National
Qualifications
SPECIMEN ONLY

S840/76/02

Human Biology
Section 1 — Questions

Date — Not applicable

Duration — 2 hours 30 minutes

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet S840/76/01.

Record your answers on the answer grid on *page 03* of your question and answer booklet.

You must leave your answer booklet on your desk; if you do not, you could lose all the marks for this paper.

S8407602

Qualifications Scotland
Teisteanasan Alba

SECTION 1 — 20 marks

Attempt ALL questions

1. If 10% of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

A 1:1

B 1:2

C 1:3

D 1:4

2. The following is a list of single gene mutations.

1 Nonsense

2 Missense

3 Frameshift

Which of these gene mutations is the result of a single-nucleotide substitution?

A 1 only

B 3 only

C 1 and 2 only

D 1, 2 and 3

3. Which of the following processes occurs during RNA splicing?

A Introns are added

B Exons are added

C Exons are removed

D Introns are removed

4. Metabolic pathways can be controlled by feedback inhibition where

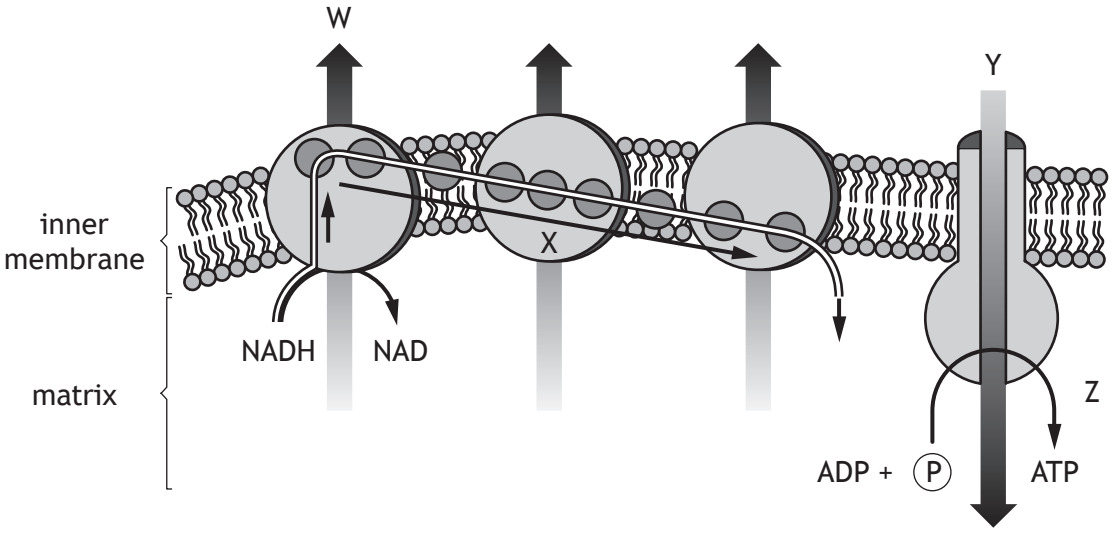
A an end product binds to an enzyme found at the start of the pathway

B an end product binds to an enzyme found at the end of the pathway

C an enzyme binds to a substrate found at the start of the pathway

D an enzyme binds to a substrate found at the end of the pathway.

5. The diagram represents some of the processes that occur at the inner membrane of a mitochondrion.



Which letter represents the flow of hydrogen ions through ATP synthase?

A W
B X
C Y
D Z

6. A function of the interstitial cells in the testes is to produce

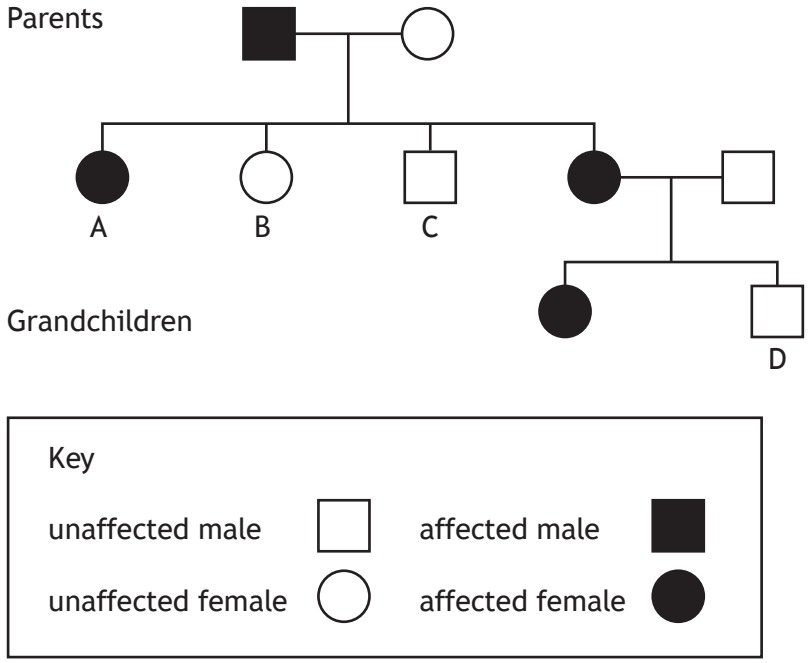
A sperm
B testosterone
C seminal fluid
D follicle stimulating hormone (FSH).

[Turn over

7. A genetic disorder is caused by an autosomal dominant allele.

The diagram shows the inheritance of the disorder through three generations of a family.

Which individual confirms that this disorder is autosomal?



8. Which of the following forms of contraception causes thickening of the cervical mucus?

A Mini-pill

B Barrier methods

C Morning-after pill

D Intra-uterine device

9. During antenatal screening, which two techniques can be used to obtain cells for production of a karyotype?

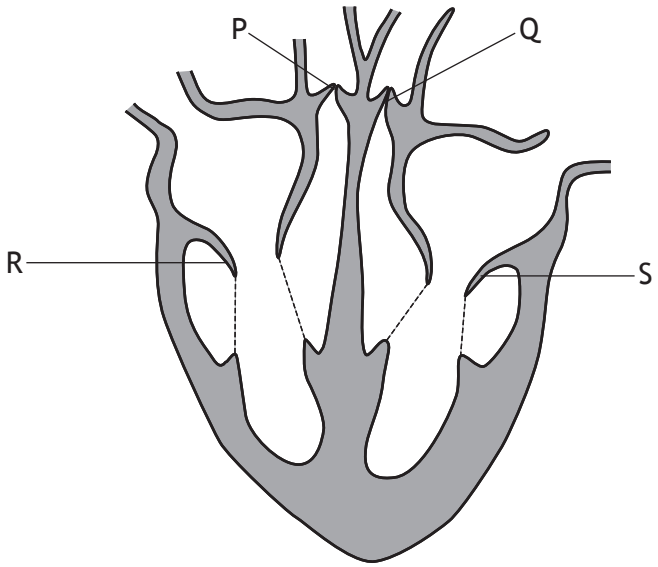
A Chorionic villus sampling (CVS) and amniocentesis

B Amniocentesis and pre-implantation genetic diagnosis (PGD)

C Intra-cytoplasmic sperm injection (ICSI) and chorionic villus sampling (CVS)

D Pre-implantation genetic diagnosis (PGD) and intra-cytoplasmic sperm injection (ICSI)

10. The diagram shows a cross-section of the heart.



Which statement describes the movement of the valves during ventricular systole?

