National
Qualifications
SPECIMEN ONLY

SQ04/H/02

Biology
Section 1—Questions

Date — Not applicable

Duration — 2 hours and 30 minutes

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

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

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

SECTION 1 — 20 marks

Attempt ALL questions

1. The genetic material in human mitochondria is arranged as

A linear chromosomes

B circular plasmids

C circular chromosomes

D inner membranes.

2. The main components of a ribosome are

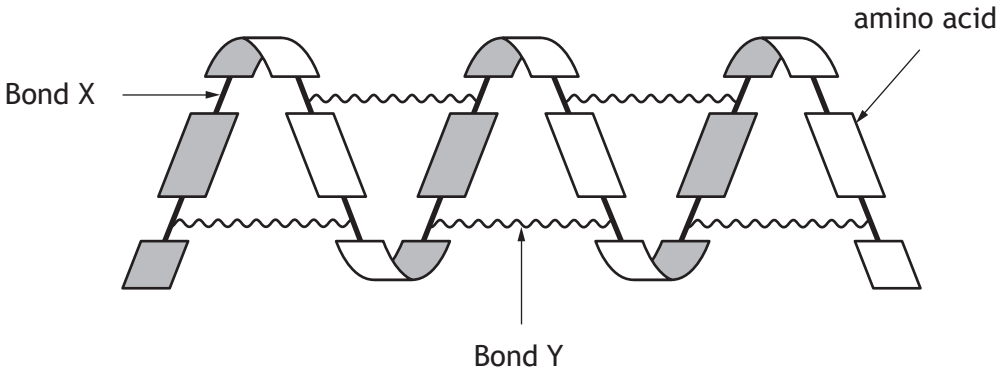
A mRNA and tRNA

B rRNA and protein

C mRNA and protein

D rRNA and mRNA.

3. The diagram below represents part of a protein molecule.



Which line in the table below identifies bonds X and Y?

	Bond X	*Bond Y*
A	hydrogen	peptide
B	hydrogen	hydrogen
C	peptide	hydrogen
D	peptide	peptide

4. Types of single gene mutation are given in the list below.

1 substitution
2 insertion
3 deletion

Which of these would affect only one amino acid in the polypeptide produced?

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

5. Which line in the table below describes meristems?

	Found in	*Type of cell present*
A	animal	specialised
B	animal	unspecialised
C	plant	specialised
D	plant	unspecialised

6. The table below provides information about ancestral and modern Brassica species. The modern species have been produced by hybridisation of two ancestral species followed by a doubling of the chromosome number in the hybrids.

Brassica species	*Ancestral or modern species*	*Crop*	*Diploid chromosome number (2 n)*
B. oleracea	ancestral	cabbage	18
B. nigra	ancestral	black mustard	16
B. rapa	ancestral	turnip	20
B. juncea	modern	Indian Mustard	36
B. carinata	modern	Ethiopian Mustard	34
B. napus	modern	oilseed rape	38

Which of the following shows the ancestral hybridisation and the modern species produced?

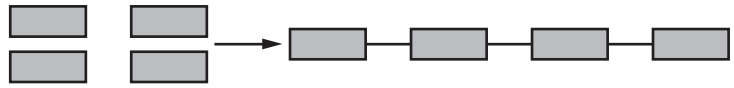
A Cabbage × turnip ⟶ oilseed rape

B Turnip × black mustard ⟶ Ethiopian mustard

C Turnip × cabbage ⟶ Indian mustard

D Cabbage × black mustard ⟶ Indian mustard

7. The diagram below shows how a molecule might be biosynthesised from building blocks in a metabolic pathway.

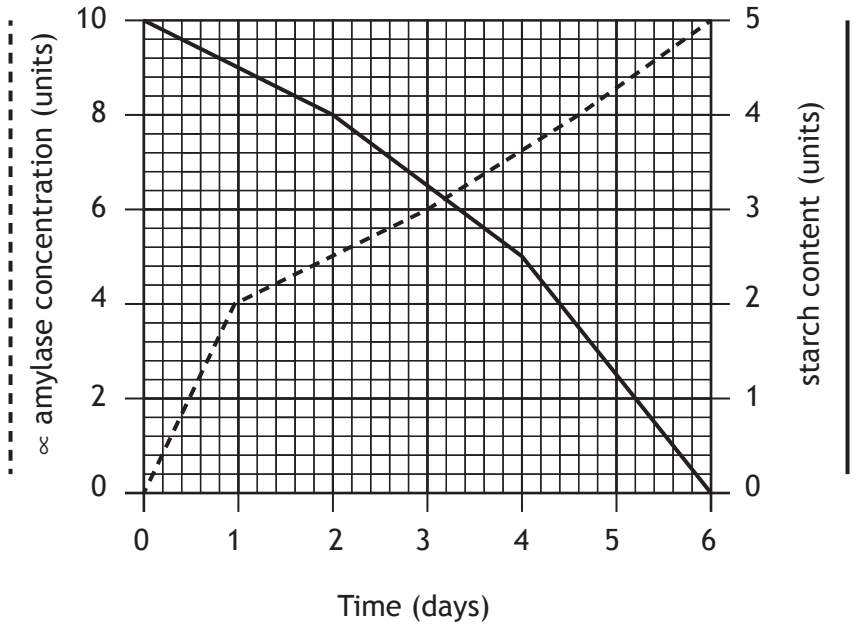


building blocks biosynthesised molecule

Which line in the table below describes the metabolic process shown in the diagram and the energy relationship involved in the reaction?

	Metabolic process	*Energy relationship*
A	anabolic	energy used
B	anabolic	energy released
C	catabolic	energy used
D	catabolic	energy released

8. The graph below shows changes in the α-amylase concentration and the starch content of a barley grain during early growth and development.



Identify the time by which the starch content of the barley grains had decreased by 50%.

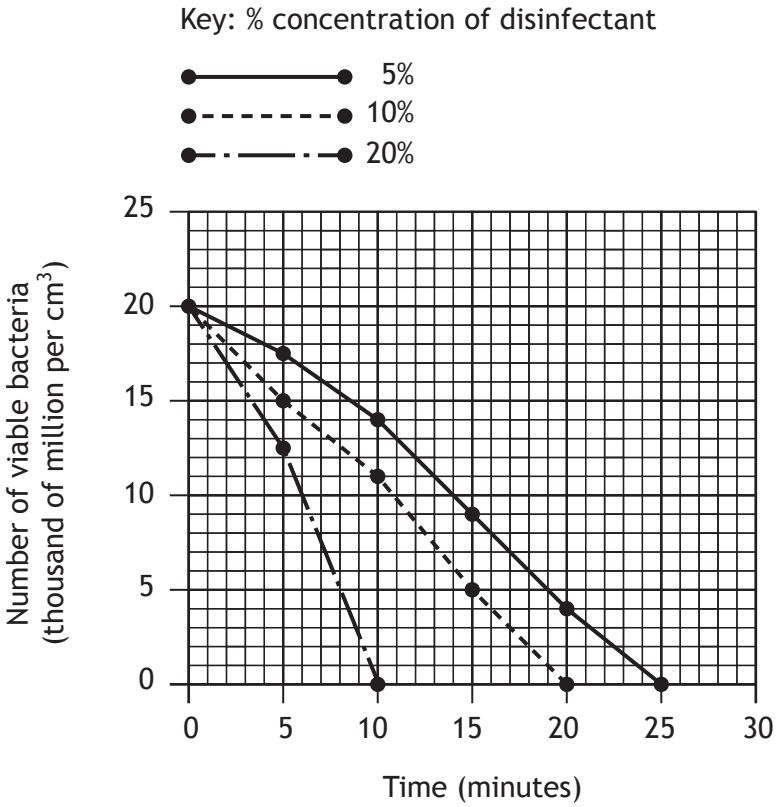
A 2·0 days

B 3·2 days

C 4·0 days

D 6·0 days

9. The graph below shows the effect of different concentrations of a disinfectant on the number of viable bacteria in liquid culture.



What percentage of bacteria was killed by 20% disinfectant after 5 minutes?

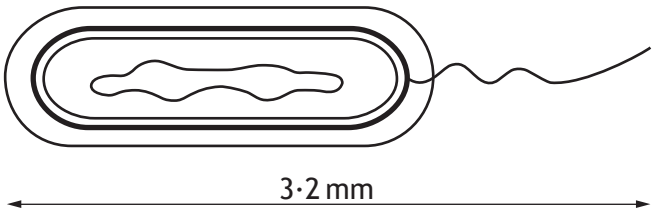
A 25

B 37·5

C 62·5

D 75

10. The diagram below shows a bacterial cell that has been magnified 800 times.



Calculate the length of the cell in micrometres (μm).

