National
Qualifications
SPECIMEN ONLY

SQ25/H/02

Human Biology
Section 1 — Questions

Date — Not applicable

Duration — 2 hours and 30 minutes

Instructions for the completion of Section 1 are given on *Page two* of your question and answer booklet SQ25/H/02.

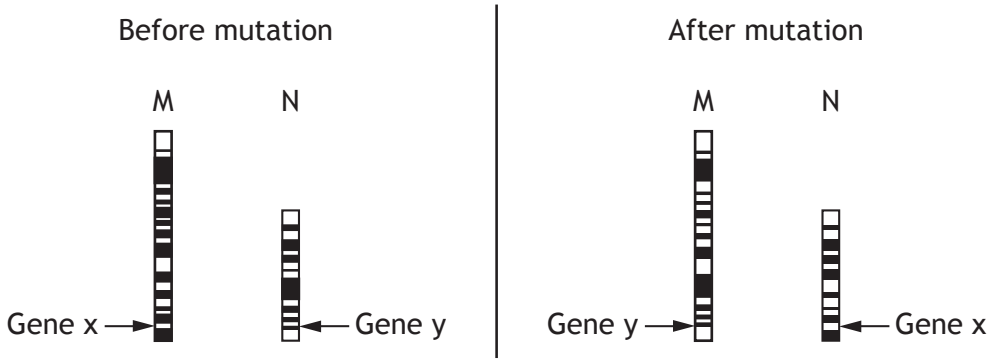
Record your answers on the answer grid on *Page three* of your question and answer booklet.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not you may lose all the marks for this paper.

SECTION 1 — 20 marks

Attempt ALL questions

1. The diagram below shows two chromosomes, M and N, before and after a chromosomal mutation.



The form of mutation that has taken place is a

A translocation

B duplication

C insertion

D deletion.

2. Amplification of DNA by PCR commences with 1000 DNA molecules in the reaction tube.

How many DNA molecules would be present after four cycles of PCR?

A 4000

B 8000

C 16000

D 32000

3. Which of the following statements about slow twitch muscle fibres is correct?

A They cannot sustain contractions for as long as fast twitch muscle fibres.

B They have many more mitochondria than fast twitch muscle fibres.

C They are better for activities like weightlifting and sprinting than fast twitch muscle fibres.

D They store fuel mainly as glycogen while fast twitch muscle fibres store fuel as fat.

4. The table below contains information about four semen samples.

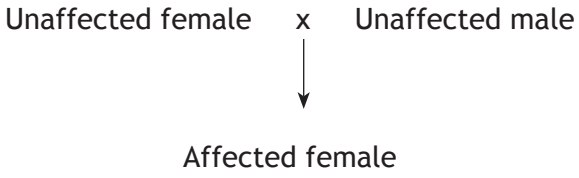
	Semen sample			
	A	B	C	D
Number of sperm in sample (millions/cm^3)	40	30	20	60
Active sperm (%)	50	60	75	40
Abnormal sperm (%)	30	65	10	70

Which semen sample has the highest number of active sperm?

5. In which of the following situations might a fetus be at risk from Rhesus antibodies produced by the mother?

	Father	*Mother*
A	Rhesus positive	Rhesus negative
B	Rhesus positive	Rhesus positive
C	Rhesus negative	Rhesus negative
D	Rhesus negative	Rhesus positive

6. The family tree below shows the pattern of inheritance of a genetic condition.



The allele responsible for this condition is both

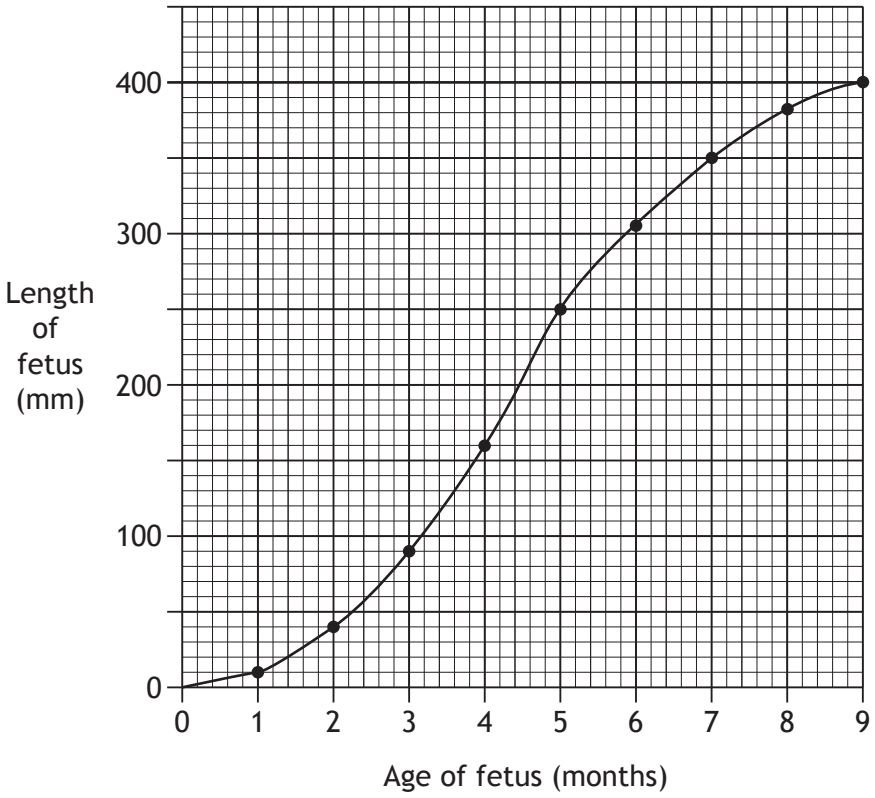
A sex-linked and recessive

B sex-linked and dominant

C autosomal and recessive

D autosomal and dominant.

7. The graph below shows the growth, in length, of a human fetus.



What is the percentage increase in length of the fetus during the final four months of pregnancy?

A 33·3%

B 60·0%

C 62·5%

D 150·0%

8. Cystic fibrosis is a genetic condition caused by an allele that is not sex-linked.

A child is born with cystic fibrosis despite neither parent having the condition.

The parents are going to have a second child.

What is the percentage chance this child will have cystic fibrosis?

A 75%

B 67%

C 50%

D 25%

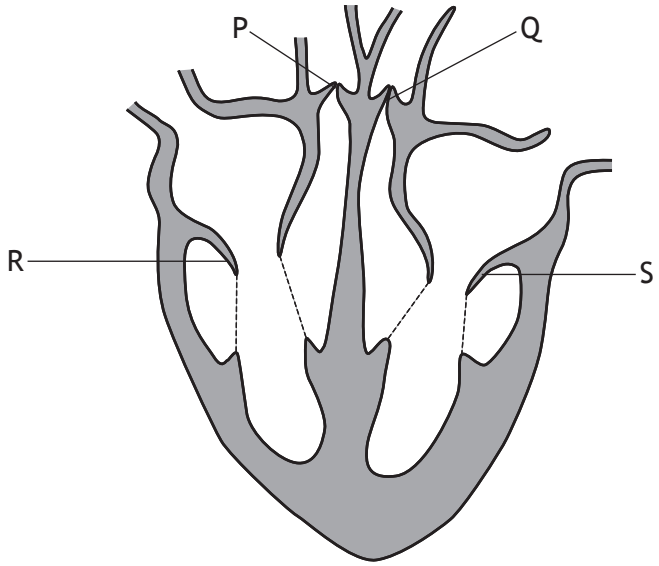
9. The duration of the stages in an individual's cardiac cycle are shown in the table below.

