



Higher Human
Biology
SQA past paper
booklet A
2018, 2017 & 2016



National
Qualifications
2018

X740/76/02

**Human Biology
Section 1 — Questions**

TUESDAY, 15 MAY

1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X740/76/01.

Record your answers on the answer grid on *page 03* 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.



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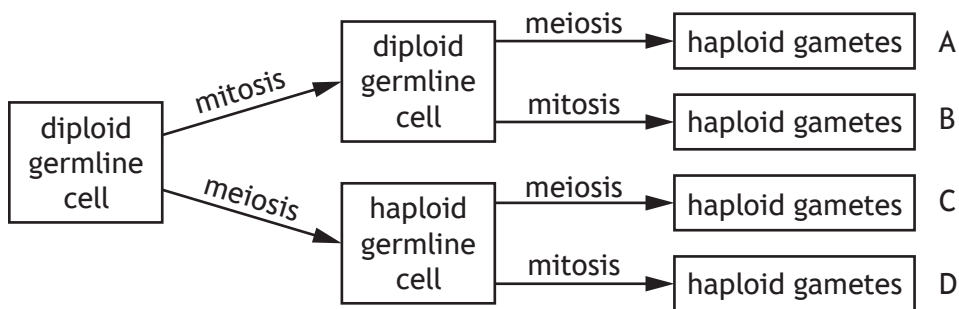
SECTION 1 — 20 marks

Attempt ALL questions

1. Each type of human cell has a different structure and function because

- A they contain different genes
- B different genes are expressed in each
- C some genes are lost during differentiation
- D some genes are gained during differentiation.

2. Which pathway describes the production of haploid gametes from diploid germline cells?



3. The table shows the number of dividing and non-dividing cells in samples of three types of tissue.

Type of tissue	Number of cells dividing	Number of cells not dividing
nerve	8	17
blood	4	16
muscle	1	19

The percentage of connective tissue cells which are dividing is

- A 5%
- B 20%
- C 25%
- D 32%

4. A fragment of DNA contained 144 nucleotide base pairs.
What is the total number of deoxyribose sugars in this fragment?

- A 48
- B 72
- C 144
- D 288

5. The table shows the positions of bases in the mRNA codons for specific amino acids.

<i>First position</i>	<i>Second position</i>				<i>Third position</i>
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	leucine		stop	stop	C
			stop	tryptophan	A
	C		leucine	proline	histidine
glutamine		U			
					A
isoleucine		threonine			asparagine
	start/ methionine		lysine	arginine	A
G	valine	alanine	aspartic acid	glycine	U
			glutamic acid		U
			G		

Which of the following mutations in a section of mRNA would result in the production of a shortened protein?

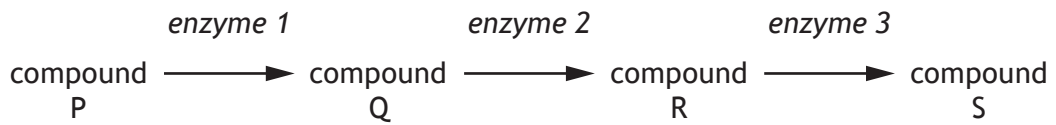
	<i>Original mRNA codons</i>	<i>Mutated mRNA codons</i>
A AUG GCC CAU AUG GCA CAU
B CAG UAC GUG CAG UAG GUG
C AAU UGG CCA AAU UGU CCA
D GUC AAC UCG GUC AAG UCG

6. A mature mRNA transcript is produced from a primary mRNA transcript by
- A adding exons
 - B adding introns
 - C removing exons
 - D removing introns.
7. DNA probes are short fragments of DNA that
- A allow RNA polymerase to begin transcription
 - B allow DNA polymerase to begin DNA replication
 - C are used to detect specific sequences in samples of DNA
 - D bind to specific target sequences in the PCR reaction to amplify DNA.
8. The list shows some of the substances produced during the respiration of glucose in the presence of oxygen.
- 1 acetyl group
 - 2 pyruvate
 - 3 citrate
 - 4 ATP

Which of the following sequences shows the order in which these substances are produced?

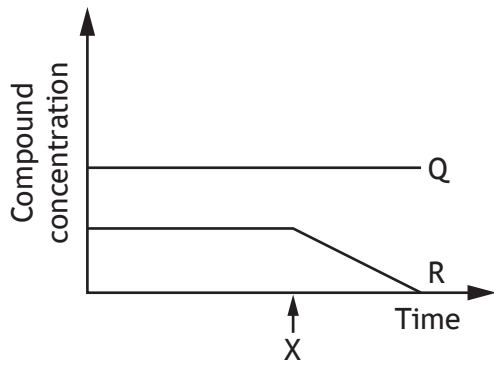
- A 4, 2, 1, 3
 - B 4, 2, 3, 1
 - C 2, 1, 4, 3
 - D 2, 3, 1, 4
9. In cellular respiration, the products of the electron transport chain are
- A water and ATP
 - B oxygen and ATP
 - C NADH and FADH₂
 - D carbon dioxide and water.

10. The following diagram shows an enzyme-controlled metabolic pathway.

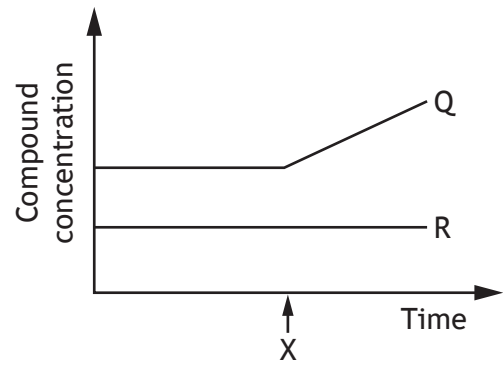


If enzyme 2 is inhibited at time X, which graph predicts the resulting concentrations of compounds Q and R?

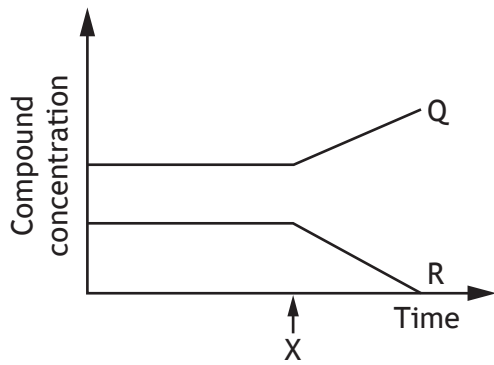
A



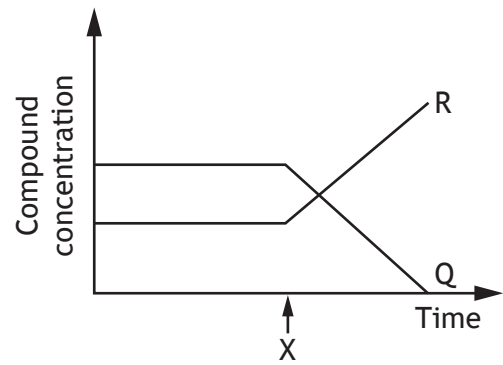
B



C

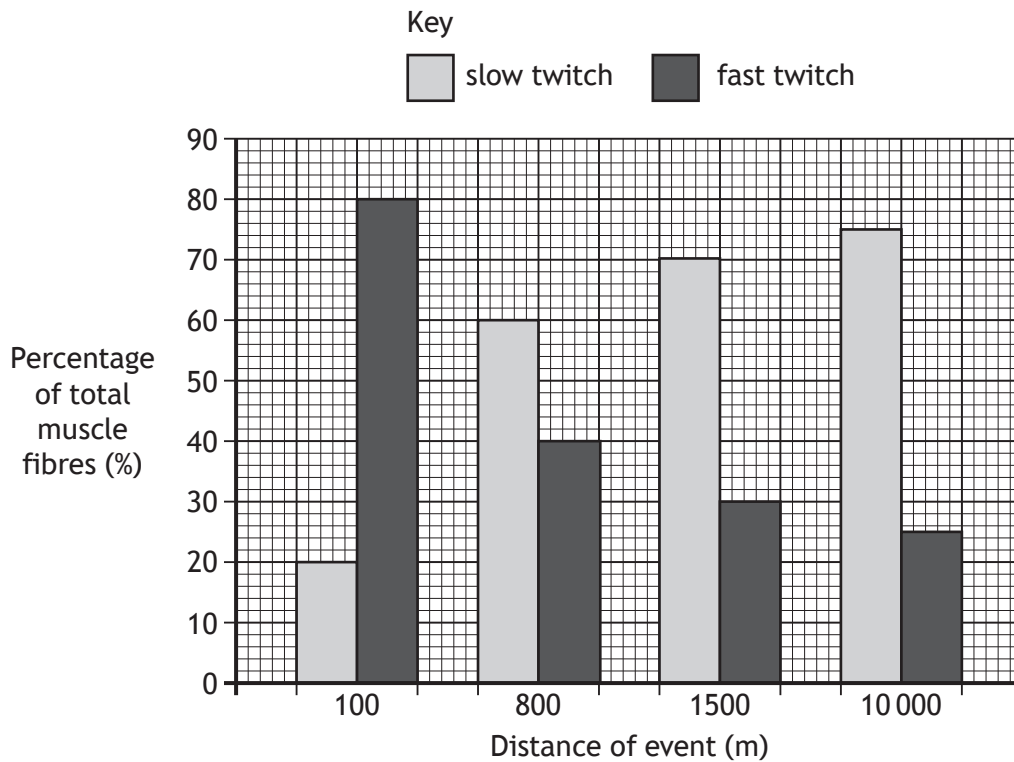


D



[Turn over

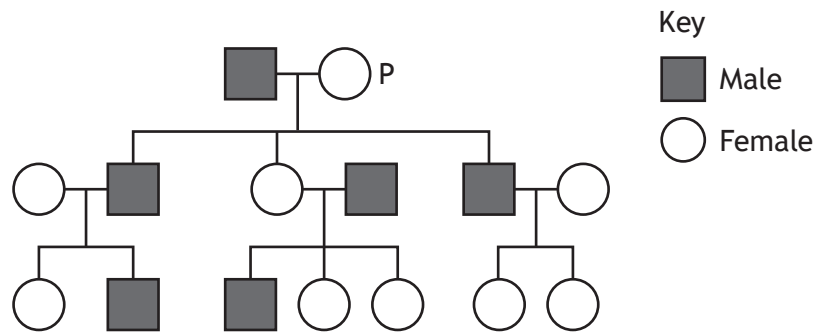
11. The graph shows the percentage of slow and fast twitch muscle fibres present in athletes who trained for events of different distances.



Which of the following conclusions can be drawn from this graph?

- A Athletes who trained for the 100 m event have 5 times more fast twitch muscle fibres than slow twitch muscle fibres.
- B Athletes who trained for the 10 000 m event have 4 times more slow twitch muscle fibres than fast twitch muscle fibres.
- C Athletes who trained for the 800 m event have twice as many slow twitch muscle fibres as athletes in the 1500 m event.
- D Athletes who trained for the 100 m event have twice as many fast twitch muscle fibres as athletes in the 800 m event.

12. The mitochondria of human cells contain DNA.
 Women can pass mitochondrial DNA to their offspring but men cannot.
 The diagram shows a family tree.



Identify the number of individuals in the family tree that have inherited mitochondrial DNA which originated from P.

- A 3
 B 4
 C 5
 D 6
13. Thalassaemia is an inherited condition that affects the ability of haemoglobin to carry oxygen. The condition is **not** sex-linked.

The table shows genotypes and phenotypes associated with thalassaemia.

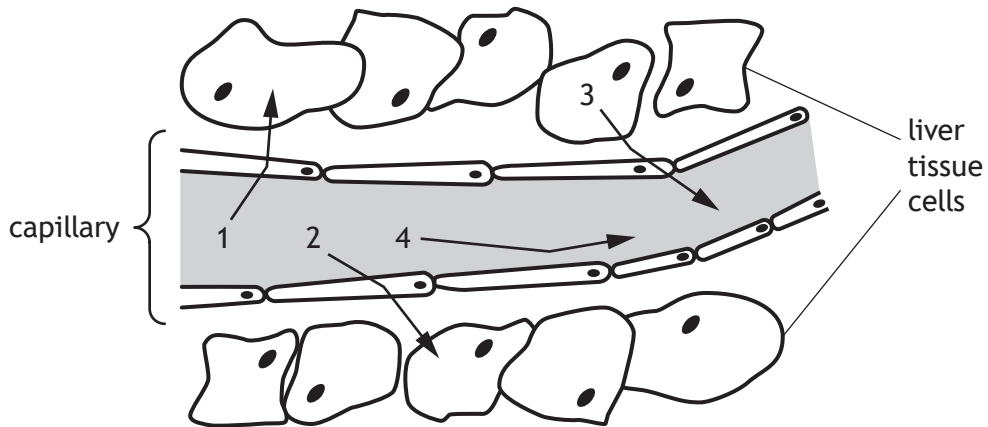
<i>Genotype</i>	<i>Phenotype</i>
AA	unaffected
AT	thalassaemia trait
TT	severe thalassaemia

An unaffected man and a woman with thalassaemia trait have a child.
 The chance that the child will also have thalassaemia trait is

- A 0%
 B 25%
 C 50%
 D 100%

[Turn over

14. The diagram shows the movement of substances between a capillary and the surrounding liver tissue cells.



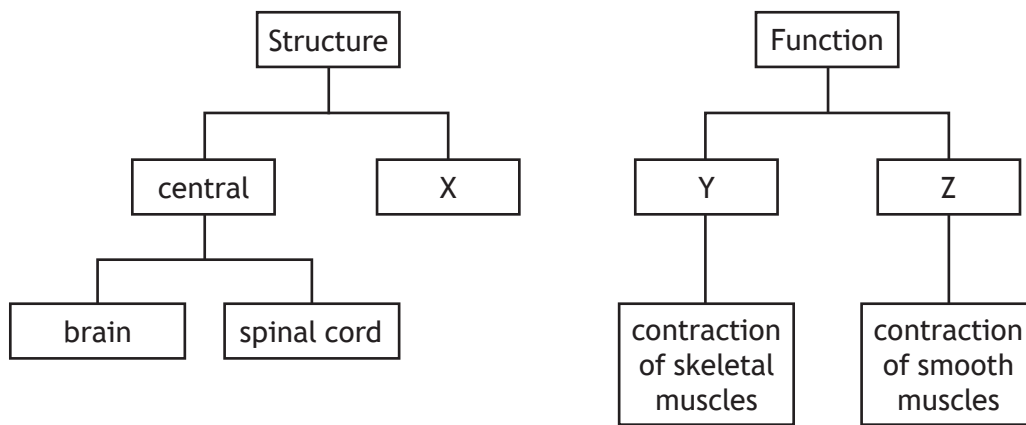
Which row in the table identifies the substances in the diagram?

	<i>Substance</i>			
	1	2	3	4
A	glucose	carbon dioxide	oxygen	protein
B	oxygen	glucose	carbon dioxide	protein
C	protein	glucose	oxygen	carbon dioxide
D	protein	oxygen	carbon dioxide	glucose

15. During the formation of a thrombus, fibrin

- A converts prothrombin to thrombin
- B causes the formation of fibrinogen
- C forms a meshwork to clot the blood
- D causes the release of clotting factors.

16. The diagrams show two ways to classify the nervous system.



Which row in the table identifies X, Y and Z?

<i>Nervous System</i>			
	X	Y	Z
A	peripheral	somatic	autonomic
B	somatic	autonomic	peripheral
C	autonomic	peripheral	somatic
D	peripheral	autonomic	somatic

17. A child was stung by a wasp. This led to them being afraid of all flying insects.

This is an example of

- A discrimination
- B generalisation
- C internalisation
- D reinforcement.

