruel / unethical / cause harm / kill beetle / eq IGNORE denatured	ACCEPT beetle moves too quickly to trace its path accurately	1
(d)	any modification that forces movement in a straight line		1
			Total: 8

Question number	Answer	Notes	Marks
4	C : two or more altitudes O : same person / people / gender / age R : repeat at each altitude / several samples M1 : count (number of red blood cells) M2 : use microscope S1 : same diet S2 : other controlled variable eg training intensity		6 max
			Total: 6

Question number			Answer	Notes	Marks
5	(a)	(i) (ii) (iii)	grass rabbit/grasshopper hawk/snake/sparrow		1 1 1
	(b)		5		1
	(c)		grass --> grasshopper --> spider --> snake --> hawk OR grass --> grasshopper --> spider --> sparrow --> hawk	1 mark for 5 organisms including spider 1 mark for correct arrows	2
	(d)		An explanation linking the following points: • hawk numbers decrease / drop / go down • (because) less food / rabbits for them to eat	ACCEPT could stay the same, as hawks eat more of other (named) prey instead	2
					Total: 8

Question number	Answer	Notes	Marks
6	An explanation linking five of the following: • bacteria / fungi / decomposers / a named example • digest / break down • body tissue / proteins / compounds / eq • (because they contain) enzymes • (leading to) loss of mass / dead mouse getting smaller / decays • release of carbon dioxide / water • release of mineral ions / named mineral ion • ref to speed depending on environmental temperature / season	ACCEPT reference to insects/invertebrates/scavenger	5
			Total: 5

Question number	Answer	Notes	Marks
7 (a)	A description including three of the following: • less glucose • less water • fewer amino acids • less urea • fewer ions	ACCEPT converse arguments for blood entering the glomerulus	3
(b)	some substances / eq absorbed/eq into the blood		2
(c)	ADH pituitary urine ureter bladder		5
			Total: 10

Question number	Answer	Notes	Marks
8 (a) (i)	An explanation linking the following points: • respiration (of the yeast) • (produces) carbon dioxide (gas)		2
(ii)	An explanation linking the following points: • increased enzyme/yeast activity / eq • increased chemical reactions / kinetic energy / eq	ACCEPT warmer gas takes up larger volume	2
(b)	no glucose / eq	IGNORE no respiration ACCEPT no gas/carbon dioxide produced	1
(c)	no change / same as **C** / does not inflate		1
			Total: 6

Question number	Answer	Notes	Marks
9 (a)	both correctly labelled		2
(b) (i)	An explanation linking four of the following points: • lipase works best with bile • (and works) least well in acidic / better in alkaline • bile is alkaline / neutralises (stomach acid) / optimum pH /eq • bile emulsifies lipid • (therefore) larger surface area (for lipase)		4 max
(ii)	carbon, hydrogen and oxygen	Allow C, H, O	1
(c)	A description including five of the following: • villi • microvilli • (have a) large surface area • (and have) thin walls / epithelium • (rich) capillary network • (to allow maximum rate of) diffusion • to carry away molecules / maintain gradient • (into) lacteals • named product of digestion		5 max
			Total :12

Question number	Answer	Notes	Marks
10 (a) (i)	faster flow, lower glucose concentration / less glucose		1
(ii)	An explanation linking the following: • if speed of flow high, then less time in bead • (so less time) to digest / in contact with enzyme/lactase	ACCEPT converse argument	2
(b) (i)	Any two from: • concentration of enzyme/lactase • type of milk • size of beads • number of beads		2 max
(ii)	An explanation linking two of the following: • more glucose / more digestion • (because) faster enzyme activity / optimum temperature • (and) higher kinetic energy / more collisions / eq	ACCEPT less glucose milk flows faster (at a higher temp) less time in contact with enzyme	2 max
(c)	lower / less glucose		1
(d)	more experiments / eq		1
			Total: 9

