



National
Qualifications
SPECIMEN ONLY

S807/76/02

Biology
Section 1 — Questions

Date — Not applicable

Duration — 2 hours 30 minutes

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet S807/76/01.

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

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



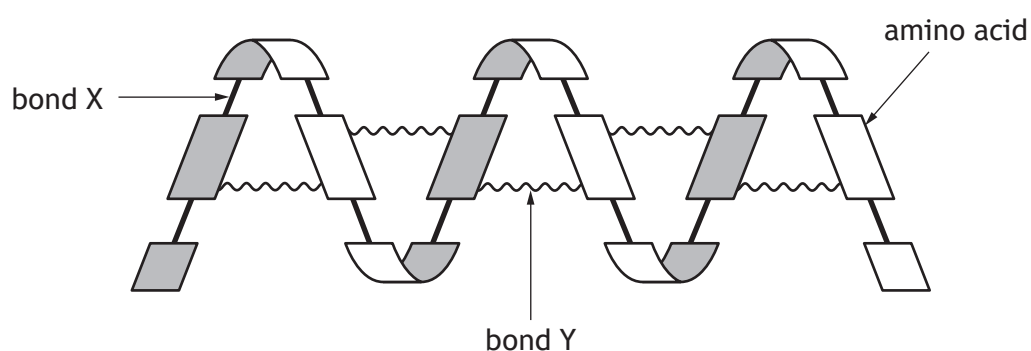
SECTION 1 — 20 marks

Attempt ALL questions

1. The main components of a ribosome are

- A mRNA and tRNA
- B rRNA and proteins
- C mRNA and proteins
- D rRNA and mRNA.

2. The diagram represents part of a protein molecule.



Which row in the table identifies bonds X and Y?

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

3. Which row in the table describes research and therapeutic uses of stem cells?

	Research use	Therapeutic use
A	To repair damaged tissue	To study how diseases develop
B	To test drugs	To provide information on cell differentiation
C	To study how diseases develop	To repair damaged tissue
D	To provide information on cell differentiation	To test drugs

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

1. substitution
2. insertion
3. deletion.

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

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

5. The statements refer to DNA sequences in the chromosomes of eukaryotic species:

1. Code for protein.
2. Regulate transcription.
3. Are transcribed but not translated.

Which statements describe the DNA sequences that make up the genome?

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

[Turn over

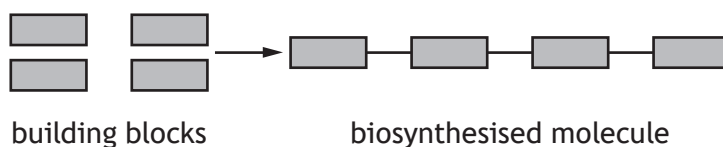
6. The table contains information about the relative genome sizes and number of genes found in a variety of organisms.

Organism	Size of genome (million base pairs)	Number of genes
Human	3080	30 000
Mouse	2600	25 307
Fruit fly	120	13 601
Yeast	12	6294
Mosquito	278	13 688
Nematode worm	97	19 873
Thale cress	125	25 000

What conclusion can be drawn from the data in the table?

- A The larger the genome, the fewer genes it contains.
 - B There is no relationship between genome size and number of genes.
 - C The larger the genome, the more genes it contains.
 - D The smaller the genome, the more genes it contains.
7. Cell membranes contain pumps that actively transport substances.
- Which of the following forms the major component of membrane pumps?
- A Protein
 - B Phospholipid
 - C Nucleic acid
 - D Cellulose

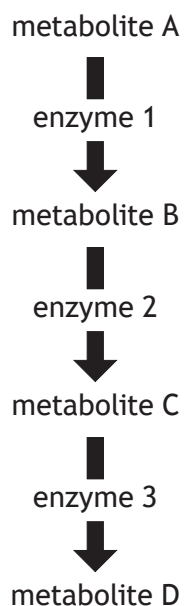
8. The diagram shows how a molecule might be biosynthesised from building blocks in a metabolic pathway.