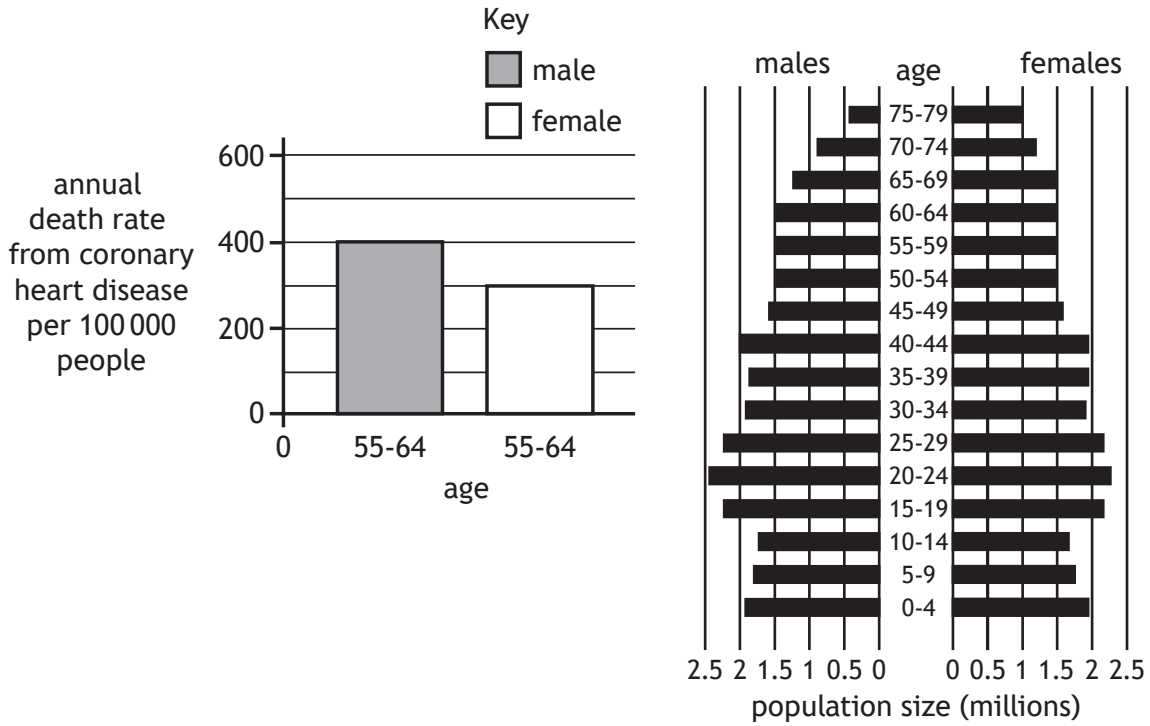
A Valves P and Q open and valves R and S close.
B Valves P and R open and valves Q and S close.
C Valves P and Q close and valves R and S open.
D Valves P and R close and valves Q and S open.

11. Which statement about lipoproteins is correct?

A Low density lipoproteins (LDLs) transport cholesterol from body cells to the heart.
B Low density lipoproteins (LDLs) transport cholesterol from body cells to the liver.
C High density lipoproteins (HDLs) transport cholesterol from body cells to the heart.
D High density lipoproteins (HDLs) transport cholesterol from body cells to the liver.

[Turn over

12. The graphs contain information about the population of Britain.



The number of British women between 55 and 64 years of age who die from coronary heart disease annually is

A 300

B 4500

C 9000

D 12 000.

13. The conversion of information into a form that memory can process is called

A storage

B encoding

C retrieval

D rehearsal.

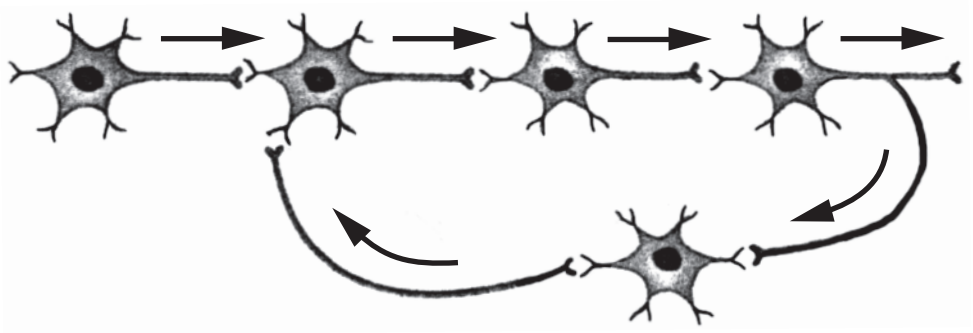
14. By calculating body mass index (BMI), it can be determined whether an individual is obese. The table contains information about four individuals.

Individual	Height (m)	Mass (kg)
1	1.60	90
2	2.10	130
3	1.80	100
4	1.30	56

Which of these individuals would be classified as obese?

A 2 only
B 2 and 3 only
C 1, 3 and 4 only
D 1, 2, 3 and 4

15. The diagram represents a neural pathway.

stimulus  response

The type of pathway shown is a

A sensory neural pathway
B diverging neural pathway
C converging neural pathway
D reverberating neural pathway.

[Turn over

16. Which statement about the action of recreational drugs on brain neurochemistry is correct?

A Desensitisation results from an increase in the number of neurotransmitter receptors due to the use of drugs that are agonists.

B Desensitisation results from an increase in the number of neurotransmitter receptors due to the use of drugs that are antagonists.

C Sensitisation results from an increase in the number of neurotransmitter receptors due to the use of drugs that are agonists.

D Sensitisation results from an increase in the number of neurotransmitter receptors due to the use of drugs that are antagonists.

17. Which of the following is **not** part of the inflammatory response?

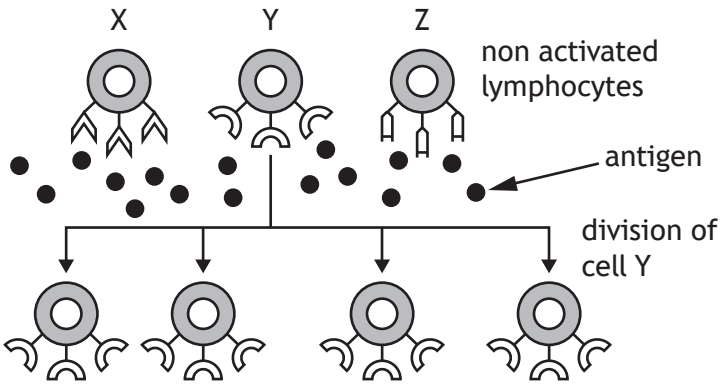
A Vasodilation

B Release of histamine

C Production of antibodies

D Increased capillary permeability

18. The diagram represents the production of a clonal population of lymphocytes.



The division of cell Y is stimulated by

A the presence of lymphocytes X and Z

B the presence of an antigen in the blood

C the binding of antibodies to receptors on the cell membrane

D the binding of antigens to receptors on the cell membrane.

19. Two groups of subjects were used when carrying out clinical trials of a vaccine.

One group was given the vaccine, while the other group was given a placebo.

The purpose of the placebo was to

A reduce experimental error

B ensure a valid comparison

C allow a statistical analysis of the results

D ensure that researchers are unaware who has been vaccinated.

20. The table contains information about the number of influenza cases over five years.

Year	Number of influenza cases in January	Number of influenza cases in July
2001	580	120
2002	620	345
2003	1200	350
2004	120	145
2005	400	100

Which of the following statements is supported by the data?

A There are always more influenza cases in January than in July.

B The number of influenza cases decreased by 75% between January and July of 2005.

C The greatest percentage decrease in influenza cases occurred between January and July of 2003.

D The greatest percentage increase in influenza cases occurred between July 2002 and January 2003.

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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Mark

S840/76/01

Human Biology Section 1 — Answer grid and Section 2

Date — Not applicable

Duration — 2 hours 30 minutes

S8407601

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day Month Year

Scottish candidate number

Total marks — 100

SECTION 1 — 20 marks

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *page 02*.

SECTION 2 — 80 marks

Attempt ALL questions.

You may use a calculator.

Question 8 and question 15 contain a choice.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Do not remove any exam materials. You must leave this booklet on your desk; if you do not, you could lose all the marks for this paper.

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S840760101

SECTION 1 — 20 marks

The questions for Section 1 are contained in the question paper S840/76/02.

Read these and record your answers on the answer grid on *page 03*.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

2. There is **only one correct** answer to each question.

3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample question

The digestive enzyme pepsin is most active in the

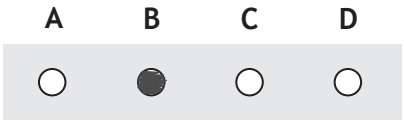
A mouth

B stomach

C duodenum

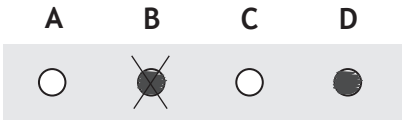
D pancreas.

The correct answer is **B** — stomach. The answer **B** bubble has been clearly filled in (see below).