Question number	Answer	Notes	Marks
11 (a)	amount of exercise / type of exercise (controlled by having) same number of exercise type temperature of room (controlled by) using thermostat / air conditioning	ACCEPT other reasonable controls	4
(b) (i)	increases		1
(ii)	An explanation linking four of the following: • muscles • (need) more oxygen • (because of) increased respiration • (to provide) more energy • (increase breathing also) removes more CO_2 • (as) waste product of respiration	ACCEPT ref to heat	max 4
			Total: 9

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Marks</th></tr>
<tr><td>12 (a)</td><td>
<table>
<tr><th>Stage</th><th>Order</th></tr>
<tr><td>Recombinant DNA inserted into the crop plant cell using a vector</td><td>4</td></tr>
<tr><td>Desired gene for herbicide resistance inserted into recipient DNA using an enzyme</td><td>3</td></tr>
<tr><td>Desired gene for herbicide resistance removed from donor cell using an enzyme</td><td>2</td></tr>
<tr><td>The plant is herbicide resistant</td><td>5</td></tr>
<tr><td>Desired gene for herbicide resistance identified</td><td>1</td></tr>
</table>
</td><td>1 mark for 1st statement correct
1 mark for last statement correct
1 marks for statement 2 before statement 3
1 mark for statement 3 before statement 4</td><td>4</td></tr>
<tr><td>(b)</td><td>virus / plasmid / gene gun</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td>restriction enzyme: to cut DNA / chop DNA

ligase enzymes: to join / stick DNA</td><td></td><td>2</td></tr>
<tr><td>(d) (i)</td><td>(substance that) kills plants</td><td></td><td>1</td></tr>
<tr><td>(ii)</td><td>to spray / kill weeds without killing crop</td><td></td><td>1</td></tr>
<tr><td>(e)</td><td>Any two from:
• crops could alter food chains/webs
• lack of control on gene transfer
• GM crops could take over ecosystems
• might be effects on health</td><td>ACCEPT
gene gets into wild plants/weeds
(so) weeds now resistant to herbicide / herbicide now non-functional</td><td>max 2</td></tr>
<tr><td></td><td></td><td></td><td>Total: 11</td></tr>
</table>

Question number	Answer	Accept	Marks
13 (a)	size suitable ; line joining points ; axes correct way round and labelled ; points correctly plotted ;;	Note: 2 marks for points, penalise 1 mark for each incorrect plot	5
(b)	A description that includes the following: • increases • up to 2005 / then levels off / plateaus	ACCEPT by 897 dm^3 per cow	2
(c)	each cow producing more milk, so fewer cows needed / total yield for the herd stays constant / less demand from consumers for milk	ACCEPT due to diversification	1
(d)	A description that includes three of: • select bulls • that produce female calves with high milk yield / eq • choose high milk-yielding cows • and then repeat with offspring		max 3
(e)	Any **two** from: nutrition / eq greater fat/lipid in diet to increase milk yield / eq keep indoors (so) more energy available for milk production sex hormones larger udders to increase milk production	ALLOW any other suitable answers	4
			Total: 15

Question number	Answer	Notes	Marks
14 (a)	nervous system	ACCEPT skeletal system	1
(b)	parents: Bb Bb gametes of parents: B b B b genotype of children: (BB Bb Bb) bb phenotype of children: (normal normal normal) affected	ALLOW Bb appearing once ALLOW only bb shown as Batten's phenotype	4
(c)	cousin may (also) carry recessive allele / they share a common ancestor (therefore) increased chance of these combining / reference to inbreeding		2
			Total: 7

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number	Candidate Number

Biology

Paper: 2B

Sample Assessment Material
Time: 1 hour

Paper Reference
4BI0/2B

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S41645A

S 4 1 6 4 5 A 0 1 1 6

PEARSON

Answer ALL questions.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

The harlequin ladybird threaten native species

Scientists have warned that the harlequin ladybird is likely to threaten more than 1000 of Britain's native species. It has spread from the south of Britain to the north in only four years and is now one of the fastest spreading non-native species in Europe, as well as the most invasive ladybird on Earth. The negative impact on biodiversity in Britain could be far-reaching and disruptive. In the United States, where the harlequin ladybird arrived over 20 years ago, it has been associated with severe declines in native species.