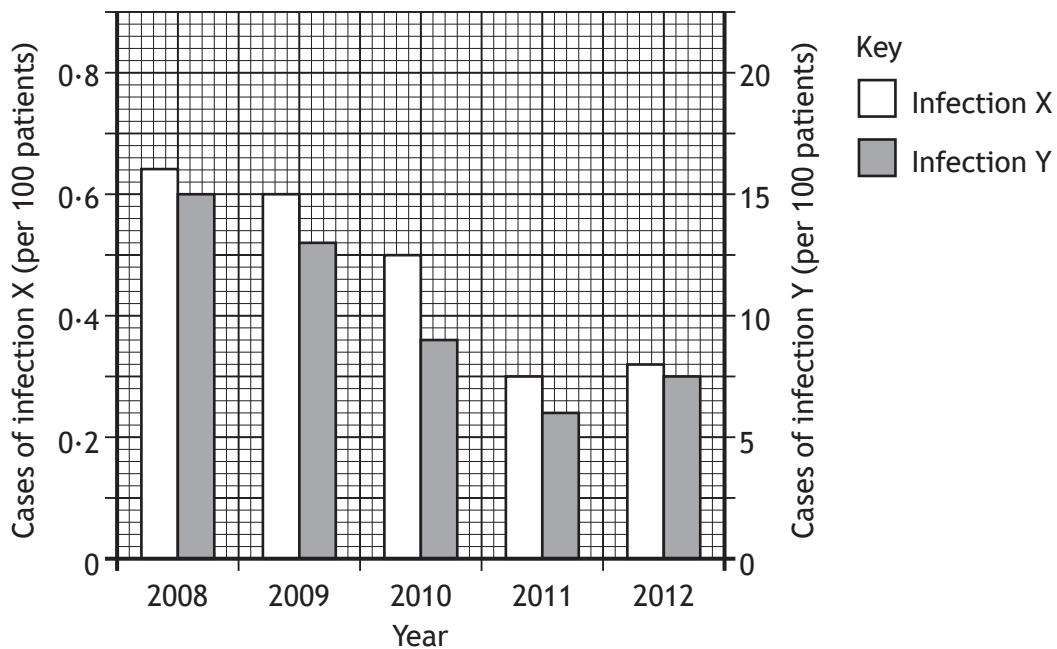
[Turn over

18. An investigation was carried out into the effect of colour on the recognition of shapes. The procedure included the following features.
- Two groups of 20 students were selected.
 - Each group was shown the same sequence of shapes but in a different colour.
 - One group was shown blue shapes and the other group was shown red shapes.
 - The time taken by each student to identify each shape was noted.

Which of the following would improve the reliability of the results?

- A Showing the same set of shapes to each group.
 - B Ensuring all the selected students were the same age.
 - C Having the same number of males and females in each group.
 - D Repeating the whole procedure with two more groups of students.
19. The virus that causes influenza can evade the specific immune response by
- A attacking phagocytes
 - B attacking lymphocytes
 - C surviving within phagocytes
 - D showing antigenic variation.

20. A hospital introduced a programme of handwashing in 2008. The graph shows the impact of this on the number of cases of two infections.



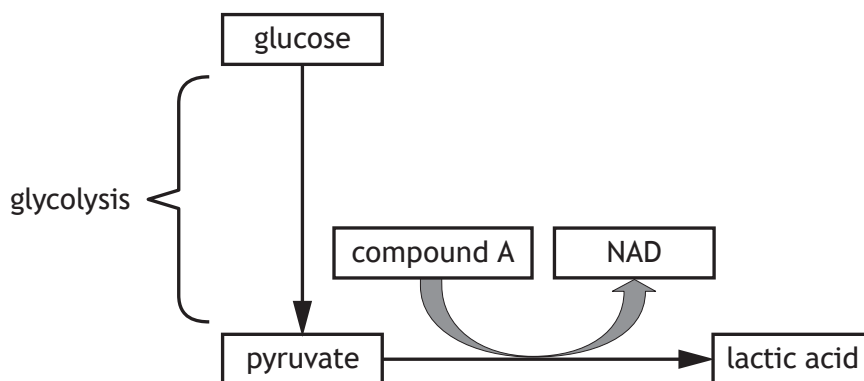
Which of the following statements is **not** correct?

- A The cases of both infections fell by 50% over the 5 year period.
- B The number of cases of infection Y was always greater than the number of cases of infection X.
- C The highest number of cases of infection X was 0.62 per 100 patients while the highest number of cases of infection Y was 15 per 100 patients.
- D The lowest number of cases of infection X was 0.3 per 100 patients while the lowest number of cases of infection Y was 6 per 100 patients.

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

SECTION 2 — 80 marks
 Attempt ALL questions
 Question 13 contains a choice

1. The diagram represents glycolysis and the metabolic pathway which synthesises lactic acid.

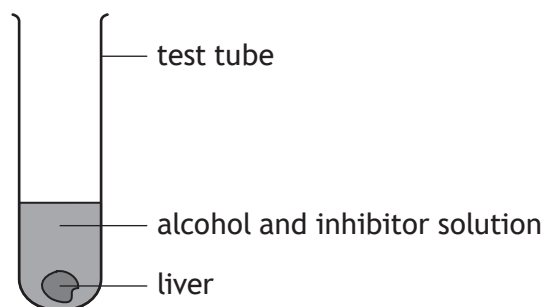


- (a) (i) State where glycolysis occurs within a cell. 1
- _____
- (ii) Describe what happens during the energy investment phase of glycolysis. 1
- _____
- _____
- (b) During lactic acid synthesis NAD is regenerated.
- (i) Name compound A. 1
- _____
- (ii) Explain the importance of the regeneration of NAD for glycolysis. 1
- _____
- _____
- (iii) State the reason why muscle cells produce lactic acid during vigorous exercise. 1
- _____
- _____



2. An investigation was carried out into the effect of inhibitor concentration on the activity of an enzyme which breaks down alcohol in liver cells.

Six test tubes were set up, each containing a piece of liver, alcohol and a different concentration of inhibitor, as shown in the diagram.



The test tubes were left for 30 minutes at 37 °C.

The final concentration of alcohol in each tube was then measured.

- (a) State **two** variables, not already mentioned, which should be kept constant to make this investigation valid. 2

1 _____

2 _____

- (b) The inhibitor used in this investigation was non-competitive.

Describe how a non-competitive inhibitor works. 1

- (c) The results of the investigation are shown in the table.

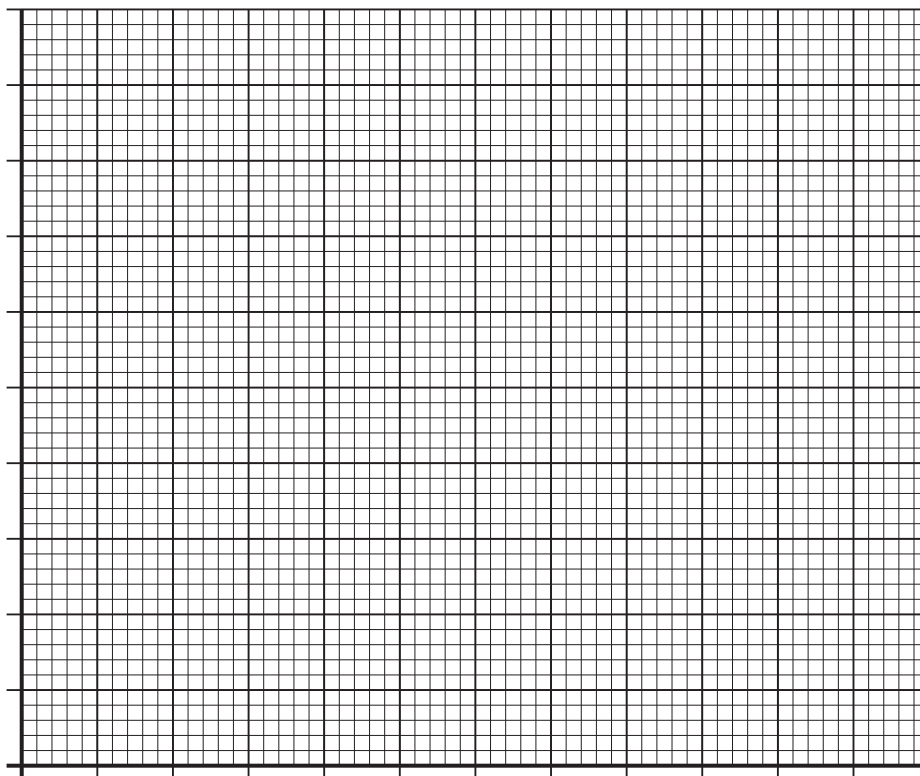
<i>Inhibitor concentration</i> (mM)	<i>Final alcohol concentration</i> (% of initial concentration)
0.5	20
1.5	28
2.5	60
3.5	96
4.5	100
5.5	100

2. (c) (continued)

(i) Construct a line graph to show the data in the table.

2

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



(ii) Use the data to describe the relationship between the concentration of inhibitor and enzyme activity.

2

(d) A second experiment, using increasing concentrations of alcohol, was carried out to show that the inhibitor was non-competitive.

Six test tubes were set up, each containing a piece of liver, an inhibitor concentration of 4.5 mM and different concentrations of alcohol.

Suggest how the results would confirm that the inhibitor was non-competitive.

1



3. Olfactory genes code for receptors in the nose that detect smells.

The base sequences from the same region of a rat olfactory gene and a human olfactory gene are shown.

Rat ... ATACGATTGCATGCCGAT...
Human ... ATACGATTGCATCCGAT...

The rat olfactory gene codes for a functional protein but the protein coded for by the human olfactory gene is non-functional.

- (a) (i) Name the type of single gene mutation that has occurred to change the human base sequence. 1

- (ii) Suggest why the changed sequence of bases in the human gene codes for a non-functional protein. 1

- (b) State the term which describes the comparison of human genome sequence data with the genomes of other species. 1



3. (continued)

- (c) The table shows the number of functional olfactory genes identified in rats, humans and chickens.

<i>Animal</i>	<i>Number of functional olfactory genes</i>
rat	1200
human	400
chicken	80

- (i) Express, as a simple whole number ratio, the number of functional olfactory genes found in the animals.

1

Space for calculation

_____ : _____ : _____
 rat human chicken

- (ii) Suggest what the number of functional olfactory genes indicates about the sense of smell of these animals.

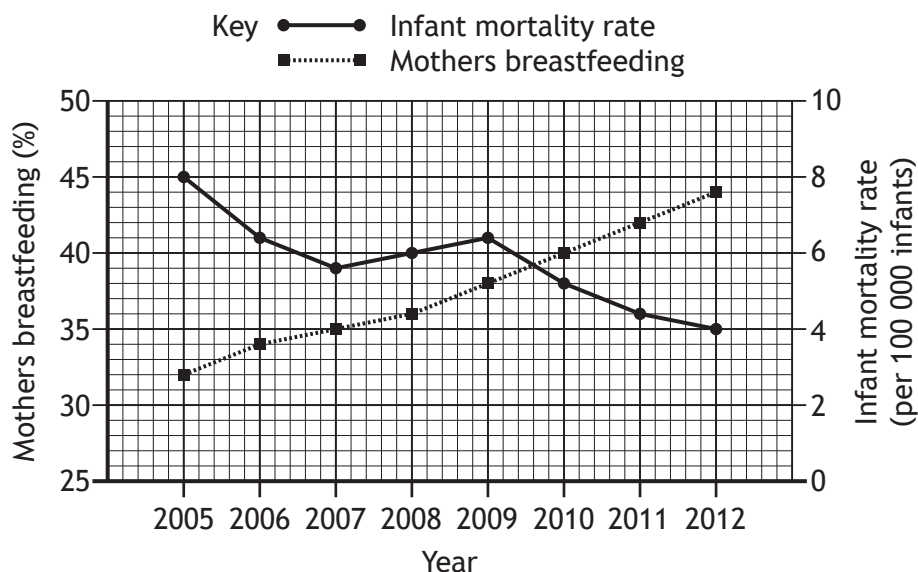
1

- (d) Describe **two** chromosome structure mutations and the overall consequence of these to the individual.

3



4. The graph contains information about breastfeeding and infant mortality in a country between 2005 and 2012.



(a) (i) State the infant mortality rate when 35% of mothers were breastfeeding. 1

(ii) Calculate the percentage decrease in the infant mortality rate between 2009 and 2012. 1

Space for calculation

_____ %

(iii) Predict the percentage of mothers who would be breastfeeding in 2013. 1

_____ %

(iv) Describe evidence from the graph which indicates that the increase in breastfeeding mothers cannot be the only reason for the decrease in infant mortality. 1



* X 7 4 0 7 6 0 1 1 0 *

4. (continued)

- (b) The table contains information from a Scottish survey comparing the incidence of diarrhoea in breastfed and bottle fed babies.

	Age of baby (months)			
	0-3		4-6	
Feeding method	Breast	Bottle	Breast	Bottle
Incidence of diarrhoea (%)	3.6	21.6	10.2	20.4

- (i) Calculate how many times greater the incidence of diarrhoea is when 0-3 month old babies are bottle fed rather than breastfed. 1

Space for calculation

_____ times greater

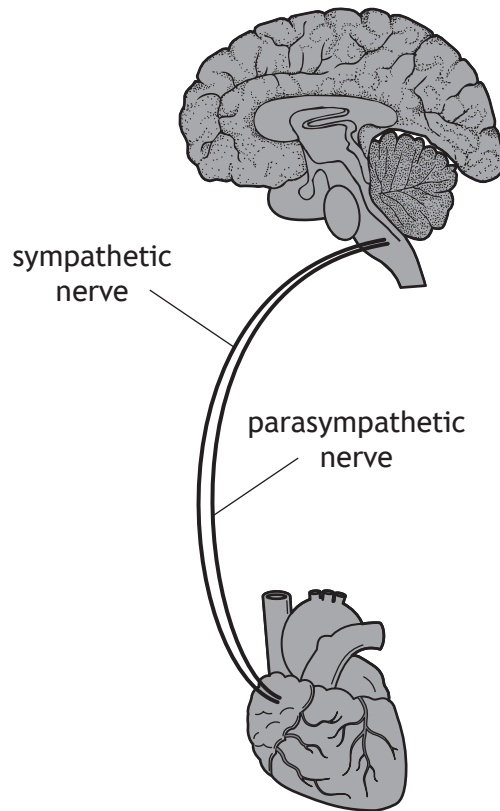
- (ii) Diarrhoea is a symptom of an intestinal infection.

Suggest why there is a greater incidence of diarrhoea in bottle fed babies. 1

[Turn over



5. The diagram represents part of the autonomic nervous system which links the brain to the heart.



- (a) Name the parts of the brain and heart which are linked by the nerves shown in the diagram. 2

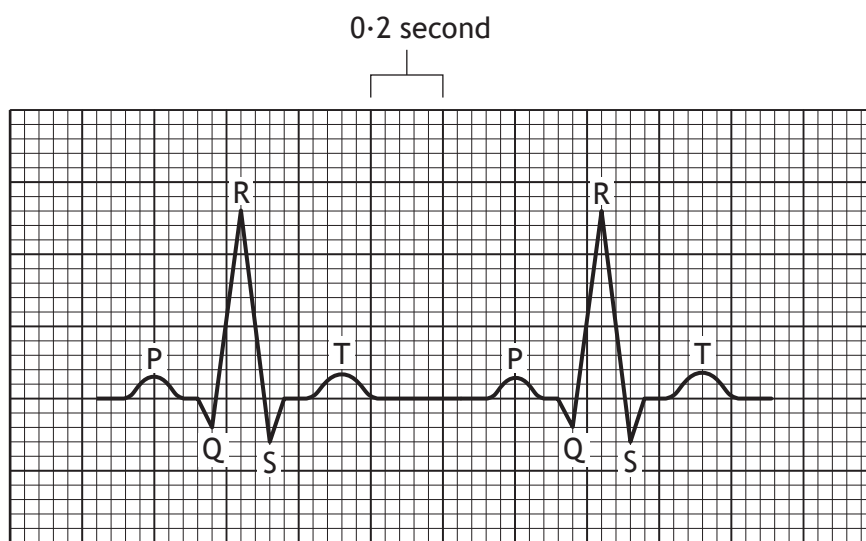
Brain _____

Heart _____

- (b) Explain how the sympathetic and parasympathetic nerves control heart rate. 2

5. (continued)

(c) The diagram shows an electrocardiogram (ECG) of an individual's heart.



(i) Use the diagram to calculate the individual's heart rate.

1

Space for calculation

_____ beats/min

(ii) Describe what happens in the heart between points Q and S.

1

[Turn over

6. The table shows the number of males in different age groups with raised cholesterol levels in Scotland between 2004 and 2013.

		Number of males with raised cholesterol levels (per 1000)								
Age group (years)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Under 15	1	1	0	1	0	0	0	2	0	1
15–44	33	33	31	29	21	21	22	16	18	14
45–64	236	232	217	209	132	139	134	137	125	128
Over 64	274	316	295	274	167	166	164	167	171	167

- (a) Calculate which age group had the greatest percentage decrease in the number of males with raised cholesterol levels between 2004 and 2013. 1

Space for calculation

_____ years

- (b) (i) Name a type of drug that is used to control cholesterol levels. 1

- (ii) Use the data in the table to identify the year in which this type of drug became widely available. 1

- (c) State **one** role of cholesterol in the body. 1



7. An office worker and an Olympic swimmer were found to have the same BMI. They each weighed 105 kg and were 1.85 m in height.