Which row in the table 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

9. The stages of an enzyme-catalysed metabolic pathway are shown.



In feedback inhibition

- A enzyme 3 binds with enzyme 1
- B enzyme 3 binds with metabolite A
- C metabolite D binds with enzyme 1
- D metabolite D binds with metabolite A.

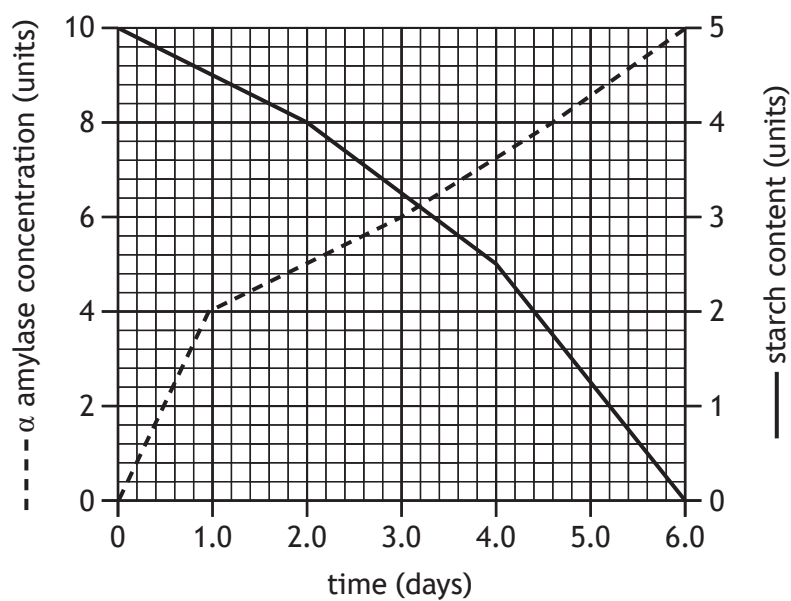
[Turn over

10. There are several mechanisms used by mammals to regulate their body temperature. Which statement describes a response to a decrease in the body temperature of a mammal?
- A Vasoconstriction and an increase in metabolic rate.
 - B Vasoconstriction and a decrease in metabolic rate.
 - C Vasodilation and an increase in metabolic rate.
 - D Vasodilation and a decrease in metabolic rate.
11. Which row in the table identifies a type of organism, the method of controlling its internal environment and the metabolic cost of this?

	Type of organism	Method of controlling internal environment	Metabolic cost
A	conformer	behavioural response only	low
B	conformer	altering metabolism	high
C	regulator	behavioural response only	high
D	regulator	altering metabolism	low

12. In which of the following domains of life are microorganisms found?
- A Bacteria only
 - B Archaea only
 - C Bacteria and archaea only
 - D Bacteria, archaea and eukaryotes

13. The graph 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

[Turn over

14. A field trial was set up to investigate the effect of mass of fertiliser applied and the application of fungicide on growth of barley.

The diagram shows the distribution of plots in the field and the treatments applied.

30	30	50
30	10	30
50	50	10
10	50	30
10	30	10
50	10	50

Key



fungicide applied



no fungicide applied

10 10 kg fertiliser applied per hectare

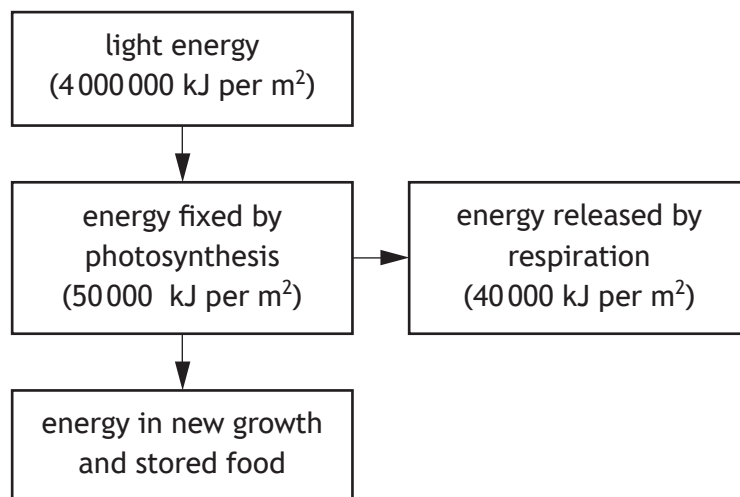
30 30 kg fertiliser applied per hectare

50 50 kg fertiliser applied per hectare

Which design feature was included to eliminate bias?