The harlequin ladybird, native to Asia, was introduced to the United States and continental Europe as a biological control agent because it eats more pest insects than any other ladybirds. Unfortunately, harlequin ladybirds will also eat non-pest and beneficial insects, including the larvae of other ladybirds and the eggs and larvae of butterflies and moths. Britain's 46 species of native ladybird and these other insects play a key role in our ecosystems, but the harlequin ladybird has the potential to put many of them at risk.

The first recorded sighting of the harlequin ladybird in Britain was in 2004. The scientists' first step has been to understand its subsequent rapid spread. The public has played a key role in monitoring the invasion through the Harlequin Ladybird Survey website, which was launched in 2005 and has since received more than 30 000 online records.

Invasive species are one of the greatest threats to global biodiversity. Using data from the Harlequin Ladybird Survey, scientists have a unique opportunity to study the early establishment, spread and adaptation of an invasive species.

The research team are now exploring how the few native enemies of the harlequin ladybird that do exist could be used to control the invasion. One idea is to use a sexually transmitted mite, which makes some ladybirds infertile. If the transmission of these mites could be encouraged, the harlequin ladybird population could be reduced.

(a) What is meant by the term **biological control** (line 9)?

(2)

(b) Using the passage and your own knowledge, give **two** different ways in which the harlequin ladybird could affect native species.

(2)

1

2

(c) Suggest what is meant by the term **global biodiversity** (line 20).

(2)

(d) State why the harlequin ladybird was deliberately introduced into the United States (line 8).

(1)

(e) Suggest **two** possible ways that the harlequin ladybird may have reached Britain.

(2)

(f) Explain why the harlequin ladybird may not be welcomed by farmers.

(2)

.....

.....

.....

.....

(g) Explain the benefits of involving the public in monitoring the spread of the harlequin ladybird.

(2)

.....

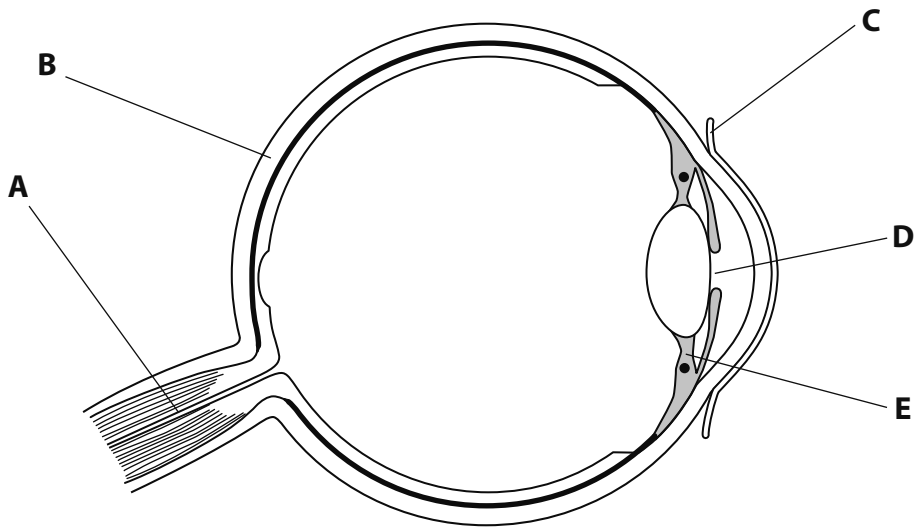
.....

.....

.....

(Total for Question 1 = 13 marks)

2 The diagram shows a section through the human eye with different parts labelled **A** to **E**.



(a) The table describes the function of some parts of the eye.

Complete the table by writing the correct label letter in the box provided. The first one has been done for you.