Stage	*Duration (s)*
Diastole	0·4
Atrial systole	0·1
Ventricular systole	0·3

What is the heart rate of this individual?

A 48 beats per minute
B 75 beats per minute
C 80 beats per minute
D 150 beats per minute

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



Which of the following statements 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 of the following statements about lipoprotein is correct?

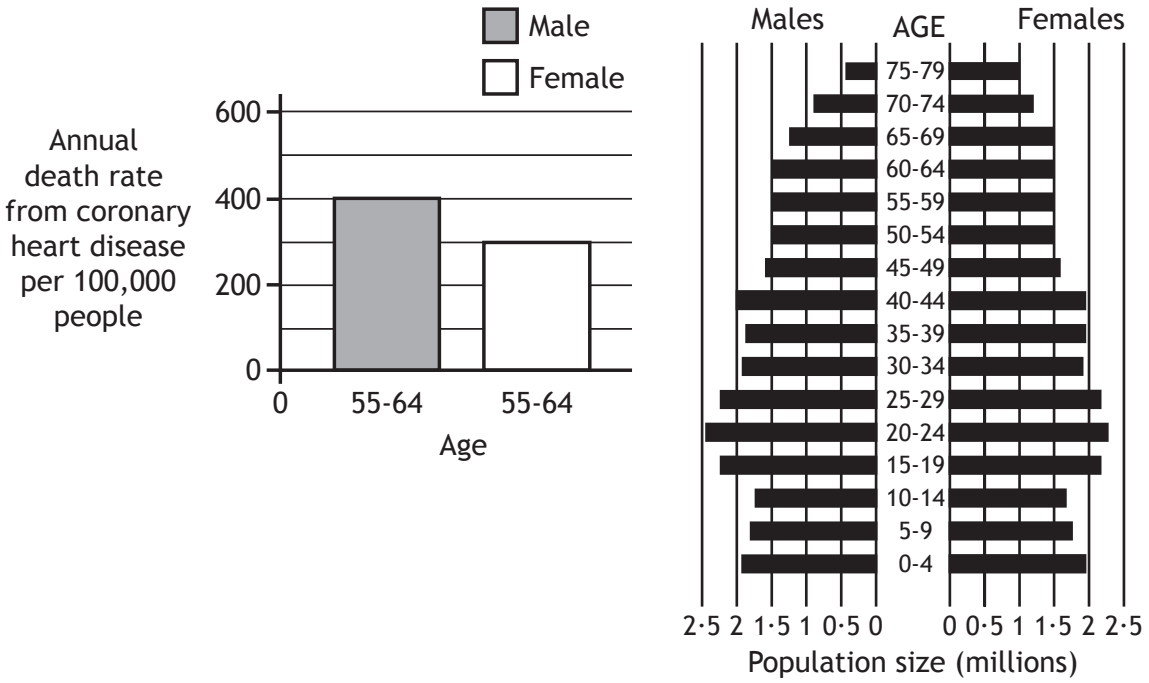
A LDL transports cholesterol from body cells to the heart

B LDL transports cholesterol from body cells to the liver

C HDL transports cholesterol from body cells to the heart

D HDL transports cholesterol from body cells to the liver

12. The graphs below 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 21000.

13. The transformation of information into a form that memory can accept is called

A shaping

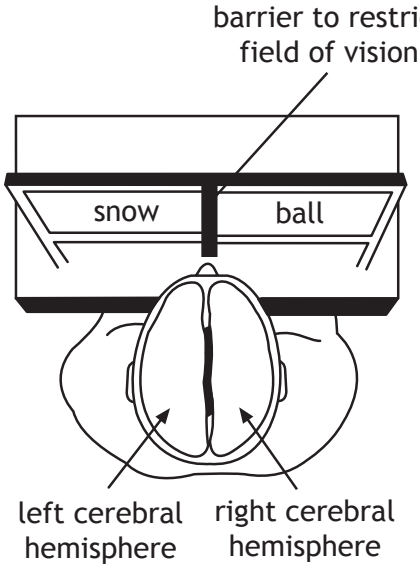
B retrieval

C encoding

D storage.

14. The diagram below shows a test on a man who had a damaged corpus callosum.

This meant that he could no longer transfer information between his right and left cerebral hemispheres.



Some of the functions of each hemisphere are described in the table below.

Left cerebral hemisphere	*Right cerebral hemisphere*
processes information from right eye	processes information from left eye
controls language production	controls spatial task co-ordination

The man was asked to look straight ahead and then the words "snow" and "ball" were flashed briefly on the screen as shown.

What would the man say that he had just seen?

A Snow

B Ball

C Snowball

D Nothing

15. Which of the following statements 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

16. An investigation was carried out to determine how long it takes students to learn to run a finger maze.

A blindfolded student was allowed to run the maze on ten occasions.

The results are given in the table below.

Trial	Time (s)
1	23
2	20
3	26
4	12
5	18
6	10
7	6
8	7
9	6
10	6

Which of the following changes to the investigation would make the results more reliable?

A Allowing other students to try to run the maze ten times.

B Allowing the same student some additional trials on the same maze.

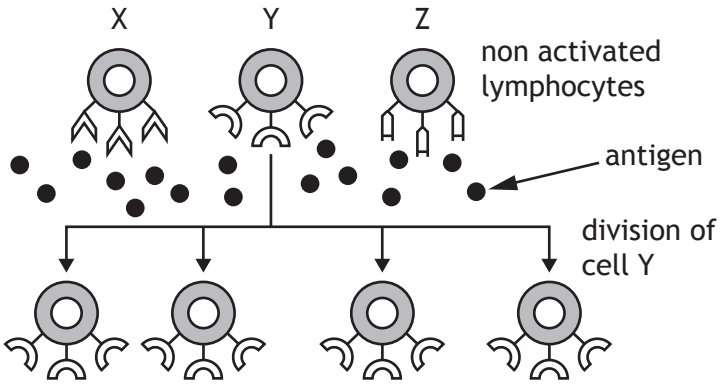
C Changing the shape of the maze and allowing the same student to repeat ten trials.

D Recording the times to one decimal place.

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 below represents clonal selection in lymphocytes.



What stimulates the division of cell Y?

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 can be made
C allow a statistical analysis of the results to be made
D ensure that researchers are unaware who has been vaccinated.

20. The table below contains data about a worldwide infection in 2009.

	Number of adults	*Number of children*
Had this infection at the start of 2009	$30{\cdot}8 \times 10^6$	$2{\cdot}5 \times 10^6$
Contracted this infection during 2009	$2{\cdot}2 \times 10^6$	$0{\cdot}4 \times 10^6$
Died from this infection during 2009	$1{\cdot}6 \times 10^6$	$0{\cdot}2 \times 10^6$

How many people in the world had this infection at the start of 2010?

