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Mark

# S840/76/01

# Human Biology
# Paper 2

Date — Not applicable

Duration — 2 hours 20 minutes

* S 8 4 0 7 6 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

Scottish candidate number

**Total marks — 95**

Attempt ALL questions.

**You may use a calculator.**

Question 17 contains 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. Score through your rough work when you have written your final 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.



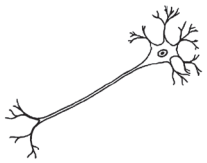
* S 8 4 0 7 6 0 1 0 1 *

**Total marks — 95**

**Attempt ALL questions**

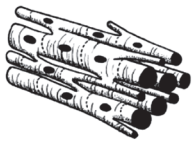
**Question 17 contains a choice**

**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 _____

_____

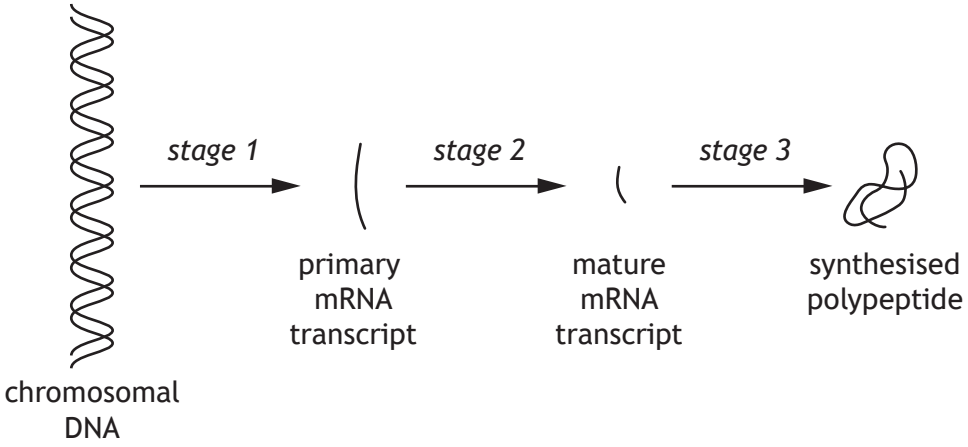
(c) A company has developed a drug that could be used to treat the symptoms of an inherited disease. Before proceeding to clinical trials using volunteers, the company decides to carry out additional tests in the laboratory using embryonic stem cells.

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

_____

_____

**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**

_____

_____

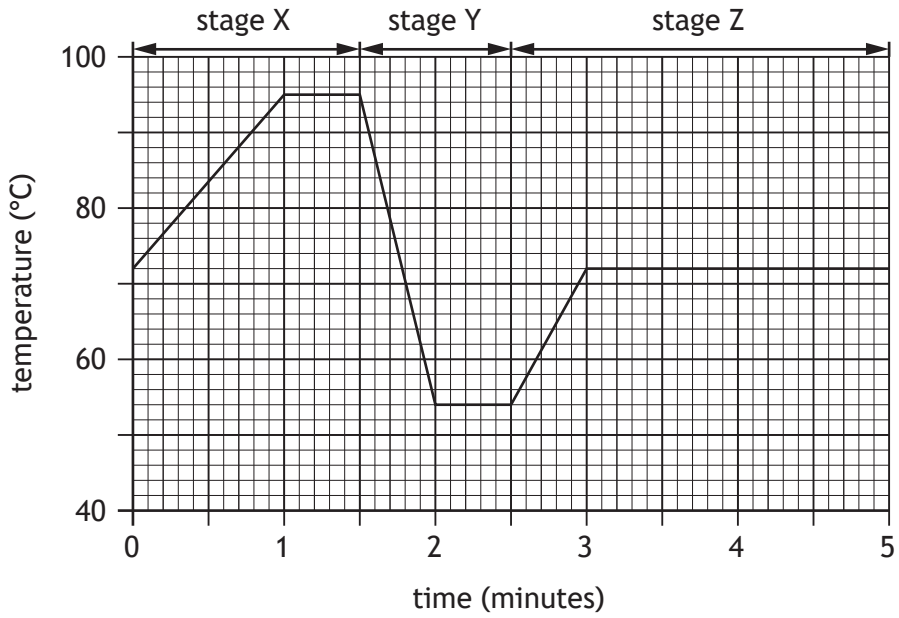
(ii) Explain why the mature mRNA transcript is shorter than the primary mRNA transcript. **1**