A 0·004

B 0·04

C 0·4

D 4·0

11. The cell membrane contains pumps that actively transport substances.

Which of the following forms the major component of membrane pumps?

A Protein

B Phospholipid

C Nucleic acid

D Carbohydrate

12. Maximum oxygen uptake per kg body mass can be used as a measure of fitness. Four athletes were weighed then given a fitness test during which their maximum oxygen uptake was measured.

Which line in the table below shows results for the least fit athlete?

Athlete	*Body mass* (kg)	*Maximum oxygen uptake* (litres per minute)
A	60	3·6
B	55	3·6
C	60	3·7
D	55	3·7

13. The list below gives some adaptations of weed plants.

1 high seed output

2 possession of storage organs

3 vegetative reproduction

4 long term seed viability

Which of these are competitive adaptations of annual weeds?

A 1 and 2 only

B 1 and 4 only

C 2 and 3 only

D 2 and 4 only

14. The table below gives measurements relating to productivity in a field of wheat grown to produce grain for making bread.

Measurement	*Productivity* (kg dry mass per hectare per year)
plant biomass	11 250
grain yield	4500

What is the harvest index of this wheat crop?

A 0·4

B 2·5

C 6750

D 15750

15. The action spectrum of photosynthesis is a measure of the ability of plants to

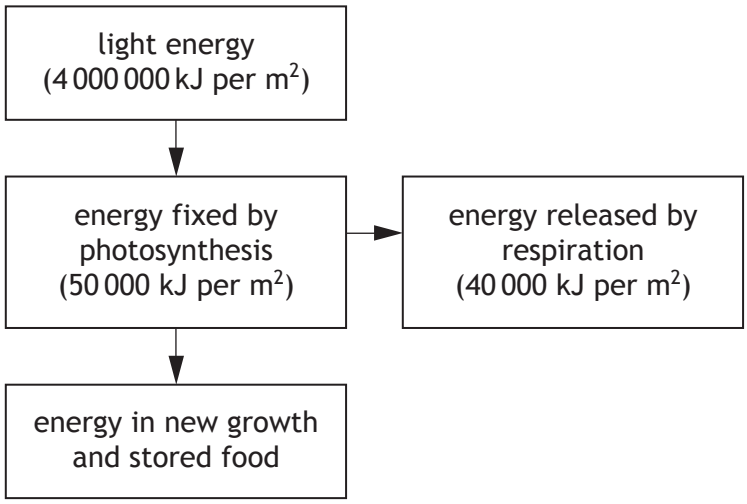
A absorb all wavelengths of light

B absorb light of different intensities

C use light to build up food

D use light of different wavelengths for photosynthesis.

16. The flow chart below shows the energy flow in a field of potatoes during one year.



What is the percentage of the available light energy present in new growth and stored food in the potato crop?

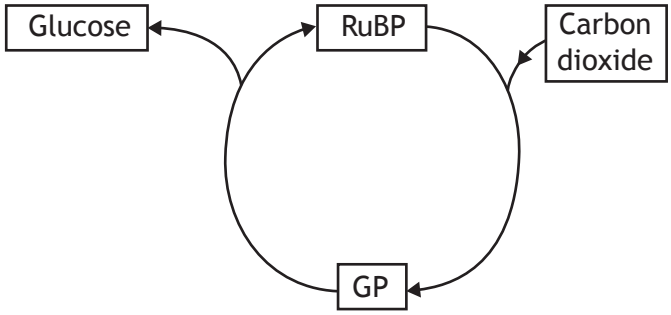
A 2·25

B 1·25

C 0·25

D 1·00

17. The diagram below represents part of the Calvin cycle within a chloroplast.



Which line in the table below shows the effect of decreasing CO_2 availability on the concentrations of RuBP and GP in the cycle?

	RuBP concentration	*GP concentration*
A	decrease	decrease
B	increase	increase
C	decrease	increase
D	increase	decrease

18. The list below describes observed behaviour of pigs on a farm.

1 Stereotypic flicking of the head

2 Repeated wounding of other pigs by biting

3 Lying in a position which does not allow suckling

Which of these behaviours indicate poor animal welfare?

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

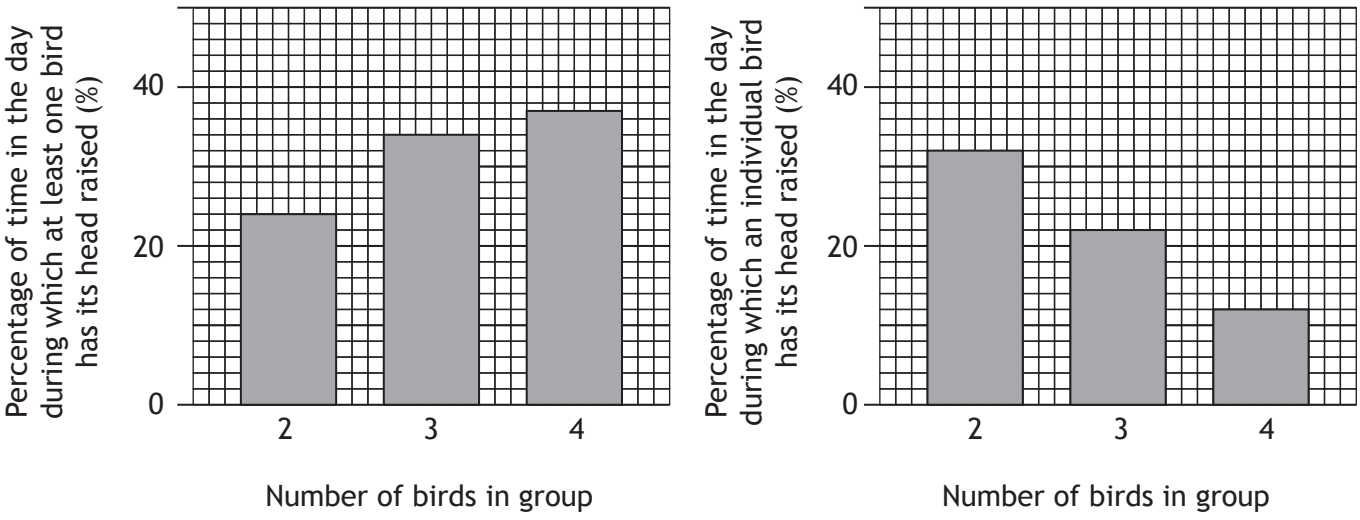
19. Adult beef tapeworms live in the intestine of humans. Segments of the adult worm are released in the faeces. Embryos that develop from them remain viable for five months. The embryos may be eaten by cattle and develop in their muscle tissue.

Which row in the table below identifies the roles of the human, tapeworm embryo and cattle?

	Role		
	human	*tapeworm embryo*	*cattle*
A	host	resistant stage	secondary host
B	host	vector	secondary host
C	secondary host	vector	host
D	secondary host	resistant stage	vector

20. Ostriches are large birds that live on open plains in Africa. They divide their time between feeding on vegetation and raising their heads to look for predators.

The graphs below show the results of a study on the effect of group size in ostriches on their behaviour.



Which of the following is a valid conclusion from these results?

In larger groups, an individual ostrich spends

A less time with its head raised so the group is less likely to see predators

B less time with its head raised but the group is more likely to see predators

C more time with its head raised so the group is more likely to see predators

D more time with its head raised but the group is less likely to see predators.

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

FOR OFFICIAL USE

National Qualifications SPECIMEN ONLY

Mark

SQ04/H/01

Biology
Section 1 — Answer Grid and Section 2

Date — Not applicable

Duration — 2 hours and 30 minutes

* S Q 0 4 H 0 1 *

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day	Month	Year
D D	M M	Y Y

Scottish candidate number

Total marks — 100

SECTION 1 — 20 marks

Attempt ALL questions.

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

SECTION 2 — 80 marks

Attempt ALL questions.

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

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

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

SQA ©

SECTION 1— 20 marks

The questions for Section 1 are contained in the question paper SQ04/H/02.
Read these and record your answers on the answer grid on Page three opposite.
Do NOT use gel pens.