A $35{\cdot}9 \times 10^6$

B $34{\cdot}1 \times 10^6$

C $33{\cdot}3 \times 10^6$

D $31{\cdot}5 \times 10^6$

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

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Mark

SQ25/H/01

Human Biology
Section 1 — Answer Grid and Section 2

Date — Not applicable

Duration — 2 hours and 30 minute

* S Q 2 5 H 0 1 *

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
D D	M M	Y Y

Scottish candidate number

Total marks — 100

SECTION 1 — 20 marks

Attempt ALL questions.

Instructions for completion of Section 1 are given on *Page two*.

SECTION 2 — 80 marks

Attempt ALL questions.

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

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

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA ©

SECTION 1— 20 marks

The questions for Section 1 are contained in the question paper SQ25/H/02.
Read these and record your answers on the answer grid on *Page three* opposite.
Do NOT use gel pens.

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.

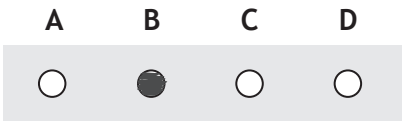
3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample Question

The digestive enzyme pepsin is most active in the

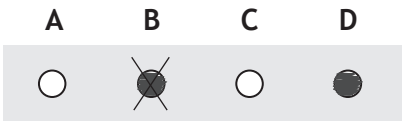
A mouth
B stomach
C duodenum
D pancreas.

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

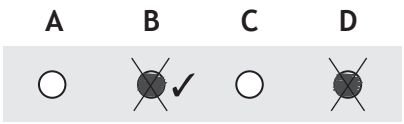


Changing an answer

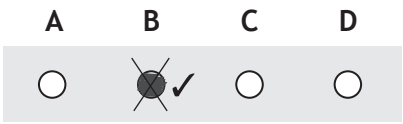
If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



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:



or



SECTION 1 — Answer Grid

OBJ20AD1

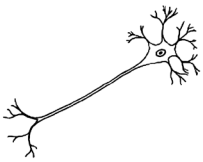
	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

SECTION 2 — 80 marks

Attempt ALL questions

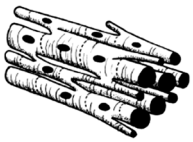
Note that question 14 contains a choice.

1. The human body contains many specialised cells, all of which have developed from stem cells in the early embryo.



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) Both germline and somatic cells retain the ability to divide.

(i) State the type of cell division that only occurs in germline cells. **1**

_____

(ii) Explain why mutations in germline cells are potentially more serious than mutations in somatic cells. **1**

_____

_____

(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 stem cells.

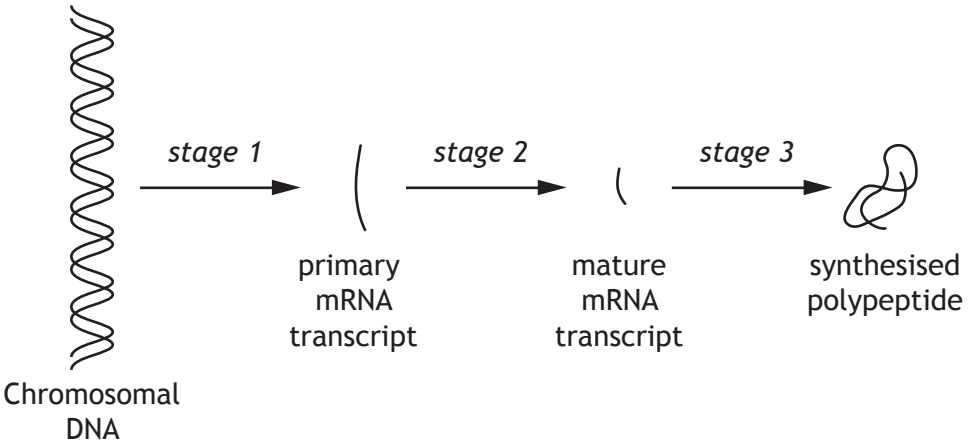
Describe one ethical consideration that might have influenced this decision to use stem cells. **1**

_____

_____

MARKS | DO NOT WRITE IN THIS MARGIN

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



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

_____

(b) Name stage 3 and state the exact location where it occurs within a cell. **1**

Name _____

Location _____

(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**

_____

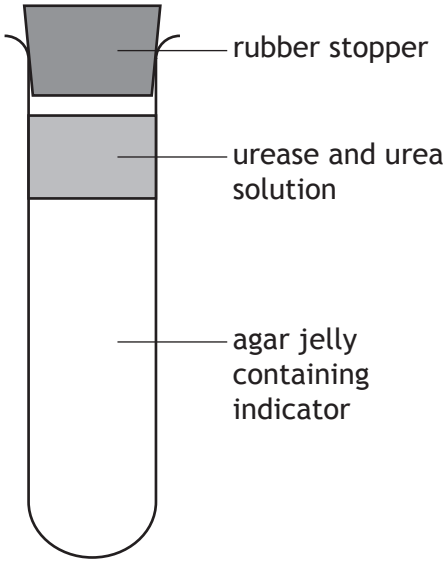
_____

3. 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.

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

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



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.

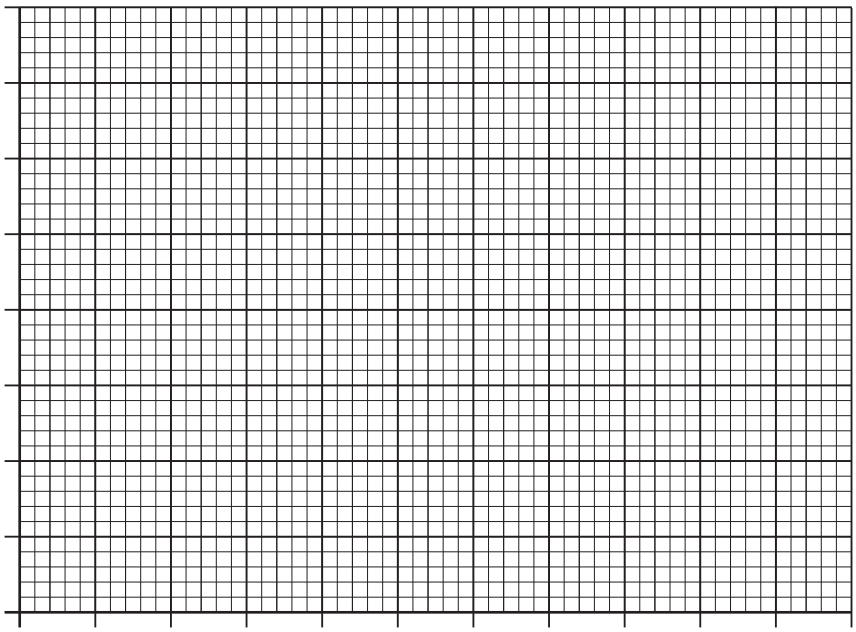
The results of the experiment are shown in the table below.

Urea concentration added (molar)	*Average length of agar jelly stained blue* (mm)
0·03	2
0·06	4
0·13	8
0·25	16
0·50	32

3. (continued)

(a) Plot a line graph to illustrate the results of the experiment.