(a) (i) Calculate their BMI.

1

Space for calculation

(ii) Suggest why, after calculating their BMI, a health professional advised only the office worker to lose weight.

1

(b) The office worker developed Type 2 diabetes.

Explain why this condition causes the blood glucose concentration to remain high.

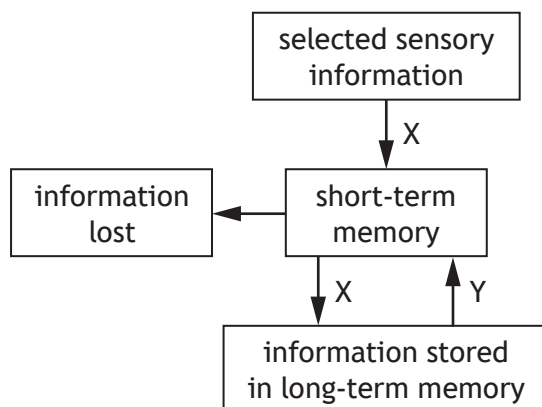
2

[Turn over



* X 7 4 0 7 6 0 1 1 5 *

8. (a) The diagram represents the flow of information through memory.



(i) Name process X. 1

(ii) Explain why information can be lost by displacement from short-term memory. 1

(iii) Rehearsal increases the chance of information being transferred from short-term to long-term memory. Describe **one** other way that information can be transferred from short-term to long-term memory. 1

(iv) Y represents the retrieval of information from long-term memory. Describe how contextual cues aid the retrieval of information. 1

(b) State where semantic memories are stored in the brain. 1

9. (a) The photograph shows cars parked in a street.



The judgement of distance depends on visual cues.

Explain how the following visual cues allow a person to judge how far away each car is from them in the street.

- (i) Size _____ 1

- (ii) Superimposition _____ 1

- (b) State the term used for the ability of the brain to judge the distance of an object based on the different images received by each eye. 1

[Turn over



9. (continued)

MARKS
DO NOT WRITE IN THIS MARGIN

(c) Students carried out the following experiment on the judgement of distance.

- 1 One student raised their right arm and closed both eyes.
- 2 A coin was randomly placed on the bench in front of them.
- 3 The student opened both eyes and immediately lowered their arm trying to touch the coin with their index finger.
- 4 The distance between the coin and the spot where the index finger landed was measured.
- 5 Steps 1–4 were repeated, firstly **only** opening the left eye and secondly **only** opening the right eye.
- 6 Then steps 1–5 were repeated another nine times.

The results are shown in the table.

Attempt	Distance between coin and spot where finger landed (mm)		
	both eyes open	left eye open	right eye open
1	2	4	12
2	2	6	15
3	1	6	16
4	1	8	14
5	1	9	13
6	0	5	14
7	0	4	17
8	1	10	18
9	0	7	
10	1	8	15
Average	0.9	6.7	15.0

(i) Calculate the missing distance for attempt 9.

1

Space for calculation

_____ mm



9. (c) (continued)

- (ii) Suggest a reason why the coin was randomly placed for each attempt.

1

- (iii) The results of the experiment show that two eyes are more accurate than one for judging distance.

State another conclusion which can be drawn from the results.

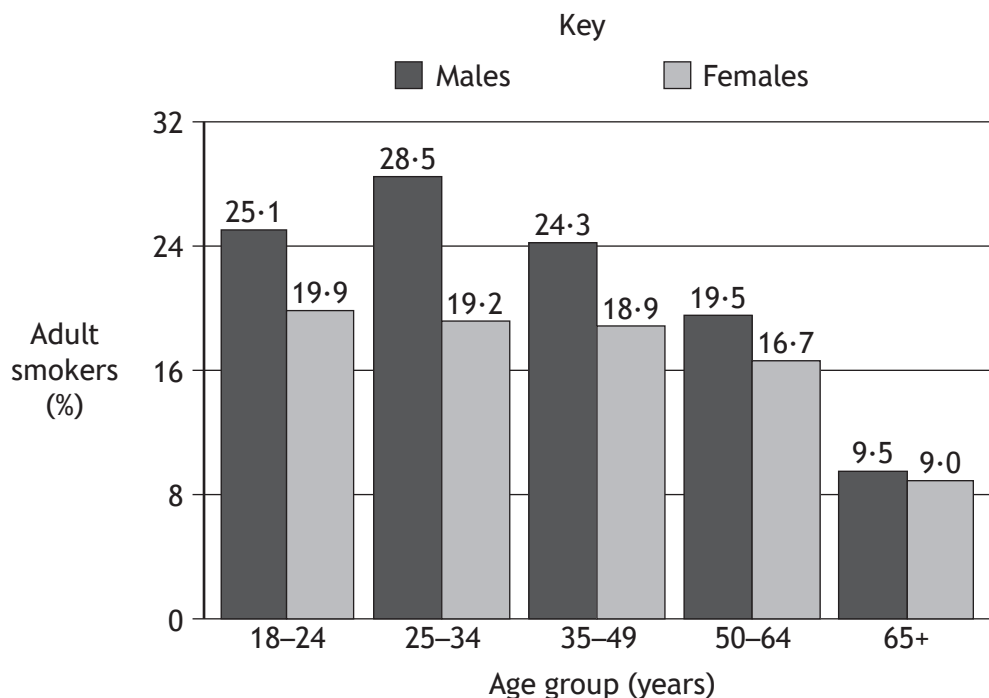
1

[Turn over



* X 7 4 0 7 6 0 1 1 9 *

10. The graph shows the percentage of adult smokers in different age groups in the UK in 2011.



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

2

1 _____

2 _____

(ii) Apart from individuals giving up smoking, suggest a reason for the difference in the percentage of 25-34 year olds and 65+ year olds smoking.

1



10. (continued)

(b) Smokers can become addicted to the nicotine in tobacco.

Nicotine acts as an agonist of acetylcholine causing an increase in the levels of dopamine.

(i) Describe how nicotine acts as an agonist at a synapse.

1

(ii) Describe how dopamine reinforces smoking behaviour.

1

(iii) Describe how repeated exposure to nicotine can lead to nicotine tolerance by desensitisation.

1

(c) Explain why anti-smoking campaigns often feature a celebrity.

1

(d) In 2011 there were 36 980 cases of lung cancer in the UK linked to smoking. This was 86% of all lung cancer cases in the UK in 2011.

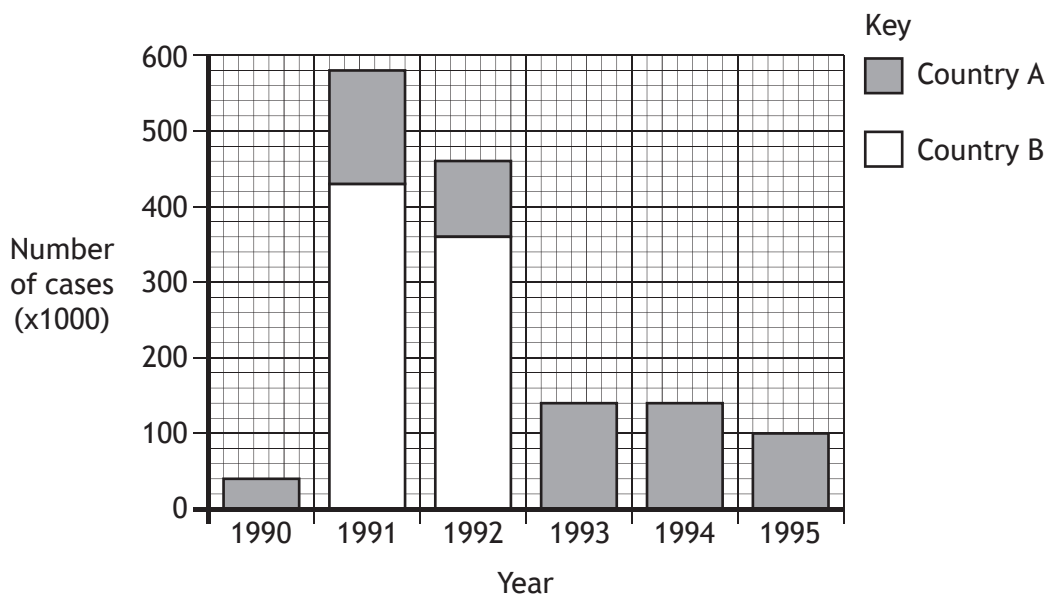
Calculate the total number of lung cancer cases in the UK in 2011.

1

Space for calculation



11. The graph compares the number of cases of a water-borne disease in two countries between 1990 and 1995.



(a) (i) Describe how the graph demonstrates that the pattern of the disease was epidemic in country B. 1

(ii) State the term which describes the pattern of disease in country A. 1

(iii) Suggest how the pattern of this disease in country A would differ if the disease was sporadic. 1



* X 7 4 0 7 6 0 1 2 2 *

11. (continued)

(b) In 1996, a programme of immunisation against this disease was started in country B. Herd immunity was established once 85% of the population was immunised.

(i) Explain why this level of immunisation protected the whole population.

1

(ii) State **one** reason why it is difficult to immunise 100% of a population against a disease.

1

[Turn over



12. The non-specific immune system provides resistance to infection by physical, chemical and cellular means.

(a) (i) Name the type of cell which forms a physical barrier in the skin. 1

(ii) In addition to forming a physical barrier, state another way in which these cells resist infection. 1

(b) Mast cells initiate the inflammatory response.
Name the chemical which they release and explain how it increases the supply of fluid into the infected tissue. 2

Chemical _____

Explanation _____

(c) (i) The cellular aspect of the non-specific response is provided by two types of white blood cell.
Complete the table by describing how these cells destroy pathogens. 2

<i>Type of cell</i>	<i>How cell destroys pathogens</i>
Phagocyte	
NK cell	

(ii) State how phagocytes and NK cells stimulate the specific immune response. 1

MARKS

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MARGIN

13. Answer either A or B in the space below.

Labelled diagrams may be used where appropriate.

A Give an account of hormonal control of puberty and sperm production in males.

8

OR

B Give an account of treatments for male and female infertility.

8



* X 7 4 0 7 6 0 1 2 5 *



National
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2017

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Section 1 — Questions**

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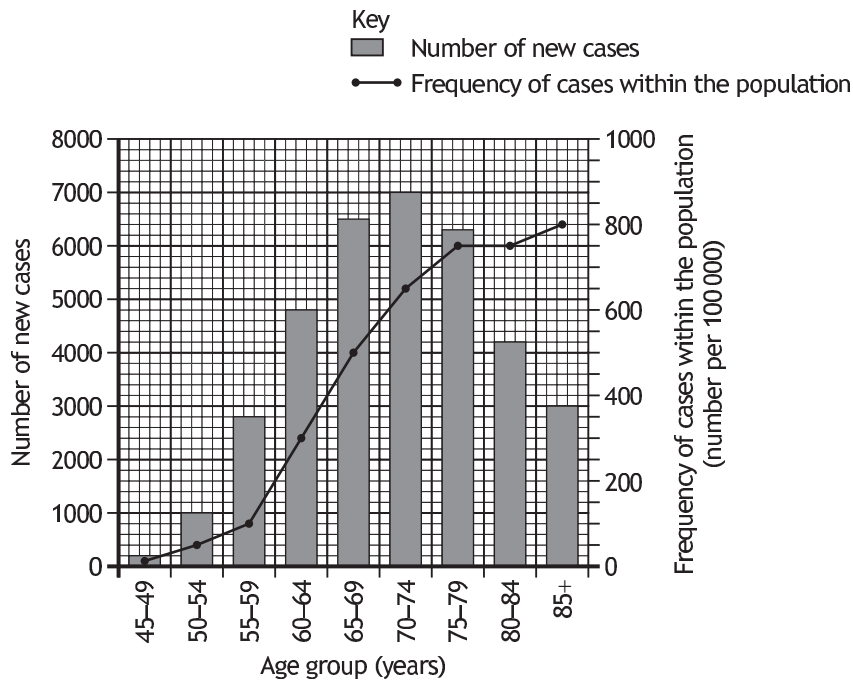
SECTION 1 — 20 marks

Attempt ALL questions

1. Which row in the table shows the type of stem cell that has the potential to form the greatest variety of specialised cells?

	<i>Type of stem cell</i>	<i>State of differentiation</i>
A	embryonic	differentiated
B	tissue	differentiated
C	embryonic	undifferentiated
D	tissue	undifferentiated

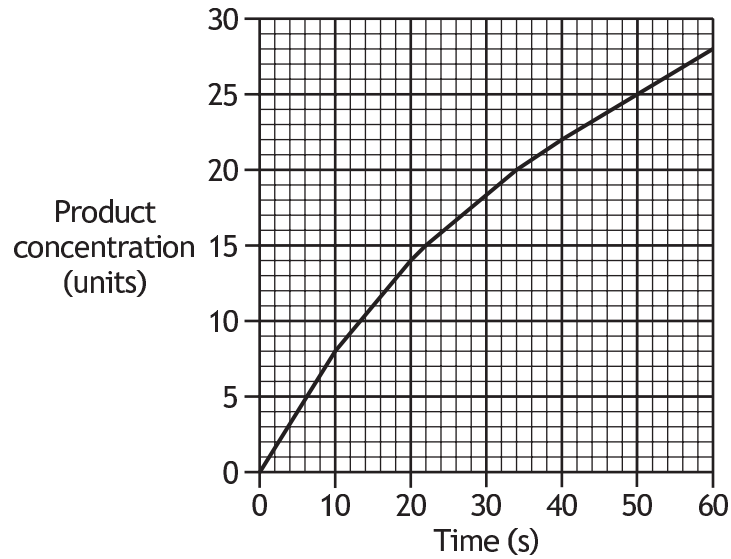
2. The graph contains information about prostate cancer in the UK in 2006.



Which of the following conclusions can be drawn from the graph?

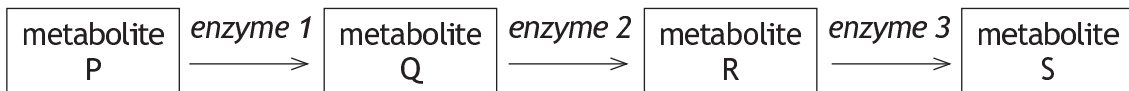
- A The highest frequency of cases within the population was in the 70–74 year old age group.
- B As the age group increases, the frequency of cases within the population always increases.
- C When there were 4800 new cases, the frequency of cases within the population was 600 per 100 000.
- D The greatest increase in the number of new cases, between consecutive age groups, occurred between 55–59 and 60–64.

3. The graph shows how the concentration of product changes during an enzyme-controlled reaction.



How long does it take the product concentration to reach 50% of its final concentration?

- A 20 s
 - B 22 s
 - C 25 s
 - D 28 s
4. A metabolic pathway is shown.



In end-product inhibition

- A enzyme 3 binds to enzyme 1
- B enzyme 3 binds to metabolite P
- C metabolite S binds to enzyme 1
- D metabolite S binds to metabolite P.

[Turn over

5. Mature red blood cells have no nucleus and no mitochondria.

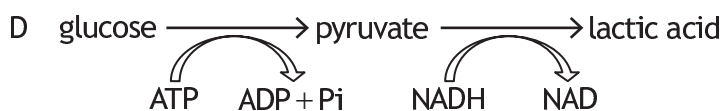
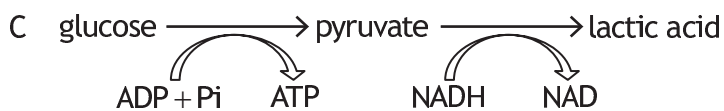
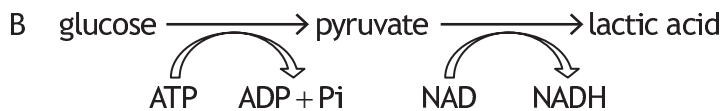
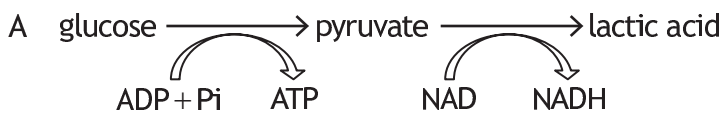
Which of the following processes can be carried out by a mature red blood cell?