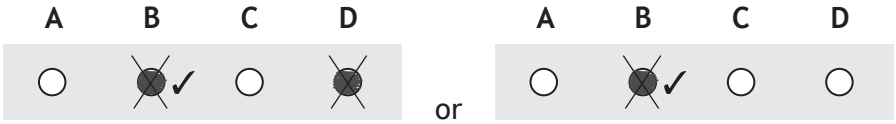


Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:



OBJ20AD1

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

S8407601103

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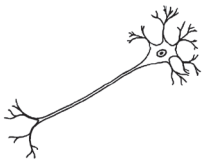
SECTION 2 — 80

Attempt ALL questions

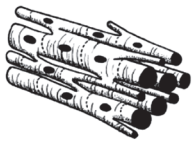
Question 8 and question 15 contains a choice

1. The human body contains many specialised cells, all of which have developed from embryonic stem cells.



nerve cells

liver cells



cardiac muscle cells

(a) Name the process by which a stem cell develops into a specialised body cell and explain how this process occurs. **2**

Process _____

Explanation _____

_____

(b) The nucleus of a germline stem cell divides twice during meiosis.

Describe what happens to chromosomes during each division. **2**

First division _____

_____

Second division _____

_____

(c) A company has developed a drug that could be used to treat the symptoms of an inherited disease. Before proceeding to clinical trials using volunteers, the company decides to carry out additional tests in the laboratory using embryonic stem cells.

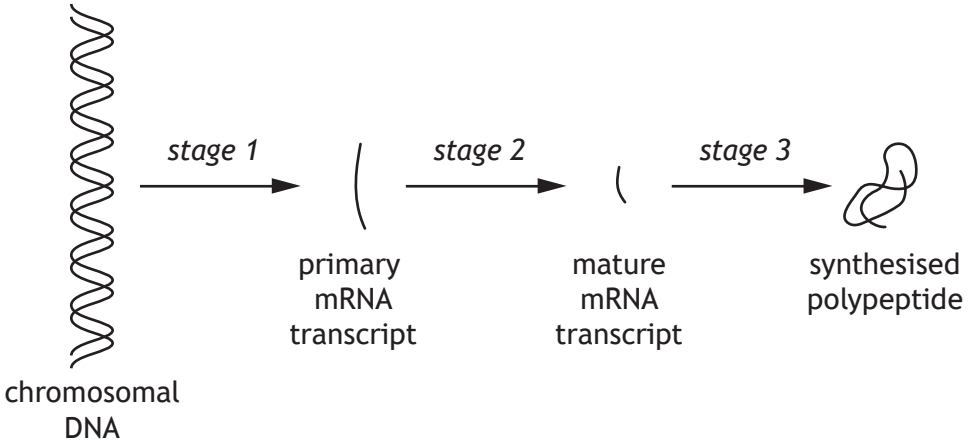
Suggest **one** ethical consideration that might have influenced this decision to use embryonic stem cells. **1**

_____

_____

[Turn over

2. The diagram shows stages in the synthesis of a polypeptide.



(a) Name the enzyme that catalyses stage 1 of this process. **1**

_____

(b) State the exact location within the cell where stage 3 occurs. **1**

_____

(c) (i) Explain why the primary mRNA transcript is so much shorter than chromosomal DNA. **1**

_____

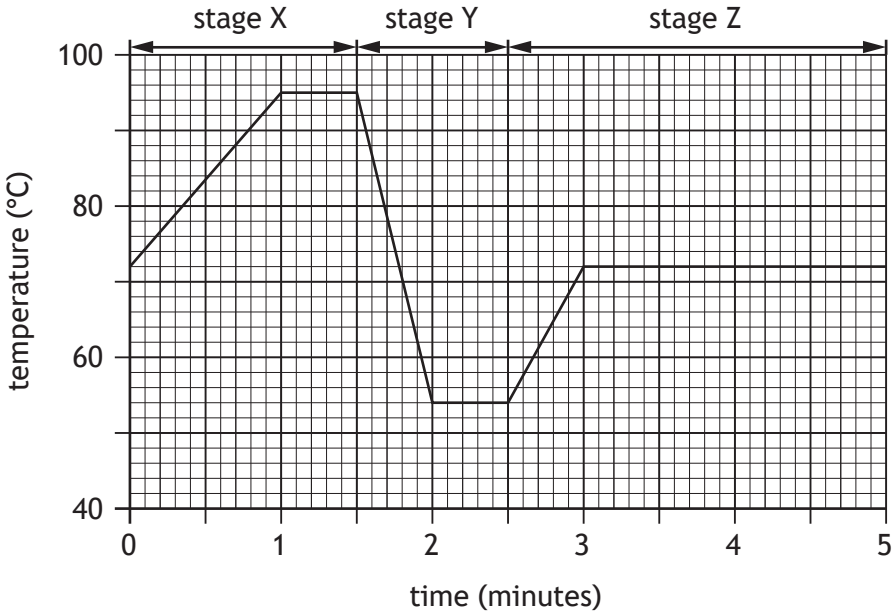
_____

(ii) Explain why the mature mRNA transcript is shorter than the primary mRNA transcript. **1**

_____

_____

3. The graph shows how the temperature of a reaction tube is changed during one cycle of the polymerase chain reaction (PCR).



(a) State the maximum change in temperature that the reaction tube experiences during one cycle of PCR. **1**

_____°C

(b) State the function of PCR. **1**

_____

_____

(c) Describe what happens to the DNA during stage X. **1**

_____

_____

(d) Short sections of DNA called primers are involved in stage Y.

Describe the role of primers in stage Y. **1**

_____

_____

[Turn over

3. (continued)

(e) A forensic scientist discovered a tiny spot of blood at a crime scene.

A sample taken from this spot contained 10 molecules of DNA.

The sample underwent PCR cycles for 30 minutes.

Use data from the graph to calculate how many molecules of DNA would be present after this time. **1**

Space for calculation

_____ molecules

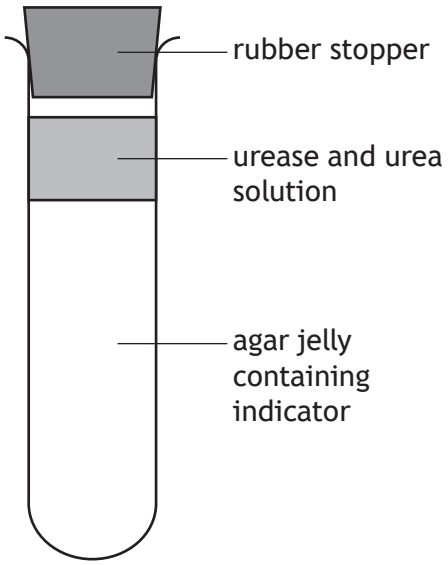
DO NOT WRITE IN THIS MARGIN

4. An experiment was carried out to investigate the effect of substrate concentration on the production of an end-product in an enzyme controlled reaction.

The enzyme urease was used, which breaks down urea into ammonia.

$$\text{urea} \xrightarrow{\text{urease}} \text{ammonia}$$

Urease and urea solutions were mixed together and added to test tubes containing agar jelly as shown in the diagram.



Five different concentrations of urea solution were added.

During the reaction the ammonia produced diffused through the agar jelly, changing the indicator from yellow to blue.

The length of the agar jelly stained blue was measured after the experiment had been allowed to run for 48 hours.

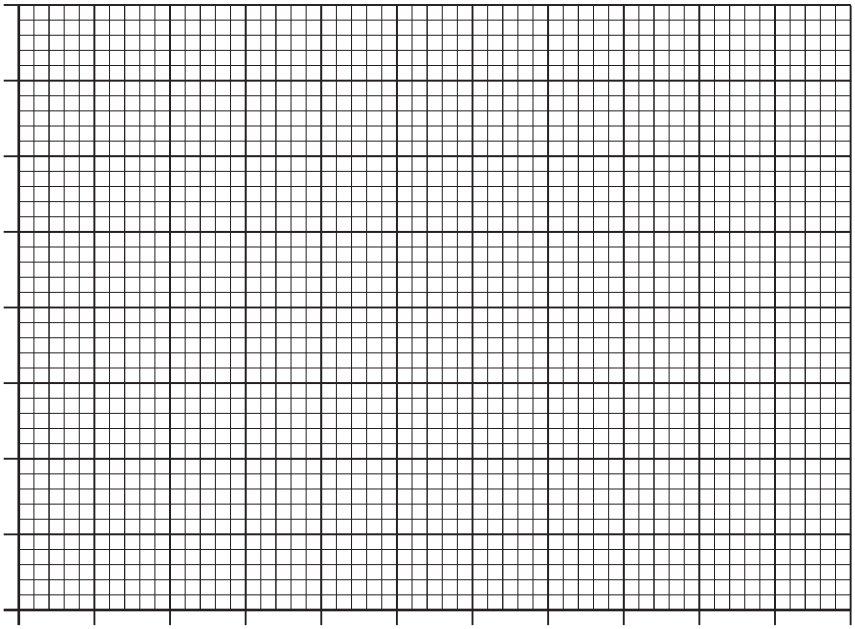
The results of the experiment are shown in the table.