(Additional graph paper, if required, can be found on *Page twenty-six*) **2**



(b) (i) Name **one** variable that should be controlled when setting up this experiment. **1**

_____

(ii) Name **one** variable that should be kept constant during the 48 hours of this experiment. **1**

_____

(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**

_____

_____

3. (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 7mm 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**

_____

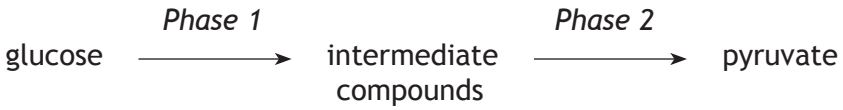
_____

(ii) Suggest why 7mm of agar jelly turned blue in this experiment. **1**

_____

_____

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



(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**

_____

_____

(c) Many athletes take creatine supplements to improve their sporting performance.

State whether sprinters or marathon runners would gain the greatest benefit from taking creatine and give a reason for your choice. **1**

Athlete _____

Reason _____

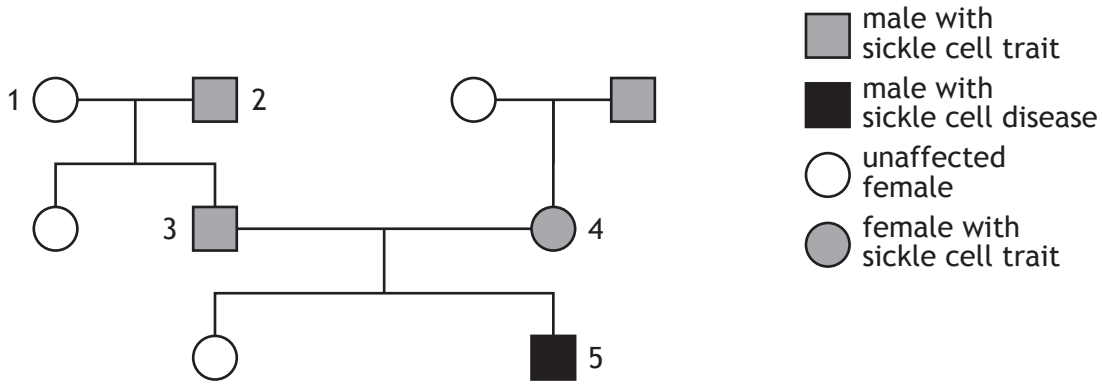
_____

5. 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 pedigree chart below 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 3rd child.

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

Space for calculation

_____%

(c) Sickle cell disease is caused by a substitution mutation in the gene that codes for haemoglobin.

(i) Describe how this form of mutation affects the structure of the gene. **1**

_____

_____

(ii) Explain how this might change the structure of a protein such as haemoglobin. **1**

_____

_____

5. (continued)

(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**

_____

(e) It has been discovered that the gene that codes for fetal haemoglobin is unaffected by the substitution mutation that causes sickle cell disease.

This gene is "switched off" at birth.

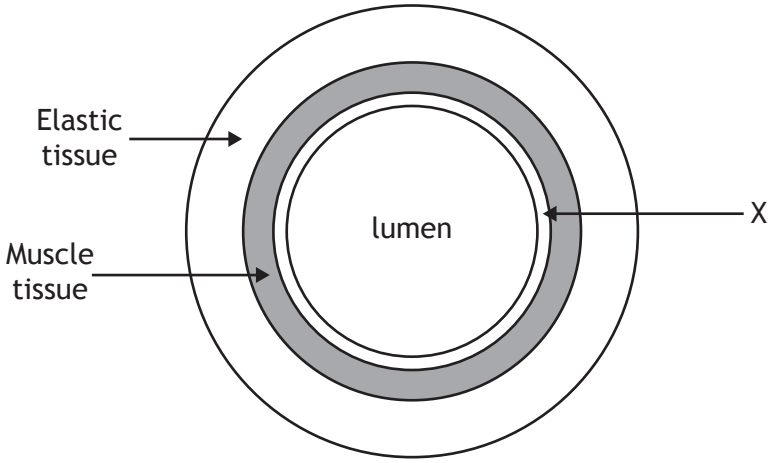
Use this information to suggest how a drug designed to treat sickle cell disease in young children could function. **1**

_____

_____

_____

6. The diagram below represents a section through an artery.



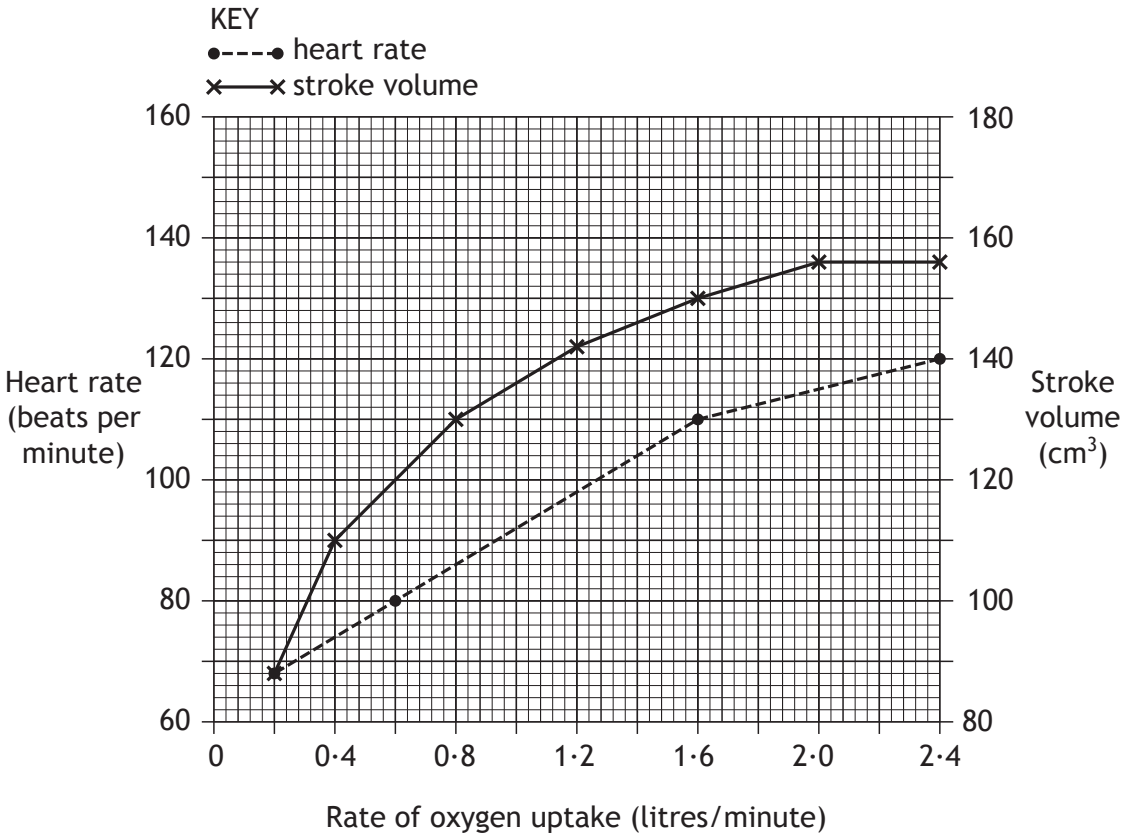
(a) Describe how the presence of muscle tissue in the artery wall helps to control the flow of blood around the body. **1**

(b) Describe how an atheroma forming under layer X may lead to the formation of a blood clot and state the possible effects of this. **5**

Space for answer

MARKS | DO NOT WRITE IN THIS MARGIN

7. The graph below 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. **1**

_____

_____

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

_____ **cm^3**

7. (continued)

(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 mm/Hg was recorded.