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

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

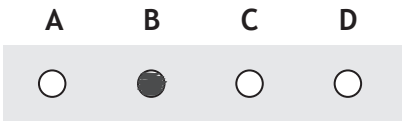
3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample Question

The thigh bone is called the

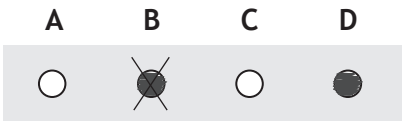
A humerus
B femur
C tibia
D fibula.

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

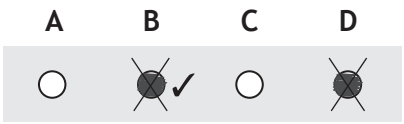


Changing an answer

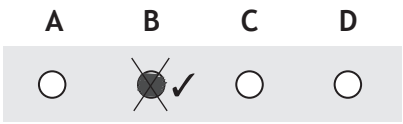
If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



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



or



SECTION 1 — Answer Grid

OBJ20AD1

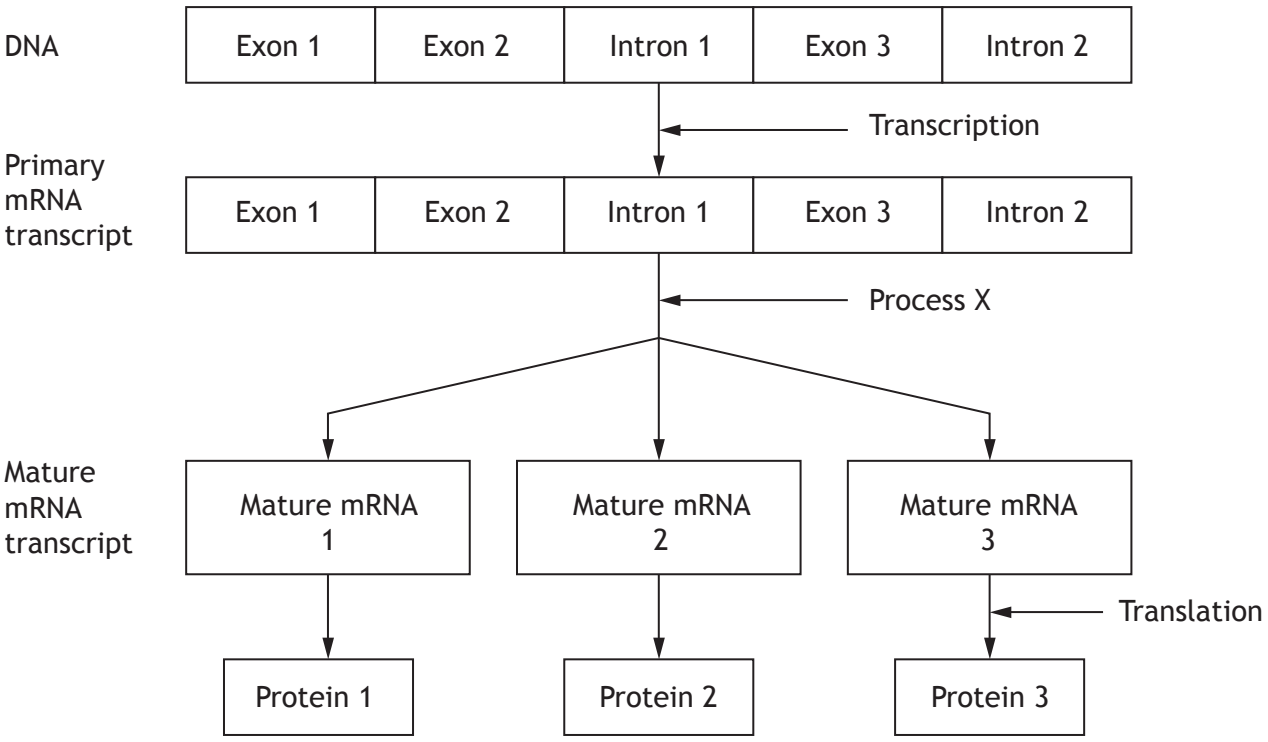
	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

SECTION 2 — 80 marks

Attempt ALL questions

It should be noted that questions 8 and 14 contain a choice.

1. The diagram below shows stages in the production of three different proteins that are coded for by one gene.



(a) (i) Identify a non-coding region of DNA. **1**

_____

(ii) Name process X. **1**

_____

(iii) Explain how process X can produce different mature mRNA transcripts. **2**

_____

_____

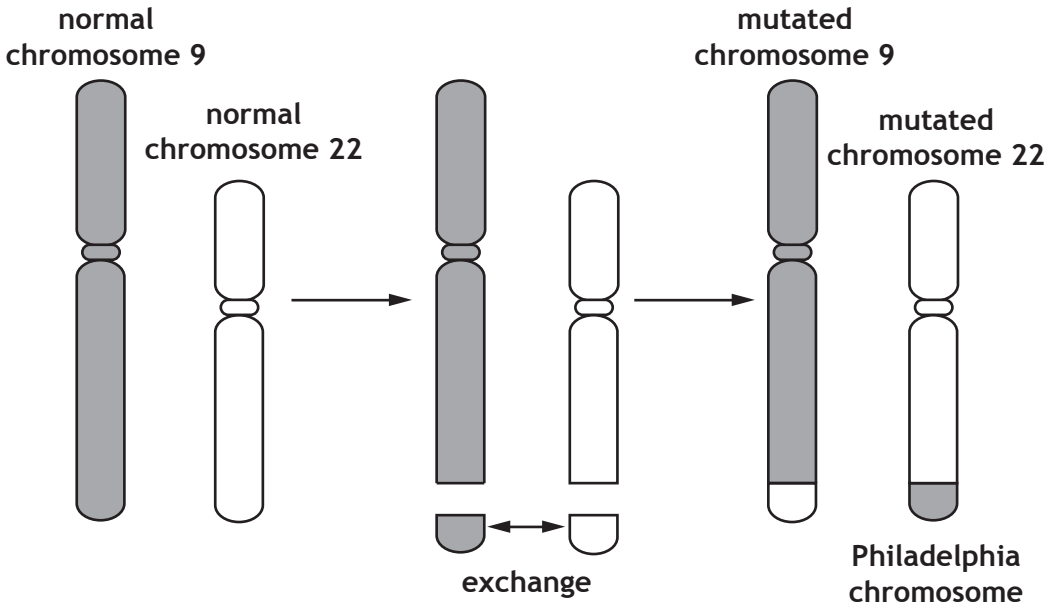
(b) Some proteins undergo post translational modification to make them functional.

Give **one** example of post translational modification. **1**

_____

2. A chromosome mutation in humans can result in the formation of the Philadelphia chromosome, which is associated with a form of leukaemia.

The stages leading to the formation of a Philadelphia chromosome are shown in the diagram below.



(a) Name the type of chromosome mutation, shown in the diagram, which results in the formation of a Philadelphia chromosome. **1**

_____

(b) (i) The presence of a Philadelphia chromosome causes a form of leukaemia through the over-production of an enzyme.

A drug has been used to successfully treat this form of leukaemia by blocking the active site of the enzyme.

Name the type of enzyme inhibition shown by this drug. **1**

_____

2. (b) (continued)

(ii) White blood cell counts in humans normally range from 5000 to 10 000 cells per µl of blood.

The table below shows the white blood cell counts from a patient with leukaemia before and after treatment with this drug.