_____

_____

**[Turn over**

**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 what happens to these primers during stage Y. **1**

_____

_____

**3. (continued)**

(e) Suggest why the temperature is increased during stage Z. **1**

_____

_____

(f) 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

**[Turn over**

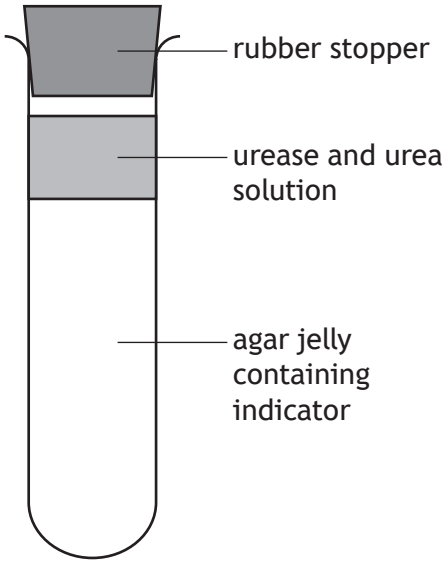
DO NOT WRITE IN THIS MARGIN

**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.

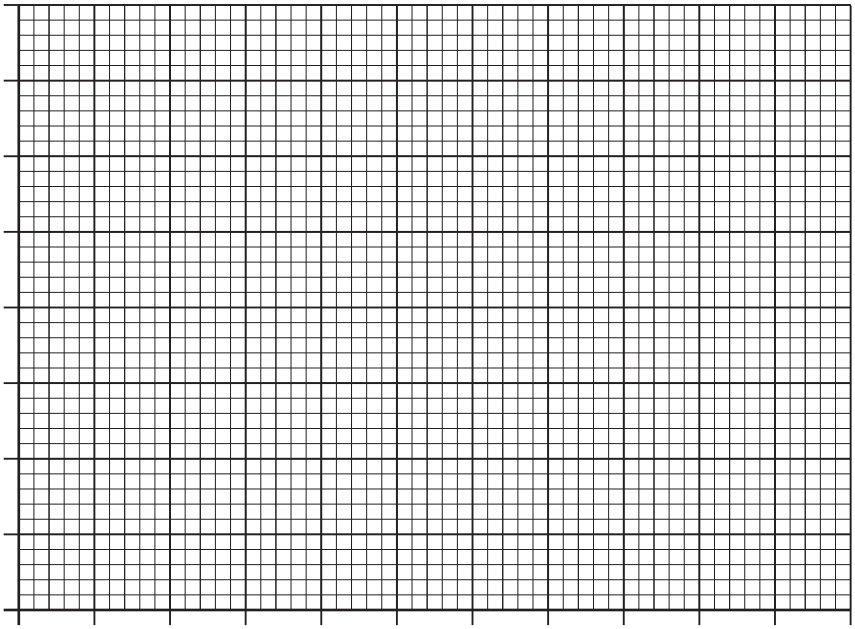
The results of the experiment are shown in the table.

| **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) (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**

_____

_____

**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.

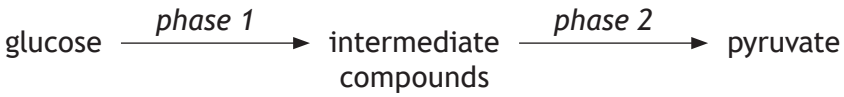
In another experiment, a test tube of agar jelly was set up containing the urease solution, 0·5 molar urea solution and thiourea.

