

INTERNATIONAL GCSE

Human Biology (9-1)

SAMPLE ASSESSMENT MATERIALS

Pearson Edexcel International GCSE in Human Biology (4HB1)

For first teaching September 2017

First examination June 2019



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Pearson

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Introduction

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

These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. 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/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked unless the candidate has replaced it with an alternative response.

Subject specific marking guidance

Symbols, terms used in the mark scheme

- Round brackets (): words inside round brackets are to aid understanding of the marking point but are not required to award the point
- Curly brackets { }: indicate the beginning and end of a list of alternatives (separated by obliques), where necessary, to avoid confusion
- Oblique /: words or phrases separated by an oblique are alternatives to each other and either answer should receive full credit.
- ecf: indicates error carried forward which means that a wrong answer given in an early part of a question is used correctly to a later part of a question.

You will not see 'owtte' (or words to that effect). Alternative correct wording should be credited in every answer unless the mark scheme has specified specific.

The Additional Guidance column is used for extra guidance to clarify any points in the mark scheme. It may be used to indicate:

- what will not be accepted for that marking point in which case the phrase 'do not accept' will be alongside the relevant marking point
- it might have examples of possible acceptable answers which will be adjacent to that marking point

Write your name here

Surname	Other names
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Pearson Edexcel International GCSE (9-1)	Centre Number <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div>	Candidate Number <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; display: inline-block; width: 30px; height: 30px;"></div>
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Human Biology

Paper 1

Sample Assessment Material for first teaching September 2017 Time: 1 hour 45 minutes	Paper Reference 4HB1/01
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You must have: Calculator, ruler	Total Marks <div style="border: 1px solid black; width: 100px; height: 40px; margin: 0 auto;"></div>
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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.*
- Calculators may be used.
- 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 ☒.

Information

- The total mark for this paper is 90.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

- 1** Dementia is a term used to describe a set of symptoms linked to different diseases of the brain.

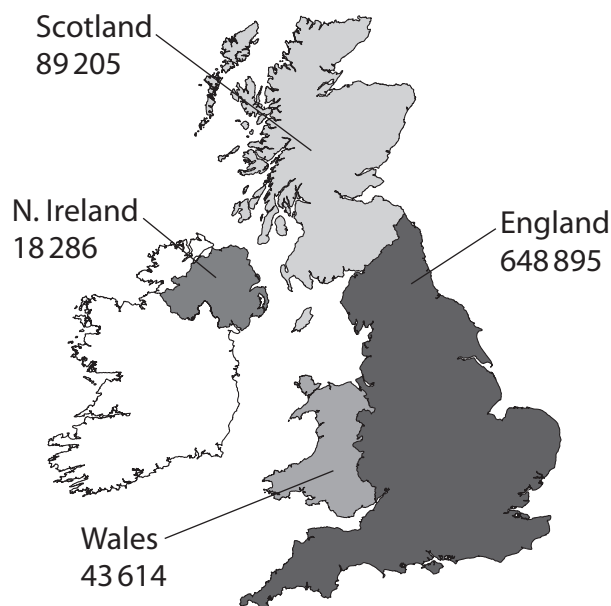
(a) Use information from the box to complete the passage about dementia.

(5)

45	heart disease	Parkinson's	forgetfulness	35
schizophrenia	poor eyesight	65	muscle tremors	stroke
	Alzheimer's	confusion	dizziness	

One disease associated with dementia is It is most common in people over the age of Vascular dementia is another type of dementia that can be caused by The symptoms shown in people affected by vascular dementia include and

- (b) The diagram shows the number of people with dementia in some parts of the UK.



- (i) Describe the distribution of dementia in the UK.
Use the diagram to help you with your answer.

(2)

- (ii) The total number of people with dementia in the UK is 800 000.
The ratio of females to males with dementia is 3:2.
Calculate the number of males with dementia in the UK.

(2)

number of males with dementia =

- (iii) Suggest why the number of cases of dementia is predicted to double by 2050.

(2)

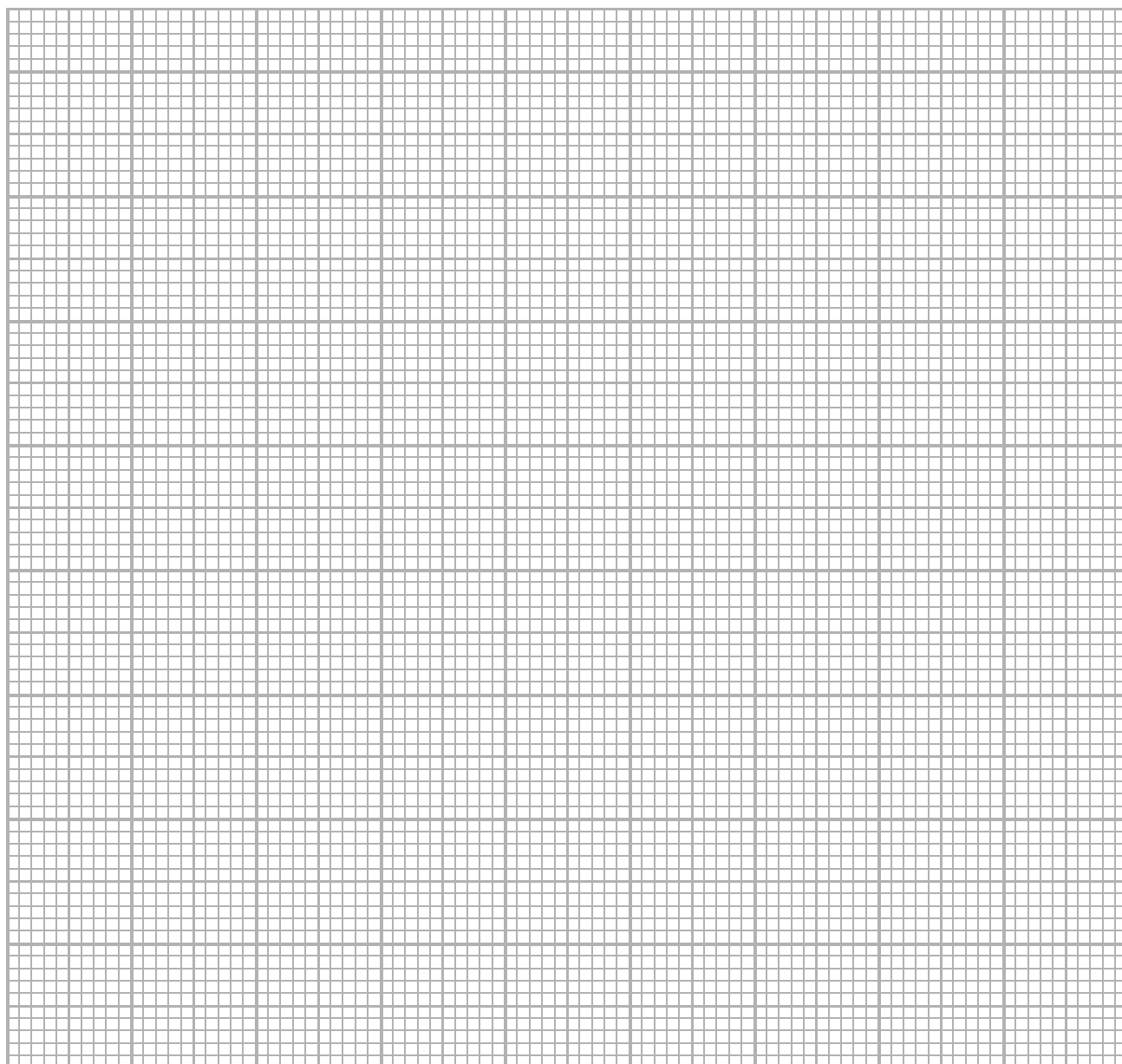
(Total for Question 1 = 11 marks)

- 2 A group of four students investigate their pulse rates at rest and after two minutes of exercise.
The table shows their results.

Student	Pulse rate at rest / bpm	Pulse rate after two minutes of exercise / bpm
1	78	142
2	86	168
3	81	157
4	78	168

- (a) Draw a bar chart to show the pulse rates of each student at rest and after two minutes of exercise.