(2)

Description of function	Label letter
protects the surface of the eye	**C**
changes diameter in response to light intensity	
sends nerve impulses to the brain	

(b) Describe how the different structures in the eye bring about changes that allow a person to see an object held near to the eye clearly.

(3)

(c) The cornea is transparent and does not contain any blood vessels.

How do the cells in the cornea obtain the oxygen they need?

(2)

.....

.....

.....

.....

(d) The passage describes a reflex action involving the eye.

Use suitable words to complete the sentences in the passage.

(4)

John blinked when he saw an object approaching his eye. This reflex action protected his eye from being damaged.

Receptor cells in the light sensitive part of his eye called the ..... detected the object. Nerve impulses were then sent to the central nervous system. The message then passed across a tiny gap called a ..... to another neurone called the ..... neurone.

Eventually the impulse passed along a motor neurone to effector cells called ..... . These cells contracted to make him blink.

(Total for Question 2 = 11 marks)

3 *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are two organisms that can be used to make yoghurt.

Milk is pasteurised by heating to 95 °C for 20 minutes. The milk is cooled to 43 °C and then the organisms are added. The mixture is incubated at a temperature of 43 °C for 4 to 6 hours. During incubation, lactose is converted into lactic acid and other substances that add flavour. Once the yoghurt is made it is cooled and kept at 5 °C.

The table shows the concentration of lactic acid produced when these organisms are used on their own or used together.

Incubation time in hours	**Lactic acid concentration in arbitrary units**		
	***Lactobacillus* alone**	***Streptococcus* alone**	***Lactobacillus* and *Streptococcus***
0	24	24	24
2	26	30	50
4	28	50	84
6	36	62	100
8	50	70	140

(a) (i) Name the group of organisms that *Lactobacillus* belong to.

(1)

.....

(ii) Give **two** structural features that are characteristic of this group.

(2)

1 .....

2 .....

(b) Using data in the table, suggest how best to use these organisms to make yoghurt.

(2)

.....

.....

.....

.....

.....

.....

(c) Calculate the percentage increase in lactic acid concentration in yoghurt over eight hours when *Streptococcus* is used alone. Show your working.

(2)

Answer ..... %

(d) Suggest **one** variable that needs to be controlled so that a valid comparison can be made between the concentrations of lactic acid produced when the organisms are used alone or when used together.

(1)

.....

.....

(e) Different temperatures are used in different parts of the yoghurt-making process. The table explains why two of these temperatures are used.

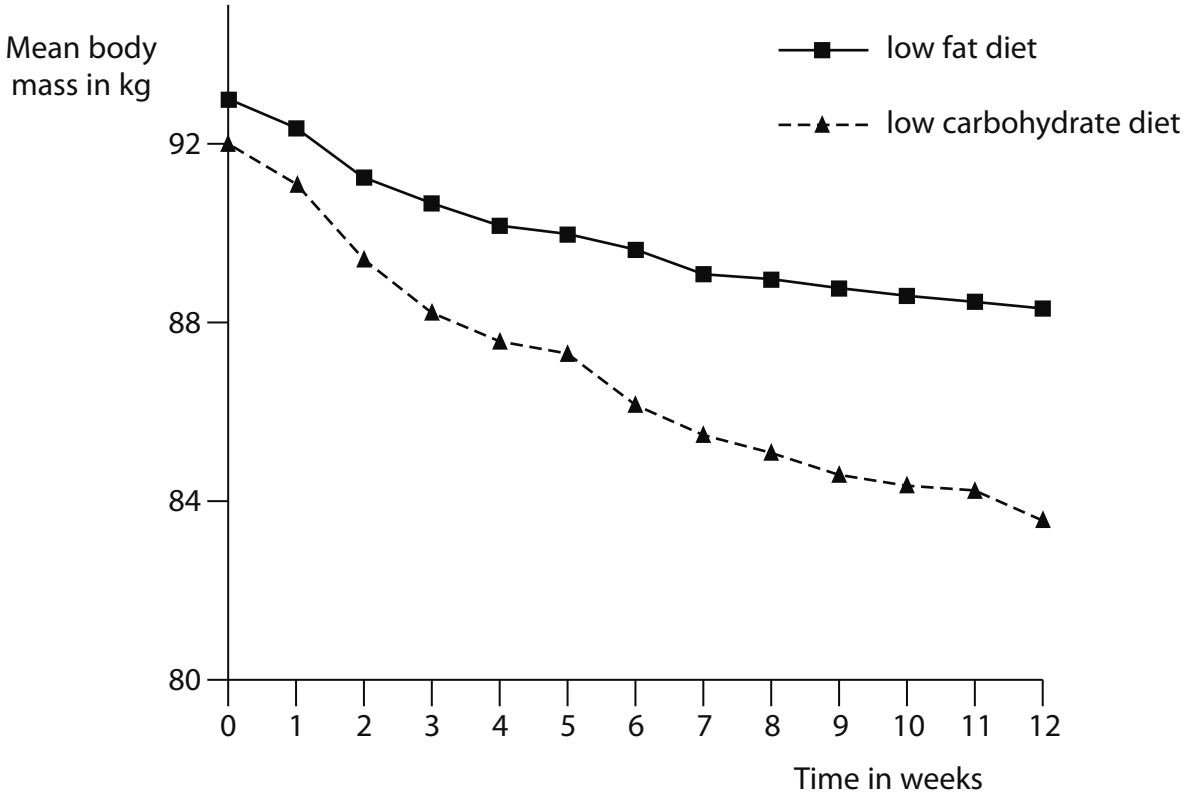
Complete the table by writing the correct temperature next to the correct explanation.