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**

**5.** The diagram 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**

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 |

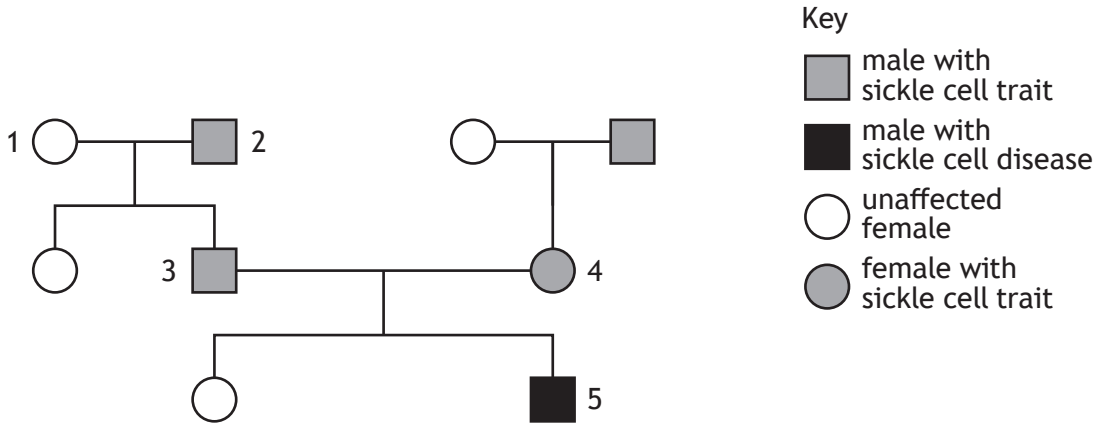
**[Turn over**

**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.

(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**

_____

_____

**6. (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.

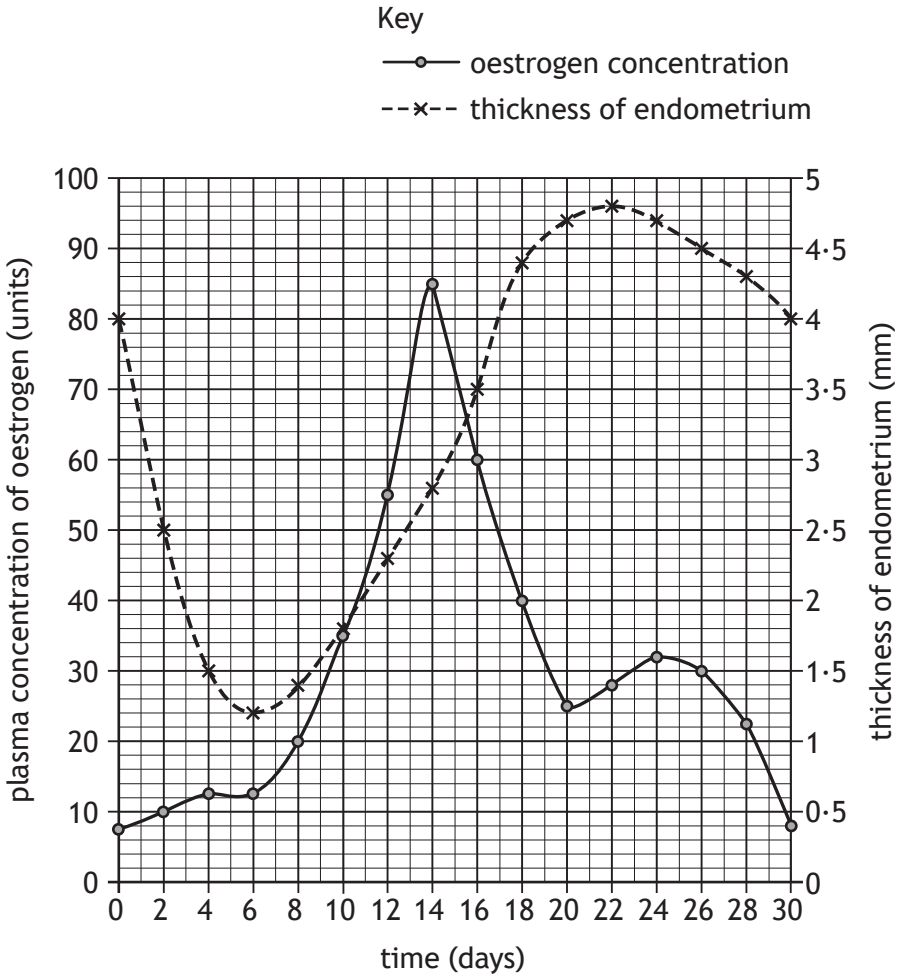
**Use this information** to suggest how a drug designed to treat sickle cell disease in young children could function. **1**

_____

_____

**[Turn over**

**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**

_____

_____

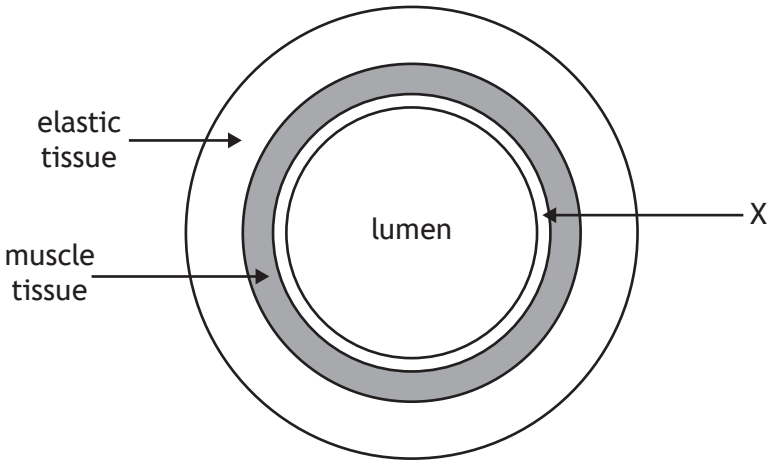
(d) Describe **one** way that ovulatory drugs stimulate ovulation. **1**