- A Application of fungicide to half of the plots.
 - B Randomisation of treatments.
 - C Application of three different masses of fertiliser.
 - D Use of three replicates.
15. An action spectrum is a measure of the ability of a plant 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 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 0.25
B 1.00
C 1.25
D 2.25
17. Chickens can be farmed intensively or have access to an outdoor, feeding and resting areas. Intensively farmed chickens would be expected to display
- A more stereotypy and require more disease control
B more stereotypy and require less disease control
C less stereotypy and require more disease control
D less stereotypy and require less disease control.
18. The following statements describe symbiotic relationships between organisms.
1. Turtles allow small cleaner fish to eat parasites from their skin.
 2. Spider crabs provide a habitat for algae which grow on them camouflaging the crabs from predators.
 3. Female mosquitoes feed on human blood from which they gain nutrients needed for the production of their eggs.

Which of these relationships can be described as mutualistic?

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

19. The following statements are examples of animal behaviour:

1. A meerkat stands guard to watch for predators while other meerkats feed.
2. Cattle allow oxpecker birds to eat ticks and other harmful insects from their bodies.
3. A vampire bat will regurgitate blood into the mouth of another vampire bat that has been unable to find a meal.

Which statement(s) describe altruistic behaviour?

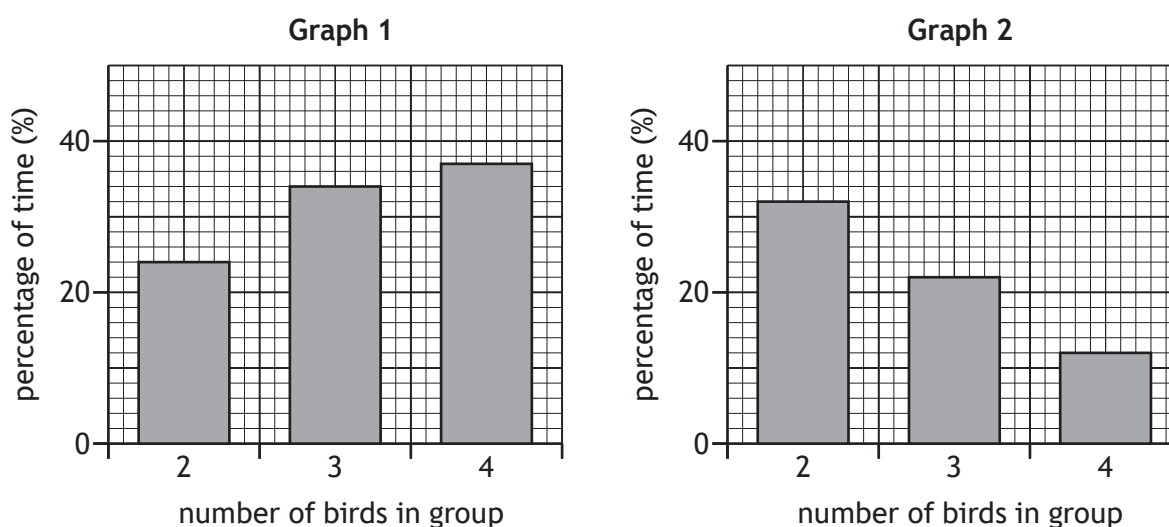
- A 1 only
- B 2 only
- C 1 and 2 only
- D 1 and 3 only

20. Ostriches are large birds that feed on vegetation occasionally lifting their heads to look for predators.

The graphs show results of a study into the effect of group size on behaviour of ostriches.

Graph 1 shows the percentage of time when at least one bird in the group had its head raised.

Graph 2 shows the percentage of time when an individual bird had its head raised.



Which statement is supported by 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]



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Mark

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S807/76/01

Biology
Section 1 — Answer grid
and Section 2

Date — Not applicable

Duration — 2 hours 30 minutes



Fill in these boxes and read what is printed below.