(4)



(b) Calculate the mean increase in pulse rate after two minutes of exercise.

(2)

mean increase in pulse rate = bpm

(c) Suggest why the value obtained for the mean increase in pulse rate may be unreliable.

(1)

(d) Give **three** possible reasons why the increase in pulse rate after two minutes of exercise is different for each student.

(3)

- 1
- 2
- 3

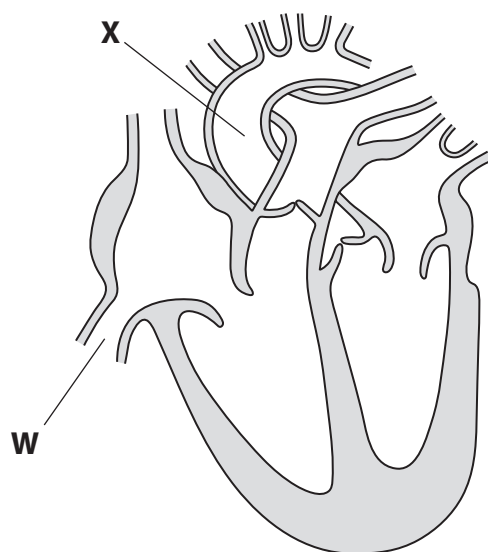
(e) Describe a method that the students could use to measure their pulse rates.

(2)

(Total for Question 2 = 12 marks)

3 Figure 1 shows a human heart.

Figure 1



(a) (i) Which part of the heart pumps blood to the lungs?

(1)

- ☐ A left atrium
- ☐ B left ventricle
- ☐ C right atrium
- ☐ D right ventricle

(ii) Name blood vessels **W** and **X**.

(2)

Blood vessel **W**.....

Blood vessel **X**.....

- (iii) Describe the differences in the composition of the blood carried by blood vessels **W** and **X**.

(2)

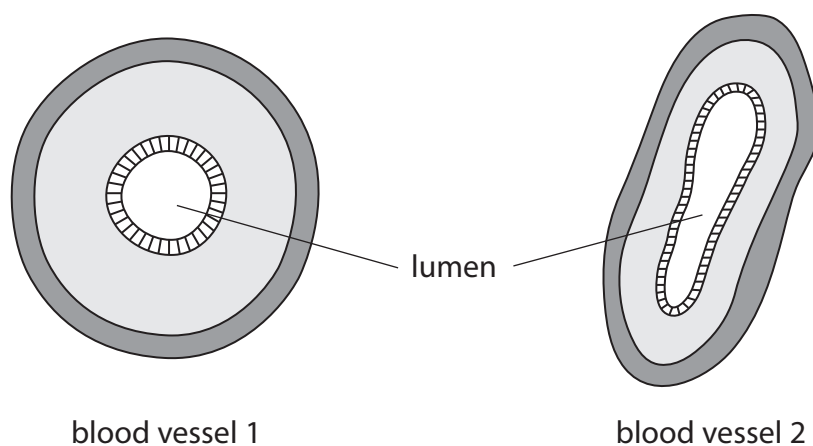
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- (b) The diagram shows two blood vessels that are connected to the heart.



- (i) Give a reason why blood vessel 1 represents **X** in Figure 1.

(1)

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- (ii) The diameter of the lumen in blood vessel 1 is 10 mm. The diagram has been drawn 50 times larger than the actual size of the blood vessel.

Calculate the actual size of the lumen of this blood vessel.
Give your answer in micrometres (μm).

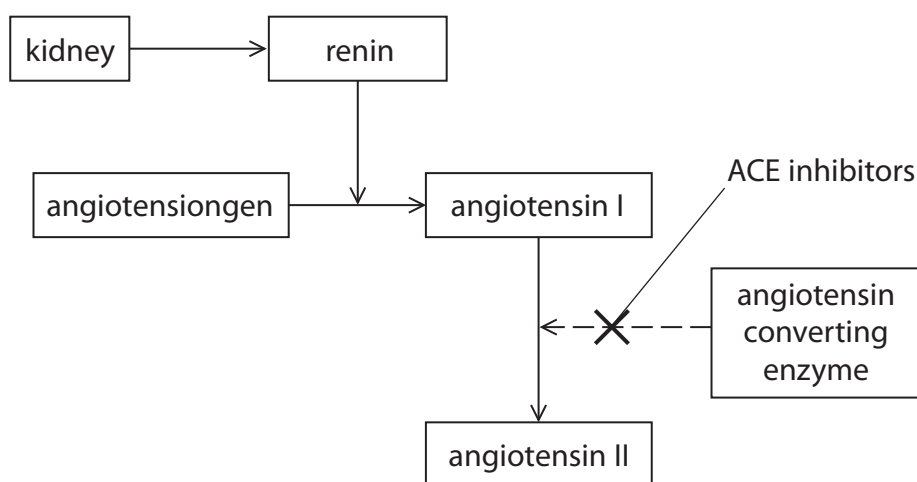
(2)

actual size = μm

- (iii) Explain how the structure of blood vessel 1 is adapted to help the blood flow through the vessel.

(2)

- (c) The diagram shows the interaction of an ACE inhibitor in the renin-angiotensin pathway. This pathway is used by the body to control blood pressure.



- (i) Explain how ACE inhibitors are used in the treatment of high blood pressure. Use the diagram to help with your answer.

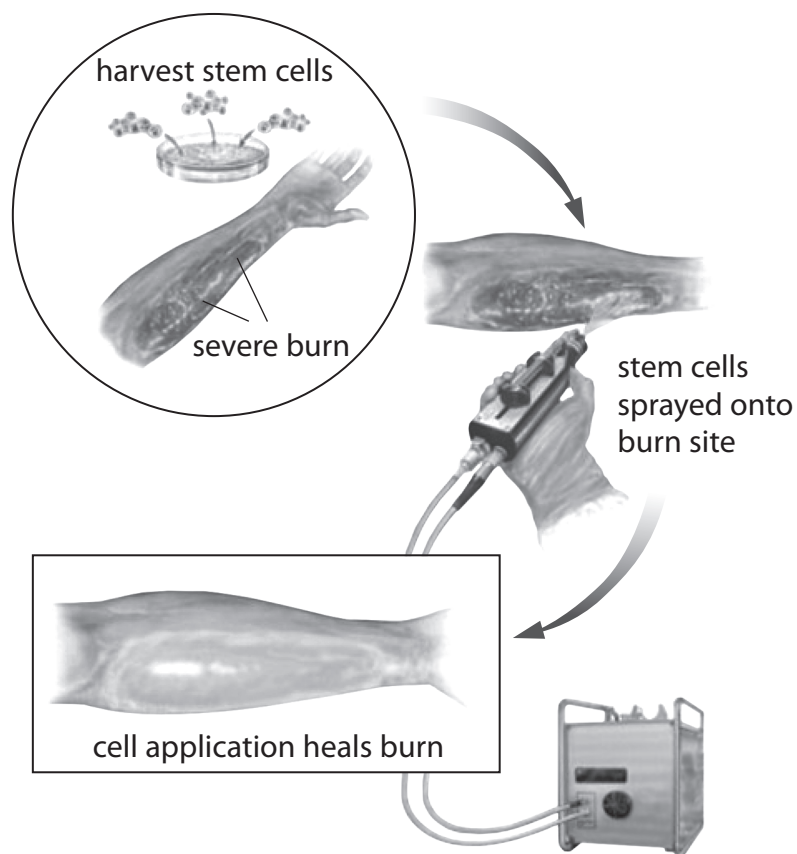
(4)

- (ii) Suggest why it is important that people with high blood pressure take medication to reduce it.

(1)

(Total for Question 3 = 15 marks)

4 The diagram shows a new approach to treating severe burns.



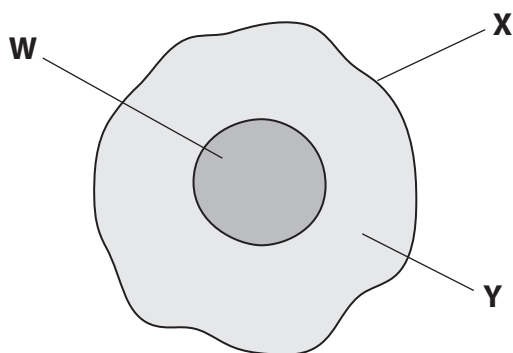
- (a) The stem cells used in this treatment are extracted from the patient's skin.
Name the type of stem cells that are used to treat the burn.