_____

_____

**[Turn over**

**8.** The diagram represents a section through an artery.




(a) Name layer X. **1**

_____

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

_____

_____

(c) 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**

_____

_____

_____

_____

_____

_____

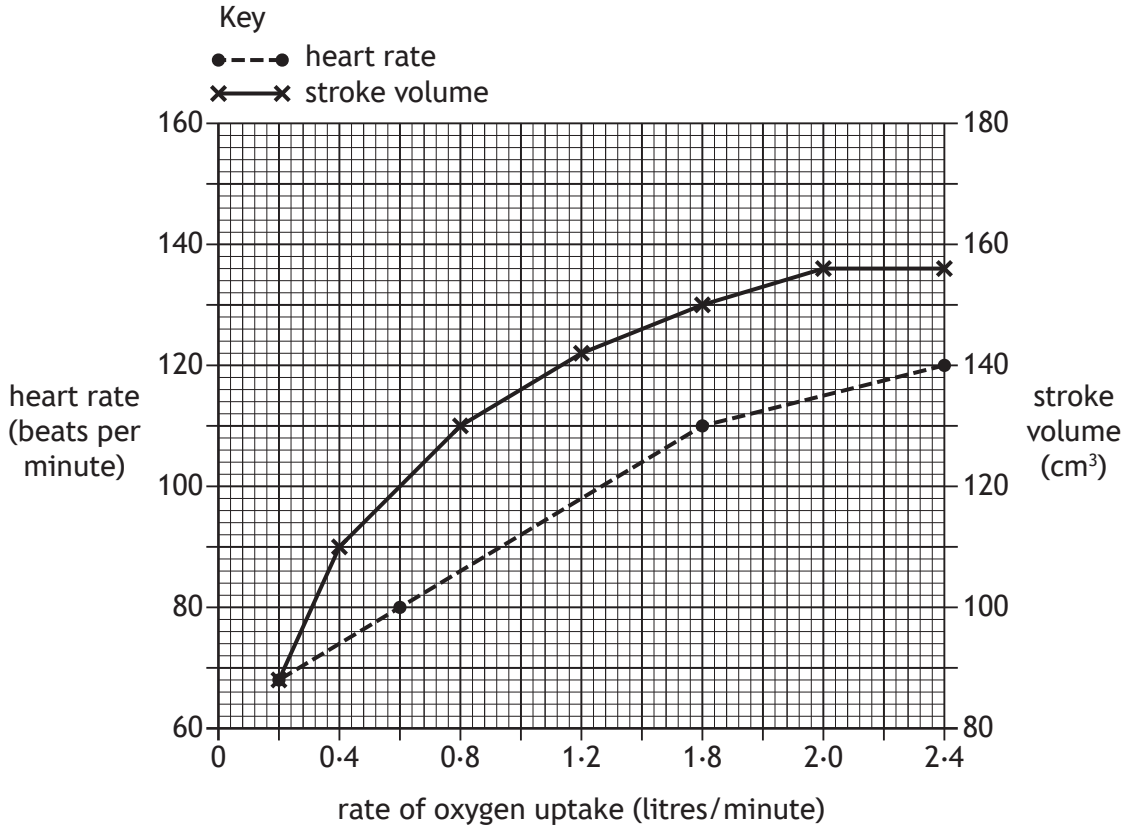
_____

_____

_____

_____

**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. **1**

_____

_____

_____

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

_____ $cm^3$

**[Turn over**

**9. (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 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**

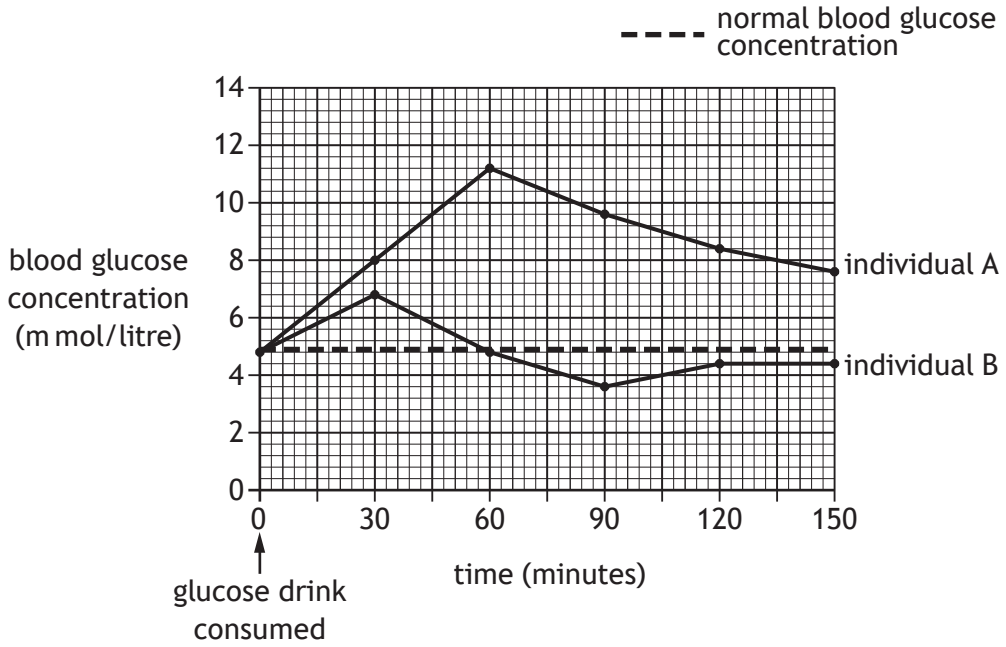
_____

_____

_____

_____

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

_____

_____

(ii) **Use data from the graph** to describe the changes that occur in the blood glucose concentration of individual A after consuming the glucose drink. **2**

_____

_____

_____

_____

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

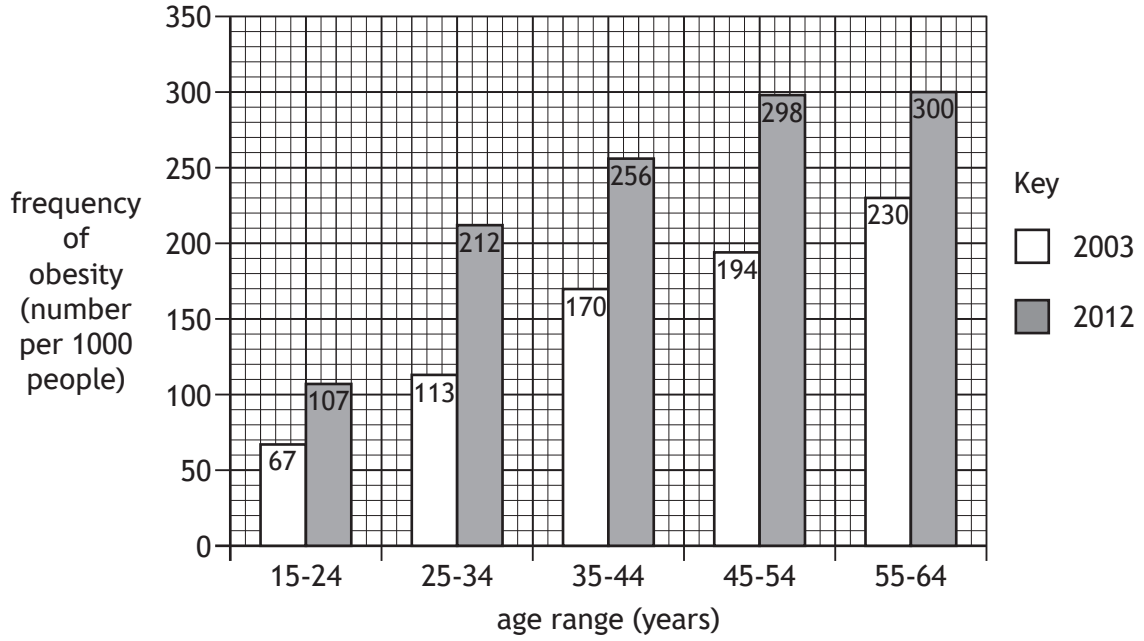
Type 1 _____

_____

Type 2 _____

_____

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




(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**

_____

_____

**12.** An investigation was carried out into how the meaning of words affects the recall of lists from long-term memory.