Urea concentration added (moles)	Average length of agar stained blue (mm)
0.03	2
0.06	4
0.13	8
0.25	16
0.50	32

4. (continued)

(a) Draw a line graph to show the results of the experiment. **2**

(Additional graph paper, if required, can be found on *page 27*.)



(b) State **two** variables, not already mentioned, that should be controlled to make the experiment valid. **2**

(c) Give the feature of this experiment that makes the results reliable. **1**

(d) Explain why the test tubes were left for 48 hours before the results were obtained. **1**

4. (continued)

(e) State **one** conclusion that can be drawn from the results of this experiment. **1**

(f) Using the **information in the table**, predict the length of agar jelly that would have been stained blue if a 0.75 molar urea solution had been used in the experiment. **1**

Space for calculation

_____ mm

(g) Thiourea is a competitive inhibitor of urease.

In another experiment, a test tube of agar jelly was set up containing the urease solution, 0.5 molar urea solution and thiourea.

After 48 hours, only 7 mm of agar jelly had turned blue.

(i) Explain why less agar jelly turned blue in this experiment than in the first experiment, which also used a 0.5 molar urea solution. **1**

(ii) Suggest why some agar jelly turned blue in this experiment. **1**

[Turn over

5. The diagram represents the glycolysis stage of respiration in a muscle cell.

glucose —*phase 1*→ intermediate compounds —*phase 2*→ pyruvate

(a) Phase 1 is the energy investment stage of glycolysis while phase 2 is the energy pay-off stage of glycolysis.

Describe what happens during the energy investment and energy pay-off phases of glycolysis. **2**

Energy investment phase _____

_____

Energy pay-off phase _____

_____

(b) Once pyruvate has been formed it can be converted into two different compounds, depending on the conditions.

Name **one** of these compounds and state under what conditions it would be produced. **2**

Name _____

Conditions _____

_____

(c) Most human muscle tissue contains a mixture of fast and slow twitch muscle fibres.

Complete the table to show differences between these two types of muscle fibre. **2**

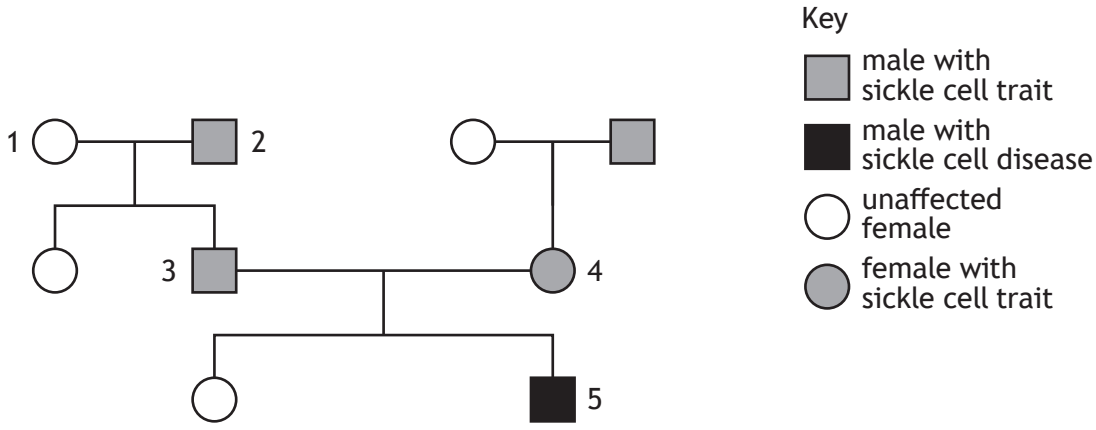
	Fast twitch	**Slow twitch**
Generation of ATP	from glycolysis	
Major storage fuel		fats

6. Sickle cell disease is an autosomal blood disorder in which a faulty form of haemoglobin, called haemoglobin S, is produced. This protein is an inefficient carrier of oxygen.

The allele for normal haemoglobin (H) is incompletely dominant to the allele for haemoglobin S (S).

Heterozygous individuals (HS) suffer from a milder condition called sickle cell trait.

The chart shows the incidence of these conditions in three generations of a family.



(a) State the genotype of individual 5. **1**

_____

(b) Individuals 3 and 4 go on to have a third child.

State the percentage chance that this child will have the same genotype as the parents. **1**

Space for working

_____%

(c) Sickle cell disease is caused by a substitution mutation in the gene that codes for haemoglobin. This mutation results in the protein having an altered shape.

Explain why this mutation leads to sickle cell disease. **1**

_____

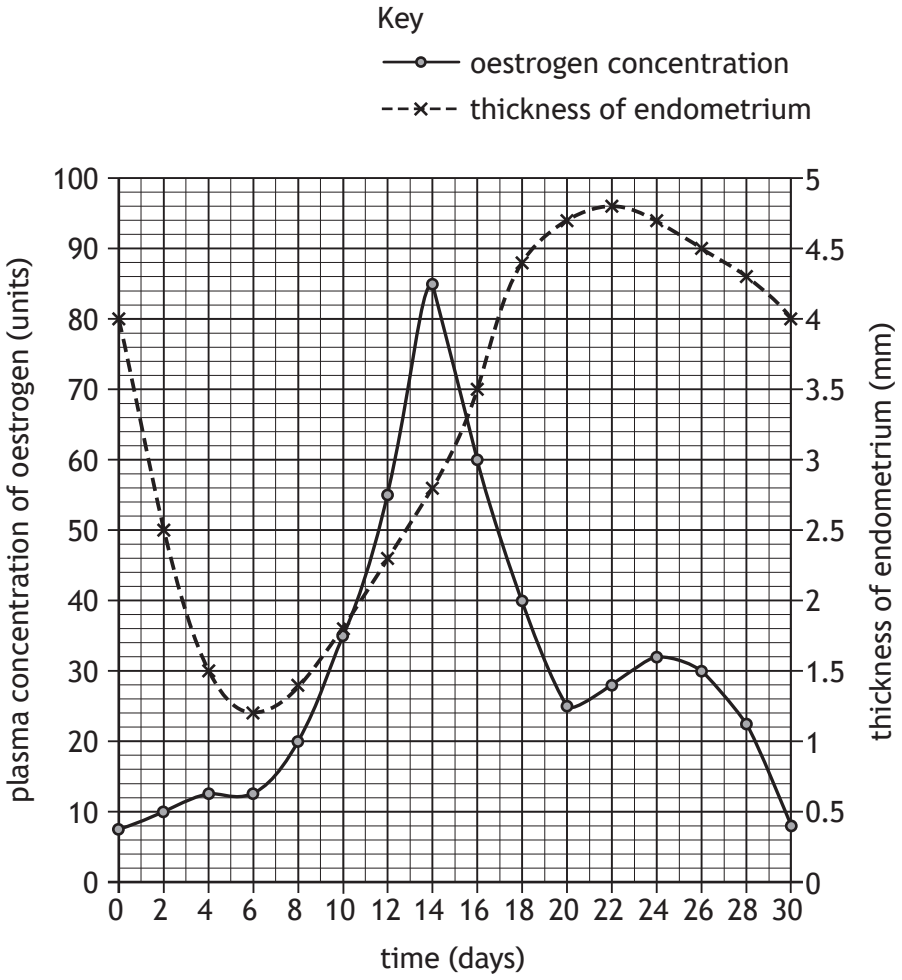
_____

(d) During IVF treatment, it is possible to detect single gene disorders in fertilised eggs before they are implanted into the mother.