	Number of white blood cells (per µl blood)
Before treatment	150 000
After treatment	7500

Calculate the percentage decrease in the number of white blood cells after treatment with this drug. **1**

Space for calculation

_____ **%**

(iii) Explain how the results suggest that the type of leukaemia in this patient was a result of the presence of a Philadelphia chromosome. **2**

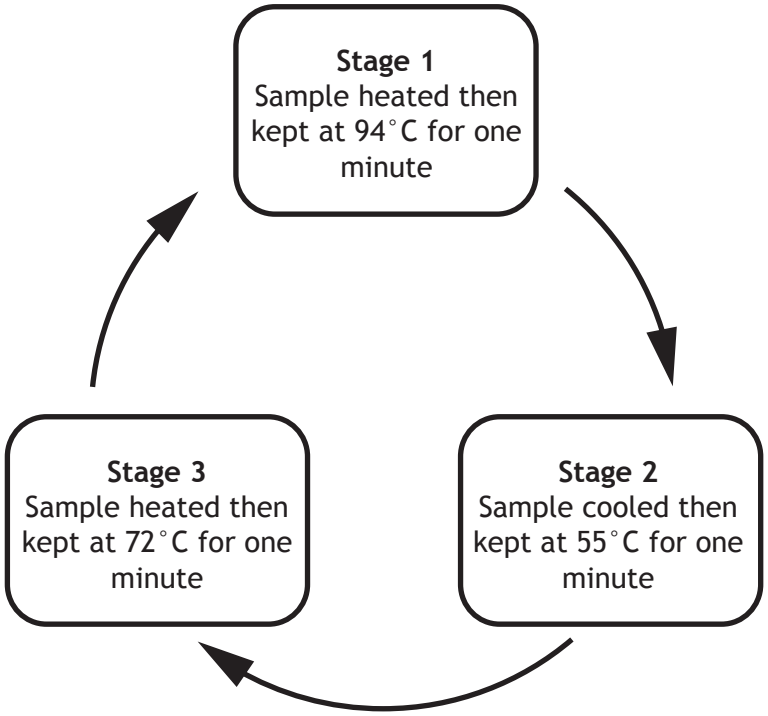
_____

_____

_____

3. The polymerase chain reaction (PCR) amplifies specific sequences of DNA.

The flow chart below shows how a sample of DNA was treated during a cycle of the PCR procedure.



(a) Explain the purpose of the different heat treatments in Stage 1 and Stage 2. **2**

3. (continued)

(b) The number of DNA molecules doubles during each cycle of the PCR procedure.

Caculate the number of cycles needed to produce 128 copies of a single DNA molecule. **1**

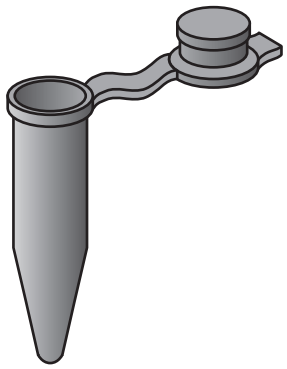
Space for calculation

_____ cycles

(c) The diagram below shows the contents of a tube used in PCR.

Contents of tube

— DNA
— DNA nucleotides
— primers
— enzyme and buffer



Describe the contents of a suitable control tube designed to show that primers are needed in the reaction. **1**

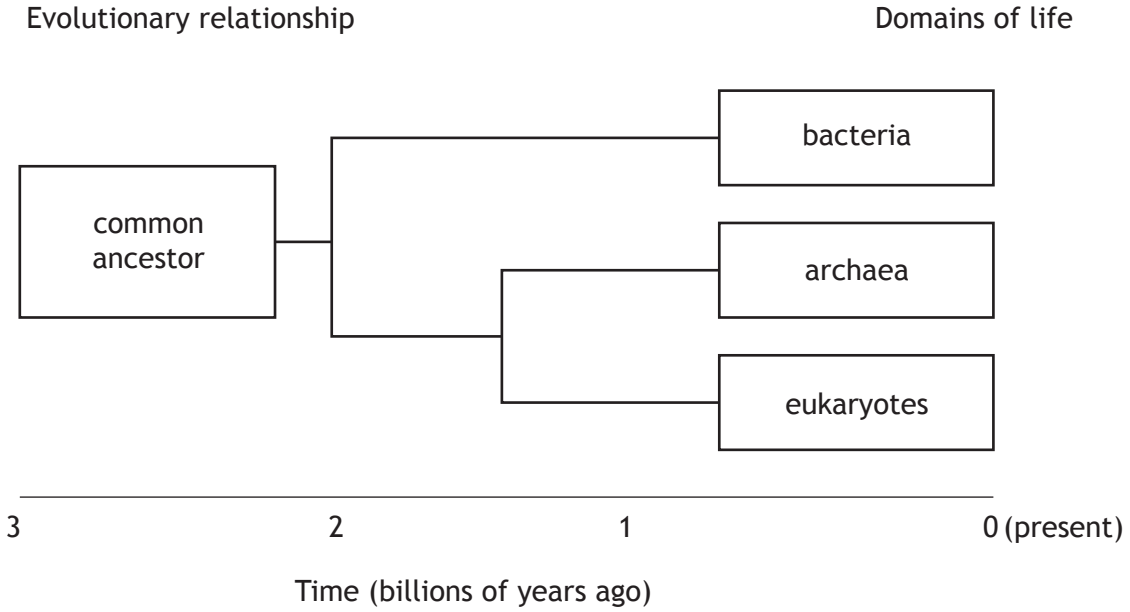
_____

_____

(d) State **one** practical application of PCR. **1**

_____

4. The phylogenetic tree below shows the evolutionary relationship between the three domains of life into which all present day living things can be divided.



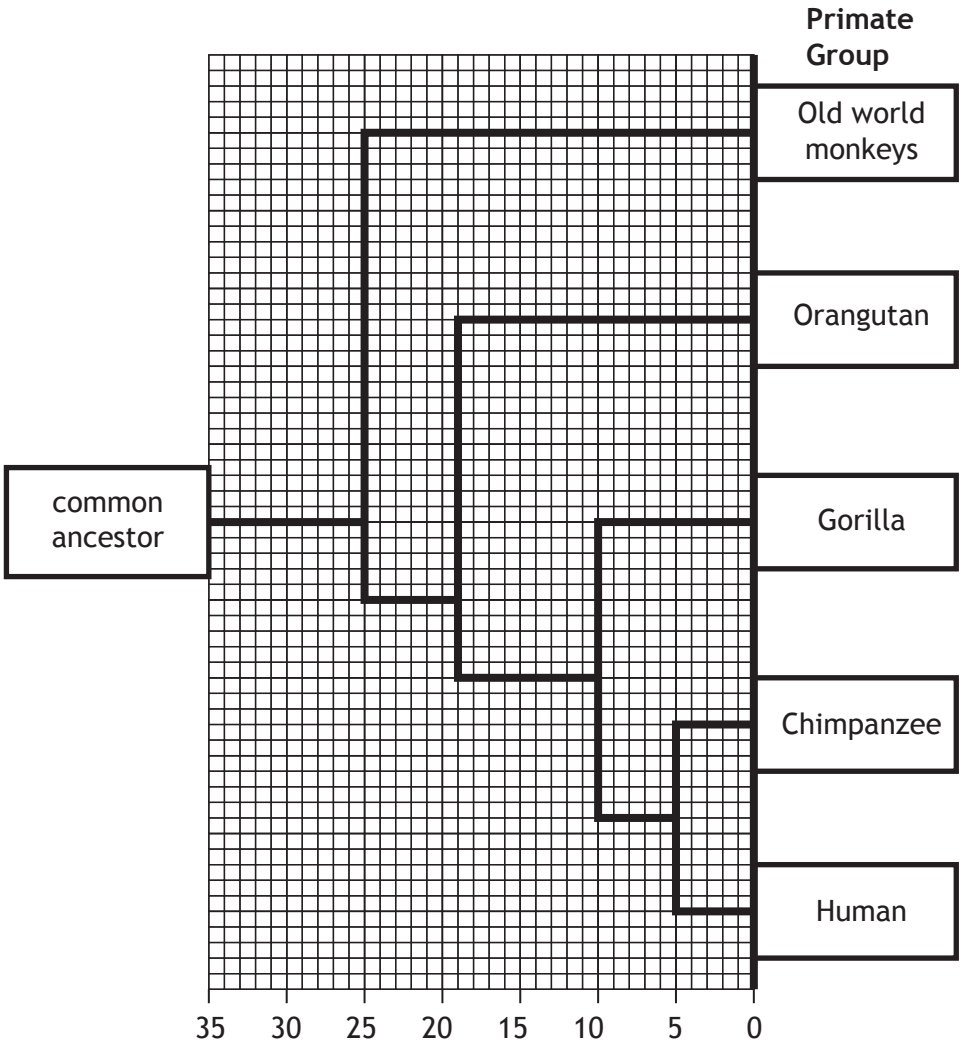
(a) Name the type of data that can be used to confirm the evolutionary relationships between the domains of life shown on the diagram. **1**

(b) Around one billion years ago genes were transferred between archaea and bacteria.

Give the term that describes this form of gene transfer. **1**

4. (continued)

(c) The phylogenetic tree below illustrates the evolutionary relationships between primate groups.