Two groups of 20 people were each shown a list of five words and asked to study them for 30 seconds.

Group 1 was shown words that all had a similar meaning, while group 2 was shown words that had different meanings.

Words shown to group 1 — *large*, *big*, *great*, *huge*, *wide*.

Words shown to group 2 — *late*, *cheap*, *rare*, *bright*, *rough*.

After reading a book for an hour, the groups were asked to write down the words that were on their list.

The results of the investigation are shown in the table.

| Group | Meaning of words shown | Number of people who correctly recalled all the words |
|---|---|---|
| 1 | similar | 11 |
| 2 | different | 17 |

(a) Describe **two** ways that the investigators could minimise variation between the two groups of people. **2**

1 _____

_____

2 _____

_____

(b) Suggest why the groups were asked to read a book for an hour. **1**

_____

_____

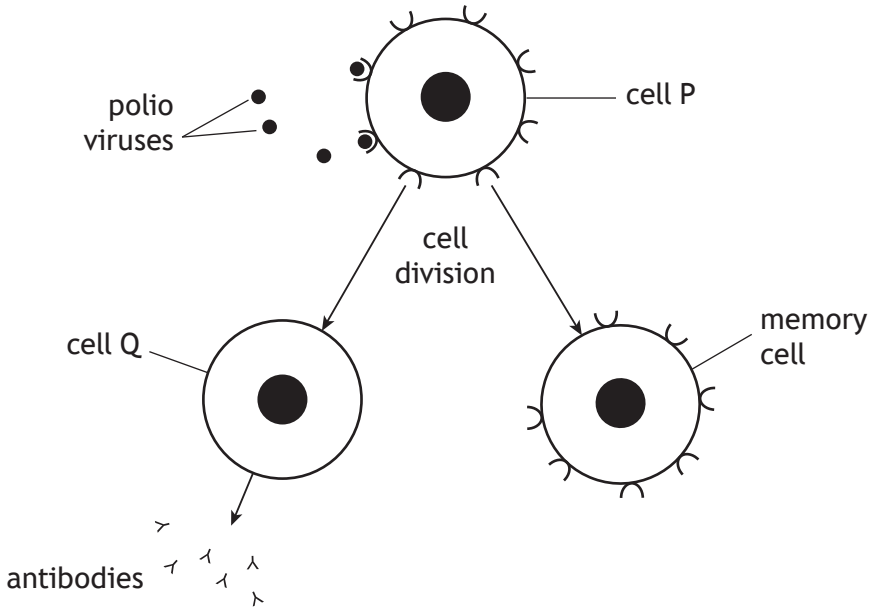
(c) State a conclusion that can be drawn from the results of the investigation. **1**

_____

_____

**[Turn over**

**13.** 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**

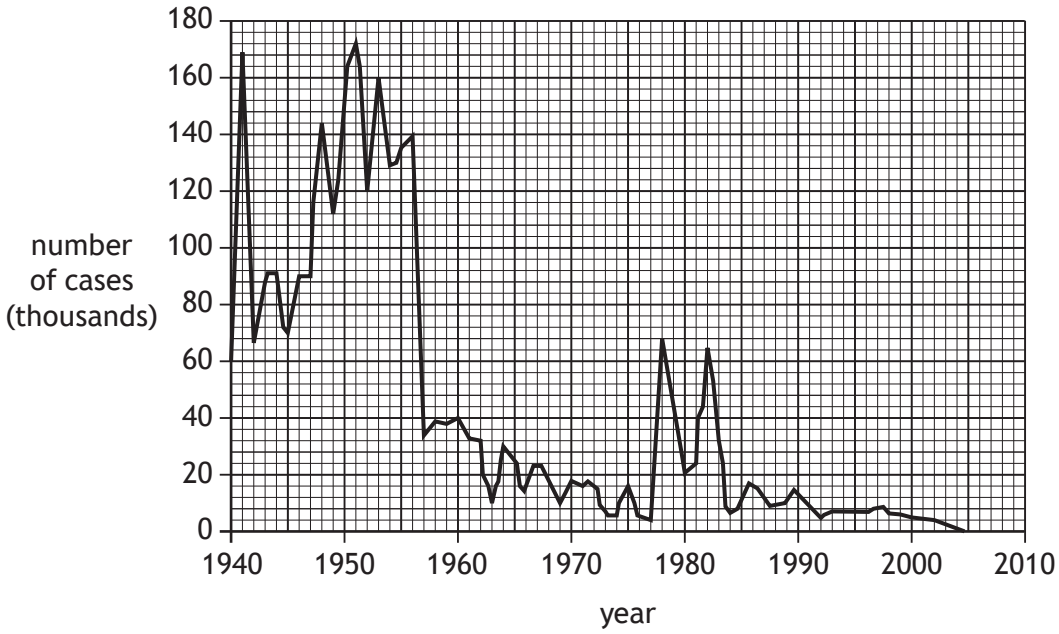
(c) Describe the role of memory cells in the immune system. **1**