- A Glycolysis
- B Cell division
- C Protein synthesis
- D Electron transport chain

6. During respiration most ATP is produced when

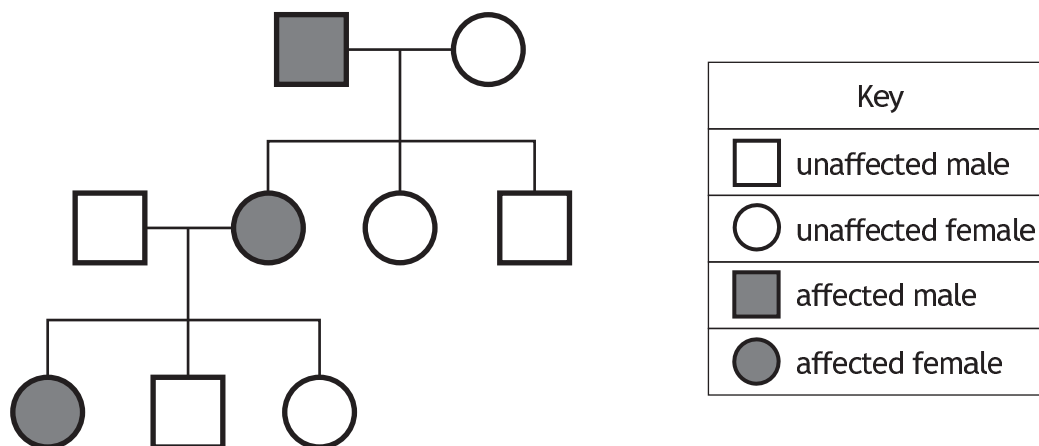
- A electrons are passed through the membrane protein ATP synthase
- B hydrogen ions are passed through the membrane protein ATP synthase
- C electrons are pumped through the outer membrane of the mitochondrion
- D hydrogen ions are moved along carriers in the inner membrane of the mitochondrion.

7. Which of the following equations summarises the conversion of glucose to lactic acid?



8. The diagram shows the inheritance of familial hypercholesterolaemia (FH) in three generations of a family.

FH is caused by an autosomal dominant allele.



How many individuals in this family are homozygous dominant for this condition?

- A 0
 B 1
 C 2
 D 3
9. Red-green colour vision deficiency is a sex-linked recessive condition. Females heterozygous for the condition are described as being 'carriers'. A colour vision deficient woman and an unaffected man have children. Which of the following show the expected phenotypic ratio of the children?

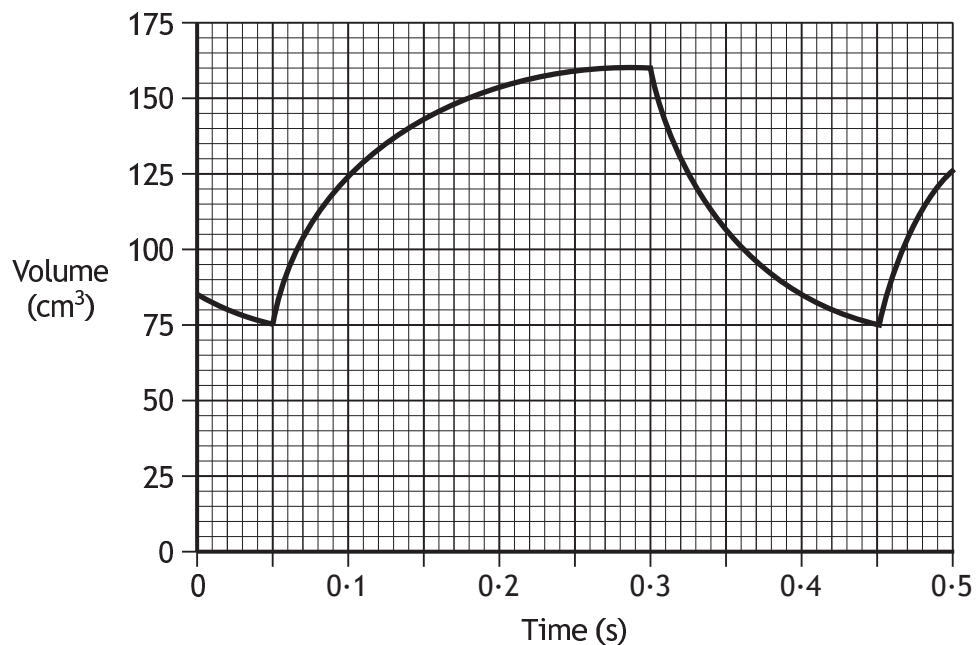
- A 1 carrier daughter : 1 colour vision deficient son
- B 1 unaffected daughter : 1 colour vision deficient son
- C 1 unaffected daughter : 1 colour vision deficient son : 1 unaffected son : 1 carrier daughter
- D 1 carrier daughter : 1 colour vision deficient son : 1 unaffected son : 1 colour vision deficient daughter

[Turn over

10. Which row in the table shows how the autonomic nervous system controls an increase in heart rate?

	<i>Branch of autonomic nervous system</i>	<i>Neurotransmitter</i>
A	sympathetic	acetylcholine
B	parasympathetic	noradrenaline
C	sympathetic	noradrenaline
D	parasympathetic	acetylcholine

11. The graph shows changes in the volume of blood in the left ventricle of an individual's heart while running.



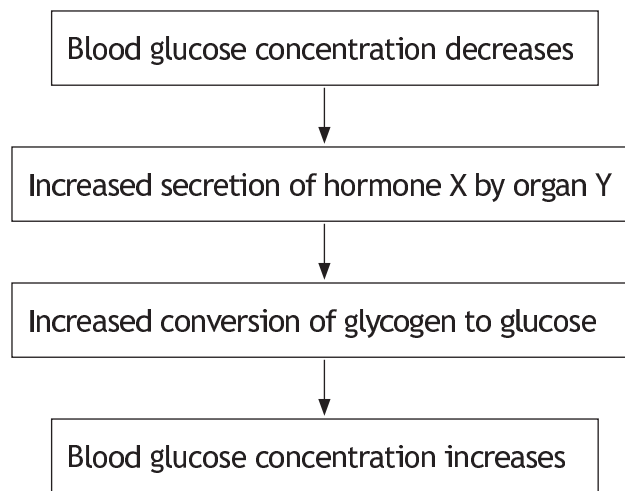
The cardiac output of this individual is

- A 5 100 cm³/min
- B 10 200 cm³/min
- C 12 750 cm³/min
- D 24 000 cm³/min.

12. During clot formation, thrombin

- A forms prothrombin
- B causes formation of fibrin threads
- C causes the release of clotting factors
- D forms a meshwork that clots the blood.

13. The flow diagram shows how the concentration of glucose in the blood is controlled during exercise.



Which row in the table identifies hormone X and organ Y?

	<i>Hormone X</i>	<i>Organ Y</i>
A	insulin	liver
B	glucagon	liver
C	insulin	pancreas
D	glucagon	pancreas

14. A person is 170 cm tall and weighs 70 kg.

They have a body mass index (BMI) of

- A 2.4
- B 24.2
- C 28.8
- D 41.2.

[Turn over

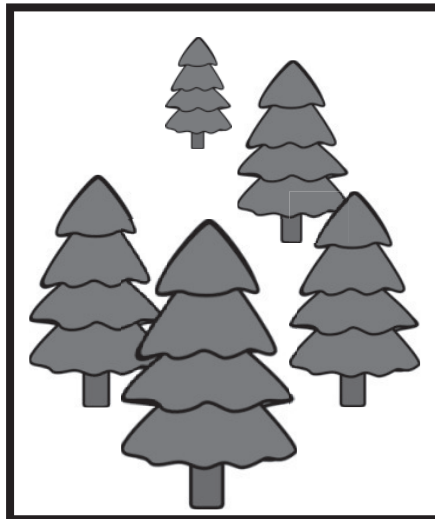
15. The following list shows three areas of the brain.

- 1 Cortex
- 2 Limbic system
- 3 Corpus callosum

Which of these areas are involved in storing spatial memories?

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

16. The picture shows a scene with trees.



What visual cues are used in the perception of depth in this picture?

- 1 Relative size
 - 2 Relative height
 - 3 Superimposition
 - 4 Perceptual constancy
- A 1 only
 - B 1 and 2 only
 - C 1, 2 and 3 only
 - D 1, 2, 3 and 4

17. Some individuals who suffer head injuries forget the events that happened a few seconds before the injury occurred.

This memory loss is most likely to be due to the injury affecting

- A retrieval
- B displacement
- C long-term memory
- D short-term memory.

18. Three groups of students were asked to make paper aeroplanes.
Each student had to make five aeroplanes.

The table shows the conditions under which each group worked.

<i>Group</i>	<i>Written set of instructions supplied</i>	<i>Demonstration given on how to fold the paper</i>	<i>Prize awarded to the first student finished</i>
1	yes	no	no
2	no	yes	no
3	no	no	yes

What behavioural term is used to describe the method of learning used by group 2 only?

- A Shaping
- B Imitation
- C Trial and error
- D Reinforcement

[Turn over for next question

19. The table shows the numbers of different types of white blood cells found in blood samples taken from a healthy person and from three different patients.

<i>Type of white blood cell</i>	<i>White blood cells found in blood sample (cells/mm³)</i>			
	<i>Healthy person</i>	<i>Patient X</i>	<i>Patient Y</i>	<i>Patient Z</i>
Phagocyte	7000	7000	8000	7000
Lymphocyte	3000	2000	3000	3500
Mast cell	1000	1000	1000	1500

Use the information above to match each condition to the correct patient.

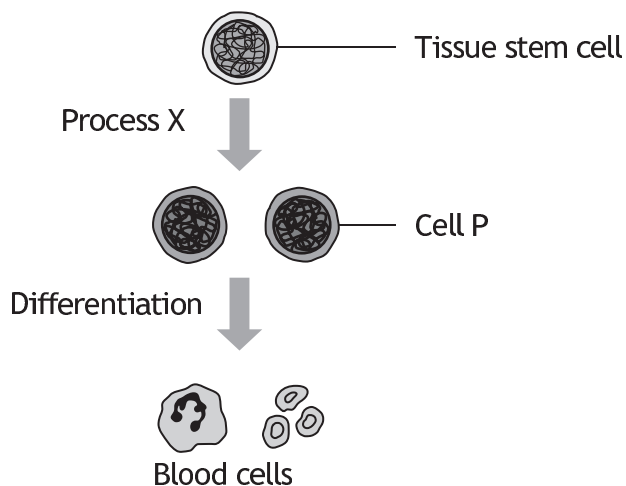
	<i>Condition</i>		
	<i>Allergic response</i>	<i>HIV</i>	<i>Infected wound</i>
A	Y	X	Z
B	X	Z	Y
C	Z	Y	X
D	Z	X	Y

20. Which term would be used to describe a global outbreak of an infectious disease?
- A Endemic
 - B Sporadic
 - C Epidemic
 - D Pandemic

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

SECTION 2 — 80 marks
 Attempt ALL questions
 Question 12 contains a choice

1. The diagram shows some stages in the development of blood cells.



(a) Name process X. 1

(b) Name the tissue type to which blood cells belong. 1

(c) Explain why red blood cells contain haemoglobin after differentiation but white blood cells do not. 1

(d) Describe how a tumour might develop from cell P. 1

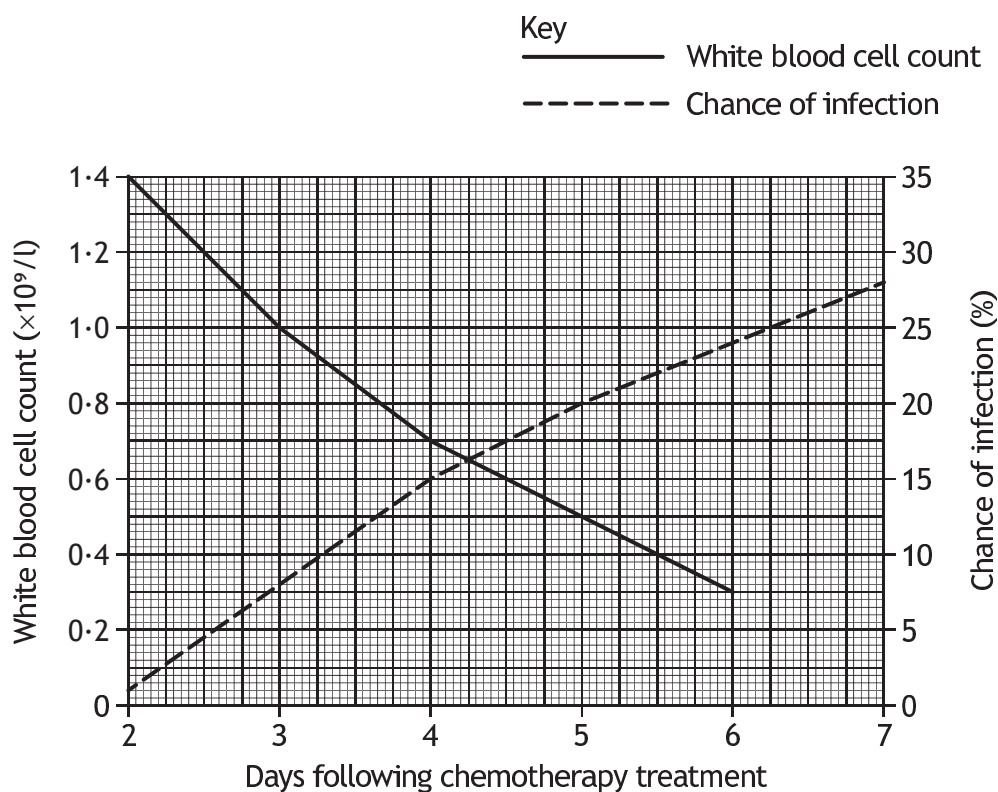


1. (continued)

(e) Cancer patients can be treated using chemotherapy.

This treatment destroys tumour cells but also reduces the number of white blood cells. As a result, patients have a higher chance of infection.

The graph shows the white blood cell count of a cancer patient and their chance of infection in the days following chemotherapy treatment.



(i) State the chance of infection after treatment when the white blood cell count was $0.7 \times 10^9/l$.

1

_____ %

(ii) Predict the white blood cell count seven days following chemotherapy treatment.

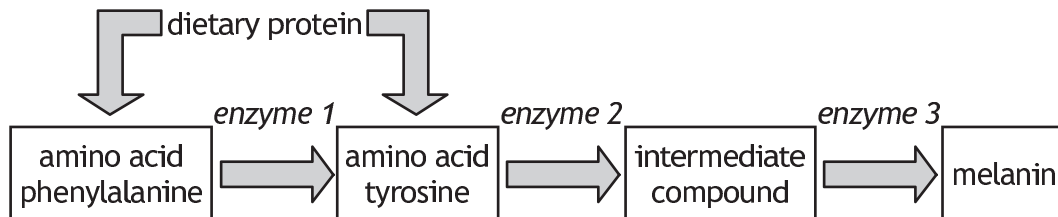
1

_____ $\times 10^9/l$

[Turn over



2. Phenylketonuria (PKU) is an example of a genetic disorder which affects the following metabolic pathway.



(a) In PKU enzyme 1 is faulty.

(i) Describe how a substitution mutation would alter the gene coding for enzyme 1. 1

(ii) Explain how a substitution mutation may cause the synthesis of a faulty enzyme. 1

(b) Use the metabolic pathway above to suggest

(i) why PKU results in a build-up of phenylalanine; 1

(ii) why individuals with PKU can still produce melanin. 1

2. (continued)

(c) Babies born with PKU can develop brain damage from the build-up of phenylalanine and its harmful metabolites.

(i) All babies are tested for PKU immediately after birth.

State the term used to describe this type of diagnostic testing.

1

(ii) Describe how brain damage can be prevented in babies diagnosed with PKU.

1

(d) PKU is caused by an autosomal recessive allele.

A couple, who are both unaffected, have a child who has PKU.

Calculate the percentage chance of their next child having this disorder.

1

Space for calculation

_____ %

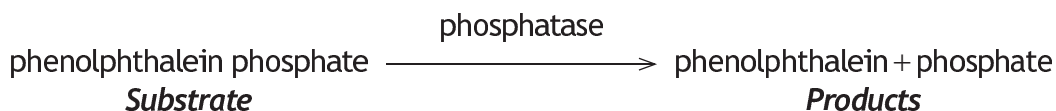
[Turn over



* X 7 4 0 7 6 0 1 0 9 *

3. An investigation was carried out into the effect of a competitive inhibitor on the activity of phosphatase at different substrate concentrations.

Phosphatase is an enzyme which catalyses the reaction shown.



Six test tubes each containing a different concentration of substrate were set up. The inhibitor and then the enzyme were added to each tube.

Figure 1 shows the contents of each tube.

After 30 minutes, 1 cm³ of alkali was added to each tube.

Phenolphthalein turns pink in the presence of alkali. The more phenolphthalein produced, the more intense the pink colour and the higher the absorbance reading measured by a colorimeter.