(i) State how long ago the last common ancestor of gorillas and old world monkeys existed. **1**

_____ million years ago

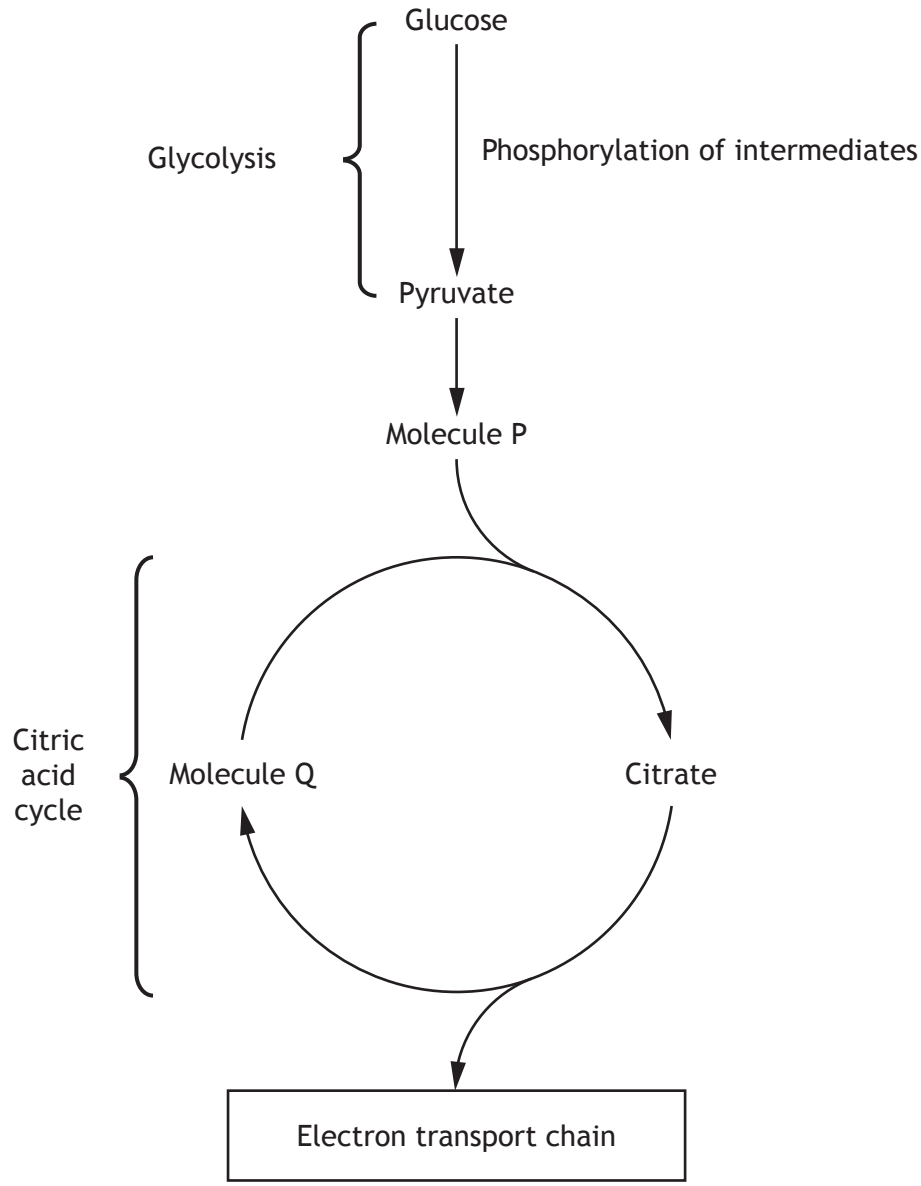
4. (c) (continued)

(ii) Humans are more closely related to chimpanzees than to orangutans.

Explain how this is known, using information from the phylogenetic tree above. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

5. The diagram below shows some stages in the aerobic respiration of glucose.



(a) Name molecules P and Q. **2**

Molecule P _____

Molecule Q _____

(b) Explain why the phosphorylation of intermediates in glycolysis is referred to as an energy investment stage. **2**

_____

_____

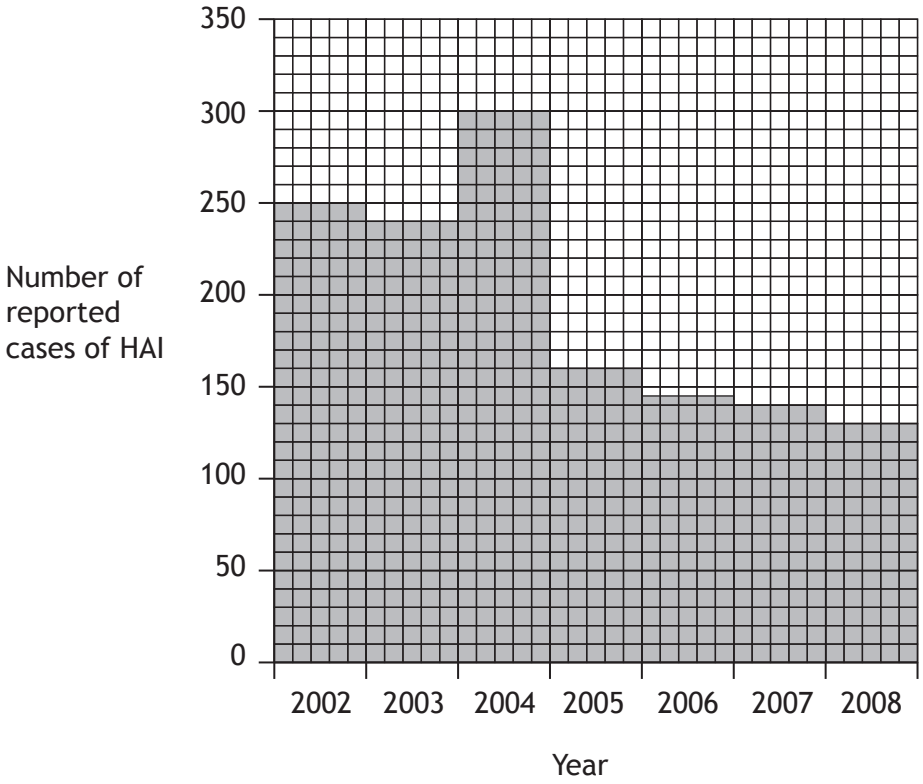
5. (continued)

(c) Describe the role of the coenzymes NAD and FAD. **2**

(d) People who suffer from chronic fatigue syndrome have mitochondria in which some of the proteins embedded in the inner mitochondrial membrane are damaged.

Explain how this might result in the tiredness that is a feature of this condition. **2**

6. The graph below shows the number of reported cases of hospital acquired infections (HAI) in one hospital between 2002 and 2008. The overall number of patients remained constant during this time.



(a) Using information from the graph, calculate the average decrease per year in reported cases of HAI between 2002 and 2008. **1**

Space for calculation

_____ cases per year

6. (continued)

(b) The decrease in the number of cases in 2005 was due to introduction of a new hand washing procedure at the hospital.

Predict what would happen to the number of reported cases of HAI in 2009.

Circle **one** answer and give a reason for your choice. **1**

increase decrease stay the same

Reason _____

_____

(c) The table below shows the percentage of cases of HAI in the hospital attributed to two types of bacteria, *Clostridium* and *Staphylococcus*, between 2002 and 2008.

	Percentage of cases of HAI in each year attributed to bacterial types						
Bacterial types	2002	2003	2004	2005	2006	2007	2008
Clostridium	32	30	30	51	54	57	59
Staphylococcus	34	32	33	30	31	33	33

Using information in the table, compare the overall trend in the percentage of *Clostridium* cases with that of *Staphylococcus* cases. **2**

_____

_____

(d) Using information from the graph and the table, draw a conclusion about the effectiveness of the hand washing procedure against *Staphlycoccus*. Justify your answer. **2**

Conclusion _____

_____

Justification _____

_____

6. (continued)

(e) Some bacteria form endospores to survive adverse conditions. Identify which of the two types of bacteria in the table forms endospores and give a reason for your answer. **1**

Bacterial type _____

Reason _____

_____

MARKS | DO NOT WRITE IN THIS MARGIN

7. Mammals are regulators and can control their internal environment.

(a) Give **one** reason why it is important for mammals to regulate their body temperature. **1**

_____

_____

(b) (i) Name the temperature monitoring centre in the body of a mammal. **1**

_____

(ii) State how messages are sent from the temperature monitoring centre to the skin. **1**

_____

(c) The blood vessels in the skin of a mammal respond to a decrease in environmental temperature.