(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**

**14.** The graph 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**

_____

(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**

_____

_____

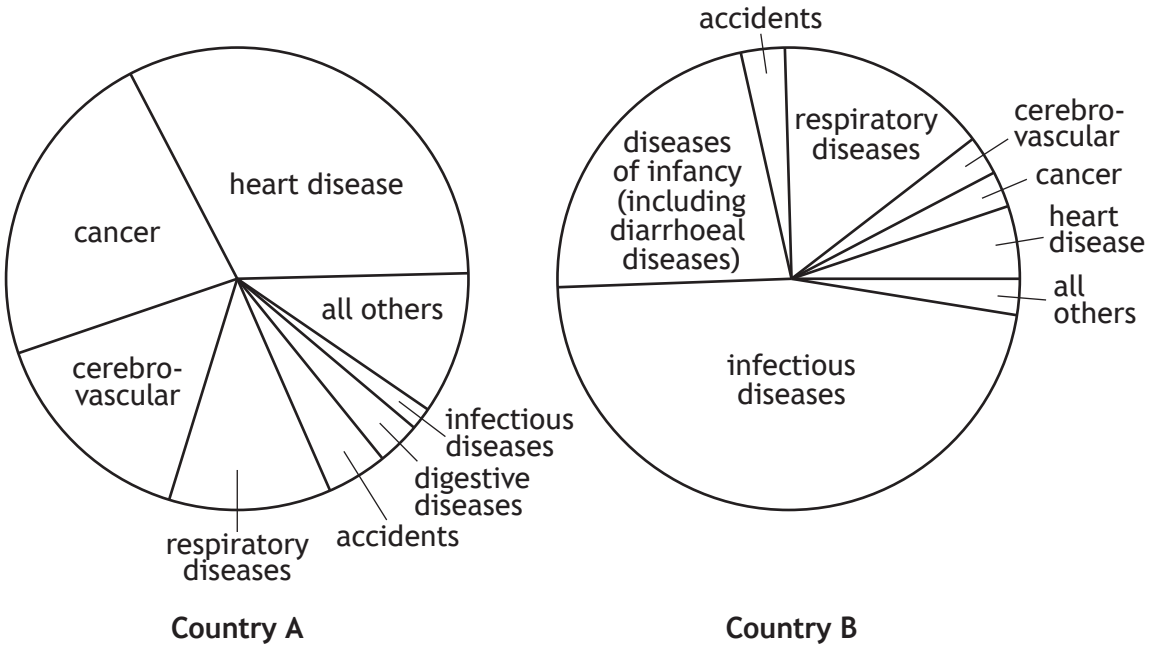
_____

_____

**[Turn over**

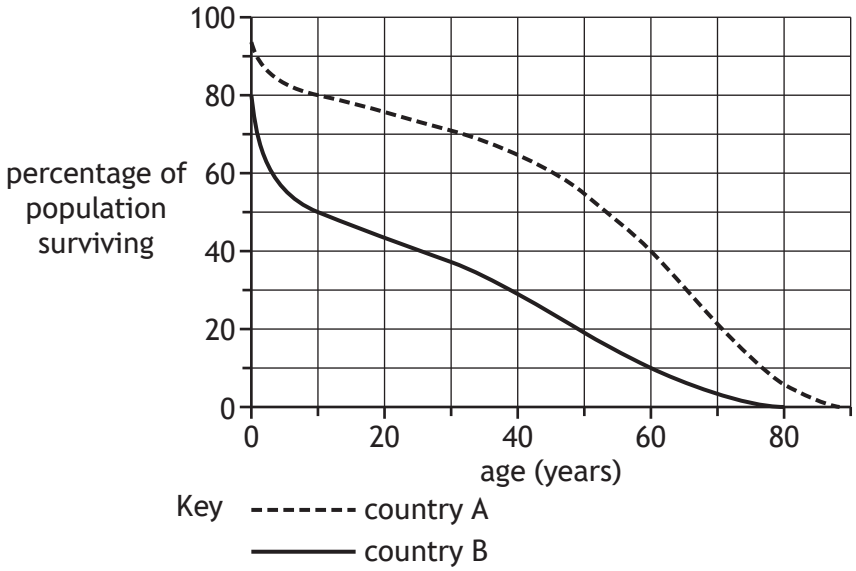
**15.** The following figures contain information about the causes of death and survival rates in two countries, A and B, in 2010.

**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**

**15. (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**

_____

_____

**[Turn over**

MARKS DO NOT WRITE IN THIS MARGIN

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

_____

_____

(iii) 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.