Table 1 shows the results of the investigation.

Figure 1

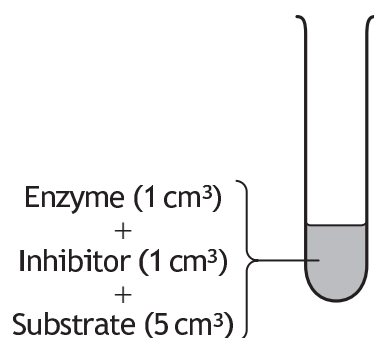


Table 1

Concentration of substrate (M)	Absorbance (units)
0.05	0.20
0.10	0.30
0.20	0.48
0.40	0.64
0.60	0.78
0.80	0.90

- (a) Suggest why alkali was **not** added to each tube at the start of the investigation.

1

- (b) State **two** variables, other than those shown above, which should be kept constant to make this investigation valid.

2

1 _____

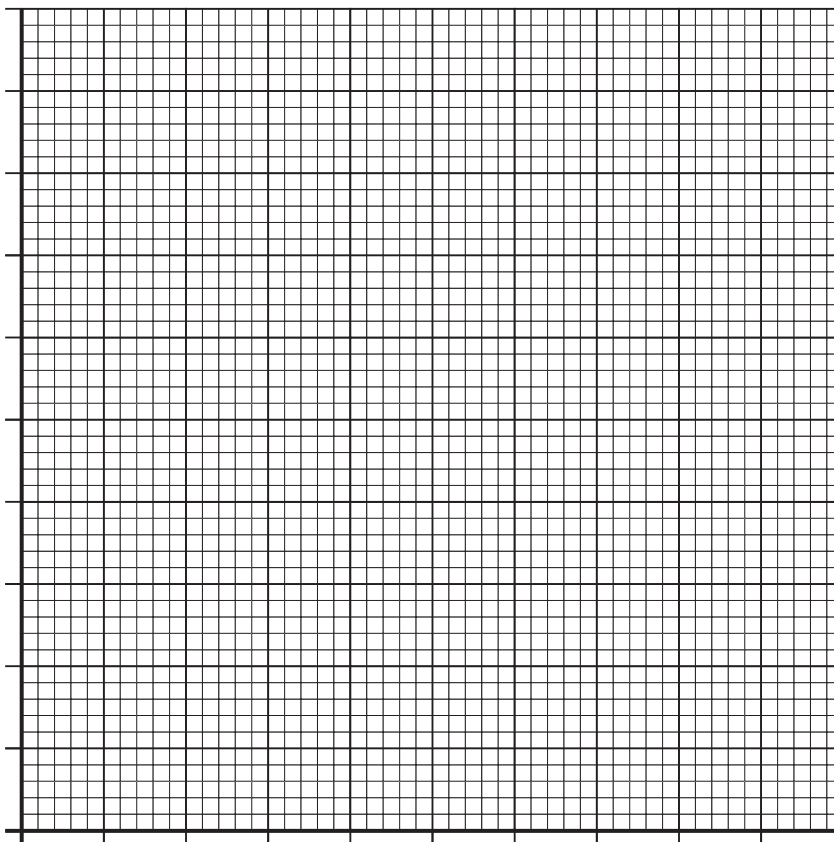
2 _____

3. (continued)

MARKS
DO NOT
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THIS
MARGIN

- (c) Construct a line graph to show the data in **Table 1**.
(Additional graph paper, if required, can be found on *Page 28*)

2



- (d) It was concluded that increasing substrate concentration reduces the effect of the competitive inhibitor.

Explain how the results of this investigation support this conclusion.

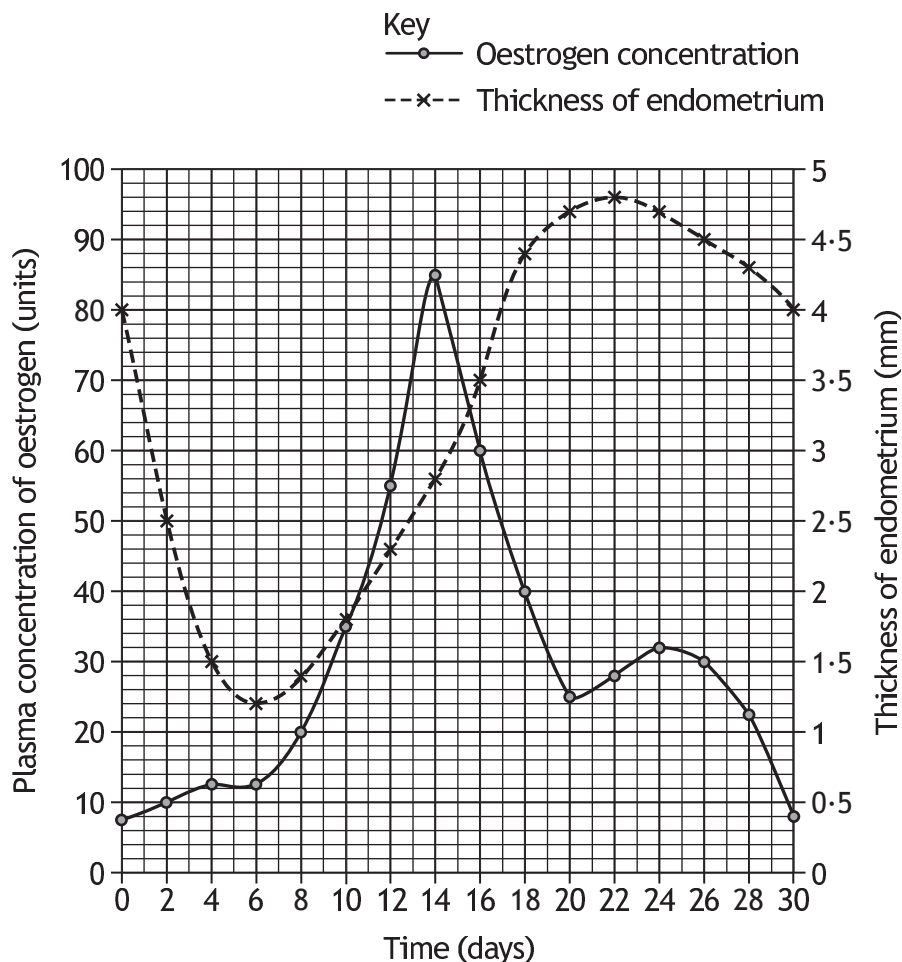
2

- (e) Suggest how the results of this investigation would be different if a non-competitive inhibitor had been used.

1



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



(a) Ovulation occurs on day 15 of this cycle.

(i) Describe the role of oestrogen in triggering this event.

1

(ii) State the thickness of the endometrium on day 15.

1

_____ mm



* X 7 4 0 7 6 0 1 1 2 *

4. (continued)

- (b) (i) Express, as a simple whole number ratio, the thickness of the endometrium on day 6 compared to day 22.

1

Space for calculation

_____ : _____
Day 6 Day 22

- (ii) Oestrogen stimulates thickening of the endometrium.

Describe evidence from the graph which indicates that another factor also stimulates thickening of the endometrium.

1

- (c) Suggest **one** way in which the graph for the next menstrual cycle would differ from this one if the woman became pregnant during that cycle.

1

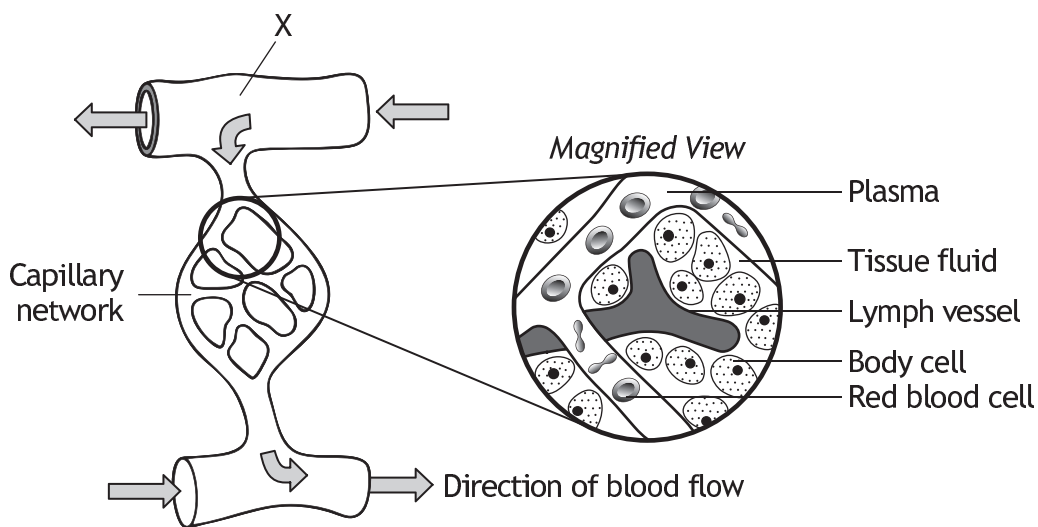
- (d) State how fertility drugs stimulate ovulation.

1

[Turn over



5. The diagram represents a capillary network, associated vessels and cells.



(a) (i) Name the type of blood vessel labelled X. 1

(ii) State how blood vessel X can reduce blood flow to the capillary network. 1

(b) (i) Name the layer of cells which forms the wall of a capillary. 1

(ii) Describe how substances pass from plasma to tissue fluid. 1

(iii) Name a type of molecule which is present in plasma but absent in tissue fluid. 1

(c) Describe **one** role of the lymph vessel in the diagram. 1

6. The picture shows a man having his blood pressure measured.



(a) A blood pressure reading consists of a high systolic value and a lower diastolic value.

Explain the difference between these two values.

1

(b) Suggest a reason why the pulse in the man's left wrist stops when the cuff is inflated.

1

(c) The man's blood pressure was measured as 160/100.

(i) Explain how atherosclerosis could have caused this high blood pressure.

2

(ii) The man's blood HDL to LDL ratio was lower than normal. Describe how this may have contributed to atherosclerosis.

1



* X 7 4 0 7 6 0 1 1 5 *

7. Hormone replacement therapy (HRT) is used by women to relieve symptoms of the menopause, which usually occurs from around the age of 50.

A study was carried out into the effects of HRT on the health of 12 000 women. The women were separated into three equal groups according to their age. Half of each group took a daily HRT tablet while the other half received a placebo. Over the next five years the number of women in each group who developed either a pulmonary embolism or coronary heart disease was recorded.

The results are shown in the table.

	<i>Conditions developed by women in the study</i>			
	<i>Pulmonary Embolism</i>		<i>Coronary Heart Disease</i>	
<i>Age group (years)</i>	<i>Number of cases in women given HRT</i>	<i>Number of cases in women given a placebo</i>	<i>Number of cases in women given HRT</i>	<i>Number of cases in women given a placebo</i>
50–59	10	5	20	18
60–69	20	12	35	33
70–79	30	15	80	76

- (a) Describe **two** trends shown by the results for pulmonary embolism. 2

1 _____

2 _____

- (b) It was concluded that taking HRT has no effect on the risk of coronary heart disease. 1
 Explain why the results of the study support this conclusion.

- (c) Suggest a factor, other than HRT, which could have influenced the results of this study. 1



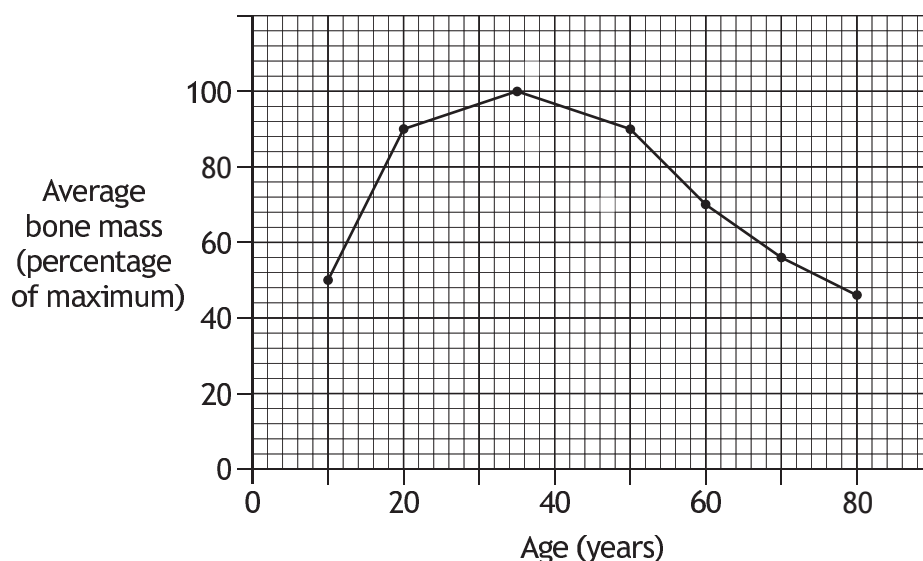
7. (continued)

- (d) Describe how the researchers attempted to make sure that the results of this study were reliable.

1

- (e) HRT can be prescribed to treat osteoporosis, a condition which increases the risk of bones thinning and breaking.

The graph shows how the average bone mass of women changes with age.



- (i) Use data from the graph to describe the changes that occur in the average bone mass between the ages of 10 and 80.

2

- (ii) State the number of years the average bone mass of women is at least 80% of the maximum.

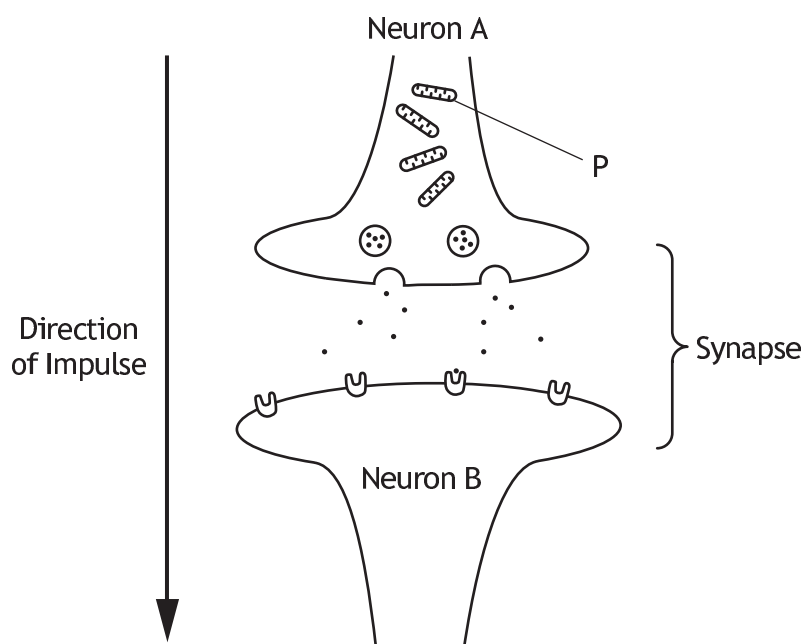
1

_____ years

[Turn over



8. The diagram represents two neurons and the synapse between them.



(a) Name the structure labelled P which generates ATP.

1

(b) Describe how an impulse is transmitted from Neuron A to Neuron B.

3

8. (continued)

- (c) Many drugs which affect synapses may cause sensitisation over a period of time.

Describe the effect that sensitisation has on the synapse and the consequences for the individual.

2

Effect _____

Consequences _____

[Turn over



* X 7 4 0 7 6 0 1 1 9 *

9. Sympathetic and parasympathetic nerves regulate heart rate.

(a) Name the part of the brain that regulates the heart rate.