(2)

Explanation	Temperature in °C
optimum temperature for enzymes	
reduces growth of living organisms	

(Total for Question 3 = 10 marks)

4 Scientists in the United States carried out a study to compare the effects of two different diets on body mass in two groups of healthy women. One group followed a low fat diet and the other group followed a low carbohydrate diet.



(a) (i) For the low carbohydrate group, calculate the rate of mass loss in kg per week for the weeks 0 to 12.

(2)

Answer ..... kg per week

(ii) Describe the results shown in the graph.

(3)

(iii) Suggest an explanation for the results shown in the graph.

(2)

(b) For the results of the investigation to be valid it is important that certain variables should be the same for both groups of healthy women.
For example, the women should all be of the same body size.

(i) Explain how different body sizes could affect loss in mass.

(3)

(ii) Suggest **two** other variables that should be the same for both groups of healthy women.

(2)

1 .....

.....

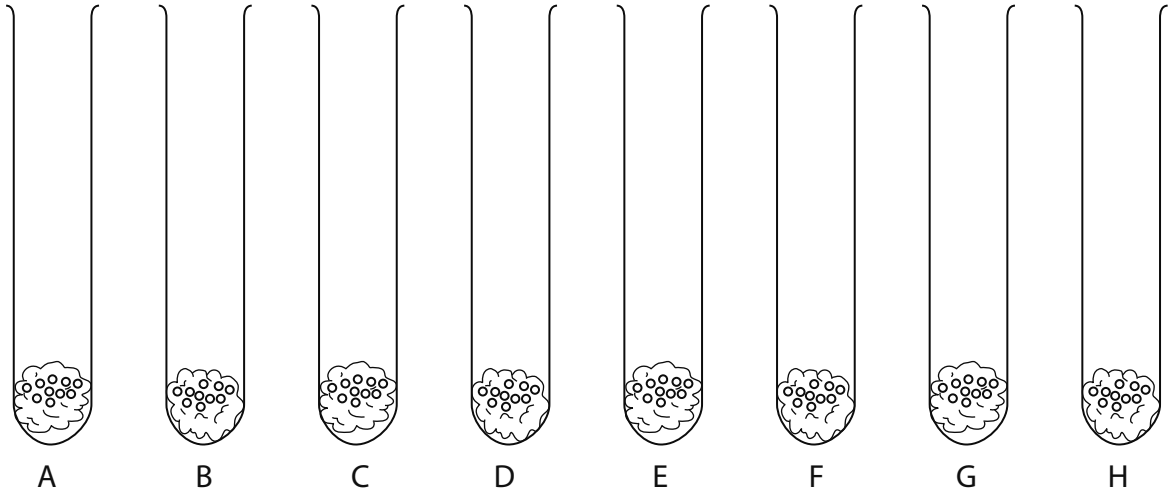
2 .....