(i) Describe this response. **1**

_____

(ii) Explain the effect of this response. **1**

_____

MARKS | DO NOT WRITE IN THIS MARGIN

8. Answer **either A or B**.

A Describe how animals survive adverse conditions. 4

OR

B Describe recombinant DNA technology. 4

Labelled diagrams may be used where appropriate.

MARKS DO NOT WRITE IN THIS MARGIN

9. The average yield, fat and protein content of the milk from each of three breeds of dairy cattle were determined.

The results are shown in the table below.

Breed	*Average milk yield per cow* (kg per day)	*Average fat content of milk* (%)	*Average protein content of milk* (%)
Pure bred Holstein	44·80	4·15	3·25
F_1 hybrid Holstein × Normande	48·64	4·25	3·10
F_1 hybrid Holstein × Scandinavian Red	51·52	4·25	3·15

(a) Calculate the percentage increase in average milk yield per cow from the F1 hybrid Holstein × Scandinavian Red compared to pure bred Holstein cattle. **1**

Space for calculation

_____ %

(b) The fat content of milk is important for butter production.

Calculate the total fat content in the milk produced in a day from a herd of 200 F1 hybrid Holstein × Normande cattle. **1**

Space for calculation

_____ kg per day

9. (continued)

(c) Select **one** from: average milk yield per cow; average fat content of milk; or average protein content of milk.

For your choice, draw a conclusion about the effects of crossbreeding. **1**

Choice _____

Conclusion _____

_____

(d) The development of pure breeds such as Holsteins has led to an accumulation of deleterious recessive alleles.

State the term that describes this. **1**

_____

(e) Some F2 offspring from crosses of F1 hybrid Holstein × Scandinavian Red cattle will have less desirable milk-producing characteristics than their parents.

(i) Give **one** reason for this. **1**

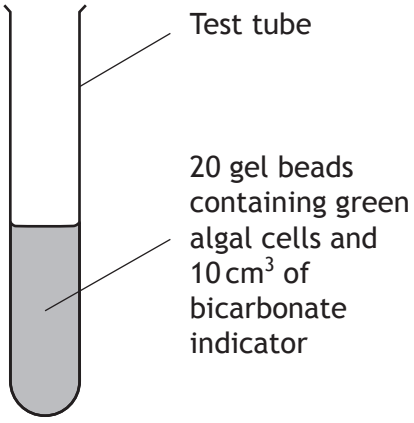
_____

_____

(ii) Name a process breeders would have to carry out to maintain the milk-producing characteristics of the F1 hybrids in further generations. **1**

_____

10. An investigation was carried out to compare the rate of photosynthesis, at different light intensities, of green algal cells immobilised into gel beads.



Seven tubes were set up as shown in the diagram and each positioned at a different distance from a light source to alter the light intensity.

Photosynthesis causes the bicarbonate indicator solution to change colour.

After 60 minutes, the bicarbonate indicator solution was transferred from each tube to a colorimeter.

The higher the colorimeter reading, the higher the rate of photosynthesis that has occurred in the tube.

Results are shown in the table.

Tube	*Distance of tube from light source* (cm)	Colorimeter reading (units)
1	25	92
2	35	92
3	50	83
4	75	32
5	100	14
6	125	6
7	200	0

10. (continued)

(a) Identify the dependent variable in this investigation. **1**

(b) Describe how the apparatus could be improved to ensure that temperature was kept constant. **1**

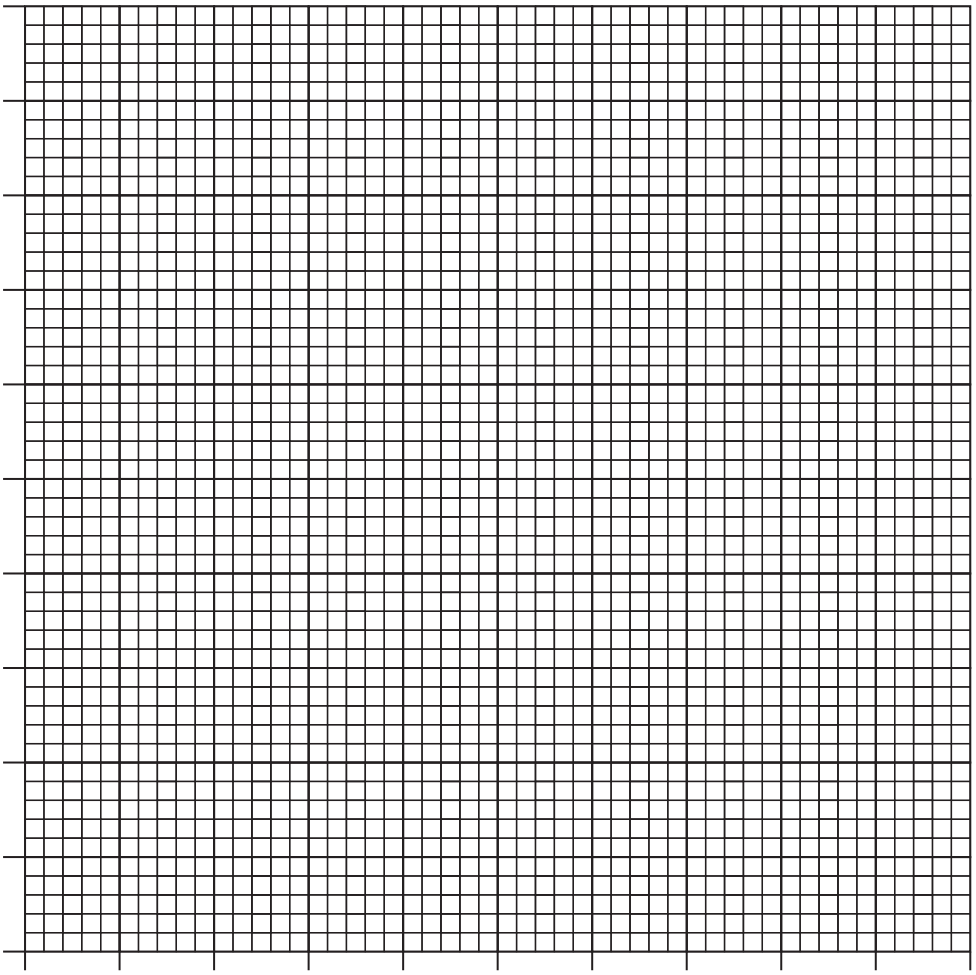
(c) State an advantage of using algae immobilised into gel beads. **1**

(d) Describe how the experimental procedure could be improved to increase the reliability of the results. **1**

10. (continued)

(e) On the grid below, complete the line graph to show the colorimeter reading against distance of tube from light source. **2**

(Additional graph paper if required will be found on *Page twenty-nine*)



(f) From the results of this investigation, draw a conclusion about the effect of light intensity on the rate of photosynthesis. **2**