Give the term that describes this procedure. **1**

_____

7. The graph shows how the plasma concentration of oestrogen and the thickness of the endometrium vary during a woman's menstrual cycle.



(a) (i) State the plasma concentration of oestrogen on day 12 of this cycle. **1**

_____ units

(ii) Describe how the pituitary gland stimulates the change in the plasma concentration of oestrogen between days 6 and 14. **2**

_____

_____

_____

_____

7. (continued)

(b) Calculate the percentage increase in the thickness of the endometrium between day 6 and day 22. **1**

Space for calculation

_____%

(c) Explain why the thickness of the endometrium decreases after day 22 of this cycle. **1**

_____

_____

(d) Describe **one** way that ovulatory drugs stimulate ovulation. **1**

_____

_____

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

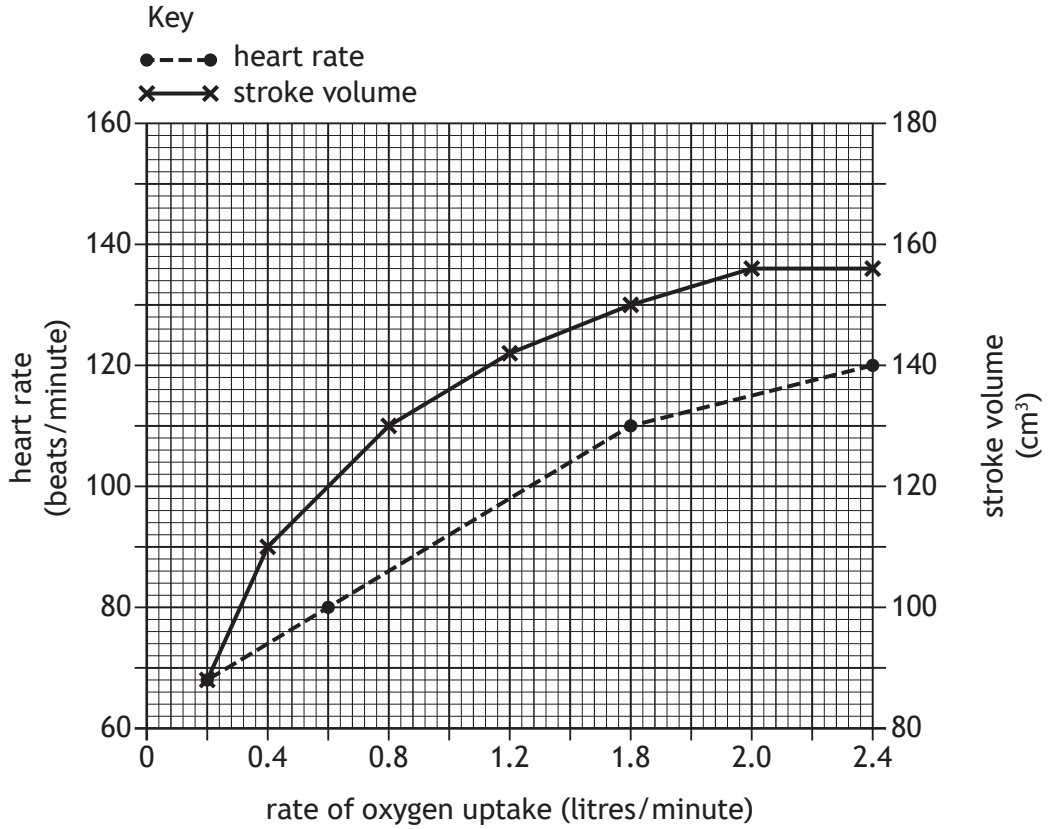
8. Attempt either A or B

A Write notes on the process of atherosclerosis and its effects. **4**

OR

B Write notes on the process of thrombosis. **4**

9. The graph shows how an individual's heart rate and stroke volume changed as their oxygen uptake increased during exercise.



(a) (i) State the individual's heart rate when the rate of oxygen uptake was 1.2 litres/minute. **1**

_____

(ii) Using data from the graph, describe how the stroke volume changed as oxygen uptake increased. **2**

_____

_____

_____

(iii) State the stroke volume when the heart rate was 110 beats per minute. **1**

_____ cm^3

[Turn over

9. (a) (continued)

(iv) Use data from the graph to calculate the simple whole number ratio of heart rate (beats per minute) at 0.8 rate of oxygen uptake (litres/minute) compared to 2.4 rate of oxygen uptake (litres/minute). **1**

Space for calculation

heart rate (beats per minute) : oxygen uptake (litres/minute)

(b) Calculate the cardiac output when the rate of oxygen uptake was 2.4 litres per minute. **1**

Space for calculation

_____ litres/min

(c) (i) When the individual's blood pressure was measured an hour after exercise, a reading of 140/90 mmHg was recorded.

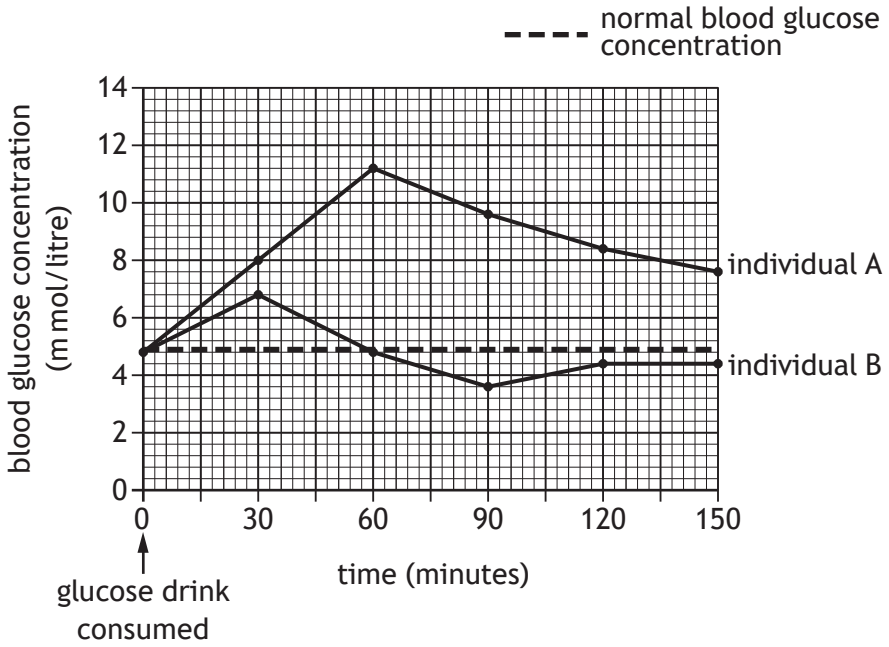
Describe what the **first** figure in a blood pressure reading represents. **1**

(ii) The individual was diagnosed as having high blood pressure.

One of the effects of this was that their ankles regularly swelled up due to a build-up of tissue fluid.

Suggest why there is a link between high blood pressure and the build-up of tissue fluid. **2**

10. The graph shows changes in blood glucose concentration in a diabetic and a non-diabetic individual after each had consumed a glucose drink.

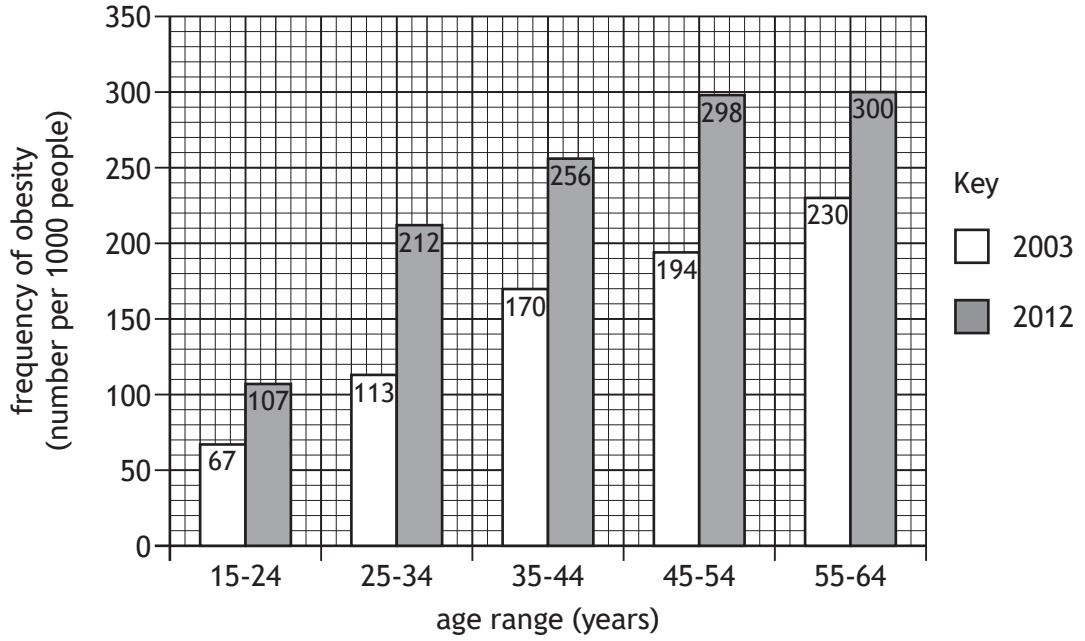


(a) Describe how the graph indicates that individual B is **not** a diabetic. **1**