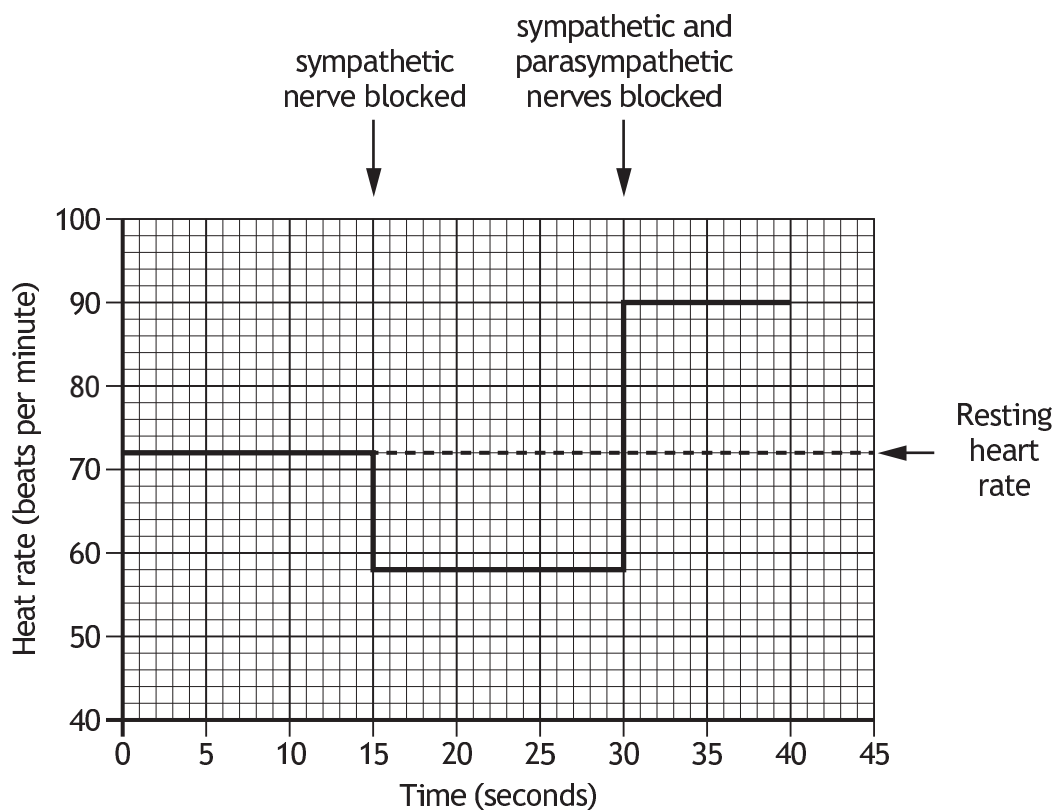
1

(b) The sympathetic and parasympathetic nerves work antagonistically. Explain what this statement means.

1

(c) An investigation was carried out to determine the effects these nerves have on heart rate by firstly blocking the sympathetic nerve and then blocking both nerves.

The graph shows the results of the investigation.



(i) State the heart rate when only the sympathetic nerve is blocked.

1

_____ beats per minute



9. (c) (continued)

(ii) Calculate the increase in the heart rate which then occurs when the parasympathetic nerve is also blocked.

1

_____ beats per minute

(d) Explain why the heart continues to contract when both nerves are blocked.

1

(e) The parasympathetic nerve has a greater effect on the resting heart rate than the sympathetic nerve.

Use information from the graph to justify this statement.

1

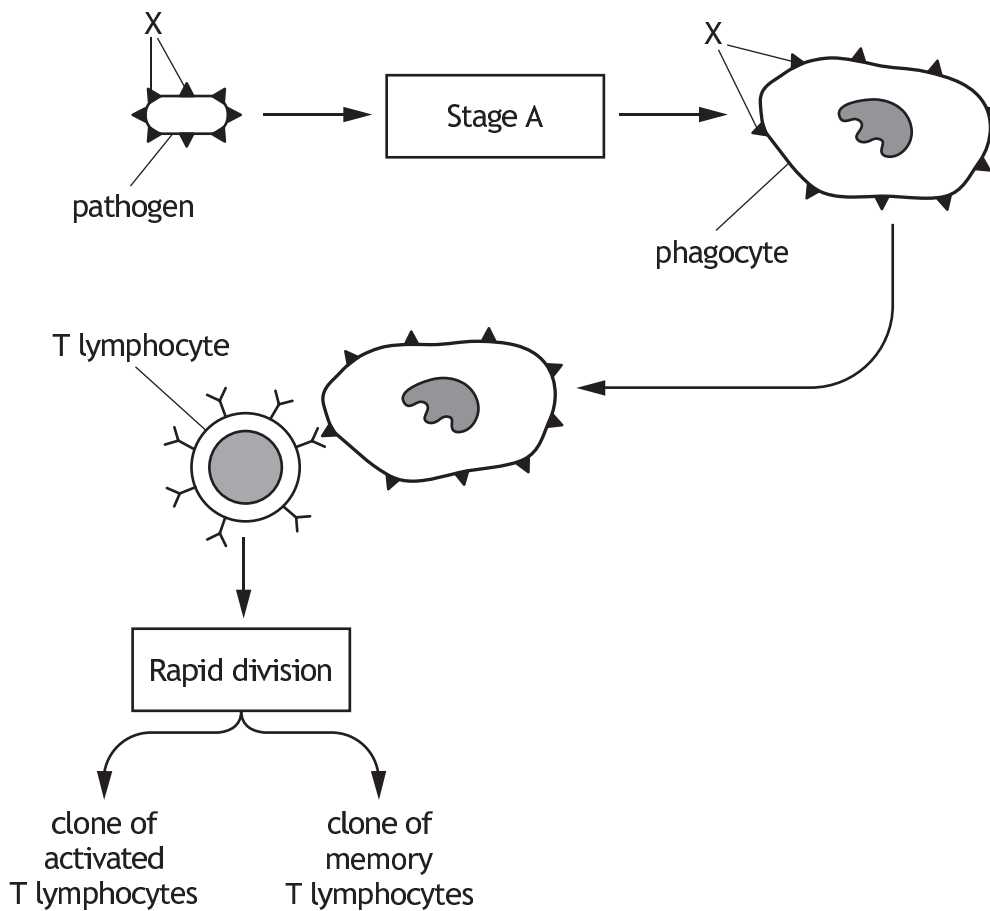
(f) State one other effect the sympathetic nervous system has on the body.

1

[Turn over



10. The diagram shows some of the stages leading to the production of a clone of T lymphocytes by the immune system in response to infection by a pathogen.



(a) Name the structures labelled X.

1

(b) Describe what happens during Stage A.

2

(c) Name the chemicals which aid the movement of T lymphocytes to the site of infection.

1

10. (continued)

- (d) The diagram shows how a clone of memory T lymphocytes is produced.
Describe an advantage of having memory cells.

1

- (e) State how a tuberculosis (TB) pathogen avoids immune detection.

1

[Turn over



* X 7 4 0 7 6 0 1 2 3 *

11. Table 1 contains information about the life expectancy of Scottish children between 1861 and 2011.

Life expectancy is the additional number of years a person is expected to survive from a given age.

Table 1

Year	Average life expectancy of child (years)		
	from birth	from age 1	from age 15
1861	42	47	43
1891	46	52	46
1921	55	59	50
1951	66	68	55
1981	72	72	59
2011	78	77	63

- (a) (i) Calculate the percentage increase in life expectancy for children born in 2011 compared to children born in 1861. 1

Space for calculation

_____ %

- (ii) Give the 30 year period during which the greatest increase in life expectancy from birth occurred. 1

From _____ to _____

- (iii) Suggest **two** reasons for an increase in life expectancy over the 150 year period. 2

1 _____

2 _____



11. (continued)

- (b) Table 2 contains information about the life span of Scottish children.
Life span is the number of years a person lives for.

Table 2

Year	Average Life Span (years)		
	from birth	from age 1	from age 15
1861	42	48	58
2011			

- (i) Use the information in Table 1 to complete Table 2 to indicate the expected average life span of children in 2011. 1
- (ii) Suggest why the figures for 1861 increase from 42 to 58 years. 1

[Turn over

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

Labelled diagrams may be used where appropriate.

A Describe the structure of DNA and the process of DNA replication.

9

OR

B Describe the structure of RNA and the process of transcription.

9



* X 7 4 0 7 6 0 1 2 6 *



National
Qualifications
2016

X740/76/02

**Human Biology
Section 1 — Questions**

MONDAY, 9 MAY

1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *Page 02* of your question and answer booklet X740/76/01.

Record your answers on the answer grid on *Page 03* 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.



* X 7 4 0 7 6 0 2 *

SECTION 1 — 20 marks

Attempt ALL questions

1. In a developing embryo, tissues such as muscle and nerve are produced by
- A somatic cells dividing by meiosis
 - B germline cells dividing by meiosis
 - C somatic cells dividing by mitosis
 - D germline cells dividing by mitosis.
2. A genetic disorder of the nervous system results from a mutation in which a nucleotide is inserted into a gene.
- Which of the following types of mutation causes this genetic disorder?
- A nonsense
 - B missense
 - C translocation
 - D frame-shift
3. The following steps occur during the Polymerase Chain Reaction (PCR).
- 1. Binding of primer
 - 2. Replication of DNA
 - 3. Heating of sample DNA
 - 4. Separation of DNA strands
- In which sequence do these steps occur?
- A 1 → 2 → 4 → 3
 - B 1 → 2 → 3 → 4
 - C 3 → 4 → 1 → 2
 - D 3 → 4 → 2 → 1

4. The diagrams below represent the shapes of an enzyme molecule and its substrate.

Enzyme molecule



Substrate molecule



Which row in the table below shows the possible shapes of two types of molecule that could inhibit the enzyme above?

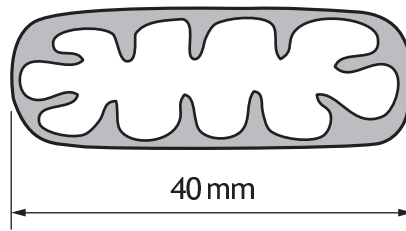
	<i>Competitive Inhibitor</i>	<i>Non-competitive Inhibitor</i>
A		
B		
C		
D		

5. During glycolysis, dehydrogenase enzymes catalyse the

- A removal of hydrogen ions from NADH_2
- B removal of hydrogen ions from citrate
- C transfer of hydrogen ions to glucose
- D transfer of hydrogen ions to NAD.

[Turn over

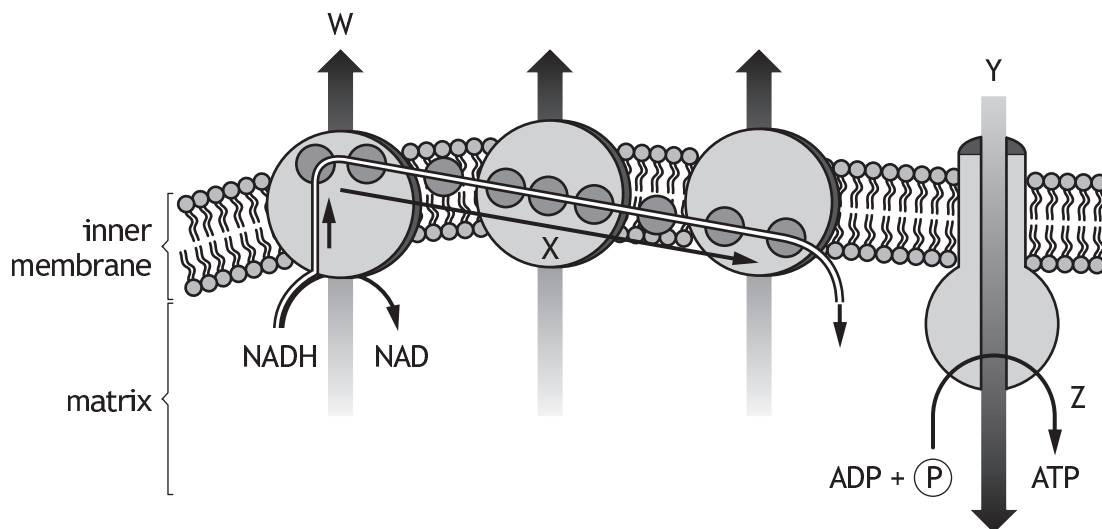
6. The diagram below represents a mitochondrion which has been magnified 10 000 times.



What is the actual length of this mitochondrion?

(1 mm = 1000 micrometres)

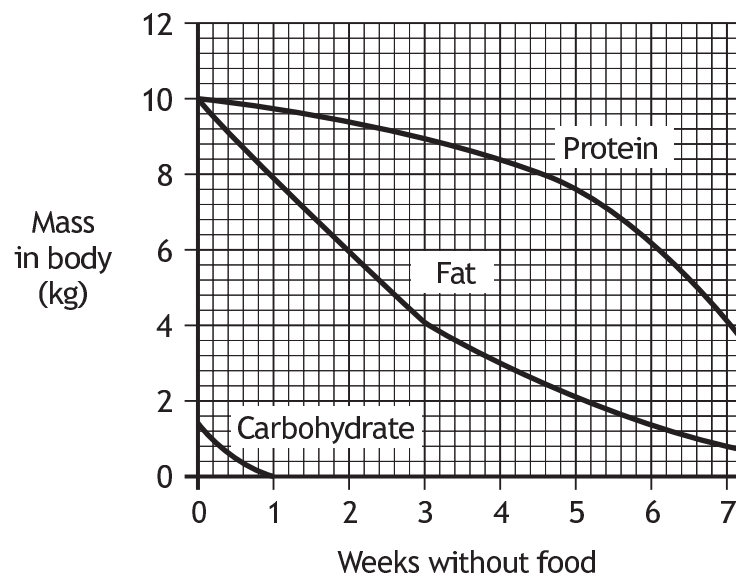
- A 0.04 micrometres
 - B 0.4 micrometres
 - C 4 micrometres
 - D 40 micrometres
7. The diagram below represents some of the processes which occur at the inner membrane of a mitochondrion.



Which letter represents the transfer of high energy electrons?

- A W
- B X
- C Y
- D Z

8. During cellular respiration, the activity of phosphofructokinase can be inhibited by
- A ATP and citrate
 - B ADP and citrate
 - C ATP and lactic acid
 - D ADP and lactic acid.
9. The graph below shows changes which occur in the masses of protein, fat and carbohydrate in a person's body during seven weeks without food.



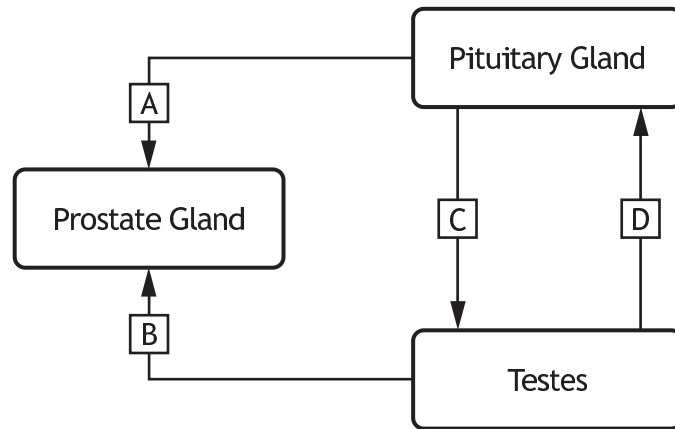
The person's starting mass was 60 kg.

Predict their mass after two weeks without food.

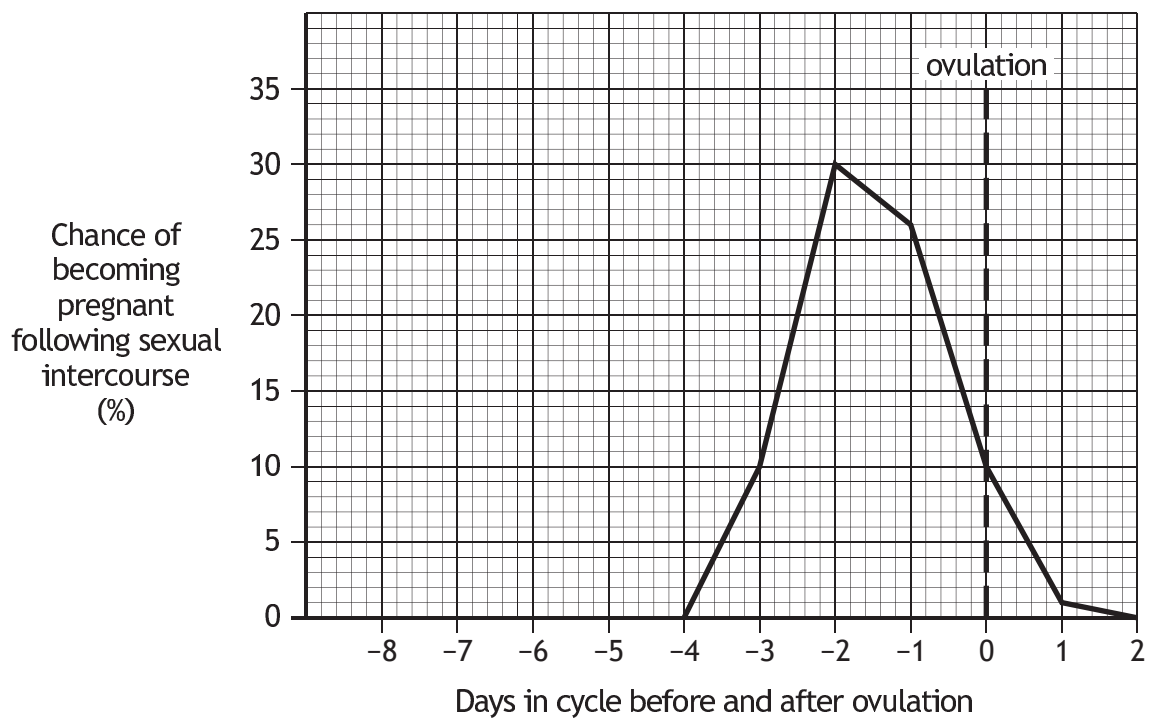
- A 57 kg
- B 54 kg
- C 50 kg
- D 43 kg

[Turn over

10. The diagram below represents connections between parts of the male reproductive system. Which arrow in the diagram does **not** represent a male reproductive hormone?