(1)

- (b) Give **one** reason why it is important that stem cells are taken from the patient's own skin and not the skin of a donor.

(1)

(c) The diagram shows a stem cell taken from the skin of the patient.



Name parts **W**, **X** and **Y**.

(3)

W

X

Y

(d) The stem cells used to treat the burn eventually form new skin tissue that heals the wound.

Describe how these stem cells form new skin tissue.

(3)

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- (e) Describe advantages of using this method of treating severe burns instead of growing the patient's skin cells in a petri dish in a laboratory.

(3)

- (f) Give reasons why some people might object to the use of certain types of stem cell in medical research.

(2)

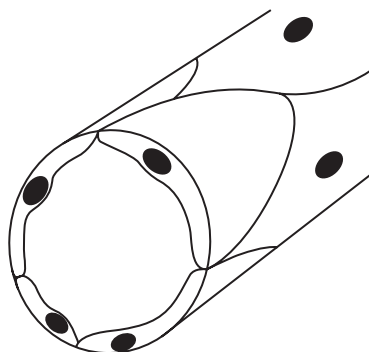
(Total for Question 4 = 13 marks)

- 5 (a) The diagrams show a red blood cell and a blood capillary drawn to the same scale.

red blood cell



blood capillary



- (i) State why only one red blood cell at a time can travel through blood capillaries.

(1)

- (ii) Explain the advantage of only one blood cell at a time travelling through a capillary.

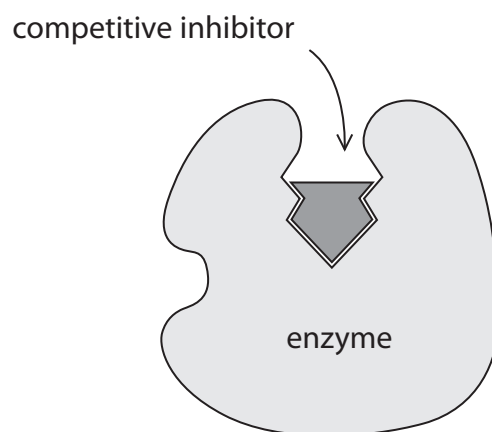
(3)

- (b) Cigarette smoke affects the function of red blood cells.
Explain why the birth weights of babies born to mothers who smoke cigarettes tend to be lower than the mean birth weight.

(3)

(Total for Question 5 = 7 marks)

- 6 (a) The diagram shows how a competitive inhibitor reduces enzyme activity.



- (i) Explain why the competitive inhibitor is able to bind to the enzyme.
Use the diagram to help with your answer.

(3)

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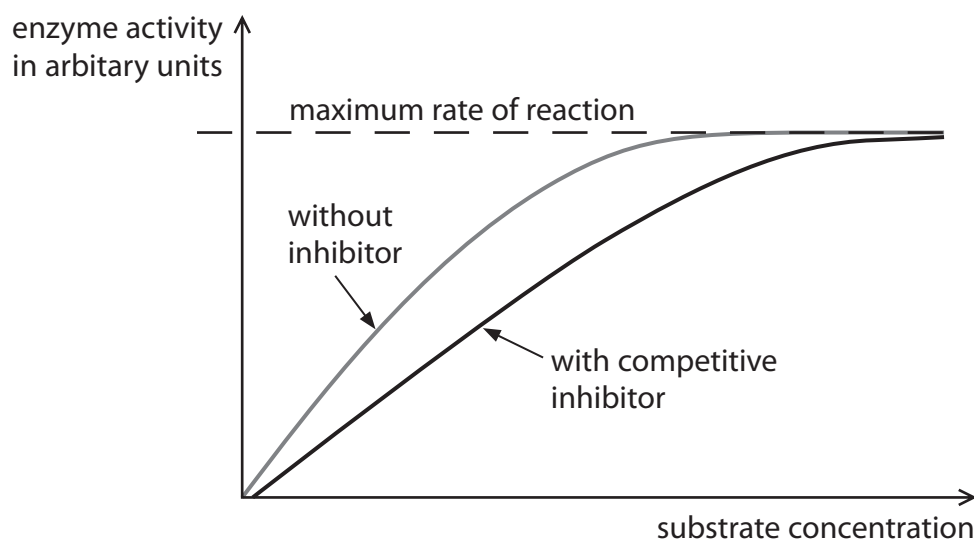
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(ii) The graph shows how a competitive inhibitor affects enzyme activity.



Describe how enzyme activity is affected by the presence of a competitive inhibitor. (2)

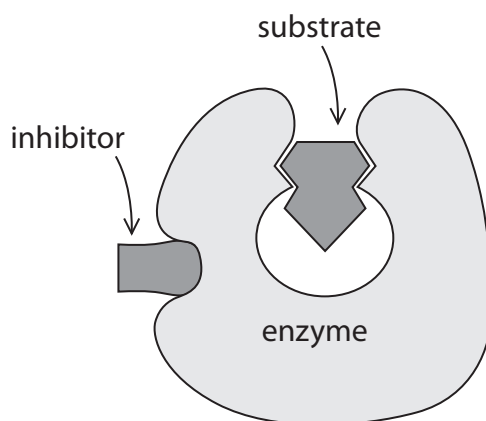
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(b) The diagram shows how another type of inhibitor binds to an enzyme.

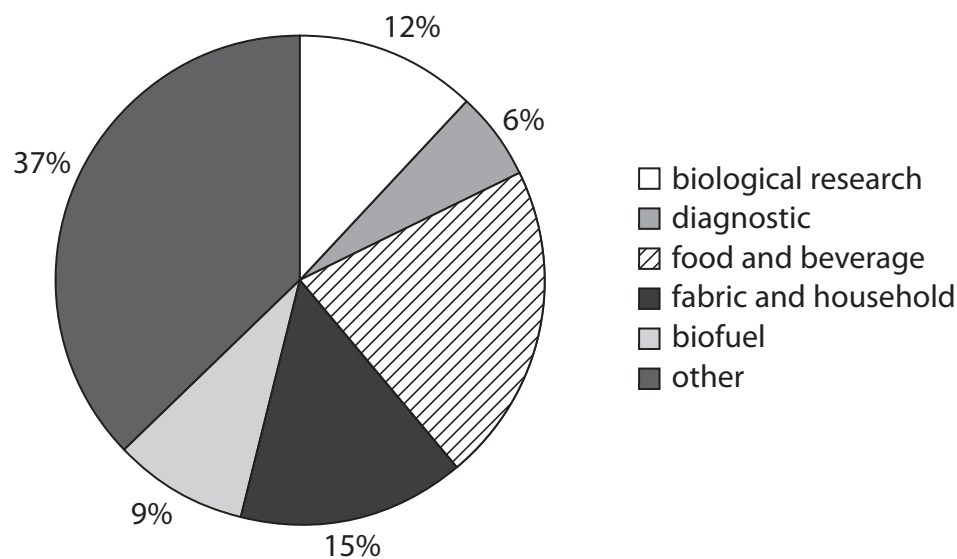


This inhibitor affects the enzyme in different ways to a competitive inhibitor.

Describe these differences.

(3)

(c) The pie chart shows the worldwide industrial uses of immobilised enzymes.



- (i) The total estimated market value of industries that use immobilised enzymes is £3.9 billion (£3 900 000 000).

Calculate the estimated value of immobilised enzymes in the food and beverage industry.

(2)

£ =

(ii) These statements are about the use of immobilised enzymes in the food and beverage industry.

1. Amylase is used to convert lactose to galactose and glucose in the production of lactose-free milk.
2. Glucose and fructose are produced from sucrose in the production of slimming foods.

Which of the statements are correct?

(1)

- ☐ A 1 only
- ☐ B 2 only
- ☐ C Both statements 1 and 2
- ☐ D Neither statement 1 nor statement 2

(d) Describe how immobilised enzymes are used to detect glucose in urine.