Explain why two figures are given for a blood pressure reading. **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.

Explain the link between high blood pressure and the build-up of tissue fluid. **2**

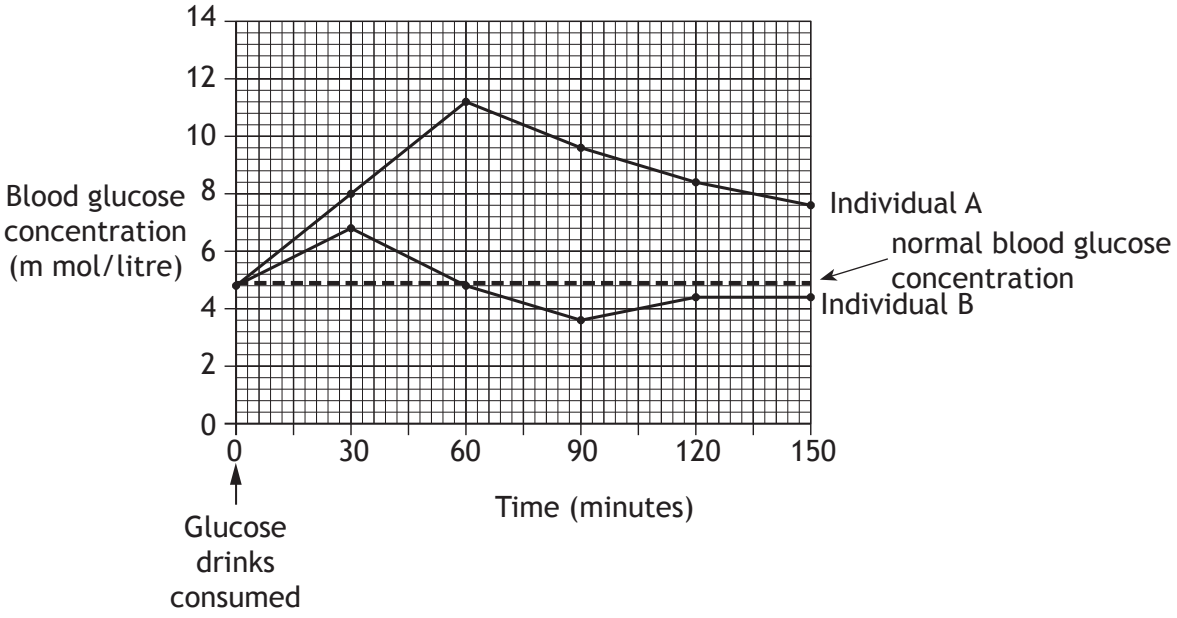
_____

_____

_____

_____

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



(a) (i) Choose **one** individual, A or B and indicate whether the individual is diabetic or non-diabetic.

Individual _____

Diabetic ☐ Non-diabetic ☐

Using evidence from the graph, justify your choice. **1**

_____

_____

(ii) Using data from the graph, describe the changes that occurred in the blood glucose concentration of individual A after consuming the glucose drink. **2**

_____

_____

_____

_____

8. (continued)

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

Type 1 _____

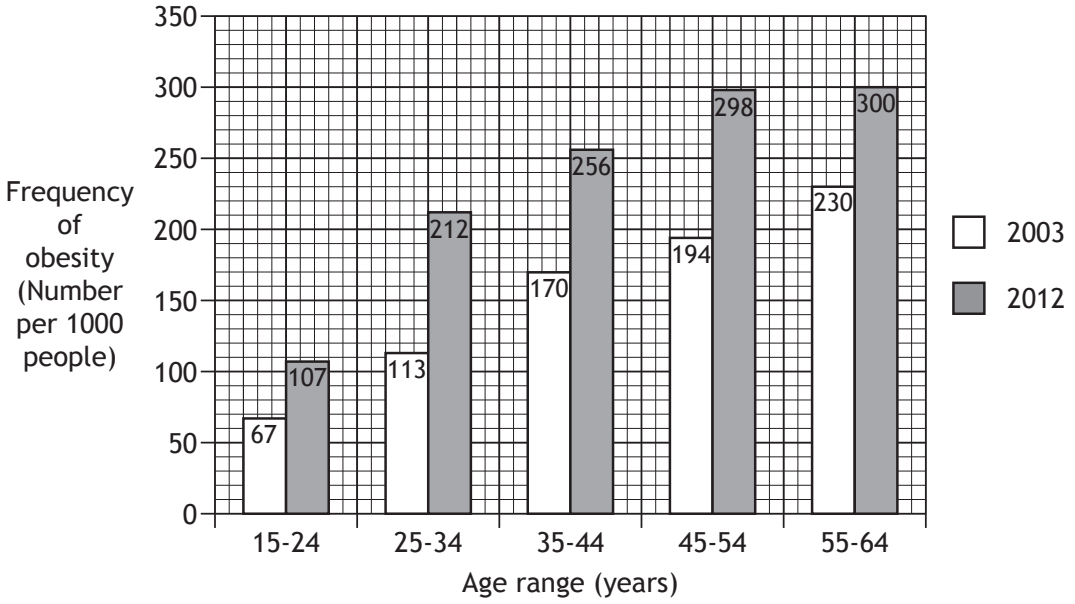
_____

Type 2 _____

_____

9. The graph below shows obesity data for a European country in 2003 and 2012.

Individuals are described as obese if they have a body mass index (BMI) of 30 or greater.



(a) (i) Describe **two** general trends shown in the graph. **2**

1 _____

_____

2 _____

_____

(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**

_____

10. A student carried out an investigation into the effect of age on learning ability.

Eight children from three different age groups were each given five attempts to complete a twenty-piece jigsaw puzzle.

The fastest times that they achieved are shown in the table below.