11. The graph below shows the chance of a woman becoming pregnant, following sexual intercourse, on the days before and after ovulation.

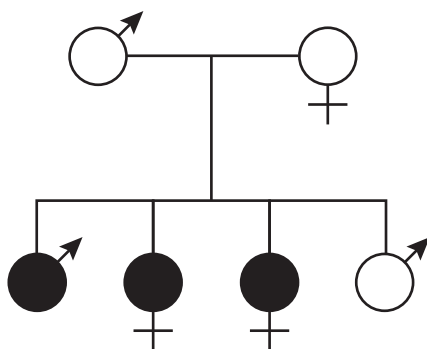


This woman has a 28 day menstrual cycle and ovulates on the 3rd of May.

On which day in May would having sexual intercourse give her the best chance of becoming pregnant?

- A 3rd May
- B 17th May
- C 29th May
- D 31st May

12. In the treatment of infertility, ovulation can be stimulated by drugs that prevent the negative feedback effect of
- A oestrogen on LH secretion
 - B oestrogen on FSH secretion
 - C progesterone on LH secretion
 - D progesterone on FSH secretion.
13. During antenatal care, which **two** techniques can be used to obtain cells for production of a karyotype?
- A Chorionic villus sampling (CVS) and amniocentesis
 - B Ultrasound imaging and chorionic villus sampling (CVS)
 - C Amniocentesis and pre-implantation genetic diagnosis (PGD)
 - D Pre-implantation genetic diagnosis (PGD) and ultrasound imaging
14. The inheritance of an allele for deafness is shown in the family tree below.



Key	
♀	Unaffected female
♂	Unaffected male
●♀	Affected female
●♂	Affected male

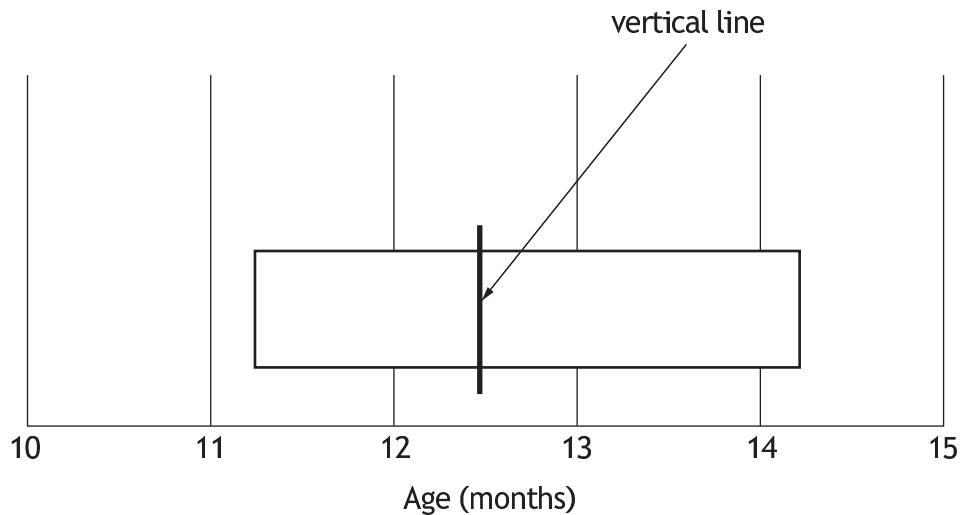
This condition is controlled by an allele which is

- A dominant and sex-linked
- B recessive and sex-linked
- C dominant and not sex-linked
- D recessive and not sex-linked.

[Turn over

15. Which of the following memories would be stored in the limbic system only?
- A The tune to your favourite song.
 - B How to keep three balls in the air when juggling.
 - C The route to your bed across your bedroom in the dark.
 - D The taste of your favourite food.
16. Playing cards normally have hearts and diamonds in red, and spades and clubs in black. An investigation showed that the speed and accuracy in recognising the cards decreased when the colours were reversed, for example when hearts appeared black. This result was most likely to have been caused by the effect of
- A a perceptual set
 - B a binocular disparity
 - C a segregation into figure and ground
 - D an organisation into coherent patterns.

17. The diagram below shows the ages at which infants are able to walk unaided. The left end of the bar shows the age at which 25% of infants can walk unaided. The right end of the bar shows the age at which 90% of infants can walk unaided. The vertical line on the bar shows the age at which 50% of infants can walk unaided.



If 24 infants, aged 12 months, were tested, how many would be expected to walk unaided?

- A 6
 B 10
 C 14
 D 18
18. The table below contains information about two groups of students who were asked to construct a paper model from a set of instructions.

<i>Group</i>	<i>Arrangement of students</i>	<i>Average time to complete model (s)</i>
1	all students together in one room	105
2	each student in a separate room	140

The improved performance of the students in group 1 is likely to be due to

- A shaping
 B discrimination
 C deindividuation
 D social facilitation.

19. When tissue is damaged, mast cells release histamine which **immediately** results in
- A an accumulation of phagocytes
 - B increased delivery of antimicrobial proteins and clotting elements
 - C increased localised blood vessel dilation and capillary permeability
 - D stimulation of a specific immune response by activating lymphocytes.
20. In Scotland cases of influenza are always present but occasionally they rise to unusually high levels. In this case, the disease is said to have changed from being
- A epidemic to endemic
 - B endemic to epidemic
 - C sporadic to epidemic
 - D endemic to sporadic.

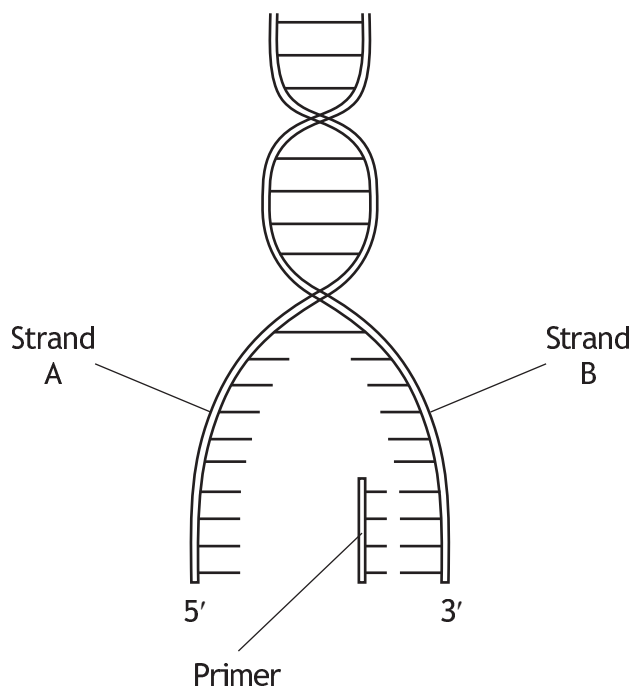
[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2
OF YOUR QUESTION AND ANSWER BOOKLET.]

SECTION 2 — 80 marks

Attempt ALL questions

Note that Question 13 contains a choice.

1. The diagram below represents a stage in the process of DNA replication.



- (a) (i) Name the type of bond which links the primer to strand B. 1

- (ii) Name the chemical group found at the 5' end of a DNA strand. 1

- (b) Strand B is replicated continuously while strand A can only be replicated in fragments.

Explain why the strands are replicated in different ways. 1



MARKS

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1. (continued)

(c) Describe the role of the following enzymes in DNA replication.

2

DNA polymerase _____

Ligase _____



* X 7 4 0 7 6 0 1 0 6 *

2. At the start of polypeptide synthesis in a cell, DNA transcription occurs in the nucleus to form mRNA.

The sequence of bases from a section of a DNA strand is shown below.

..... C A C G A T C G A T A G G A T

- (a) (i) State the sequence of bases in the primary mRNA transcript formed from this strand of DNA. 1

- (ii) State the term used to describe the coding regions of a primary mRNA transcript. 1

- (iii) Name the process by which the coding regions of a primary mRNA transcript are joined together to produce a mature mRNA transcript. 1

- (iv) The sequence of bases in the mature mRNA transcript, formed from the section of the DNA strand, is shown below.

..... G U G C U A U C C U A

Using this mature mRNA transcript, state the order of bases in the intron present in the primary mRNA transcript. 1

- (b) State the location for the translation of a mature mRNA transcript into a polypeptide. 1

- (c) Describe **one** form of post-translational modification of a polypeptide. 1

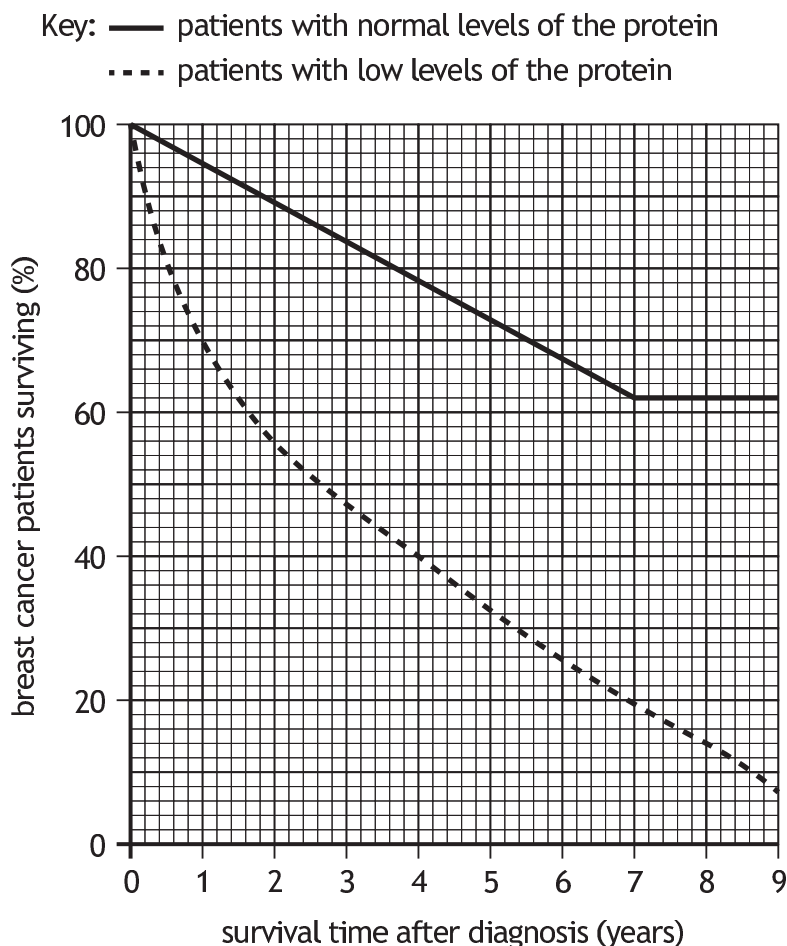
[Turn over



3. A naturally occurring cell protein (nm23) has been shown to inhibit the activity of cancer cells.

Individuals produce varying levels of this protein depending on their genetic make-up.

The graph below shows the results of a 9 year study of women diagnosed with breast cancer. The women were divided into two groups according to their production of the protein.



- (a) (i) In a city, 1000 women were diagnosed with breast cancer. Of these women, 900 had normal levels of the protein while 100 had low levels.

Using the results from the study, calculate how many of the 1000 women would be expected to survive for 4 years after diagnosis.

1

Space for calculation



3. (a) (continued)

- (ii) Use data from the graph to describe the changes in the percentage of surviving breast cancer patients with normal levels of the protein during the study.

2

- (b) Describe how cancer can develop and spread through the body.

3

[Turn over



* X 7 4 0 7 6 0 1 0 9 *

4. A student carried out an investigation into the effect of physical activity on respiration rate.

The rate of respiration of six individuals was measured after carrying out three different activities for five minutes.

Immediately after completing the activity, each individual breathed into a bottle containing a pH indicator solution. This indicator changes colour from blue to yellow in the presence of a high concentration of carbon dioxide.

Figure 1 – Apparatus used

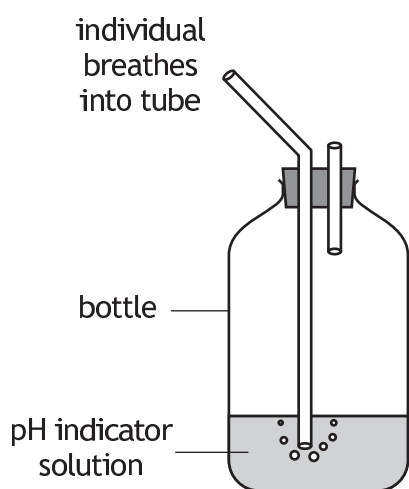


Table 1 – Results of Investigation

Individual	Time taken for pH indicator to turn yellow (s)		
	Activity 1 resting	Activity 2 walking	Activity 3 running
1	33	28	22
2	29	14	11
3	22	16	12
4	30	26	20
5	44	35	22
6		31	21
Average time taken (s)	33	25	18

- (a) State **two** variables which would have to be kept constant when setting up the apparatus shown in Figure 1.

2

- 1 _____
 2 _____

- (b) Calculate the time taken for the indicator to turn yellow after individual 6 had completed Activity 1.

1

Space for calculation

_____ s

4. (continued)

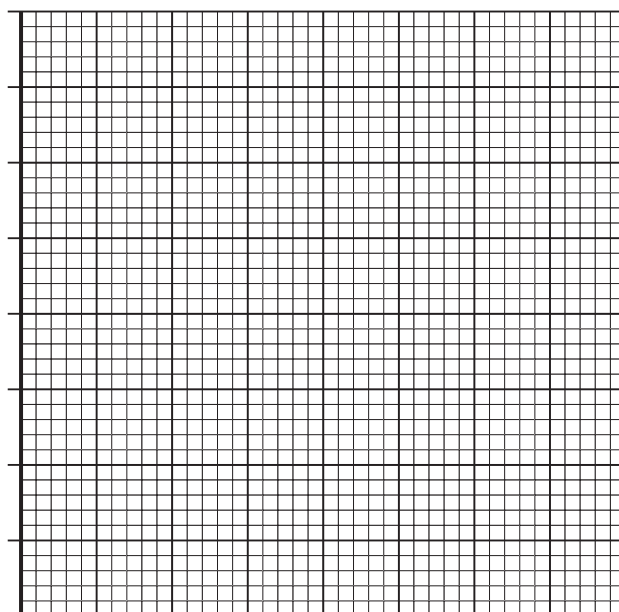
(c) Describe how the student increased the reliability of the results.

1

(d) Construct a bar graph to show the average results obtained in this investigation.

2

(Additional graph paper, if required, can be found on *Page 31*)



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

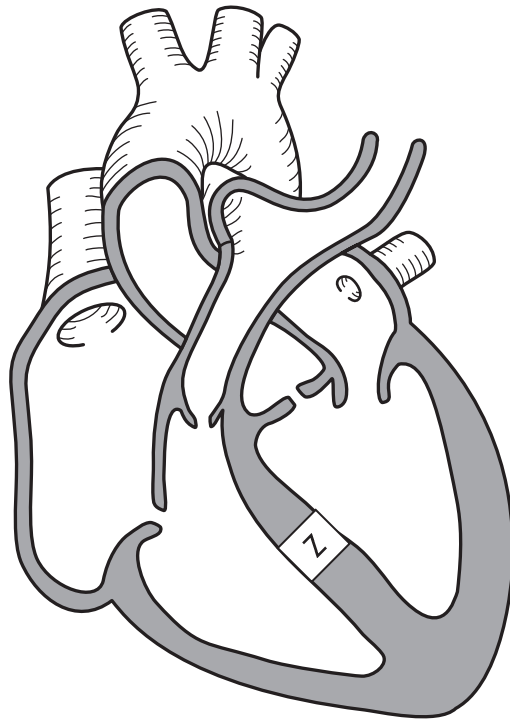
1

(f) Suggest an explanation for the results obtained in this investigation.