(4)

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(Total for Question 6 = 15 marks)

7 The table shows the hearing range of different species of animal.

Species	Lowest frequency hearing / Hz	Highest frequency hearing / Hz
dog	50	46 000
cat	30	50 000
human	20	20 000
frog	100	3000
mouse	1000	100 000

(a) Identify the species with the greatest hearing range.

(1)

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(b) Describe a method to investigate the frequency range audible to humans.

(3)

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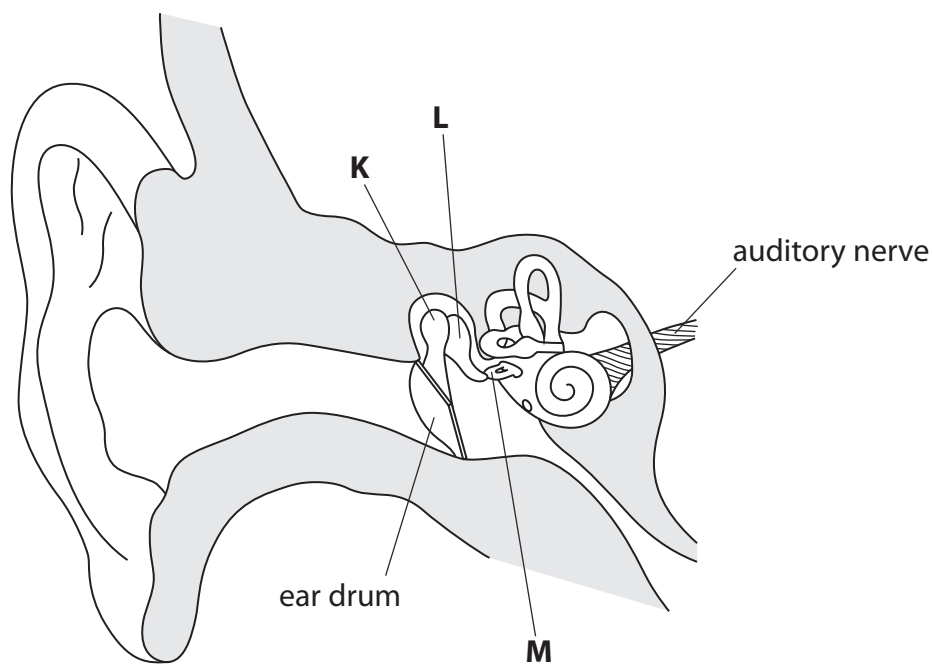
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(c) The diagram shows a human ear.



(i) Name structures **K**, **L** and **M**.

(3)

K

L

M

(ii) Describe the role of structures **K**, **L** and **M** in hearing.

(2)

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.....

(d) The auditory nerve contains sensory neurones.

Draw a diagram of a sensory neurone in the space below.

Add the following labels to the diagram:

- axon
- cell body
- dendron
- myelin sheath.

(5)

(e) Explain how damage to the auditory nerve might affect hearing.

(3)

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(Total for Question 7 = 17 marks)

TOTAL FOR PAPER = 90 MARKS

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Paper 1 (4HB1/01)

Question number	Answer	Mark
1(a)	<p>In the following order:</p> <ul style="list-style-type: none"> Alzheimer's (1) 65 (1) stroke (1) forgetfulness (1) confusion (1) <p>} either order</p>	5

Question number	Answer	Mark
1(b)(i)	<p>A description that makes reference to two of the following points:</p> <ul style="list-style-type: none"> greatest number of people with dementia in England (1) lowest number of people with dementia in Northern Ireland (1) manipulation of data, e.g. 605 208 more people with dementia in England compared to Wales (1) 	2

Question number	Answer	Additional guidance	Mark
1(b)(ii)	<p>Process:</p> <ul style="list-style-type: none"> $800\,000 \times (2 \div 5)$ (1) 320 000 (1) 	allow 2 marks for correct final answer	2

Question number	Answer	Additional guidance	Mark
1(b)(iii)	<p>A suggestion that makes reference to any of two of the following points:</p> <ul style="list-style-type: none"> poor diet (in early life)/high fat diet (1) smoking/reference to atmospheric pollution (1) leading to stroke (1) lack of blood/oxygen to brain (1) people living longer so more chance of it developing (1) 	allow reference to genetic inheritance where greater number of people to pass on genes that predispose to dementia	2

Total for Question 1 = 11 marks

Question number	Answer	Mark
2(a)	<p>A bar chart showing:</p> <ul style="list-style-type: none"> two bars for each student plotted correctly (1) a key to clearly indicate resting pulse and pulse after two minutes of exercise (1) horizontal and vertical axes with labels and units (1) an appropriate scale (1) 	4

Question number	Answer	Additional guidance	Mark
2(b)	<p>Process:</p> $(64 + 82 + 76 + 90) \div 4 (1)$ $= 78 (1)$	allow 2 marks for correct final answer	2

Question number	Answer	Mark
2(c)	A suggestion that makes reference to pulse rate at rest/pulse rate after exercise not repeated or incorrect reading of pulse at rest/following exercise	1

Question number	Answer	Mark
2(d)	<p>Any three of the following possible reasons:</p> <ul style="list-style-type: none"> gender differences (1) differences in body mass (1) reference to health of lungs/heart/fitness of students (1) different exercises carried out (1) 	3

Question number	Answer	Additional guidance	Mark
2(e)	<p>A description that makes reference to any two of the following points:</p> <ul style="list-style-type: none"> place two fingers gently, not thumb (1) on wrist/neck (1) count for 15 seconds (1) 	<p>do not award radial pulse if linked to neck</p> <p>do not award carotid pulse if linked to wrist</p> <p>allow reference to digital pulse meter for first bullet point</p> <p>allow number of pulses within a set timeframe to work out pulse rate per minute</p>	2

Total for Question 2 = 12 marks

Question number	Answer	Mark
3(a)(i)	D	1

Question number	Answer	Mark
3(a)(ii)	W = (inferior) vena cava (1) X = aorta (1)	2

Question number	Answer	Additional guidance	Mark
3(a)(iii)	A description that makes reference to the following two points: <ul style="list-style-type: none"> blood vessel W carries deoxygenated blood (1) and contains more carbon dioxide (1) 	or reverse argument blood vessel X	2

Question number	Answer	Additional guidance	Mark
3(b)(i)	Thicker wall/narrower lumen/elastic muscle tissue	ignore reference to pressure	1

Question number	Answer	Mark
3(b)(ii)	An explanation that makes reference to any two of the following points: <ul style="list-style-type: none"> small lumen so high blood pressure maintained (1) muscular wall that contracts forcing blood forward (1) contains elastic tissue which recoils (1) 	2

Question number	Answer	Additional guidance	Mark
3(b)(iii)	Process: <ul style="list-style-type: none"> $(10 \div 50) = 0.2 \text{ mm}$ (1) $(0.2 \times 1000) = 200 \mu\text{m}$ (1) 	allow 2 marks for correct final answer	2

Question number	Answer	Mark
3(c)(i)	<p>An explanation that makes reference any four of the following points:</p> <ul style="list-style-type: none"> • ACE inhibitor blocks action of angiotensin converting enzyme/ACE (1) • prevents angiotensin I from binding to ACE (1) • angiotensin I not converted to angiotensin II (1) • blood vessels remain dilated/vasodilation/vasoconstriction prevented (1) • production of ADH reduced (1) • less water in blood (1) • lower blood pressure (1) 	4

Question number	Answer	Mark
3(c)(ii)	To reduce the risk of stroke/heart attack/heart disease/kidney failure	1

Total for Question 3 = 15 marks

Question number	Answer	Mark
4(a)	Adult (stem cells)	1

Question number	Answer	Mark
4(b)	No rejection or same tissue type	1

Question number	Answer	Mark
4(c)	W = nucleus (1) X = cell membrane (1) Y = cytoplasm (1)	3

Question number	Answer	Mark
4(d)	A description that makes reference to any of the three following points: <ul style="list-style-type: none"> • (stem cells) differentiate/become specialised (1) • (stem cells) divide (1) • by mitosis (1) • forming genetically identical cells (1) 	3