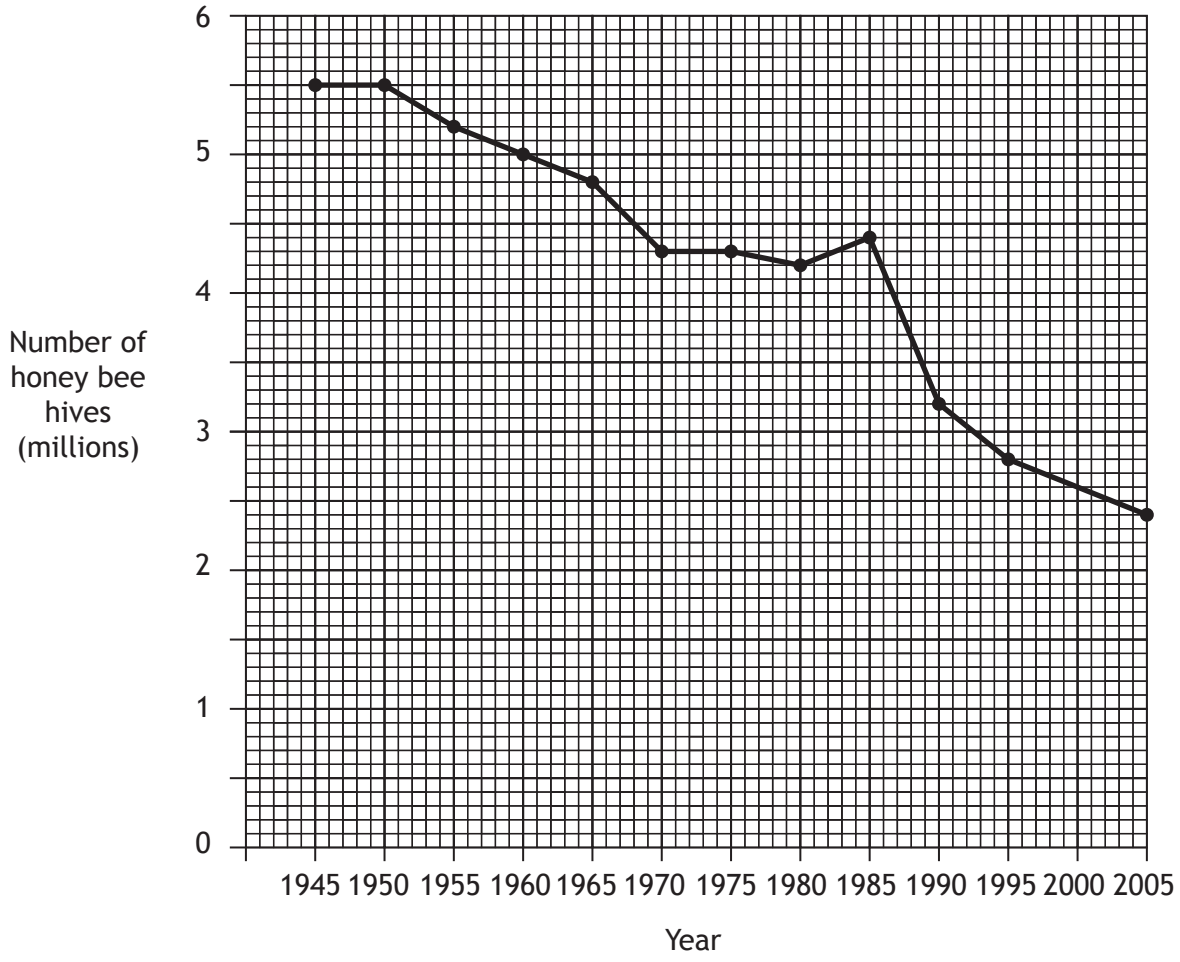
MARKS | DO NOT WRITE IN THIS MARGIN

11. (a) The honey bee (*Apis mellifera*) is a social insect that lives in colonies.

The queen is the only female in a colony that reproduces. Other females are workers that collect food, maintain the colony and care for the developing offspring.

Explain the advantage to the worker bees of caring for the offspring of the queen. **2**

(b) The graph below shows the changes in the number of honey bee hives kept by bee-keepers in the USA from 1945 to 2005.



11. (b) (continued)

(i) **Using values from the graph**, describe changes in the number of bee hives from 1980 to 1995. **1**

_____

_____

(ii) Calculate the simplest whole number ratio of the number of bee hives in 1965 and 2005. **1**

Space for calculation

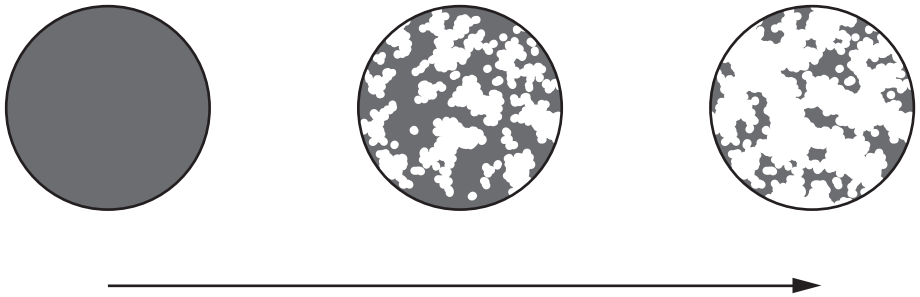
_____ hives in 1965 : _____ hives in 2005

MARKS | DO NOT WRITE IN THIS MARGIN

12. The biodiversity and the genetic diversity of individual species are affected when fragments of woodland become isolated.

The diagram below illustrates habitat fragmentation of an area of woodland over time.

The shaded areas represent woodland.



(a) (i) Name **one** component of genetic diversity. **1**

(ii) Suggest a reason why a decrease in genetic diversity of an individual species can lead to local extinctions within habitat fragments. **1**

(b) Suggest how habitat edge species might affect interior species as the habitat fragments become smaller. **1**

(c) Habitat corridors can be created to remedy habitat fragmentation.

(i) State what is meant by the term "habitat corridor". **1**

(ii) Explain how a habitat corridor can increase biodiversity after local extinction. **1**

MARKS | DO NOT WRITE IN THIS MARGIN

13. Japanese knotweed (*Fallopia japonica*) was introduced to Britain as an ornamental plant. It grows to 3 metres in height and has large leaves. It has become naturalised and has colonised many parts of the country where it out-competes native plants.

(a) Give the term used for a naturalised species that eliminates native species. **1**

_____

(b) Name **one** resource for which Japanese knotweed may outcompete the native plants. **1**

_____

(c) An insect from Japan, which feeds on Japanese knotweed, has been proposed as a biological control agent.

(i) Describe **one** possible risk of introducing this insect into Britain. **1**

_____

_____

_____

(ii) Describe a procedure that should be carried out to assess the risk of introducing this insect. **1**

_____

_____

MARKS | DO NOT WRITE IN THIS MARGIN

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

A Describe DNA under the following headings. **9**

(i) Structure of DNA

(ii) Replication of DNA

B Describe the evolution of new species under the following headings. **9**

(i) Isolation and mutation

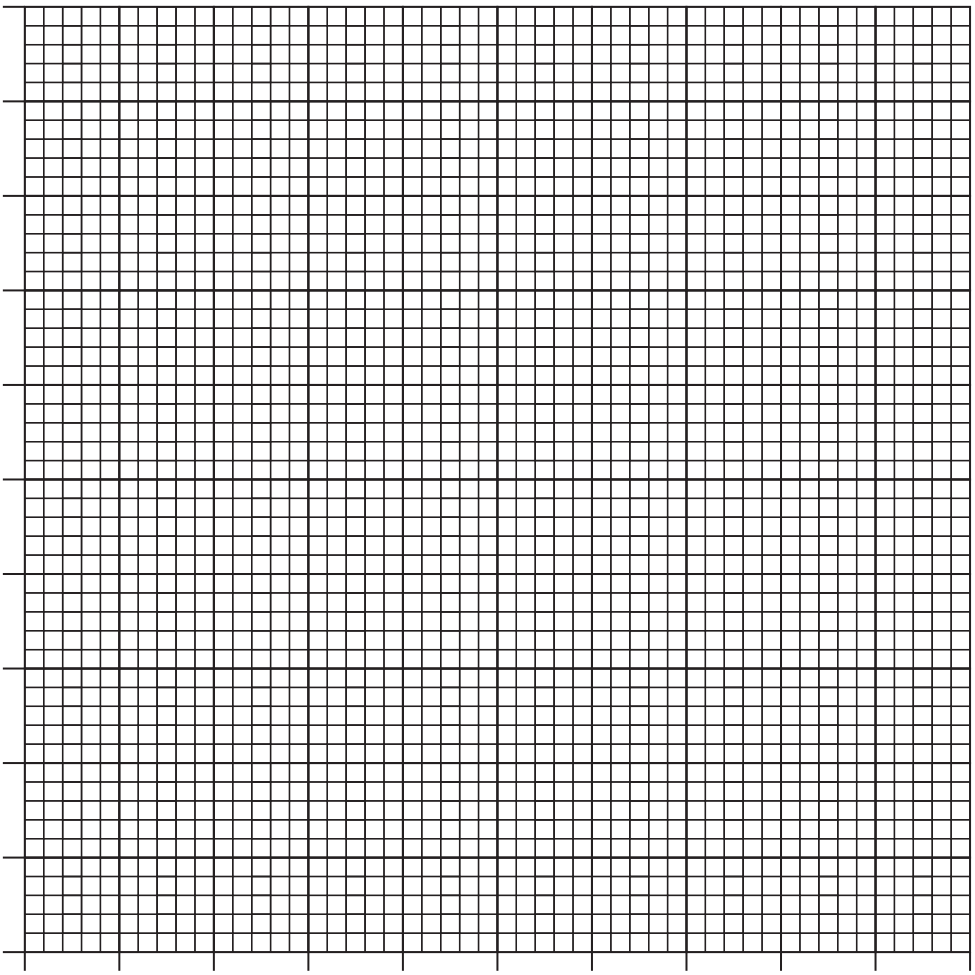
(ii) Selection

Labelled diagrams may be used where appropriate.