.....

(Total for Question 4 = 12 marks)

5 Jagdeep carried out an investigation into the conditions necessary for germination in pea seeds.

She set up 8 tubes with 10 seeds in each tube.



The conditions for each tube are shown below.

- Tubes A and B contained dry cotton wool and were kept at 16 °C.
- Tubes C and D contained wet cotton wool and were kept at 16 °C.
- Tubes E and F contained wet cotton wool and were kept at 4 °C.
- Tubes G and H contained dry cotton wool and were kept at 4 °C.

She left all the tubes for 14 days and recorded the number of seeds that had germinated in each tube.

(a) What would Jagdeep observe to confirm that the seeds had germinated?

(2)

(b) Jagdeep counted the number of seeds that germinated after 14 days in each tube and put her results in a table. However, she put two of her numbers in the wrong places. Her table is shown below.

Tube	Number of seeds germinated
A	1
B	8
C	9
D	2
E	2
F	1
G	0
H	0

Which **two** tubes have the wrong numbers written beside them? Give a biological explanation for your answer.

(3)

(c) After the seeds have germinated the seedlings must be exposed to light or they will not grow well and their leaves will be yellow.

Explain why.

(2)

.....

.....

.....

.....

.....

(Total for Question 5 = 7 marks)

6 To test the quality of water, a sample is collected and kept in a sealed container in the dark. After five days, the biological oxygen demand or BOD is found by measuring how much oxygen in the water has been used up by microorganisms breaking down organic matter.

BOD is measured in mg per dm^3.

(a) Suggest why the sealed samples are kept in the dark.

(2)

.....

.....

.....

.....

(b) Farm waste contains organic matter and, by law, farms are not allowed to release waste that produces a BOD greater than 25 mg of oxygen per dm^3.

The table below gives readings for the BOD in the waste produced by four farms.

Farm	Volume of waste produced per week in dm^3	BOD in mg per dm^3
A	180	28
B	30	20
C	20	115
D	134	76

(i) Which of these farms are breaking the law?

(1)

.....

(ii) Which farm causes the greatest BOD problem?

(1)

.....

(c) Explain the possible effects on a river of releasing waste with a high BOD.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 6 = 7 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Paper 2B

Question number	Answer	Notes	Marks
1 (a)	using one organism / predator to kill another pest organism		2
(b)	competition for food / eq eat / prey on them	ACCEPT resources	2
(c)	number of species in the world		2
(d)	because it eats more pests than native species / eq		1
(e)	Any two from: • flew • brought by winds • carried on crop plants • brought in (with cargo) by transport		max 2
(f)	An explanation linking the following points: • kills beneficial species • which could pollinate flowers	ACCEPT named species e.g. other ladybirds / butterflies	2
(g)	An explanation linking the following points: • increase size of sample / extend data / eq • (therefore) better reliability / eq	ACCEPT increase geographic area of study (therefore) more complete picture / better coverage	2
			Total: 13

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><table><tr><th>Description of function of part</th><th>Label letter</th></tr><tr><td>protects the surface of the eye</td><td>(C)</td></tr><tr><td>changes diameter in response to light intensity</td><td>D</td></tr><tr><td>sends nerve impulses to the brain</td><td>A</td></tr></table></td><td></td><td>2</td></tr>
<tr><td>(b)</td><td>A description including three of the following:
• lens
• more curved / eq
• ciliary muscles contract
• (so) sharp/focused image is presented on retina</td><td>ACCEPT becomes more convex</td><td>max 3</td></tr>
<tr><td>(c)</td><td>diffusion
(from) air / aqueous humour</td><td></td><td>2</td></tr>
<tr><td>(d)</td><td>retina
synapse
relay
muscles</td><td></td><td>4</td></tr>
<tr><td></td><td></td><td></td><td>Total: 11</td></tr>
</table>

