Write your name here

Surname	Other names

Edexcel GCSE

Centre Number | Candidate Number

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Sample Assessment Material
Time: 1 hour

Paper Reference
5BI2H/01

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.*

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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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Answer ALL questions

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

DNA

1 The two strands of a DNA molecule are linked together by paired bases.

Shutterstock

(a) (i) Draw **one** straight line from each base to its complementary base.

(2)

base	complementary base
	A
A	C
	G
C	T
	U

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The base pairs in a DNA molecule are held together by

(1)

☒ **A** weak hydrogen bonds

☒ **B** strong hydrogen bonds

☒ **C** weak ionic bonds

☒ **D** strong ionic bonds

(b) DNA can be extracted from onion cells.

Explain why it is important to crush the onion cells gently at the start of the process.

(2)

.....

.....

.....

.....

(c) Organisms can be genetically engineered to make them more useful to humans.

Suggest how wheat could be genetically engineered to allow it to grow in wet, marshy land.

(3)

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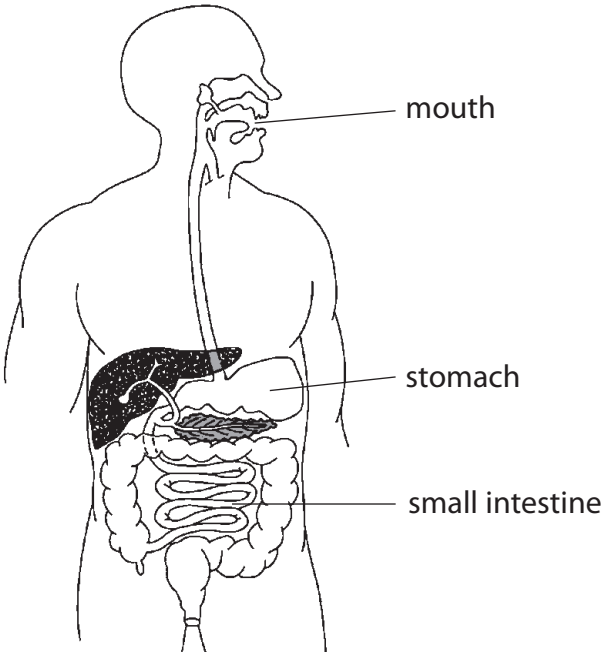
(Total for Question 1 = 8 marks)

The digestive system

2 The diagram shows part of the human digestive system.



(a) Describe how food is moved from the mouth to the stomach.

(2)

.....

.....

.....

.....

(b) Explain the role of the gall bladder in the digestion of fats.

(2)

.....

.....

.....

.....

(c) Celiac disease can destroy the villi that line the small intestine.

Explain how this will affect a person with celiac disease.

(4)

(Total for Question 2 = 8 marks)

The human heart

3 The human heart pumps blood around the body through the circulatory system.

(a) Label the aorta on the diagram above.

(1)

(b) Put a cross (☒) in the box next to your answer.

How many chambers are there in the human heart?

(1)

- ☒ **A** two
- ☒ **B** three
- ☒ **C** four
- ☒ **D** six

(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

Oxygenated blood is pumped by the

(1)

- ☒ **A** left and right atria
- ☒ **B** left and right ventricles
- ☒ **C** left atrium and left ventricle
- ☒ **D** right atrium and right ventricle

(d) What is the role of valves in the heart?

(1)

.....

.....

(e) (i) Cardiac output is the volume of blood pumped by the heart per minute.

Sasha's cardiac output can be calculated by the equation:

cardiac output = heart rate × stroke volume

Calculate the cardiac output for Sasha at rest when her heart rate is 70 beats per minute with a stroke volume of 60 cm^3.

(2)

..... cm^3 per minute

(ii) During exercise, Sasha's heart rate increased.

Suggest the effect of the increased heart rate on her cardiac output.

(2)

.....

.....

.....

.....

(f) Suggest why Sasha's heart rate increased during exercise.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

Plants and carbon dioxide

4 This headline appeared in a newspaper:

> Scientists are worried that the destruction of tropical rainforests will result in much higher levels of carbon dioxide in the atmosphere.

(a) Put a cross (☒) in the box next to your answer.

What process removes carbon dioxide from the atmosphere?

(1)

☒ **A** respiration

☒ **B** transpiration

☒ **C** photosynthesis

☒ **D** osmosis

(b) Suggest why the destruction of rainforests may result in higher levels of carbon dioxide in the atmosphere.