	Fastest time achieved (seconds)		
	8-year-olds	*12-year-olds*	*16-year-olds*
	123	97	99
	98	68	74
	111	75	62
	138	112	67
	87	93	84
	136	83	101
	79	75	58
	120	81	55
average	**111·5**		**75·0**

(a) Calculate the average fastest time achieved by the 12 year-old children and write your answer in the table above. **1**

Space for calculation

(b) Describe **two** additional variables that would have to be kept constant to ensure a valid comparison could be made between the three groups of children. **2**

Variable 1 _____

_____

Variable 2 _____

_____

10. (continued)

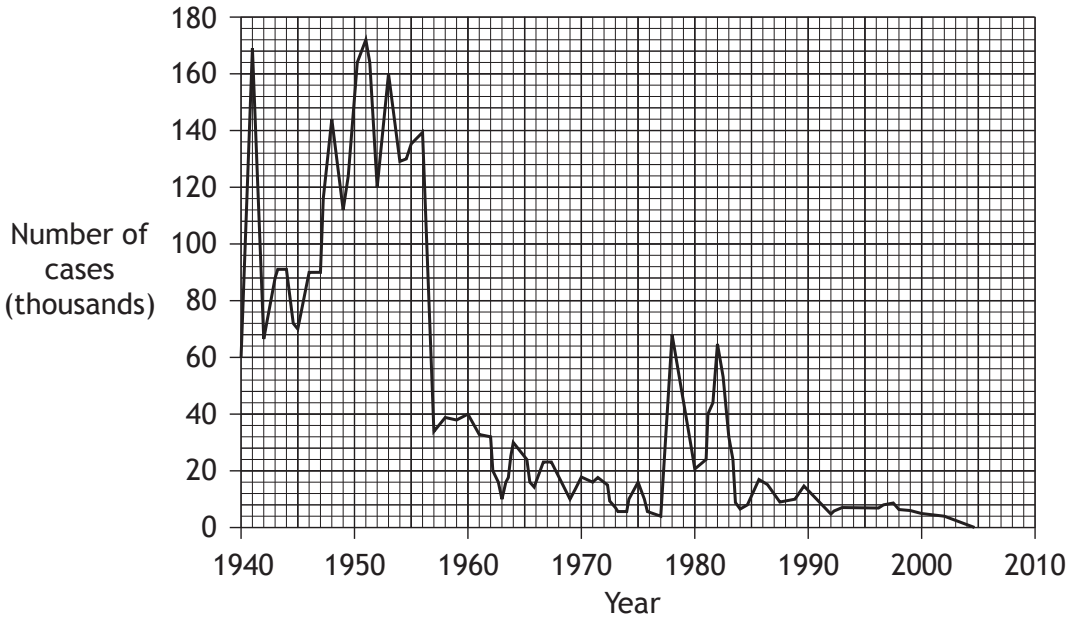
(c) State a conclusion that can be drawn from the results of this investigation. **1**

(d) (i) Explain why the first attempt to complete the puzzle was always slower than the fifth attempt, no matter the age of the child. **1**

(ii) Suggest why some children did not produce their fastest time on their fifth attempt. **1**

(e) Suggest how the student could adapt the investigation to demonstrate social facilitation. **1**

11. The graph below shows the number of whooping cough cases over a 65 year period in a country.



(a) (i) Using information from the graph, state the year in which a vaccine for whooping cough was introduced. **1**

Year _____

(ii) Suggest a reason for the unexpected increase in the number of cases of whooping cough in 1977. **1**

_____

_____

(b) The number of cases of whooping cough decreases to a very low level after 2000 because of herd immunity.

Explain what is meant by the term "herd immunity". **2**

_____

_____

_____

_____

12. The diagrams below contain information about the causes of death and survival rates in two countries in 2010.

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

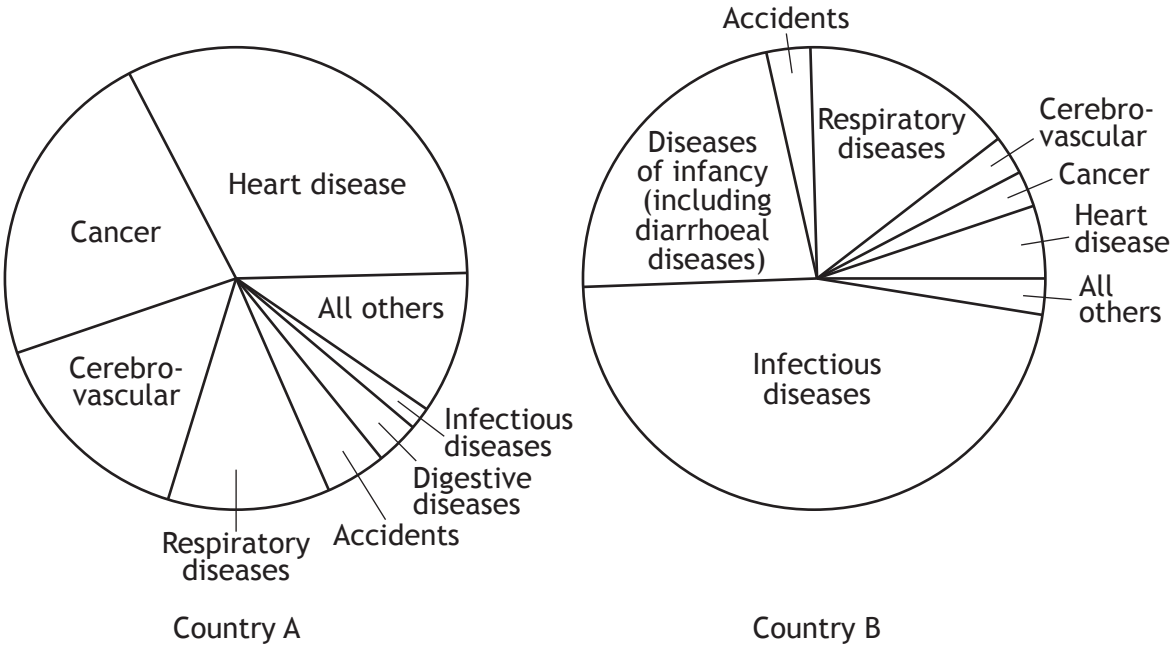
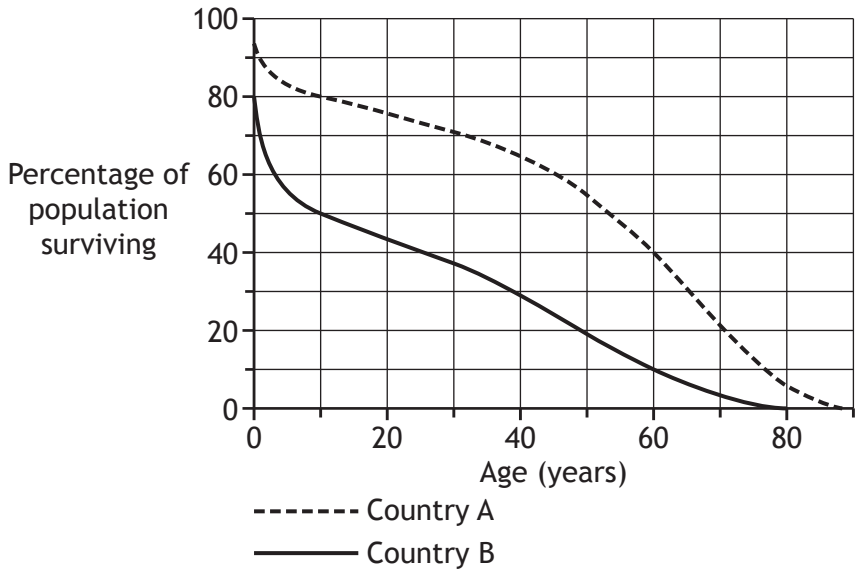


Figure 2 - Percentage survival rates in countries A and B in 2010



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

12. (a) (continued)

(ii) Give an example of how diseases of infancy can be reduced in Country B through community responsibility, other than by vaccination programmes. **1**

_____

_____

(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

_____

MARKS | DO NOT WRITE IN THIS MARGIN

13. 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 below 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) Suggest how pulmonary TB is transmitted between individuals. **1**

(b) (i) In which 5 year period was the greatest decrease in the total number of cases of TB? **1**

Space for calculation

(ii) Suggest a reason for this decrease. **1**

(iii) Compare the trend in the number of cases of pulmonary TB with that of non-pulmonary TB between 1991 and 2006. **1**

13. (b) (continued)

(iv) 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

(c) Non-pulmonary TB is often associated with HIV infection.