(b) Describe the role of insulin in the development of type 2 diabetes. **1**

[Turn over

11. The graph shows data on obesity for a European country in 2003 and 2012.



(a) (i) Describe **one** general trend shown in the graph. **1**

_____

_____

(ii) In 2012 the number of people in this country aged 35 to 44 was 6 million.

Calculate how many people aged 35 to 44 were obese. **1**

Space for calculation

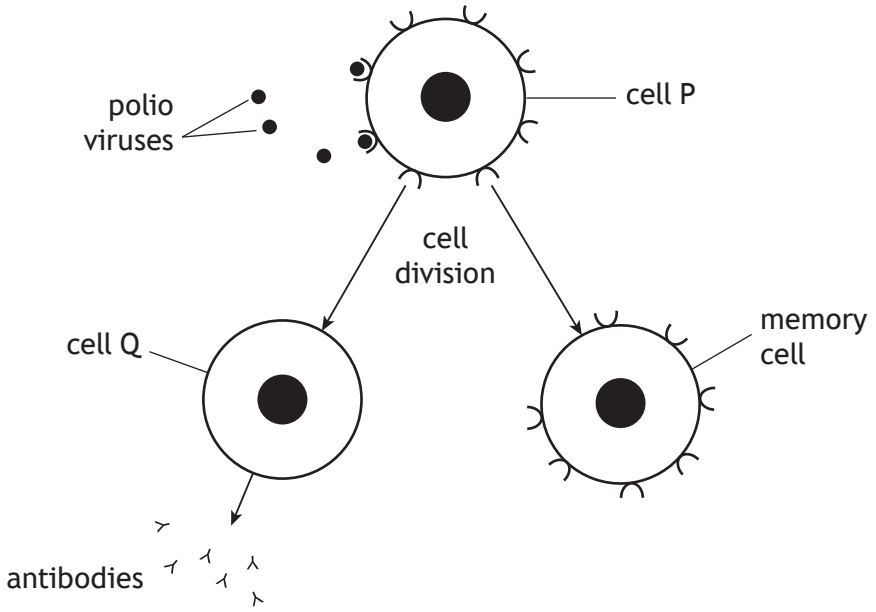
Number of people _____

(b) State **one** piece of advice that an obese individual would be given to adapt their diet or lifestyle in order to avoid long-term health problems. **1**

_____

_____

12. The diagram shows how the immune system responds to polio viruses in a vaccine.



(a) Describe how a polio virus is able to attach to cell P. **1**

(b) Name cell Q. **1**

(c) Describe the role of memory cells in the immune system. **1**

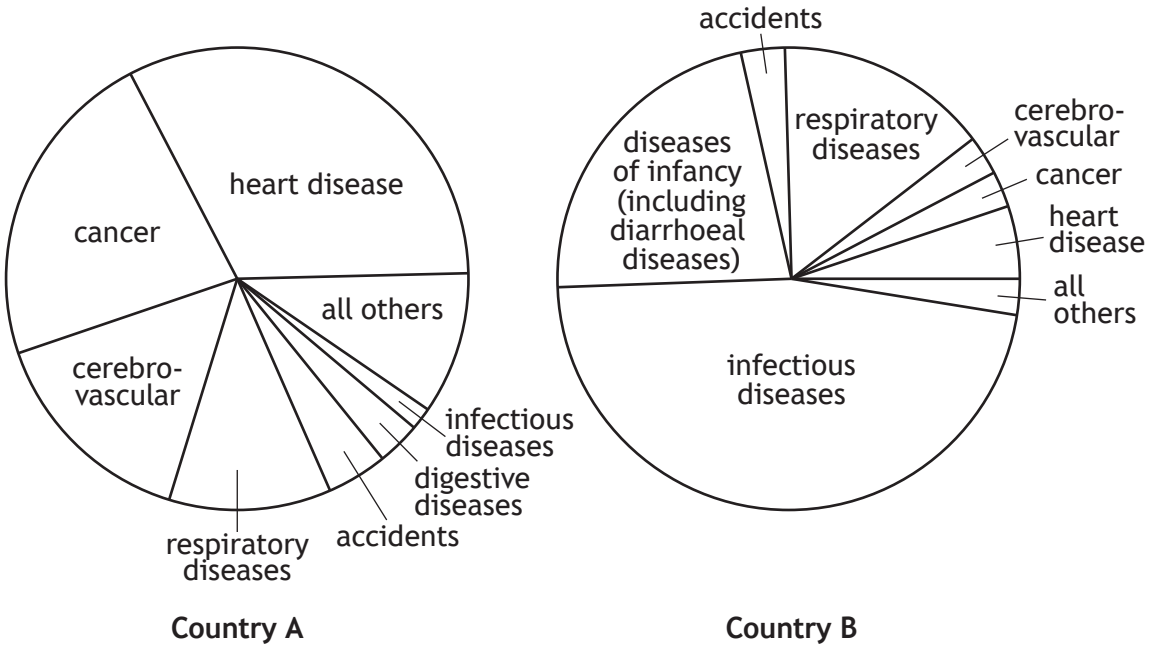
(d) Explain why vaccination against polio would **not** provide immunity against the influenza virus. **1**

(e) Clinical trials of vaccines often use a double-blind protocol.

Describe what is meant by the term double-blind. **1**

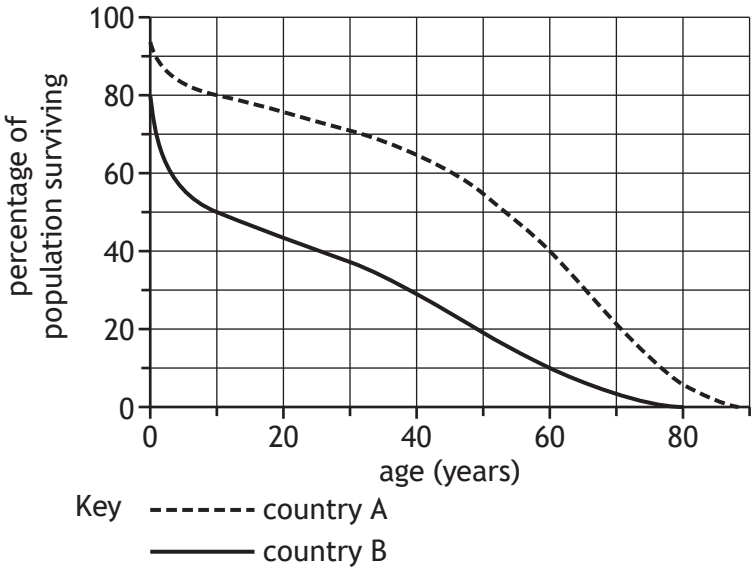
13. The following figures contain information about the causes of death and survival rates in two countries, A and B, in 2010.

Figure 1 - Causes of death in countries A and B during 2010



Country A **Country B**

Figure 2 - Percentage survival rates in countries A and B in 2010



(a) Use information from **Figure 2** to explain the lower incidence of heart disease in country B. **1**

13. (continued)

(b) (i) Calculate the percentage of the population of country A that die before the age of 10. **1**

Space for calculation

_____%

(ii) In 1950 three million babies were born in country B.