(2)

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.....

(c) Explain one adaptation of a leaf which enables it to carry out gas exchange.

(2)

.....

.....

.....

.....

(d) A cleared rainforest is used to grow crops.

(i) Diego used a half metre quadrat to investigate the number of weeds in a field next to the rainforest.

Each side of the half metre quadrat is half a metre long.

He randomly placed the half metre quadrat and found an average of seven weeds in each quadrat.

The field had dimensions of 100 m by 180 m.

Use the information to calculate an estimate of the number of weeds in the field.

(2)

..... weeds in the field

(ii) Describe how Diego could improve the quality of the data in his investigation.

(3)

.....

.....

.....

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.....

.....

(Total for Question 4 = 10 marks)

Exercise, oxygen and heart rate

5 Pearl is training for the London marathon.

Marathon runners mainly use aerobic respiration.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(a) (i) The products of aerobic respiration are

(1)

☒ **A** carbon dioxide and energy

☒ **B** lactic acid and energy

☒ **C** carbon dioxide and water

☒ **D** water and energy

(ii) Aerobic respiration requires red blood cells.

Explain how **one** structure of red blood cells relates to its function.

(2)

.....

.....

.....

.....

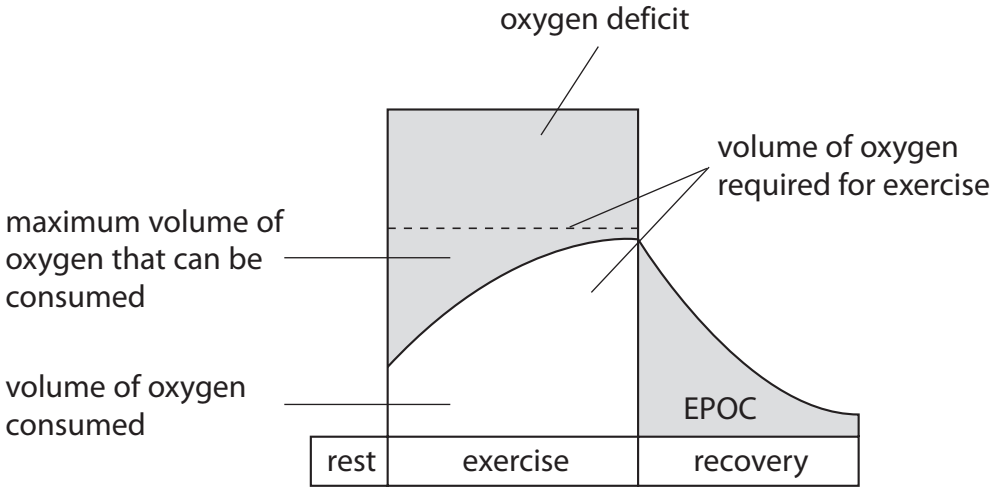
(b) Pearl measures her heart rate during three different types of exercise.

	swimming	cycling	sprinting
before exercise (pulse rate in beats per minute)	69	73	69
after exercise (pulse rate in beats per minute)	98	110	149

Explain why the exercises have different effects on her pulse rate.

(3)

*(c) The diagram shows the volume of oxygen the body consumed during exercise. It also shows the EPOC (excess post-exercise oxygen consumption) during recovery.



Use the diagram to help to explain why these changes in oxygen consumption occur during exercise and recovery.

(6)

(Total for Question 5 = 12 marks)

The pink iguana

6 Iguanas are reptiles that usually have green or yellow skin.
Some iguanas found on the Galapagos Islands have a pink skin.

pink iguana

(a) The colour of the pink iguana is the result of a gene mutation.

Put a cross (☒) in the box next to your answer.

Which of these two statements about gene mutations are true?

1 Gene mutations change the base sequence of DNA
2 Gene mutations are always harmful

(1)

☒ **A** 1 only

☒ **B** 2 only

☒ **C** both 1 and 2

☒ **D** neither 1 nor 2

(b) (i) The change in the DNA sequence that causes the pink skin in iguanas is a result of four amino acids being altered.

How many bases code for four amino acids?

(1)

.....

.....

(ii) DNA analysis suggests that the pink iguanas split from the more common yellow iguana population 5.7 million years ago.

Give one reason why the fossil record has not been able to support this date.

(1)

*(c) Iguanas are reptiles and do not give birth to live young.

Describe the stages in cloning a pink iguana.