Suggest a reason for this association. **1**

_____

_____

MARKS | DO NOT WRITE IN THIS MARGIN

14. Answer **either** A **or** B in the space below.

A Describe the structure and function of the autonomic nervous system. **7**

OR

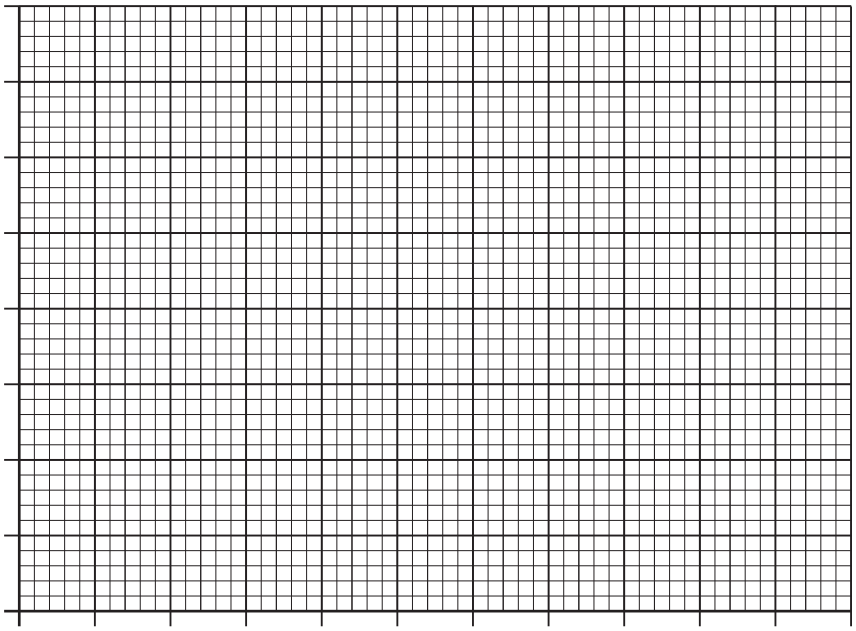
B Describe the function and mechanism of neurotransmitter action at the synapse. **7**

[END OF SPECIMEN QUESTION PAPER]

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional Graph for Question 3 (a)



MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

National
Qualifications
SPECIMEN ONLY

SQ25/H/01 Human Biology

Marking Instructions

These Marking Instructions have been provided to show how SQA would mark this Specimen Question Paper.

SQA ©

General Marking Principles for Human Biology Higher

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.

b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

c) Half marks may not be awarded.

d) Where a candidate makes an error at an early stage in a multi-stage calculation, credit should normally be given for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.

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

f) Larger mark allocations may be fully accessed whether responses are provided in continuous prose, linked statements or a series of discrete developed points.

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) If two answers are given where one is correct and the other is incorrect, no marks are awarded.

j) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.

k) The assessment is of skills, knowledge and understanding in Human Biology, so marks should be awarded for a valid response, even if the response is not presented in the format expected. For example, if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested, give the mark.

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

m) Content that is outwith the course assessment specification should be given credit if used appropriately eg metaphase of meiosis.

n) 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, candidates should not be penalised repeatedly.

o) If incorrect **spelling** is used:
- and the term is recognisable then give the mark;
- and the term can easily be confused with another biological term then do not give the mark eg ureter and urethra;
- and the term is a mixture of other biological terms then do not give the mark, eg mellum, melebrum, amniosynthesis.

p) When presenting data:
- if a candidate provides two graphs or charts in response to one question (eg one in the question and another at the end of the booklet), mark both and give the higher mark
- for marking purposes no distinction is made between bar charts (used to show discontinuous features, have descriptions on the x-axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x-axis and have contiguous columns)
- other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not give the mark(s) for this. Where provided, marks may still be awarded for correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used), etc.
- the relevant mark should not be awarded if the graph uses less than 50% of the axes; if the x and y data are transposed; if 0 is plotted when no data for this is given (ie candidates should only plot the data given)

q) Marks are awarded only 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 name or present in brief form;
- **calculate**, they must determine a number from given facts, figures or information;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **evaluate**, they must make a judgement based on criteria;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **predict**, they must suggest what may happen based on available information;
- **suggest**, they must apply their knowledge and understanding of Human Biology to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of Human Biology.

Marking Instructions for each question

Section 1

Question	Response	Mark
1	A	1
2	C	1
3	B	1
4	D	1
5	A	1
6	C	1
7	B	1
8	D	1
9	B	1
10	A	1
11	D	1
12	C	1
13	C	1
14	B	1
15	D	1
16	A	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 characteristic for that cell are expressed	**2**	
	b	**i**	Meiosis.	**1**	
		ii	Mutations in germline cells can be passed to offspring (while mutations in somatic cells cannot)	**1**	
	c		It is safer than using the drug directly on humans / trial subjects **or** Is it right to use embryos to extract stem cells? **or** Is it right to deprive sufferers of a potential treatment? **or** Is it right to use stem cells rather than animals?	**1**	
2	**a**		RNA polymerase	**1**	
	b		Translation **and** 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**	
3	**a**		Correct scales and labels on axes Points correctly plotted and line drawn	**2**	Remove one mark if urea concentration is plotted on the vertical axis. Remove 1 mark if less than half the graph paper is used.
	b	**i**	volume of urea solution **or** volume of urease solution **or** concentration of urease solution **or** volume / length of agar / diameter of test tube	**1**	

Question			Expected response	Max mark	Additional guidance
			or volume / concentration of indicator in agar		
		ii	Temperature of the <u>tube contents</u> / of the <u>test tubes</u>	**1**	
	c		The experiment was repeated <u>at each urea concentration</u> (and an average calculated)	**1**	
	d		To allow time for the ammonia to (fully) diffuse / spread through the agar / jelly	**1**	
	e		As the urea concentration increased more ammonia was produced **or** As the urea concentration decreased less ammonia was produced	**1**	Answer must relate to ammonia and not restate results (length of blue agar produced)
	f		48	**1**	
	g	**i**	Thiourea blocked the <u>active site</u> on the urease/enzyme	**1**	
		ii	Not all active sites were blocked **or** some active sites were still available	**1**	
4	**a**		*Energy investment* - ATP molecules are broken down / used up (to provide energy) **or** <u>Phosphorylation</u> / addition of <u>phosphate</u> to glucose / intermediates occurs. *Energy pay-off* - ATP molecules are produced	**2**	
	b		Acetyl (group) / acetyl coenzyme A / acetyl CoA produced when oxygen is present / in aerobic conditions **or** Lactic acid produced when oxygen is absent / insufficient / in anaerobic conditions	**2**	
	c		Athlete – Sprinter Reason – creatine (phosphate) releases energy at a fast rate / for a short period of time / runs out quickly.	**1**	
5	**a**		SS	**1**	
	b		50	**1**	
	c	**i**	It alters the (DNA) <u>nucleotide sequence</u> **or** <u>replaces one nucleotide</u> with another	**1**	
		ii	An incorrect <u>amino acid</u> is placed in the protein / polypeptide chain / haemoglobin **or**	**1**	