Question number	Answer	Mark
4(e)	A description that makes reference to any three of the following points: <ul style="list-style-type: none"> • burn/wound healed more quickly (1) • takes less time to treat (1) • chemicals needed to produce tissue (1) • less risk of contamination (1) 	3

Question number	Answer	Mark
4(f)	A description that makes reference to two of the following points: <ul style="list-style-type: none"> • extracting embryonic stem cells (1) • may harm embryos (1) • potential life (1) 	2

Total for Question 4 = 13 marks

Question number	Answer	Mark
5(a)(i)	(red blood cells) are a similar size/diameter as the lumen of the capillary	1

Question number	Answer	Mark
5(a)(ii)	<p>An explanation that makes reference to any three of the following points:</p> <ul style="list-style-type: none"> • more diffusion of oxygen (into cells) (1) • slower flow (of red blood cells) (1) • because more time for diffusion to take place (1) • greater surface area in contact with capillary walls/shorter diffusion distance (1) 	3

Question number	Answer	Mark
5(b)	<p>An explanation that makes reference to any three of the following points:</p> <ul style="list-style-type: none"> • less oxygen transported (to baby) (1) • (due to) presence of carbon monoxide(1) • has a higher affinity for red blood cells than oxygen or binds more strongly to red blood cells or binds irreversibly to red blood cells (1) • forms carboxyhaemoglobin (1) • less aerobic respiration/less energy released (in baby) (1) • less growth (1) 	3

Total for Question 5 = 7 marks

Question number	Answer	Mark
6(a)(i)	<p>An explanation that makes reference to the following linked points:</p> <ul style="list-style-type: none"> • similar/same shape to the substrate (1) • therefore complementary in shape to the enzyme (1) • binds to the active site (1) • enzyme is lock and substrate is the key/according to lock and key hypothesis (1) 	3

Question number	Answer	Mark
6(a)(ii)	<p>A description that makes reference to any two of the following points:</p> <ul style="list-style-type: none"> • lowers activity (of enzyme) (1) • takes longer to reach maximum rate of reaction (1) • no effect at maximum substrate concentration (1) 	2

Question number	Answer	Mark
6(b)	<p>A description that makes reference to any three of the following points:</p> <ul style="list-style-type: none"> • this is non-competitive inhibition (1) • binds at a place on the enzyme other than the active site (1) • changes shape of enzyme/active site (1) • substrate cannot bind to enzyme/active site (1) • irreversible (1) 	3

Question number	Answer	Additional guidance	Mark
6(c)(i)	<p>Process: $(3\,900\,000\,000 \div 100) \times 21$ (1) $= £820\,000\,000$ (1)</p>	<p>award 2 marks for correct final answer</p> <p>allow £819 000 000 for both marks</p>	2

Question number	Answer	Mark
6(c)(ii)	B	1

Question number	Answer	Mark
6(d)	<p>A description that makes reference to the following points:</p> <ul style="list-style-type: none"> • immobilised enzyme bound to cardboard strip (1) • urine passed over strip including the enzyme (1) • glucose binds to immobilised enzyme if present converting it to hydrogen peroxide/gluconic acid (1) • causes a colour change/visible colour to appear (1) 	4

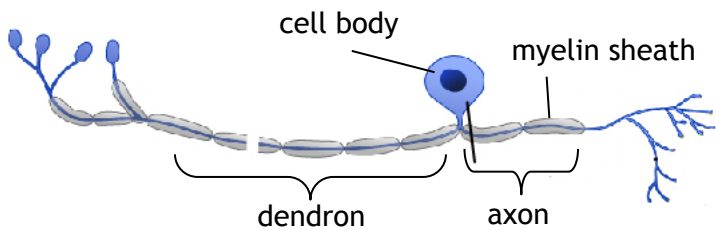
Total for Question 6 = 15 marks

Question number	Answer	Mark
7(a)	Mouse	1

Question number	Answer	Mark
7(b)	<p>A description that makes reference to any three of the following points:</p> <ul style="list-style-type: none"> reference to instrument producing sound (1) at a range of frequencies (1) from low to high pitch (1) indication of when sound can/cannot be heard (1) 	3

Question number	Answer	Additional guidance	Mark
7(c)(i)	<p>K = hammer (1)</p> <p>L = anvil (1)</p> <p>M = stirrup (1)</p>	<p>allow:</p> <p>malleus (1)</p> <p>incus (1)</p> <p>stapes(1)</p>	3

Question number	Answer	Mark
7(c)(ii)	<p>A description that makes reference any two of the following points:</p> <ul style="list-style-type: none"> amplifies sound signals (1) transmit sound/vibrations (1) from eardrum (1) to cochlea/oval window (1) 	2

Question number	Answer	Mark
7(d)	<p>Diagram (1)</p> <p>axon (1)</p> <p>cell body (1)</p> <p>dendron (1)</p> <p>myelin sheath (1)</p> 	5

Question number	Answer	Mark
7(e)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • hearing is reduced (1) • (because) impulse not instigated/information from cochlea not detected (1) • therefore impulses not transmitted (1) • to temporal lobe/auditory cortex (1) • to brain/CNS (1) 	3

Total for Question 7 = 17 marks

TOTAL FOR PAPER = 90 MARKS

Write your name here			
Surname	Other names		
Centre Number		Candidate Number	
Pearson Edexcel International GCSE (9 - 1)		<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
<h1 style="margin: 0;">Human Biology</h1> <h2 style="margin: 0;">Paper 2</h2>			
Sample Assessment Material for first teaching September 2017 Time: 1 hour 45 minutes		Paper Reference 4HB1/02	
You must have: Calculator, 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.*
- Calculators may be used.
- 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 ☒.

Information

- The total mark for this paper is 90.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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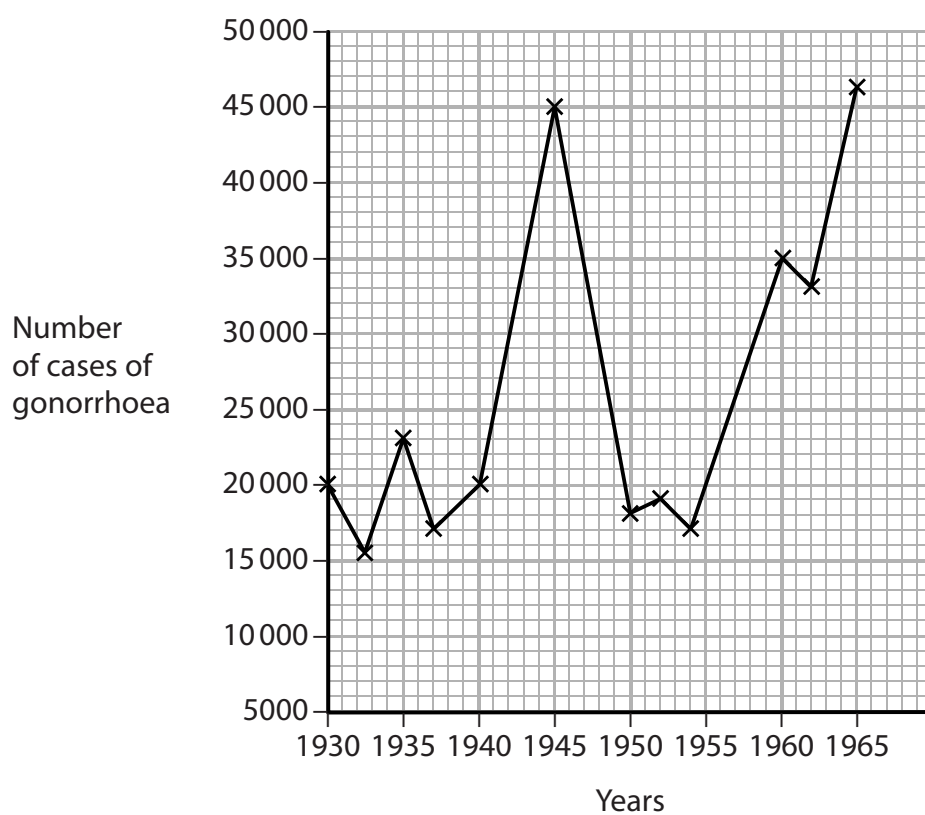
Answer ALL questions. Write your answers in the spaces provided.