You may draw a diagram to help with your answer.

(6)

(d) Discuss the advantages and disadvantages of cloning organisms.

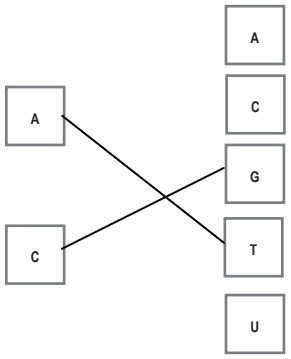
(3)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Unit B2: The Components of Life (Higher Tier)

Question number	Answer	Mark
1(a)(i)	1 mark for each line  	**(2)**

Question number	Answer	Mark
1(a)(ii)	**A**	**(1)**

Question number	Answer	Acceptable answers	Mark
1(b)	an explanation including the following: to release the DNA from the nucleus/ break up the cells (cell walls)/to release the nucleus or nuclear material (1) gently so that the DNA is not broken up (1)	accept to get/to remove genetic material/chromosomes/genes	**(2)**

Question number	Answer	Mark
1(c)	an answer describing the process that includes three of the following: identify gene that allows plant to grow in wet or marshy area (1) extract/cut out the gene with a restriction (endonuclease)/enzyme (1) use vector/agrobacterium/ plasmid/to put desired gene into wheat/crop (1)	**(3)**

TOTAL: 8 MARKS

Question number	Answer	Acceptable answers	Mark
2(a)	a description that includes **two** of the following in a logical order. food moistened with saliva (1) food swallowed (1) peristalsis/muscles behind (bolus of) food contract/muscles in front of (bolus of) food relax (1)	 accept wall of gullet/oesophagus for muscles	 **(2)**

Question number	Answer	Mark
2(b)	a explanation to include the following: production of bile (1) which emulsifies fats (1)	 **(2)**

Question number	Answer	Mark
2(c)	an explanation that links the following: intestinal wall will have a reduced surface area (1) digested food absorbed less efficiently (1) across the intestinal wall into the bloodstream (1) (so) have low energy/slower growth/more likely to show deficiency diseases (1)	 **(4)**

TOTAL: 8 MARKS

Question number	Answer	Mark
3(a)	label clearly to any part of aorta	**(1)**

Question number	Answer	Mark
3(b)	**C**	**(1)**

Question number	Answer	Mark
3(c)	**C**	**(1)**

Question number	Answer	Acceptable answers	Mark
3(d)	stop backflow of blood	stop blood flowing wrong way	**(1)**

Question number	Answer	Mark
3(e)(i)	70 × 60 (1) 4 200 (cm^3 per minute) (1)	**(2)**

Question number	Answer	Mark
3(e)(ii)	an answer including the following: cardiac output would increase (1) if stroke volume increased it would increase by a greater extent/if stroke volume decreased it would increase by a lesser extent (1)	**(2)**

Question number	Answer	Mark
3(f)	an answer linking the following: heart rate increases so blood flows faster (1) due to an increased demand for glucose and oxygen by the cells for respiration (1)	**(2)**

TOTAL: 10 MARKS

Question number	Answer	Mark
4(a)	**C**	**(1)**

Question number	Answer		Mark
4(b)	any **two** from: reduced photosynthesis so less carbon dioxide removed from the atmosphere (1) increased decomposition causing microorganisms to release carbon dioxide by respiration (1) if trees are burned, increased combustion releases carbon dioxide (1)		**(2)**

Question number	Answer	Acceptable answers	Mark
4(c)	an explanation linking the following: guard cells/stomata (become turgid which causes the pore to open) (1) and enable diffusion of CO_2 and O_2 (1) leaf is thin (1) which allows diffusion of CO_2 and O_2 (1)	accept air spaces in the spongy mesophyll (1) allow CO_2 and O_2 to diffuse to and from all cells	**(2)**

Question number	Answer	Acceptable answers	Mark
4(d)(i)	7 × 4 (= number of weeds in 1 m^2) = 28 (1) 28 × 100 × 180 = 504 000/500 000/half a million (weeds on the field) (1)	credit any correct answer for both marks Transferred error possible Most likely TE being 7 × 100 × 180/126 000	**(2)**

Question number	Answer	Acceptable answers	Mark
4(d)(ii)	a description to include **three** of the following: appropriately sized (large) sample (1) measure the perimeter of the area (1) divide area up into equal sized sections (1) use random number generators/tables to select sample areas (1)	Accept belt transect	**(3)**