Calculate how many of these individuals were still alive in 2010, assuming no migration occurred. **1**

Space for calculation

_____

(c) Suggest **one** reason why a widespread vaccination programme against infectious diseases might **not** be possible in country B. **1**

_____

_____

(d) When a large percentage of the population is immunised, herd immunity can be established.

(i) State **one** factor that determines the herd immunity threshold. **1**

_____

_____

(ii) Explain why herd immunity is important to reduce the spread of a disease. **1**

_____

_____

[Turn over

14. Pulmonary tuberculosis (TB) is an infectious disease of the lungs caused by a bacterium.

This bacterium can also damage other organs in the body. When this happens it is called non-pulmonary TB.

The table shows the number of reported cases of pulmonary and non-pulmonary TB in Scotland between 1981 and 2006.

Year	Number of cases of pulmonary TB	Number of cases of non-pulmonary TB
1981	659	140
1986	500	178
1991	452	97
1996	408	102
2001	275	125
2006	255	153

(a) (i) Calculate in which five year period the greatest decrease in the total number of cases of TB occurred. **1**

Space for calculation

_____

(ii) Calculate, as a simple whole number ratio, the number of cases of pulmonary TB compared to non-pulmonary TB in 2001. **1**

Space for calculation

_____ : _____

pulmonary TB non-pulmonary TB

(b) Non-pulmonary TB is often associated with HIV infection. **1**

Suggest a reason for this association.

_____

_____

MARKS | DO NOT WRITE IN THIS MARGIN

15. Attempt **either** A **or** B. Write your answer in the space below and on *page 26*.

A Describe the autonomic nervous system (ANS) and how it affects heart rate and digestive processes. **8**

OR

B Describe how neurotransmitters relay impulses across the synapse. **8**

You may use labelled diagrams where appropriate.

[Turn over

DO NOT WRITE IN THIS MARGIN

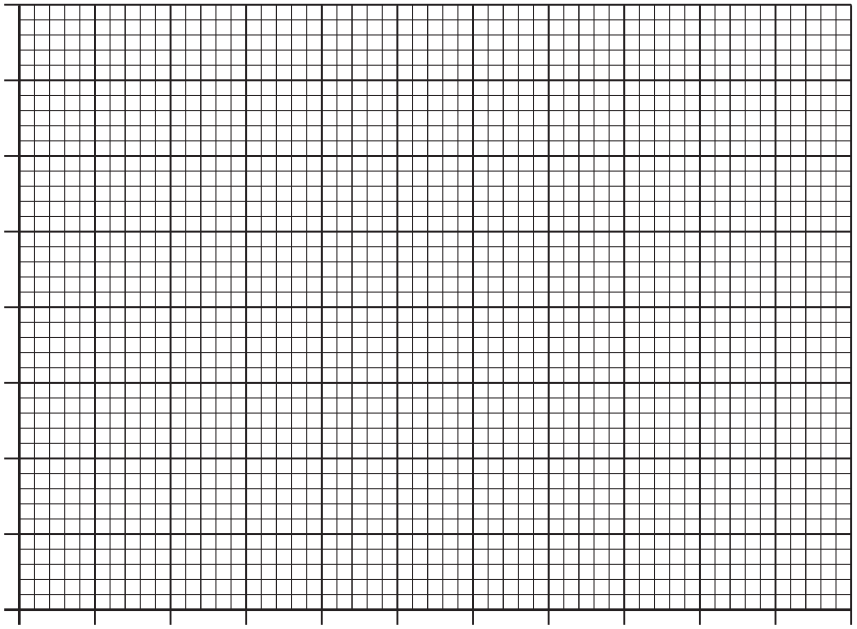
ADDITIONAL SPACE FOR ANSWER to question 15

[END OF SPECIMEN QUESTION PAPER]

DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 4 (a)



DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

National
Qualifications
SPECIMEN ONLY

S840/76/01 Human Biology

Marking Instructions

These marking instructions have been provided to show how Qualifications Scotland would mark this specimen question paper.

Qualifications Scotland
Teisteanasan Alba

General marking principles for Higher Human Biology

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(c) Do not award half marks.

(d) Where a candidate makes an error in the first part of a question, award marks for subsequent answers that are correct with regard to this original error. Do not penalise candidates more than once for the same error.

(e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final answer (including units, if appropriate) on its own.

(f) Candidates should not use bulleted lists to answer extended-response questions. They must respond to the 'command' word as appropriate and provide extended answers to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.

(g) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.

(h) In the detailed marking instructions, words separated by / are **alternatives**.

(i) A correct response can be negated if the candidate includes:
- an extra, incorrect, response
- additional information that contradicts the correct response

(j) Where the candidate is instructed to choose one question to answer but instead answers two questions, mark both responses and award the higher mark.

(k) Unless otherwise required by the question, the use of abbreviations (for example DNA, ATP) or chemical formulae (for example CO_2, H_20) are acceptable alternatives to naming.

(l) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, do not penalise candidates repeatedly.

(m) If incorrect spelling is given:
- If the correct word is recognisable then award the mark.
- If the word can easily be confused with another biological term then **do not** award the mark, for example glucagon and glycogen.

(n) Presentation of data:

- If a candidate provides two graphs, in response to one question, mark both and award the higher mark.
- If a question asks for a particular type of graph/chart and the candidate gives the wrong type, do not award full marks. Candidates cannot achieve the plot mark but **may** be able to achieve the mark for scale and label. If the x and y data are transposed, then do not award the scale and label mark.
- If the graph uses less than 50% of the axes then do not award the scale and label mark.
- If 0 is plotted when no data for this is given, then do not award the plot mark — candidates should only plot the data given.

(o) Only award marks for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify, name, give** or **state**, they need only answer or present in brief form
- **describe**, they must provide a statement as opposed to simply one word
- **explain**, they must provide a reason for the information given
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between topics being examined
- **calculate**, they must determine a number from given facts, figures or information
- **predict**, they must indicate what may happen based on available information
- **suggest**, they must apply their knowledge and understanding to a new situation

Marking instructions for each question

Section 1

Question	Answer	Max mark
1.	D	1
2.	C	1
3.	D	1
4.	A	1
5.	C	1
6.	B	1
7.	B	1
8.	A	1
9.	A	1
10.	A	1
11.	D	1
12.	C	1
13.	B	1
14.	C	1
15.	D	1
16.	D	1
17.	C	1
18.	D	1
19.	B	1
20.	B	1

Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)		Process – Differentiation. Explanation – Only the genes for producing proteins (characteristic) for that type of cell are expressed/switched on.	**2**	
	(b)		First division – Homologous chromosomes are separated. Second division – Chromatids are separated.	**2**	
	(c)		That embryos are destroyed in order to obtain stem cells.	**1**	Accept that doing this may be safer than using the drug directly on humans/trial subjects. **OR** Accept that people suffering from the disease will be delayed getting/deprived of a potential treatment. **OR** Accept that embryonic stem cells may be used in place of animals.
2.	(a)		RNA polymerase	**1**	
	(b)		Ribosome	**1**	
	(c)	(i)	Only one gene is transcribed/forms mRNA. **OR** The primary mRNA only codes for one protein.	**1**	
		(ii)	Introns/non coding regions of genes are removed (in RNA splicing). **OR** The mature mRNA transcript only contains exons/coding regions of genes.	**1**	

Question			Expected response	Max mark	Additional guidance
3.	(a)		41	**1**	Accept – 54 to 95.
	(b)		Amplification/replication/copying of DNA.	**1**	
	(c)		Separation of the (DNA) strands. **OR** Breaking of hydrogen bonds between the (DNA) strands.	**1**	
	(d)		Allows nucleotides to be added. **OR** Allows DNA to be amplified/ amplification to start. **OR** Provides a starting point for the amplification.	**1**	
	(e)		640	**1**	

Question			Expected response	Max mark	Additional guidance
4.	(a)		Axes have correct scales and labels. **(1)** Points correctly plotted and line drawn. **(1)**	**2**	
	(b)		Volume of urea solution/urease solution/indicator in agar. **OR** Concentration of urease solution/indicator in agar. **OR** Volume/length of agar/diameter of test tube. **OR** Temperature of the tube contents.	**2**	If 3 or more variables are listed and at least 1 is correct award 1 mark for the question. If all answers are correct award 2 marks.
	(c)		The experiment was repeated at each urea concentration. **OR** The experiment was repeated and averages calculated.	**1**	
	(d)		To allow time for the ammonia to (fully) diffuse/spread through the agar/jelly.	**1**	
	(e)		As the urea/substrate concentration increased more ammonia/ end-product was produced. **OR** As the urea/substrate concentration decreased less ammonia/ end-product was produced.	**1**	The conclusion must relate to the aim, which was investigating the effect of substrate concentration on end-product production. Therefore, answers must refer to ammonia/end-product and not simply restate the results by referring to the length of blue agar produced.
	(f)		48	**1**	