- 1** (a) What type of microorganism causes gonorrhoea?

(1)

- ☐ **A** bacterium
- ☐ **B** fungus
- ☐ **C** protozoan
- ☐ **D** virus

- (b) The graph shows the number of cases of gonorrhoea treated in UK clinics between 1930 and 1965.



(i) Find the number of cases of gonorrhoea in 1945.

(1)

number of cases =

(ii) Describe the trend in the number of cases of gonorrhoea between 1954 and 1965.

(2)

.....

.....

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(c) (i) State **two** ways to reduce the chances of catching gonorrhoea.

(2)

1

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2

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(ii) State **one** treatment for gonorrhoea.

(1)

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(d) Explain why oral contraceptives are ineffective in preventing the spread of sexually transmitted diseases.

(2)

(Total for Question 1 = 9 marks)

- 2 Osteoporosis is a disease that affects bones. Bones become weak and can easily be damaged. Once bones are damaged from osteoporosis they are difficult to repair.

One in every three women and one in nine men over the age of 60 in the UK have osteoporosis.

In 1990, data showed that 1.7 million people worldwide fractured their hip bone. 30% of these were men.

Osteoporosis is known as the 'silent disease'.

Taking measures in early life to prevent this condition is more appropriate than treating the condition once it has become established.

- (a) (i) Calculate the total number of men worldwide who fractured their hip bone in 1990. Show your working.

(2)

total number =

- (ii) In 1990, only 25% of people in the UK that fractured their hip bone were men. Suggest **two** possible reasons for the difference in the percentage of men worldwide and the percentage of men in the UK who fractured their hip bone.

(2)

- 1
- 2

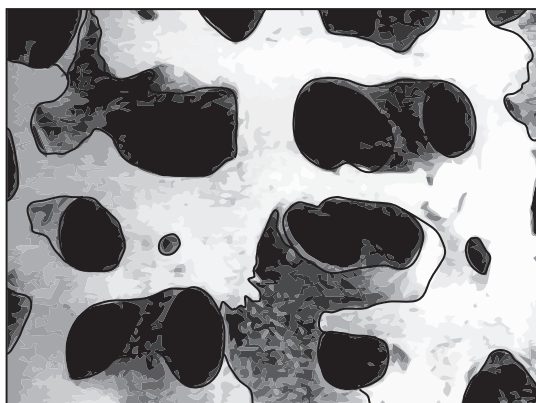
(b) Explain **two** measures that can be taken in early life to prevent osteoporosis.

(4)

1

2

(c) The photographs show the structure of healthy bone and bone that is damaged by osteoporosis.



healthy bone



bone damaged by osteoporosis

- (i) Describe how bone damaged by osteoporosis differs from healthy bone.
Use the photographs to help you with your answer.

(2)

- (ii) Suggest why osteoporosis is known as the 'silent disease'.

(2)

(Total for Question 2 = 12 marks)

- 3 Polydactyly is a genetic condition caused by the presence of a dominant allele. The photograph shows the feet of a person with polydactyly.



(Source: www.fotolia.com)

- (a) State what is meant by the term **dominant allele**.

(2)

(b) A man with polydactyly has a son who has no symptoms of the disorder. The son and his wife produce two children. The first child, a boy, does not have polydactyly. The second child, a girl, is affected by the disorder.

- (i) Draw a family pedigree to show the genotypes of the man, his wife, his son, his son's wife and their children.

Use the symbol D to represent the allele for polydactyly and d to represent the allele for normal hands.

(6)

- (ii) The son and his wife have a third child.
Calculate the probability that this third child will be a boy affected by polydactyly.

(3)

probability =

(Total for Question 3 = 11 marks)

- 4 (a) Two types of nucleic acid are found in cells. These are DNA and RNA.

Describe **three** differences between DNA and RNA.

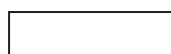
(3)

1

2

3

- (b) The symbols shown can be used to represent the components of nucleotides that join together to make nucleic acid.



base



phosphate



sugar

Draw a section of RNA consisting of two nucleotides using the symbols given.

(3)

(c) A student investigates DNA taken from a human cheek cell. The student finds that 37% of the nucleotides contain adenine.

- (i) Calculate the percentage of nucleotides in the sample that contain guanine. Show your working.

(3)

percentage containing guanine = %

- (ii) The student repeats the investigation twice using a muscle cell and then a red blood cell.

Explain the results that the student should expect for each investigation.

(5)

muscle cell.....

.....

.....

.....

red blood cell.....

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.....

(d) The DNA of rice plants can be modified to produce Golden Rice. Golden Rice has been modified to have high levels of

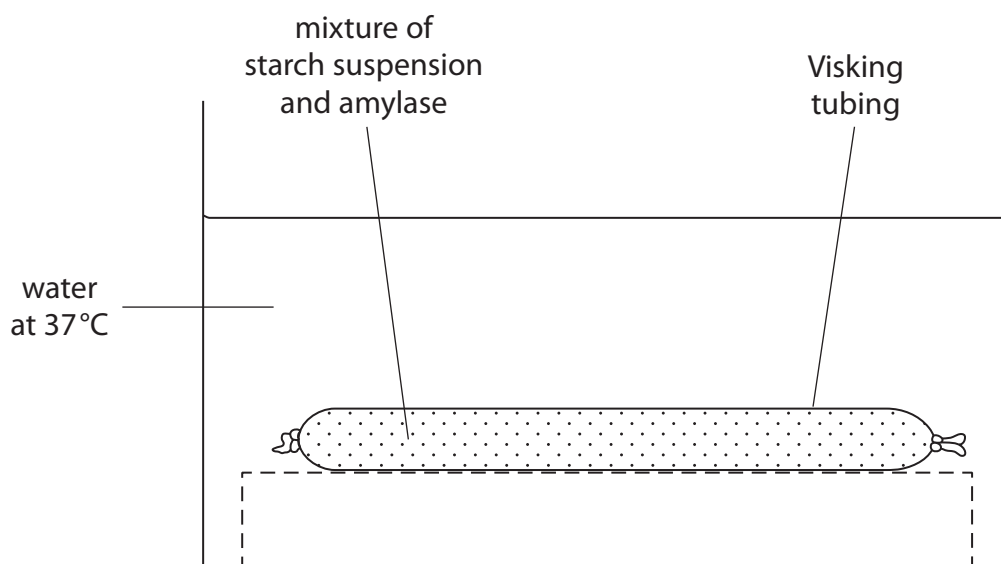
(1)

- ☐ **A** insect resistance
- ☐ **B** iron
- ☐ **C** protein
- ☐ **D** vitamin A

(Total for Question 4 = 15 marks)

- 5 A student carries out an investigation to compare the rates that two different solutions of amylase, P and Q, digest starch.

The student mixes 5 cm³ of starch suspension with 5 cm³ of amylase P solution and pours it into the Visking tubing. This is then placed in a water bath at 37 °C, as shown in the diagram.



The experiment is left for four hours. Every hour, the Visking tubing is removed from the water bath. It is dried, weighed and returned to the water bath.