_____

_____

**17.** 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.**

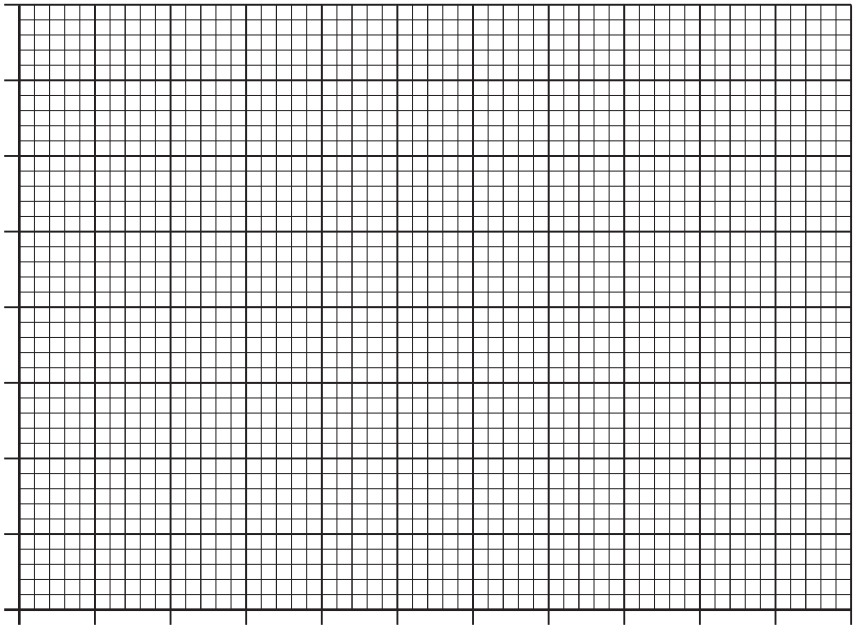
MARKS | DO NOT WRITE IN THIS MARGIN

**ADDITIONAL SPACE FOR ANSWER to question 17**

**[END OF SPECIMEN QUESTION PAPER]**

## ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 4 (a)



MARKS | DO NOT WRITE IN THIS MARGIN

**ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK**

National
Qualifications
SPECIMEN ONLY

**S840/76/01**

**Human Biology**
**Paper 2**

# Marking Instructions

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



SQA
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**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, sound out the words.
- 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**