1



5. The diagram below represents the structure of the heart and its associated blood vessels.



- (a) On the diagram, **label** the pulmonary artery with the letter P. 1
- (b) Sometimes babies can be born with a ventricular septal defect (VSD) in which a "hole" occurs at point Z in the heart.
- Explain how the presence of this hole would affect the oxygen concentration of the blood leaving the heart through the aorta. 2



5. (continued)

(c) Babies with a VSD sometimes have irregular heart rhythms. This can be detected by recording the electrical activity from the heart.

(i) Name the chamber of the heart in which this electrical activity originates.

1

(ii) Name the type of graph that displays such patterns of electrical activity.

1

(d) Babies with a VSD often have a lower stroke volume than babies who have a normal heart structure.

Despite this, both groups of babies often have similar cardiac outputs.

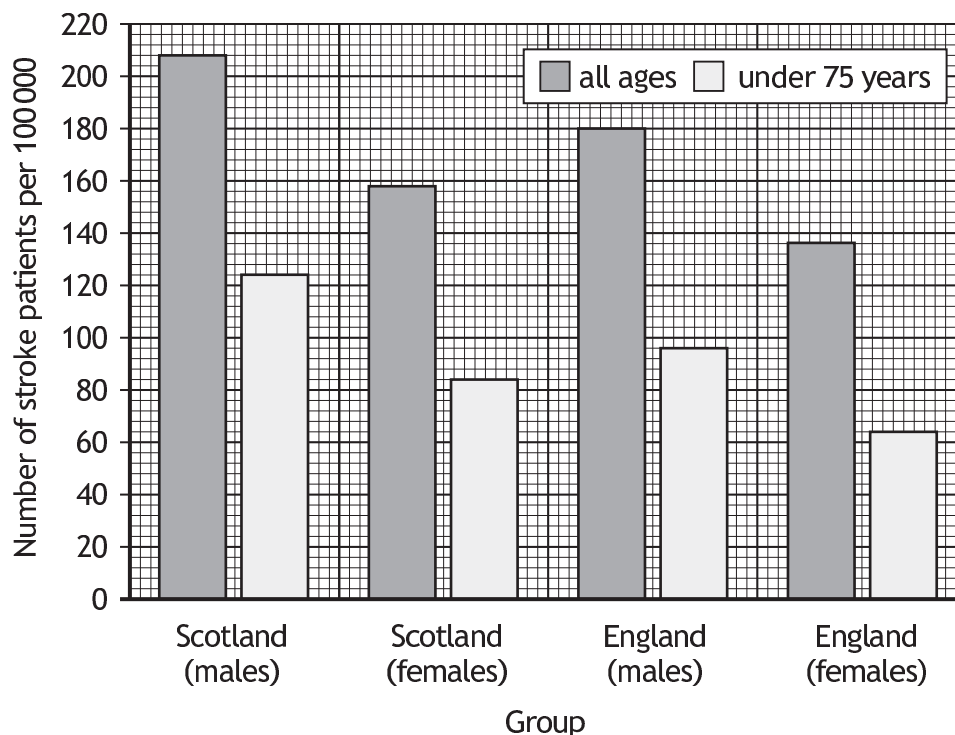
Suggest how babies with a VSD are able to achieve a similar cardiac output to babies with a normal heart structure.

1

[Turn over



6. The graph below shows the number of stroke patients in different groups from Scotland and England in 2007.



- (a) (i) Calculate the difference in the number of male stroke patients of all ages in Scotland and England in 2007. 1

Space for calculation

_____ per 100 000

- (ii) Explain the importance of presenting the data as the number of stroke patients **per 100 000**. 1



6. (a) (continued)

(iii) Scotland's population was 5.1 million in 2007.

Calculate the number of female stroke patients in Scotland under 75 years of age in this year.

1

Space for calculation

(iv) Express, as a simple whole number ratio, the number of male stroke patients under 75 years of age compared to female stroke patients under 75 years of age in England in 2007.

1

Space for calculation

_____ : _____
 male patients female patients

(b) Describe what causes a stroke.

1

(c) Paralysis occurs when voluntary muscle is unable to contract.

Explain how a stroke could lead to muscle paralysis on the left side of the body.

2



7. The table below contains information about five obese patients who attended a weight loss clinic for 12 weeks.

Patient	Height (m)	Starting weight (kg)	Starting BMI	Final Weight (kg)	Final BMI
P	1.74	92	30.5	82	27.2
Q	1.68	98	34.8	90	32.1
R	1.81	104	31.8	97	29.7
S	1.89	121	33.9	113	31.4
T	1.90	100	32.3	94	

(a) (i) Calculate the final BMI of patient T. 1
Space for calculation

Final BMI = _____

(ii) State why patient Q was still classed as obese after 12 weeks. 1

(b) Explain why all the patients were advised to exercise regularly to increase their weight loss. 1



MARKS

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7. (continued)

(c) Rugby players may have a BMI which indicates that they are obese.

Suggest why a BMI reading may not be a reliable indicator of obesity in rugby players.

1

[Turn over



* X 7 4 0 7 6 0 1 1 7 *

8. Statins are drugs which reduce the production of cholesterol in the liver. A year-long trial was carried out to investigate the effects of taking a newly-developed statin on blood cholesterol levels.

Sixty individuals with raised blood cholesterol levels were selected and divided into two groups of thirty.

Individuals in Group 1 were prescribed a capsule, containing 20 mg of the statin, to take each day. Individuals in Group 2 were the control group. At two-monthly intervals, blood samples were taken from all individuals and their blood cholesterol levels measured.

The results are shown in the table below.

<i>Month of trial</i>	<i>Average blood cholesterol level (mmol/l)</i>	
	Group 1	Group 2
0	6.3	6.3
2	6.3	6.3
4	6.3	6.1
6	6.3	6.3
8	5.6	6.1
10	5.3	6.2
12	5.1	6.1

- (a) Using the results in the table, give one reason why this drug might be recommended _____ 2

not recommended _____

- (b) Suggest what was prescribed to the individuals in Group 2 during this trial. 1



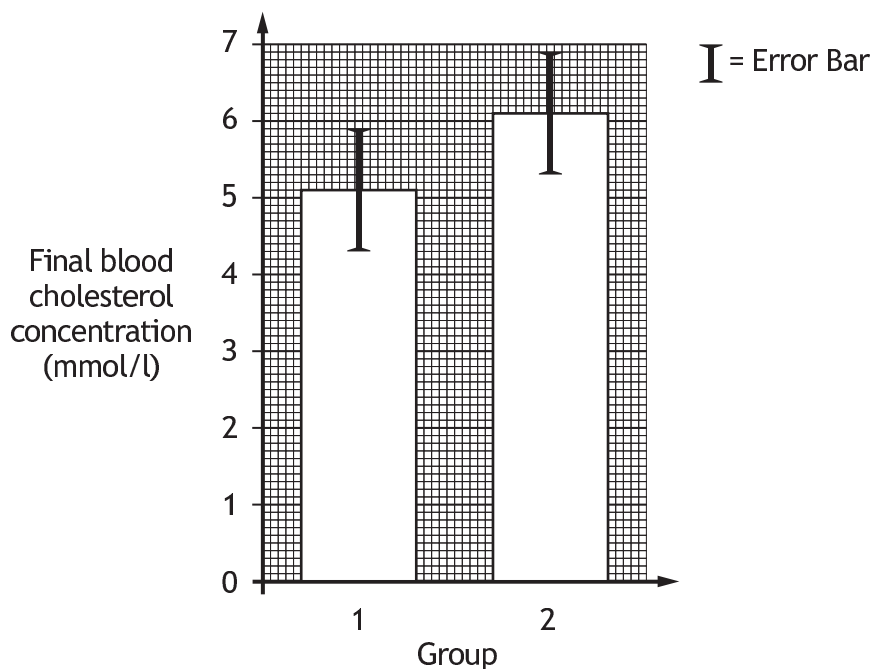
8. (continued)

- (c) Describe the design features which would have been used to ensure that this was both a randomised and a double-blind trial. 2

randomised _____

double-blind _____

- (d) The bar graph below summarises the data collected in the final month of this trial.





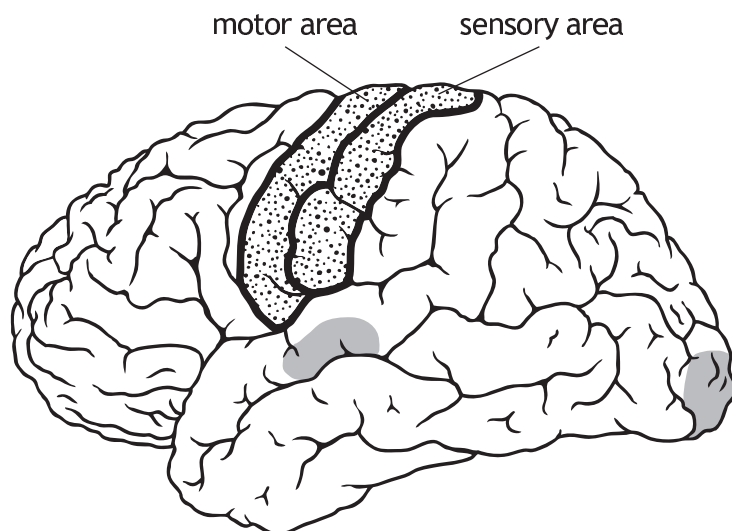
- Using evidence from the bar graph, suggest why it was decided that this statin was not worth further development. 1

- (e) Describe **one** function of cholesterol in the human body. 1



9. The diagram below represents areas of high activity in a part of the brain of an individual as a task is described to them which they then complete.

-  areas of high activity during the description of the task
-  areas of high activity during the completion of the task



(a) Name the part of the brain shown in the diagram. 1

(b) Explain how the diagram supports the suggestion that there is localisation of function in the brain. 1

(c) Explain the high level of brain activity during the description of the task. 1

MARKS

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9. (continued)

(d) The task was to fold a piece of paper.

Explain why the diagram shows high levels of activity in the sensory and motor areas.

2

Sensory area _____

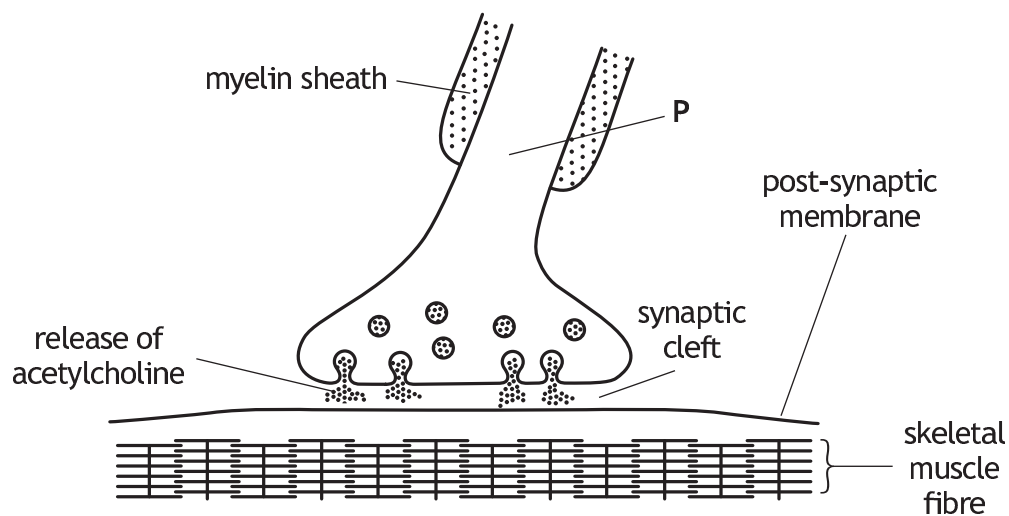
Motor area _____

[Turn over



* X 7 4 0 7 6 0 1 2 1 *

10. The diagram below shows a synapse in skeletal muscle of a weightlifter.



(a) Name the part of the motor neuron labelled P. 1

(b) Describe what acetylcholine does when it reaches the post-synaptic membrane. 1

(c) Name the type of skeletal muscle fibres which will be the most common in the arm muscles of a champion weightlifter. 1

10. (continued)

(d) Nicotine is a drug that is an agonist of acetylcholine.

(i) Explain how an agonist works.

1

(ii) Suggest how nicotine induces feelings of pleasure and so reinforces smoking behaviour.

1

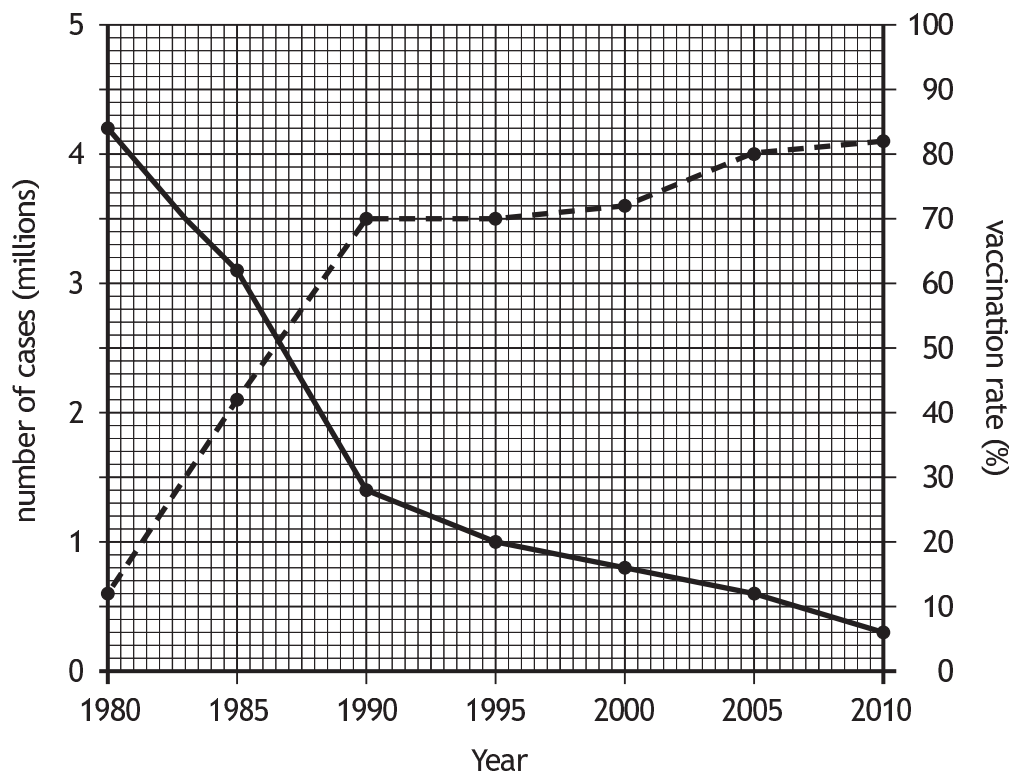
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* X 7 4 0 7 6 0 1 2 3 *

11. The graph below shows the number of cases of measles that occurred in the world between 1980 and 2010. It also shows the global vaccination rate against measles over the same period.

Key: ●——● number of cases ●- - - -● vaccination rate



- (a) State how many cases of measles there were in 1985. 1
- _____
- (b) State the vaccination rate when there were 3.5 million cases of measles in the world. 1
- _____ %
- (c) Calculate the percentage decrease in the number of cases of measles between 1995 and 2010. 1
- Space for calculation*
- _____



11. (continued)

(d) In many countries herd immunity has been established against measles.

(i) Explain why people in these countries who have not been vaccinated are still protected against measles.

1

(ii) Suggest **one** reason why widespread vaccination programmes against measles are not possible in all countries of the world.

1

(e) In 2010 the population of the world was 6900 million.

Using the information from the graph, calculate how many people in the world had not been vaccinated against measles in 2010.

1

Space for calculation

_____ million

(f) The World Health Organisation (WHO) has set a goal of eliminating measles worldwide by 2020.

Explain how the information in the graph indicates that this goal can be achieved.

1

[Turn over



12. Specific cellular defences are part of the body's immune system and give protection against individual types of pathogen.

(a) (i) Explain how a clonal population of lymphocytes would be formed when a pathogen invades the body.

2

(ii) Describe the role of phagocytes in the specific immune response.

2

(b) Failure of the immune system can lead to conditions such as allergy and autoimmune disease.

Choose **one** of these conditions and complete the table below with information about it.

2

Condition _____

<i>Type of white blood cell involved</i>	<i>Description of immune system failure</i>

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

Labelled diagrams may be used where appropriate.

A Discuss the causes, development and associated health problems of atherosclerosis.

8

OR

B Discuss the diagnosis, treatment and role of insulin in Type 1 and Type 2 diabetes.

8



* X 7 4 0 7 6 0 1 2 7 *