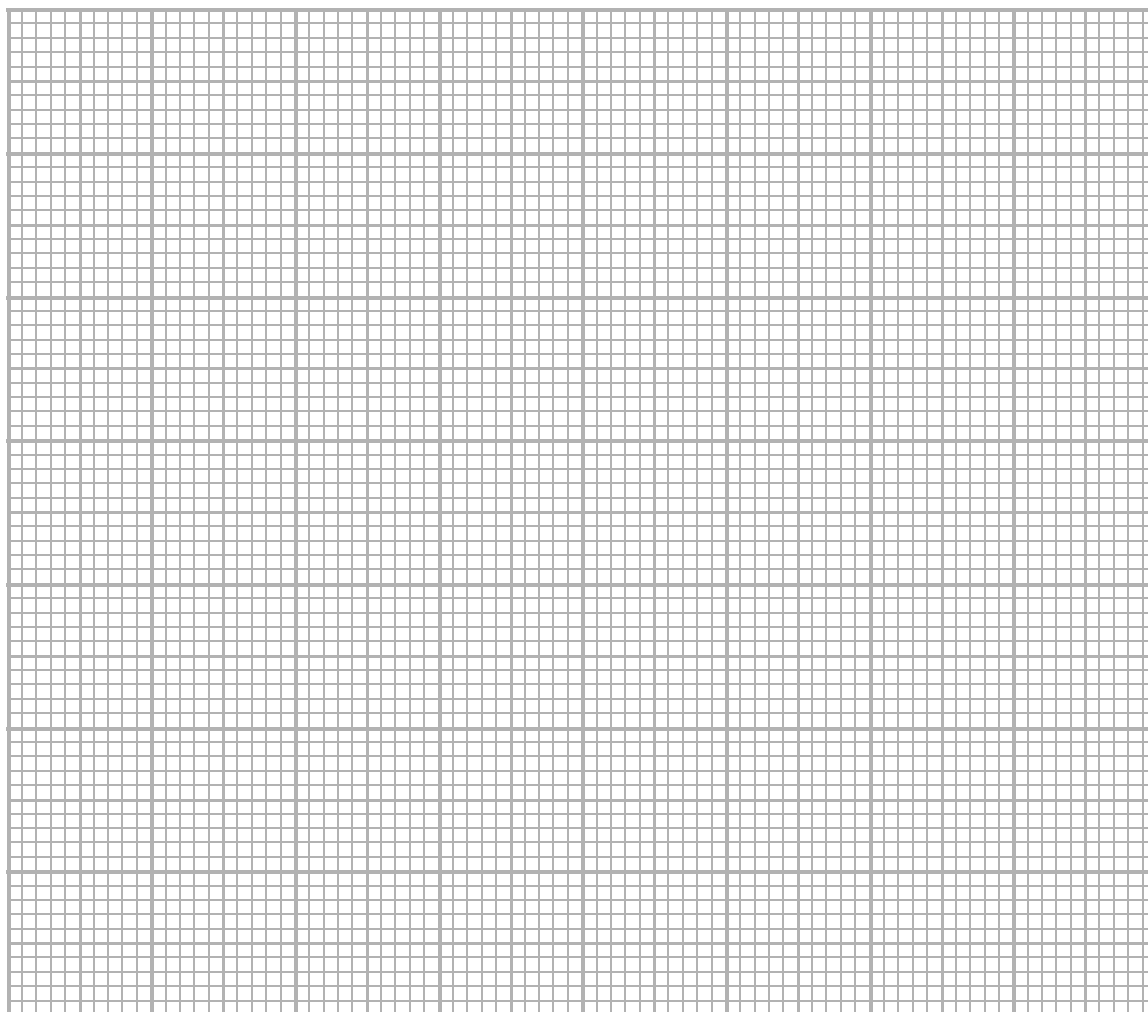
The experiment is repeated, with amylase Q solution instead of amylase P solution.

The table shows the results obtained by the student.

Time / hours	Increase in mass of tubing / g	
	amylase P	amylase Q
0	0.00	0.00
1	0.05	0.20
2	0.10	1.10
3	0.20	1.60
4	0.25	1.80

(a) Plot the results of this investigation joining the points with straight lines.

(5)



(b) (i) Explain why there is an increase in the mass of the Visking tubing during the investigation.

(3)

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(ii) Explain why the rate of increase of mass is lower after 3 hours in both investigations.

(2)

(iii) Two factors that are kept constant in the investigation are the concentration of amylase and the pH of the solution.

Explain why these two factors should be kept constant.

(2)

concentration

pH

(c) State why the tubing is dried before each weighing.

(1)

(d) State **two** places in the body where amylase is produced.

(2)

1

2

(e) Describe a test to detect glucose.

(3)

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(Total for Question 5 = 18 marks)

- 6 Homeostasis in humans involves the deamination of excess amino acids. Deamination includes the removal of nitrogen from the amino acid and the formation of urea.

(a) (i) State what is meant by the term **homeostasis**.

(2)

(ii) State where the process of deamination occurs.

(1)

(b) Describe how a person obtains amino acids for the body to produce new proteins.

(3)

- (c) An investigation is carried out to show the daily amounts of nitrogen-containing compounds excreted in the urine of two people, **A** and **B**.

The two people are on different diets.

The results of the investigation are shown in the table.

Nitrogen-containing compound in urine	Mass excreted / g	
	person A	person B
urea	14.30	2.10
uric acid	0.16	0.08
ammonia	0.50	0.34
creatinine	0.60	0.60

- (i) Explain how the diet of person **A** is different from the diet of person **B**.
Use information in the table to help you with your answer.

(4)

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- (ii) The figures for creatinine do not vary even though the diets of person **A** and person **B** are different.

State why the figures for creatinine do not vary.

(1)

- (d) If certain steroid drugs are taken, the balance of nitrogen-containing compounds in the body changes. This results in less nitrogen-containing compounds being excreted.

Suggest the effect that taking these drugs could have on the body.

(1)

(Total for Question 6 = 12 marks)

- 7 (a) Movement of air in and out of the lungs during breathing is achieved by various volume and pressure changes occurring in the lungs and thorax.

Complete the following passage using the most appropriate words.

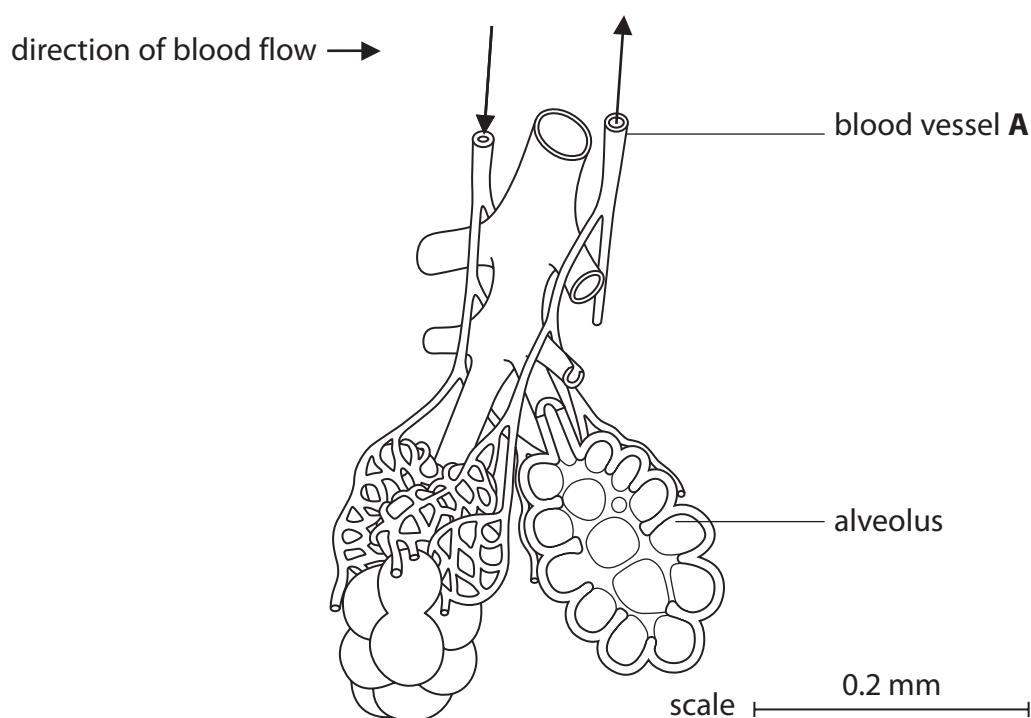
(5)

During the process of breathing in, in the thorax is reduced.

This is brought about by an increase in the of the thorax.

These changes are due to the becoming flat and the ribs moving out and up. This means that the external air pressure is greater. This causes air to travel a pressure gradient. This results in the lungs

- (b) The diagram shows a section through part of a lung.



- (i) Blood vessel **A** labelled on the diagram is the pulmonary vein.

State why blood vessel **A** is the pulmonary vein.

Use information from the diagram to help you with your answer.

(1)

- (ii) Determine the actual thickness of the wall of the alveolus using a ruler and the scale shown on the diagram.
Show the stages in your calculation.

(4)

- (iii) Explain the significance of the thickness of the wall of the alveolus to the efficiency of gas exchange.