Question			Expected response	Max mark	Additional guidance
4.	(g)	(i)	The inhibitor/thiourea blocked the active site on the urease/enzyme.	**1**	
		(ii)	Not all active sites were blocked. **OR** Some active sites were still available.	**1**	
5.	(a)		Energy investment - ATP molecules are broken down/used up (to provide energy). **OR** Phosphorylation addition of phosphate to glucose/intermediates occurs. **(1)** Energy pay-off - ATP molecules are produced. **(1)**	**2**	
	(b)		Name - acetyl (group)/acetyl coenzyme A/acetyl CoA. **(1)** Conditions - when oxygen is present/in aerobic conditions. **(1)** **OR** Name – lactate/lactic acid. **(1)** Conditions - when oxygen is absent or insufficient/in anaerobic conditions. **(1)**	**2**	
	(c)		Slow twitch – from aerobic respiration/the electron transport chain/ATP synthase. **(1)** Fast twitch – glycogen. **(1)**	**2**	

Question			Expected response	Max mark	Additional guidance
6.	(a)		SS	**1**	
	(b)		50	**1**	
	(c)		It alters the (DNA) nucleotide sequence. **OR** It replaces one nucleotide with another.	**1**	
	(d)		Pre-implantation genetic diagnosis/PGD.	**1**	
7.	(a)	(i)	55	**1**	
		(ii)	The pituitary gland releases follicle stimulating hormone/FSH. **(1)** FSH stimulates the follicle/ovary to release oestrogen. **(1)**	**2**	
	(b)		300	**1**	
	(c)		The corpus luteum has started to degenerate/break down so it produces less progesterone.	**1**	
	(d)		They prevent the negative feedback effect of oestrogen on FSH secretion. **OR** They mimic the action of FSH/LH.	**1**	

Question			Expected response	Max mark	Additional guidance
8.	**A**		1. Atherosclerosis is the formation of an atheroma/plaque beneath the endothelium 2. Atheroma/plaque is the accumulation of fatty material/cholesterol/fibrous material/calcium) 3. (As the atheroma grows) the artery wall thickens and loses its elasticity 4. The lumen becomes reduced/smaller 5. Blood flow is restricted resulting in increased blood pressure	**4**	
	B		1. Atheroma ruptures damaging the endothelium 2. Clotting factors are released 3. They catalyse the conversion of the prothrombin to its active form thrombin 4. Thrombin causes molecules of the plasma fibrinogen to form fibrin 5. The fibrin threads form a meshwork that forms a clot/thrombus	**4**	

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	98 beats/minute	**1**	Units are essential.
		(ii)	As rate of oxygen uptake increased from 0.2 (litres/minute) stroke volume increased from 88 cm^3 to 156 cm^3/by 68 cm^3 **(1)** between 2.0 to 2.4 (litres/minute) rate of oxygen uptake/after 2.0 (litres/minute) rate of oxygen uptake stroke volume remained constant/ stayed at 156 cm^3. **(1)**	**2**	Award one mark if candidate states it increases up to 2.0 (litres/minute) and then decreases. Answer must indicate each units at least once.
		(iii)	150	**1**	
		(iv)	4 : 7	**1**	
	(b)		18.72	**1**	
	(c)	(i)	It represents systolic blood pressure. **OR** It is when blood is surging/being pumped through the arteries. **OR** It is when the artery wall is stretched.	**1**	
		(ii)	High blood pressure forces (more) fluid out of the capillaries. **(1)** Lymph vessels cannot reabsorb all the excess (tissue) fluid. **(1)**	**2**	
10.	(a)		Their blood glucose concentration starts to decrease after 30 minutes. **OR** Their blood glucose concentration returns to normal after 60 minutes. **OR** Their blood glucose concentration increases at a slower rate/to a lower level/for a shorter time compared to individual A.	**1**	
	(b)		Cells are less sensitive to insulin/have fewer insulin receptors/have developed insulin resistance.	**1**	

Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	As age increases, the frequency/ number of cases of obesity increases. **OR** The frequency/number of cases is always higher in 2012 (compared to 2003).	**1**	
		(ii)	1.536 million/1 536 000	**1**	
	(b)		Reduce their intake of fats/sugars/carbohydrates. **OR** Take more exercise/become more active.	**1**	
12.	(a)		Cell P has membrane receptors that are specific to the polio virus/antigens on the virus.	**1**	
	(b)		B lymphocyte	**1**	
	(c)		They quickly respond to another attack by the same virus/pathogen so preventing infection. **OR** They produce specific lymphocytes that destroy the virus/pathogen before the individual shows symptoms.	**1**	
	(d)		The polio and influenza viruses have different antigens.	**1**	
	(e)		Neither the subjects nor the researchers know whether the subject is getting the vaccine or the placebo.	**1**	

Question			Expected response	Max mark	Additional guidance
13.	(a)		Shorter life span/lower survival rate, so no time to develop heart disease.	**1**	
	(b)	(i)	20	**1**	
		(ii)	300 000	**1**	
	(c)		Poverty/malnutrition **OR** Rejection/refusal of the vaccine/lack of education. **OR** Difficulty in population accessing the vaccine/geographical remoteness/access to doctors.	**1**	
	(d)	(i)	Type of disease/the effectiveness of the vaccine/the density of the population.	**1**	
		(ii)	There is less chance of non-immune individuals coming in contact with infected individuals.	**1**	
14.	(a)	(i)	1986-1991	**1**	
		(ii)	11 : 5	**1**	
	(b)		HIV attacks/destroys T lymphocytes weakening the immune system/reducing the ability of the body to respond to the infection. **OR** Individuals with AIDS have a weakened immune system and so are more vulnerable to opportunistic infections.	**1**	

Question			Expected response	Max mark	Additional guidance
15.	**A**		1. The autonomic nervous system (ANS) works automatically/without conscious control 2. It is controlled by the medulla (region of the brain) 3. It is made up of sympathetic and parasympathetic systems 4. These two systems are antagonistic in action 5. The SAN/sino-atrial node controls heart rate 6. The sympathetic system speeds up the heart rate/impulses leaving the SAN 7. by releasing noradrenaline 8. The parasympathetic system slows down the heart rate/impulses leaving the SAN 9. by releasing acetylcholine 10. The parasympathetic system increases the rate of peristalsis while the sympathetic system decreases it 11. The parasympathetic system increases the rate of intestinal secretions while the sympathetic system decreases it	**8**	Award 1 mark for each correct description, up to a maximum of 8 marks. Check any diagram(s) for relevant information not present in text and award marks accordingly.

Question			Expected response	Max mark	Additional guidance
15.	**B**		1. Neurotransmitters relay/carry messages from nerve to nerve/muscle 2. The gap between nerves/nerves and muscles is called the synaptic cleft 3. Neurotransmitters are stored in vesicles 4. Arrival of an impulse causes vesicles to fuse with the (presynaptic) membrane and release their contents/neurotransmitter (molecules) 5. Neurotransmitters diffuse across the cleft/gap/synapse 6. Neurotransmitters bind to receptors 7. A minimum number/threshold of neurotransmitter molecules must attach to receptors to trigger an impulse 8. Receptors determine whether the signal is excitatory or inhibitory 9. Neurotransmitters are removed by enzymes/re-uptake 10. Removal prevents continuous stimulation of the postsynaptic neurons 11. Summation of weak stimuli can release enough neurotransmitter to trigger an impulse	**8**	Award 1 mark for each correct description, up to a maximum of 8 marks. Check any diagram(s) for relevant information not present in text and award marks accordingly.

[END OF SPECIMEN MARKING INSTRUCTIONS]

Published: August 2026

Change since last published:

We've replaced Question Paper 1 and Question Paper 2 with a single question paper that has two sections. The duration has been shortened and the number of marks reduced. Some questions have been removed from the previous specimen question papers, some have been edited or updated, and some have been replaced.