TOTAL: 10 MARKS

Question number	Answer	Mark
5(a)(i)	**C**	**(1)**

Question number	Answer	Mark
5(a)(ii)	an explanation linking a pair of the following: biconcave disc shape (1) (so) bigger surface area for maximum carriage of oxygen (1) no nucleus (1) (so) contains more haemoglobin for maximum carriage of oxygen (1)	**(2)**

Question number	Answer	Mark
5(b)	an explanation linking the following: (idea that) the higher the impact of the exercise the higher the pulse rate (1) (idea that) higher pulse rate means the heart is beating faster (1) (idea that) because there is an increased energy demand (from aerobic respiration) for the high impact sport (1)	**(3)**

Question number		Indicative content	Mark
***5(c) QWC**		an explanation to include some of the following: • volume of oxygen consumed during exercise increases • because of increased aerobic respiration • an oxygen deficit is built up during exercise • as a result of anaerobic respiration • during exercise breathing rate increases • oxygen absorbed more quickly/more oxygen transported in the bloodstream • aerobic respiration increases until oxygen cannot reach cells any faster • anaerobic respiration starts/increases **as well** as aerobic respiration • lactic acid is produced • which may cause cramp • continue to breathe heavily after race until return to resting rate • EPOC is used to process lactic acid • in liver • EPOC = the oxygen deficit whilst exercising	**(6)**
Level	**0**	No rewardable material	
1	**1-2**	• a limited explanation of the effect of exercise on oxygen consumption • there is some attempt to explain the physiological effects of exercise on oxygen consumption in terms of more oxygen is needed • communicates ideas using simple language and some scientific terminology. Spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a clear but incomplete explanation of the main effects of exercise on oxygen consumption • the response is likely to explain the physiological effects in terms of increased oxygen/aerobic respiration and production of lactic acid, but fails to explain the change in oxygen consumption • communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. Spelling, punctuation and grammar are used with some accuracy	
3	**5-6**	• a clear explanation of the effect of exercise on oxygen consumption, oxygen deficit and EPOC • the response explains the physiological effects in terms of increased oxygen consumption, aerobic and anaerobic respiration and the removal of lactic acid • communicates ideas clearly and uses a range of scientific terminology appropriately. Spelling, punctuation and grammar are used with few errors	

TOTAL: 12 MARKS

Question number	Answer	Mark
6(a)	**A**	**(1)**

Question number	Answer	Acceptable answers	Mark
6(b)(i)	12	accept 4 codons	**(1)**

Question number	Answer	Mark
6(b)(ii)	any one of: • fossil records do not always form • soft tissues/skin/colour are not preserved • many fossils are yet to be found	**(1)**

Question number		Indicative content	Mark
*6(c) QWC		a description to include some of the following: • diploid nucleus is removed from the body cell of a pink iguana/the organism to be cloned • a donor egg is enucleated/its nucleus is removed • the diploid nucleus from the animal being cloned is inserted into the enucleated egg cell • division of the nucleus is stimulated by electric shock/chemicals • cell divides by mitosis • cell is put into surrogate iguana (which creates an egg) • cell divides further and differentiates to form an embryo • organism that hatches from egg is a pink iguana The above points could be made diagrammatically, but a written description is also required.	(6)
Level	**0**	No rewardable material	
1	**1-2**	• limited description of stages involved in cloning a pink iguana • many of the stages will be missing or in incorrect order • the process described is only partially complete and, if applied, would not result in a cloned animal • communicates ideas using simple language and some scientific terminology. Spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a detailed description of some of the stages involved in cloning a pink iguana • some of the stages will be missing or in incorrect order • the process described is mostly complete and, if applied, may result in a cloned animal • communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. Spelling, punctuation and grammar are used with some accuracy	
3	**5-6**	• a detailed description of the stages involved in the cloning of a pink iguana • most or all of the stages will be present and in the correct order • the process described is complete and, if applied, would result in a cloned animal • communicates ideas clearly and uses a range of scientific terminology appropriately. Spelling, punctuation and grammar are used with few errors	

Question number	Answer	Mark
6(d)	a discussion linking **three** of the following points (in order to gain maximum marks at least one advantage and one disadvantage must be discussed): prevents extinction of species (1) may be possible to clone human body parts (1) reduction in the gene pool (1) potential reduced life expectancy (1)	**(3)**

TOTAL: 12 MARKS