<table>
<tr><th colspan="2">Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>3 (a)</td><td>(i)</td><td>bacteria</td><td></td><td>1</td></tr>
<tr><td></td><td>(ii)</td><td>Any two from
• plasmids
• circular chromosome / DNA
• flagellum
• capsule
• slime layer</td><td>ACCEPT no nucleus</td><td>max 2</td></tr>
<tr><td>(b)</td><td></td><td>use both bacteria together

incubate for 8 hours / incubate for longer time</td><td></td><td>2</td></tr>
<tr><td>(c)</td><td></td><td>(70 – 24) ÷ 24 x 100%

= 192(%)</td><td>ALLOW 1 mark for 70 - 24 or 46

ACCEPT 191.7, 191.666 etc</td><td>2</td></tr>
<tr><td>(d)</td><td></td><td>number of bacteria in starter culture / same milk / same initial pH</td><td>ALLOW any other valid variable</td><td>1</td></tr>
<tr><td>(e)</td><td></td><td><table><tr><th>Explanation</th><th>Temperature in °C</th></tr><tr><td>optimum temperature for enzymes</td><td>43</td></tr><tr><td>reduces growth of living organisms</td><td>5</td></tr></table></td><td></td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Total: 10</td></tr>
</table>

Question number	Answer	Notes	Marks
4 (a) (i)	(92 – 83.5) ÷ 12 = 0.71 ACCEPT 0.708 or more figures	ACCEPT 84 or 83 as week 12 figure ACCEPT conseq on week 12 figure	2
(ii)	A description including any three from: • loss in mass with both diets • low carbohydrate falls more than low fat • greatest rate of fall for both between week 1 and 2 / linear fall after 7 weeks in low fat diet • starting mean mass is different / eq • correct manipulation of data		max 3
(iii)	An explanation linking two of the following: • less carbohydrate / less energy available from food • (but) body still requires energy for metabolic processes • (therefore) fat stores respired / broken down to release energy		max 2
(b) (i)	An explanation linking three of the following: • small people have large surface area to volume ratio • (therefore) more heat loss • respiration (to replace heat lost) • maintain body temperature • uses more carbohydrate / fat	ALLOW converse arguments	max 3
(ii)	Any two from: • exercise • state of health • pregnant or not • age	ALLOW any other acceptable variable	max 2
			Total: 12

Question number	Answer	Notes	Marks
5 (a)	Any **two** from: • growth of root / radical • growth of shoot / plumule /cotyledons • testa splitting / eq		max 2
(b)	B and D **AND** B should be lower / same as A B (warm but)too dry / eq **OR** D should be higher / same as C D wet and warm		3
(c)	An explanation linking two of the following: • (light needed for) photosynthesis • (to stop) food reserves running out • to produce chlorophyll		max 2
			Total: 7

Question number	Answer	Notes	Marks
6 (a)	prevent photosynthesis (which produces oxygen)		2
(b) (i)	A, C and D / all except B		1
(ii)	D		1
(c)	An explanation linking three of the following: • bacteria / decomposers increase • (therefore) less oxygen • (and less) respiration • (leading to) death (of plants / animals in river) • eutrophication		max 3
			Total: 7

Further copies of this publication are available from:

Edexcel Publications
Adamsway
Mansfield
Nottingham
NG18 4FN

Tel: 01623 467467

Fax: 01623 450481

Email: Publication.orders@edexcel.com
Intpublication.orders@edexcel.com

For more information on Edexcel and BTEC qualifications
please visit our website: www.edexcel.com

Pearson Education Limited. Registered in England and
Wales No. 872828
Registered Office: Edinburgh Gate, Harlow, Essex CM20 2JE
VAT Reg No GB 278 537121

Publication code UG030030