[END OF SPECIMEN QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

ADDITIONAL GRAPH PAPER FOR QUESTION 10 (e)



ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

National
Qualifications
SPECIMEN ONLY

SQ04/H/01 Biology

Marking Instructions

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

SQA ©

General Marking Principles for Biology Higher

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

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

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

c) Half marks may not be awarded.

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

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

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

g) In the detailed Marking Instructions, if a word is **<u>underlined</u>** then it is essential; if a word is **(bracketed)** then it is not essential.

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

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

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

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

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

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

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

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

p) When presenting data:

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

q) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidates to:

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

Marking Instructions for each question

SECTION 1

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

SECTION 2

Question			Expected response	Max mark	Additional Guidance
1	a	i	Intron/Intron1/Intron 2	1	
1	a	ii	(Alternative) RNA splicing	1	
1	a	iii	Depending on which RNA segments are treated as exons and introns (1) different segments can be spliced together to produce different mRNA transcripts (1) **or** appropriate example from diagram	2	
1	b		Cutting and combining different protein chains **or** adding phosphate to the protein **or** adding carbohydrate to the protein	1	
2	a		translocation	1	
2	b	i	competitive	1	
2	b	ii	95	1	
2	b	iii	Drug was effective as white blood count reduced to normal Drug works by inhibiting the enzyme produced by Philadelphia chromosome	2	
3	a		Stage 1 separates strands or breaks H bonds Stage 2 allows primer to bond/anneal to strand/target sequence	2	
3	b		7	1	
3	c		identical set up but without primers	1	
3	d		forensic use/paternity testing	1	
4	a		sequence data	1	
4	b		horizontal/lateral	1	
4	c	i	25	1	

Question			Expected response	Max mark	Additional Guidance
4	**c**	**ii**	Last common ancestor of humans and chimpanzees was more recent than humans and orangutans Chimpanzees and humans 5 million years ago, orangutans and humans 19 million years ago	**2**	
5	**a**		P is Acetyl CoA Q is Oxaloacetate	**2**	
5	**b**		ATP/Energy is required (1) A greater amount of energy/ATP is produced (1)	**2**	
5	**c**		Carry hydrogen and high energy electrons (1) to the electron transport chain (1)	**2**	
5	**d**		Less ATP/energy is produced (1) Fewer electrons are passed to electron transport chain **or** fewer hydrogen ions are pumped through the membrane **or** ATP synthase is damaged (1)	**2**	
6	**a**		20	**1**	
6	**b**		increase – people becoming complacent about hand washing or bacteria becoming resistant **or** no change – everyone now using procedure **or** decrease – increased uptake of procedure	**1**	
6	**c**		*Clostridium* increases, *Staphylococcus* remains fairly constant	**2**	

Question			Expected response	Max mark	Additional Guidance
6	**d**		Conclusion - effective Justification – although percentage of cases remains similar number of cases falls	**2**	
6	**e**		Type - *Clostridium* Reason - percentage of cases due to *Clostridium* increased	**1**	
7	**a**		enzymes have an optimum temperature or only work within a certain temperature range	**1**	
7	**b**	**i**	hypothalamus	**1**	
7	**b**	**ii**	nerve (impulse)	**1**	
7	**c**	**i**	vasoconstriction/vessels get narrower	**1**	
7	**c**	**ii**	reduces blood flow to skin so less heat loss	**1**	
8	**a**		1 metabolic rate reduced 2 dormancy can be predictive or consequential 3 hibernation in winter usually mammals 4 aestivation allows survival in periods of drought or high temperature 5 daily torpor is reduced activity in animals with high metabolic rates 6 example of hibernation or aestivation or daily torpor	**4**	1 mark should be allocated for each correct description up to a maximum of 4. Check any diagram(s) for relevant information not present in text and award accordingly.
8	**b**		1 plant/animal gene transferred into microorganism that makes plant/animal protein 2 restriction endonuclease to cut gene out/cut plasmid 3 genes introduced to increase yield or prevent microbe surviving in external environment 4 ligase seals gene into plasmid	**4**	1 mark should be allocated for each correct description up to a maximum of 4. Check any diagram(s) for relevant information not present in text and award accordingly

Question			Expected response	Max mark	Additional Guidance
			5 recombinant yeast cells to overcome polypeptides being incorrectly folded or lacking post translational modifications 6 regulatory sequences in plasmids/artificial chromosomes to control gene expression		
9	**a**		15	**1**	
9	**b**		413·44	**1**	
9	**c**		milk yield/fat content increased by crossbreeding protein content decreased by crossbreeding	**1**	
9	**d**		Inbreeding depression	**1**	
9	**e**	**i**	F2 has a variety of genotypes	**1**	
9	**e**	**ii**	selection or backcrossing	**1**	
10	**a**		rate of photosynthesis	**1**	
10	**b**		use a water bath	**1**	
10	**c**		easier to separate algae from solution **or** easier to control algae concentration	**1**	
10	**d**		repeat at each distance/light intensity	**1**	
10	**e**		axes and labels plotting and joined with a ruler	**2**	
10	**f**		as light intensity increases rate increases at higher light intensities rate remains constant	**2**	
11	**a**		worker bees are related to queen's offspring so worker bees share genes with queen's offspring	**2**	

Question			Expected response	Max mark	Additional Guidance
11	**b**	**i**	increase from 4·2 million (in 1980) to 4·4 million (in 1985) then decrease to 2·8 million (in 1995)	**1**	
11	**b**	**ii**	2 : 1	**1**	
12	**a**	**i**	Number/frequency of alleles in a population	**1**	
12	**a**	**ii**	Small populations may lose the genetic variation necessary to enable evolutionary responses to environmental change **or** the loss of genetic diversity can lead to inbreeding which results in poor reproductive rates	**1**	
12	**b**		Edge species may invade the interior of the habitat and compete with interior species	**1**	
12	**c**	**i**	Area of natural habitat linking fragments	**1**	
12	**c**	**ii**	individual members of the locally extinct species can move into the fragment and recolonise	**1**	
13	**a**		invasive	**1**	
13	**b**		Light **or** water **or** minerals **or** nutrients	**1**	
13	**c**	**i**	may eat native plants **or** may become invasive	**1**	
13	**c**	**ii**	test effect on native species in an enclosed area	**1**	
14	**A**		1 double strand of nucleotides/double helix 2 deoxyribose sugar, phosphate and base 3 sugar phosphate backbone	**9**	1 mark should be allocated for each correct description. No more than 5 marks should be awarded from points 1 – 7.

Question			Expected response	Max mark	Additional Guidance
			4 complementary bases pair or A-T and C-G 5 H bonds between bases 6 antiparallel structure with deoxyribose and phosphate at 3´ and 5´ends 7 proteins/histones 8 DNA unwinds into 2 strands 9 primer needed to start replication 10 DNA polymerase adds nucleotides to 3´(deoxyribose) end of strand 11 DNA polymerase adds nucleotides in one direction 12 one strand replicated continuously, the other in fragments 13 fragments joined by ligase		No more than 4 marks should be awarded from points 8 – 13. Check any diagram(s) for relevant information not present in text and award accordingly.
14	**B**		1 isolation barriers prevent gene flow between populations/ populations interbreeding 2 geographical isolation leads to allopatric speciation 3 behavioural isolation leads to sympatric speciation 4 ecological isolation leads to sympatric speciation 5 different mutations occur on each side of isolation barrier 6 some mutations may be favourable 7 natural selection is non-random increase in frequency of genetic sequences that increase survival 8 sexual selection is non-random increase in frequency of genetic sequences that increase reproductive success 9 Any 2 from disruptional/ directional/stabilising selection 10 third type of selection from 9	**9**	1 mark should be allocated for each correct description. No more than 4 marks should be awarded from points 1 – 6. No more than 5 marks should be awarded from points 7 – 13. Check any diagram(s) for relevant information not present in text and award accordingly.

Question			Expected response	Max mark	Additional Guidance
			11 after many generations/long period of time 12 new species form 13 if populations can no longer interbreed to produce fertile young then different species		

[END OF SPECIMEN MARKING INSTRUCTIONS]