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **1.** | (a) | | Process – Differentiation<br><br>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.<br><br>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.<br>**or**<br>Accept that people suffering from the disease will be delayed getting / deprived of a potential treatment.<br>**or**<br>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<br>**or**<br>The primary mRNA only codes for one protein. | **1** | |
| | | (ii) | Introns / non coding regions of genes are removed (in RNA splicing)<br>**or**<br>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<br>**or**<br>Breaking of hydrogen bonds between the (DNA) strands. | **1** | |
| | (d) | | They bind/anneal/join to (the ends of) target/complementary sequences of the DNA (being copied). | **1** | |
| | (e) | | To provide an optimum / better temperature for DNA polymerase. | **1** | |
| | (f) | | 640 | **1** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **4.** | (a) | | Axes have correct scales and labels. **(1)**<br><br>Points correctly plotted and line drawn. **(1)** | **2** | |
| | (b) | (i) | Volume of urea solution<br>**or**<br>Volume of urease solution<br>**or**<br>Concentration of urease solution<br>**or**<br>Volume / length of agar / diameter of test tube<br>**or**<br>Volume / concentration of indicator in agar. | **1** | |
| | | (ii) | Temperature of the tube contents / test tubes. | **1** | |
| | (c) | | The experiment was repeated at each urea concentration<br>**or**<br>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<br>**or**<br>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** | |
| | (g) | (i) | The inhibitor / thiourea blocked the active site on the urease / enzyme. | **1** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **4.** | (g) | (ii) | Not all active sites were blocked<br>**or**<br>Some active sites were still available. | **1** | |
| **5.** | (a) | | Energy investment - ATP molecules are broken down / used up (to provide energy)<br>**or**<br>Phosphorylation / addition of phosphate to glucose / intermediates occurs. **(1)**<br><br>Energy pay-off - ATP molecules are produced. **(1)** | **2** | |
| | (b) | | Name - acetyl (group) / acetyl coenzyme A / acetyl CoA. **(1)**<br><br>Conditions - when oxygen is present / in aerobic conditions **(1)**<br>**OR**<br><br>Name – lactate / lactic acid. **(1)**<br><br>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)**<br><br>Fast twitch – glycogen. **(1)** | **2** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **6.** | (a) | | SS | **1** | |
| | (b) | | 50 | **1** | |
| | (c) | (i) | It alters the (DNA) nucleotide sequence<br>**or**<br>It replaces one nucleotide with another. | **1** | |
| | | (ii) | An incorrect amino acid is placed in the protein / polypeptide / haemoglobin<br>**or**<br>One amino acid is replaced by another in the protein / polypeptide / haemoglobin<br>**or**<br>The amino acid sequence / protein becomes shorter (due to a stop codon). | **1** | |
| | (d) | | Pre-implantation genetic diagnosis / PGD | **1** | |
| | (e) | | This drug could switch on the gene for fetal haemoglobin (in the child so haemoglobin is produced)<br>**or**<br>This drug could stop the gene for fetal haemoglobin being switched off (in the child so haemoglobin is produced). | **1** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **7.** | (a) | (i) | 55 | **1** | |
| | | (ii) | The pituitary gland releases follicle stimulating hormone / FSH. **(1)**<br><br>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<br>**or**<br>They mimic the action of FSH / LH. | **1** | |
| **8.** | (a) | | The endothelium | **1** | |
| | (b) | | It can contract / vasoconstrict to reduce blood flow (to some areas)<br>**or**<br>It can relax / vasodilate to increase blood flow (to some areas). | **1** | |
| | (c) | | <u>Formation</u><br>1. The atheroma can rupture damaging the endothelium / layer X.<br>2. Clotting factors are released.<br>3. Prothrombin is converted / changed / activated into thrombin.<br>4. Fibrinogen is converted into fibrin (by thrombin).<br>5. Fibrin / threads form a meshwork that seals the wound / clots the blood.<br><br><u>Effects</u><br>6. The clot / thrombus formed may break loose, forming an embolus.<br>7. A clot / thrombus may lead to a heart attack / stroke. | **5** | Candidates must give at least one point from each area to gain 5 marks. |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **9.** | (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) | It represents systolic blood pressure<br>**or**<br>It is when blood is surging / being pumped through the arteries<br>**or**<br>It is when the artery wall is stretched. | **1** | |
| | | (ii) | High blood pressure forces (more) fluid out of the capillaries. **(1)**<br><br>Lymph vessels cannot reabsorb all the excess (tissue) fluid. **(1)** | **2** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **10.** | (a) | (i) | Their blood glucose concentration starts to decrease after 30 minutes<br>**or**<br>Their blood glucose concentration returns to normal after 60 minutes<br>**or**<br>Their blood glucose concentration increases at a slower rate / to a lower level / for a shorter time compared to individual A. | **1** | |
| | | (ii) | Between 0 and 60 minutes blood glucose concentration increased and then it decreased between 60 and 150 minutes. **(1)**<br><br>It increased from 4·8 m mol/litre to 11·2 m mol/litre / by 6·4 m mol/litre<br>**or**<br>It decreased from 11·2 m mol/litre to 7·6 m mol/litre / by 3·6 m mol litre. **(1)** | **2** | Accept it increases up to 60 minutes and then decreases.<br><br>Answer must indicate m mol/litre for at least one figure. |
| | (b) | | Type 1 – Insulin is not produced (so blood glucose concentration cannot be controlled). **(1)**<br><br>Type 2 - Cells are less sensitive to insulin / have fewer insulin receptors / have developed insulin resistance. **(1)** | **2** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **11.** | (a) | (i) | 1. As age increases, the frequency / number of cases of obesity increases. **(1)**<br><br>2. The frequency / number of cases is always higher in 2012 (compared to 2003). **(1)** | **2** | |
| | | (ii) | 1·536 million / 1 536 000 | **1** | |
| | (b) | | Reduce their intake of fats / sugars /carbohydrates<br>**or**<br>Take more exercise /become more active. | **1** | |
| **12.** | (a) | | 1. Use people of similar ages / have a similar age range (in each group). **(1)**<br><br>2. Use people of the same gender / have a similar gender balance (in each group). **(1)** | **2** | Accept – use people of similar memory ability in each group. |
| | (b) | | To prevent rehearsal of the words keeping them in short-term memory<br>**or**<br>To remove the words from short-term memory<br>**or**<br>To make sure that any words recalled had come from long-term memory. | **1** | |
| | (c) | | Lists are easier to recall (from long-term memory) if the words do not have a similar / have a different meaning<br>**or**<br>Lists are harder to recall (from long-term memory) if the words have a similar meaning / do not have a different meaning. | **1** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **13.** | (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<br>**or**<br>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** | |
| **14.** | (a) | (i) | 1955/1956 | **1** | |
| | | (ii) | Decrease in vaccination rate / lack of vaccines available<br>**or**<br>Mass immigration<br>**or**<br>Mutation of the whooping cough bacteria<br>**or**<br>Adverse publicity about the vaccine. | **1** | |
| | (b) | | A large percentage of the population has been immunised. **(1)**<br><br>This means that there is a very low chance that non-immune individuals will come into contact with infected individuals. **(1)** | **2** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **15.** | (a) | | Shorter life span / lower survival rate, so no time to develop heart disease. | **1** | |
| | (b) | (i) | 20 | **1** | |
| | | (ii) | 300 000 | **1** | |
| | (c) | | Widespread vaccination might not be possible due to the effects of poverty. | **1** | Accept<br>Widespread vaccination might not be possible due to rejection by some of the population / lack of education / malnutrition<br>**OR**<br>Widespread vaccination might not be possible due to lack of access to doctors / nurses /medical resources / vaccines / geographical remoteness. |
| **16.** | (a) | (i) | 1986-1991 | **1** | |
| | | (ii) | Cases of pulmonary TB decreased while cases of non-pulmonary TB increased. | **1** | |
| | | (iii) | 11 : 5 | **1** | |
| | (b) | | HIV attacks / destroys T lymphocytes weakening the immune system / reducing the ability of the body to respond to the infection. | **1** | |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **17.** | A | | 1. The autonomic nervous system (ANS) works automatically / without conscious control.<br>2. It is controlled by the medulla (region of the brain).<br>3. It is made up of sympathetic and parasympathetic systems.<br>4. These two systems are antagonistic in action.<br>5. The SAN / sino-atrial node controls heart rate.<br>6. The sympathetic system speeds up the heart rate / impulses leaving the SAN<br>7. by releasing noradrenaline.<br>8. The parasympathetic system slows down the heart rate / impulses leaving the SAN<br>9. by releasing acetylcholine.<br>10. The parasympathetic system increases the rate of peristalsis while the sympathetic system decreases it.<br>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.<br><br>Check any diagram(s) for relevant information not present in text and award marks accordingly. |

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **17.** | B | | 1. Neurotransmitters relay / carry messages from nerve to nerve / muscle.<br>2. The gap between nerves / nerves and muscles is called the synaptic cleft.<br>3. Neurotransmitters are stored in vesicles.<br>4. Arrival of an impulse causes vesicles to fuse with the (presynaptic) membrane and release their contents / neurotransmitter(molecules).<br>5. Neurotransmitters diffuse across the cleft / gap / synapse.<br>6. Neurotransmitters bind to receptors.<br>7. A minimum number / threshold of neurotransmitter molecules must attach to receptors to trigger an impulse.<br>8. Receptors determine whether the signal is excitatory or inhibitory.<br>9. Neurotransmitters are removed by enzymes / re-uptake.<br>10. Removal prevents continuous stimulation of the postsynaptic neurons.<br>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.<br><br>Check any diagram(s) for relevant information not present in text and award marks accordingly. |

**[END OF SPECIMEN MARKING INSTRUCTIONS]**