Question			Expected response	Max mark	Additional guidance
			One amino acid is replaced by another in the protein / polypeptide chain /haemoglobin **or** The amino acid sequence is shortened (due to a stop codon)		
	d		Pre-implantation Genetic Diagnosis / PGD /pre-implantation genetic screening	**1**	
	e		This drug could switch on the gene for fetal haemoglobin (in the child so haemoglobin is produced) **or** This drug could stop the gene being switched off (in the child)	**1**	
6	**a**		It can contract / vasoconstrict to reduce blood flow to some areas **or** It can relax / vasodilate to increase blood flow to some areas	**1**	
	b		1. Endothelium is damaged 2. Clotting factors are released 3. Prothrombin (enzyme) is converted / activated / changed into thrombin 4. Fibrinogen is converted into fibrin (by thrombin) 5. Fibrin / threads form a meshwork (that seals the wound) 6. The clot / thrombus formed may break loose, forming an embolus 7. A clot / thrombus may lead to a heart attack / stroke	**5**	1 mark should be allocated for each correct description up to a maximum of 5 Check any diagram(s) for relevant information not present in text and award accordingly
7	**a**	**i**	98 beats/minute	**1**	Units are essential
		ii	Stroke volume increased as oxygen uptake increased, until 2 litres/min, after which it remained constant.	**1**	
		iii	150	**1**	
	b		18·72	**1**	
	c	**i**	The first figure is systolic blood pressure / when blood is surging through the arteries / when the artery wall is stretched **and** the second figure is diastolic blood pressure / when blood is not surging through the arteries / when the artery wall has recoiled	**1**	
		ii	High blood pressure forces more fluid out of the capillaries Lymph vessels cannot reabsorb all the excess	**2**	

Question			Expected response	Max mark	Additional guidance
			tissue fluid		
8	**a**	**i**	*A* - Diabetic because blood glucose concentration increases faster / to a higher level / for a longer time **or** because blood glucose concentration does not return to normal (after 150 minutes) *B* - Non-diabetic because blood glucose increases slower / to a lower level / for a shorter time **or** because blood glucose concentration returns to normal (after 60 minutes)	**1**	Mark is awarded for the selection of the correct evidence to indicate a diabetic or non-diabetic individual
		ii	Blood glucose concentration increases for 60 minutes <u>and</u> then decreases At least one blood glucose concentration given with units eg Start = 4.8 m mol/litre 60 minutes = 11.2 m mol/litre 150 minutes = 7.6 m mol/litre	**2**	
	b		Type 1 – Insulin is not produced <u>so</u> blood glucose concentration cannot be controlled Type 2 - Insulin is produced <u>but</u> cells are less sensitive to insulin / have fewer insulin receptors / have developed insulin resistance	**2**	
9	**a**	**i**	1. As age increases, the frequency / number of cases of obesity increases 2. The frequency / number of cases is higher in 2012 (compared to 2003)	**2**	
		ii	1·536 million / 1 536 000	**1**	
	b		Reduce their intake of fats / sugars / carbohydrates **or** exercise more/become more active	**1**	
10	**a**		85·5	**1**	
	b		1. Each group has a similar gender balance 2. Each group completed the same jigsaw puzzle 3. Each group contained children with similar (physical / mental) abilities 4. The investigation was carried out in the same environmental conditions / same room / same temperature / same time of day / no distractions were present	**2**	1 mark should be allocated for each correct description up to a maximum of 2

Question			Expected response	Max mark	Additional guidance
	c		As children get older they learn faster (how to complete puzzles)	1	
	d	i	By the fifth attempt the children had learned / memorised where the pieces went (as a result of experience)	1	
		ii	Some children had become bored with / lost interest in the puzzle (by the fifth attempt / through lack of reinforcement)	1	
	e		Repeat the investigation in front of an audience / as a competition	1	
11	a	i	1955 **or** 1956	1	
		ii	Decrease in vaccination rate / lack of vaccines available **or** mass immigration **or** mutation of the whooping cough bacteria **or** adverse publicity about the vaccine	1	
	b		A large percentage of the population have been immunised This means that there is a very low chance that non-immune individuals will come into contact with infected individuals	2	
12	a	i	Shorter life span / lower survival rate, so no time to develop heart disease	1	
		ii	Better medical care / more doctors / more hospitals / more drugs **or** more use of insecticides / vector control **or** clean water / sewage treatment	1	Accept any other relevant example
	b	i	20%	1	
		ii	300 000	1	
13	a		Inhaled air / droplet infection.	1	Description must indicate the role of breathing
	b	i	1986 - 1991	1	
		ii	Increased vaccination **or** more effective antibiotic treatment.	1	
		iii	Cases of pulmonary TB decreased between 1991 and 2006 while cases of non-pulmonary	1	

Question			Expected response	Max mark	Additional guidance
			TB increased between 1991 and 2006		
		iv	11 : 5	**1**	
	c		HIV attacks lymphocytes reducing the ability of the immune system to respond to the bacterial infection	**1**	
14	**A**		1. ANS works automatically / without conscious control 2. Impulses originate in the medulla (region of the brain) 3. It is made up of the sympathetic and parasympathetic systems 4. These two systems are antagonistic in action 5. The sympathetic system prepares the body for fight or flight 6. The parasympathetic system prepares the body for rest and digest 7. Correct description of the effect of the ANS in controlling heart rate 8. Correct description of the effect of the ANS in controlling breathing rate 9. Correct description of the effect of the ANS in controlling peristalsis 10. Correct description of the effect of the ANS in controlling intestinal secretions	**7**	*1 mark should be allocated for each correct description up to a maximum of 7* *Check any diagram(s) for relevant information not present in text and award accordingly*
14	**B**		1. Neurotransmitters relay messages from nerve to nerve / muscle 2. Gap between them is called the synaptic cleft 3. Neurotransmitters are stored in vesicles 4. Arrival of an impulse causes vesicles to fuse with membrane and release neurotransmitter 5. Neurotransmitters diffuse across the cleft 6. Neurotransmitters bind to receptors 7. Receptors determine whether the signal is excitory or inhibitory 8. Neurotransmitters are removed by enzymes / re-uptake 9. Removal prevents continuous stimulation of post-synaptic neurones 10. Summation of weak stimuli can release enough neurotransmitter to fire an impulse	**7**	*1 mark should be allocated for each correct description up to a maximum of 7* *Check any diagram(s) for relevant information not present in text and award accordingly*

[END OF SPECIMEN MARKING INSTRUCTIONS]