(3)

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(Total for Question 7 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

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Paper 2 (4HB1/02)

Question number	Answer	Mark
1(a)	A	1

Question number	Answer	Mark
1(b)(i)	45 000	1

Question number	Answer	Mark
1(b)(ii)	A description that makes reference to any two of the following points: <ul style="list-style-type: none">• large (1)• increase (1)• more than doubled (1)	2

Question number	Answer	Mark
1(c)(i)	One mark for each of the following: <ul style="list-style-type: none">• abstain from/reduce sexual partners (1)• use condom (1)	2

Question number	Answer	Mark
1(c)(ii)	Antibiotics/named antibiotic	1

Question number	Answer	Mark
1(d)	An explanations that makes reference to any two of the following points: <ul style="list-style-type: none">• lack of barrier (1)• allows fluids to mix (1)• fluids contain bacteria/viruses/fungi (1)	2

Total for Question 1 = 9 marks

Question number	Answer	Additional guidance	Mark
2(a)(i)	Process: (30 ÷ 100) × 1.7 million (1) = 510 000 (1)	allow 2 marks for correct final answer	2

Question number	Answer	Mark
2(a)(ii)	Any two possible suggestions from the following: <ul style="list-style-type: none"> different causes/named example/not all because of osteoporosis (1) different diet in UK (1) effective preventative measures in UK (1) 	2

Question number	Answer	Mark
2(b)	Any two linked explanations from the following: <ul style="list-style-type: none"> increase intake of calcium/phosphate (1) as this forms part of compact bone (1) vitamin D supplement (1) helps uptake of calcium salts (1) increase exercise (1) prevents bones becoming weaker (1) 	4

Question number	Answer	Mark
2(c)(i)	A description that makes reference to the following two points: <ul style="list-style-type: none"> bone structure/mass becomes less (1) bone strength reduced (1) 	2

Question number	Answer	Mark
2(c)(ii)	A suggestion that makes reference to any two of the following points: <ul style="list-style-type: none"> bones internal/cannot be seen (1) therefore only become aware when bone breaks (1) unlikely to be noticed/diagnosed until a fracture occurs (1) 	2

Total for Question 2 = 12 marks

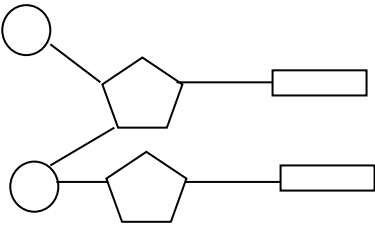
Question number	Answer	Mark
3(a)	<p>A response that makes reference to the following points:</p> <ul style="list-style-type: none"> • form of gene (1) • characteristic (gene) that is expressed (1) 	2

Question number	Answer	Mark
3(b)(i)	<p>man Dd (1)</p> <p>wife Dd/dd (1)</p> <p>son dd and son's wife Dd (1)</p> <p>child 1 (boy) dd and child 2 (girl) Dd (1)</p> <pre> graph TD man --- wife man --- son wife --- son son --- son_wife[son's wife] son --- child1[child 1] son_wife --- child1 son_wife --- child2[child 2] </pre> <p>2 marks for setting out as a family tree (minus 1 for each mistake)</p>	6

Question number	Answer	Additional guidance	Mark
3(b)(ii)	<p>Process:</p> <p>probability of boy = 1 : 1/1 in 2/0.5/50% (1)</p> <p>probability of polydactyly = 1 : 1/1 in 2/0.5/50% (1)</p> <p>probability of boy with polydactyly is 0.5×0.5</p> <p>= 1 : 3/1 in 4/0.25/25% (1)</p>	allow 3 marks for correct final answer	3

Total for Question 3 = 11 marks

Question number	Answer	Mark
4(a)	<p>A description that makes reference to the following points:</p> <ul style="list-style-type: none"> DNA double versus RNA single-stranded (1) DNA contains thymine while RNA contains uracil (1) DNA contains deoxyribose while RNA contains ribose (1) 	3

Question number	Answer	Mark
4(b)	<p>A drawing that includes:</p> <ul style="list-style-type: none"> organic bases attached to correct position on ribose (1) phosphate attached at C3 and C5 (1) 	3

Question number	Answer	Additional guidance	Mark
4(c)(i)	<p>Process:</p> <ul style="list-style-type: none"> 37% must be thymine (1) $100 - (2 \times 37) = 26\%$ must be guanine (G) and cytosine (C) (1) so guanine = $26 \div 2 = 13\%$ of nucleotides (1) 	allow 3 marks for correct final answer	3

Question number	Answer	Mark
4(c)(ii)	<p>An explanation that makes reference to the following points:</p> <p><i>muscle cell</i> adenine 37%/same amount as cheek cell (1) because genetically identical to cheek cell (1)</p> <p><i>red blood cell</i> adenine 0% (1) no nucleus (1) DNA in nucleus/no DNA (1)</p>	5

Question number	Answer	Mark
4(d)	D	1

Total for Question 4 = 15 marks

Question number	Answer	Mark
5(a)	<p>A graph showing:</p> <ul style="list-style-type: none"> vertical axis scale half grid and linear (1) lines drawn connecting points (1) horizontal axis labelled hours and vertical axis labelled grams (1) points plotted correctly (1) key for amylase Q/amylase P (1) 	5

Question number	Answer	Mark
5(b)(i)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> starch digested/broken down to glucose (1) therefore causes water to enter tubing (1) by osmosis (1) 	3

Question number	Answer	Mark
5(b)(ii)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> substrate/starch concentration reduced (1) less for enzymes to digest (1) 	2

Question number	Answer	Mark
5(b)(iii)	<p>An explanation that makes reference to the following points:</p> <p><i>concentration</i> amylase will change the rate of reaction (1)</p> <p><i>pH</i> enzyme activity changes with pH (1)</p>	2

Question number	Answer	Mark
5(c)	To ensure that the mass is not affected by water	1

Question number	Answer	Mark
5(d)	<p>Salivary glands (1)</p> <p>Pancreas (1)</p>	2

Question number	Answer	Mark
5(e)	<p>A description that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • Benedict's test (1) • heat sample (1) • brick red/orange colour shows presence of glucose (1) 	3

Total for Question 5 = 18 marks

Question number	Answer	Mark
6(a)(i)	An answer that makes reference to any two of the following points: <ul style="list-style-type: none"> • maintenance of (1) • a constant internal environment (1) • despite external changes (1) 	2

Question number	Answer	Mark
6(a)(ii)	Liver	1

Question number	Answer	Mark
6(b)	A description that makes reference to any three of the following points: <ul style="list-style-type: none"> • in diet/food as protein (1) • protein is digested (1) • resulting amino acids are absorbed (1) • non-essential amino acids produced by body (1) 	3

Question number	Answer	Mark
6(c)(i)	An explanation that makes reference to the following points: <ul style="list-style-type: none"> • more protein in diet A (1) • therefore more urea in urine (1) • 14.3 g versus 2.1 g (1) • excess amino acids converted to urea then excreted (1) 	4

Question number	Answer	Mark
6(c)(ii)	Does not come from the breakdown of excess amino acids	1

Question number	Answer	Mark
6(d)	Body tissue/muscle increases	1

Total for Question 6 = 12 marks

Question number	Answer	Additional guidance	Mark
7(a)	Reponses in the following order: pressure (1) volume (1) diaphragm (1) down (1) inflating (1)	reject along	5

Question number	Answer	Mark
7(b)(i)	Arrow shows blood is flowing away from lung/alveolus	1

Question number	Answer	Mark
7(b)(ii)	Process: <ul style="list-style-type: none"> width of wall (measured with ruler) is 1 mm (1) scale 18 mm = 0.1 mm (1) actual width = $0.1 \div 18$ (1) 0.0055/0.006 mm (1) 	4

Question number	Answer	Mark
7(b)(iii)	An explanation that makes reference to the following points: <ul style="list-style-type: none"> thin wall (1) therefore short diffusion pathway (1) oxygen/carbon dioxide will pass across in shorter time (1) 	3

Total for Question 7 = 13 marks

TOTAL FOR PAPER = 90 MARKS

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