Full name of centre

--

Town

--

Forename(s)

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Surname

--

Number of seat

--

Date of birth

Day

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Month

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Year

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Scottish candidate number

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Total marks — 100

SECTION 1 — 20 marks

Attempt ALL questions.

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

SECTION 2 — 80 marks

Attempt ALL questions.

You may use a calculator.

Questions 7 and 14 contain a choice.

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

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

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



The questions for Section 1 are contained in the question paper S807/76/02.

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

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

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).
2. There is **only one correct** answer to each question.
3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample question

The 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).

A	B	C	D
☐	☒	☐	☐

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**.

A	B	C	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:

A	B	C	D
☐	☒	☐	☒

or

A	B	C	D
☐	☒	☐	☐



* S 8 0 7 7 6 0 1 0 2 *



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



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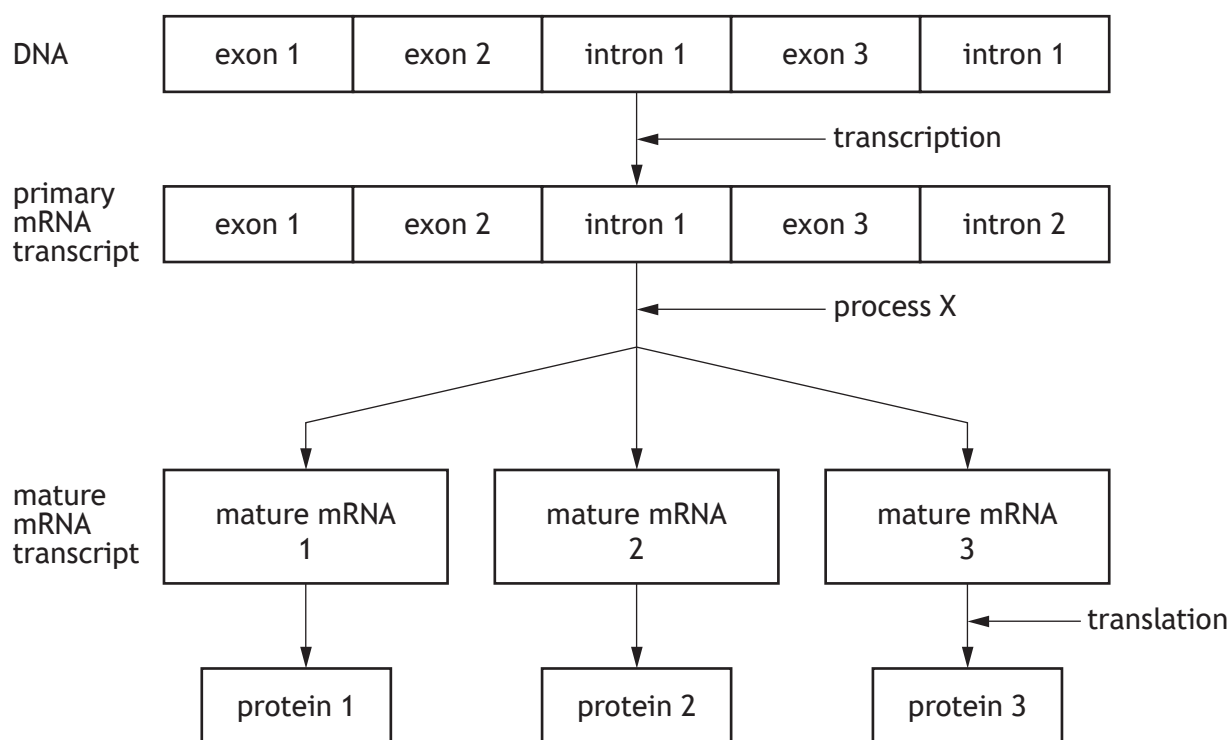
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SECTION 2 — 80 marks

Attempt ALL questions

Questions 7 and 14 contain a choice.

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



- (a) Identify a non-coding region of DNA. 1
- _____
- (b) Name process X. 1
- _____
- (c) Explain how process X can produce different mature mRNA transcripts. 2
- _____
- _____

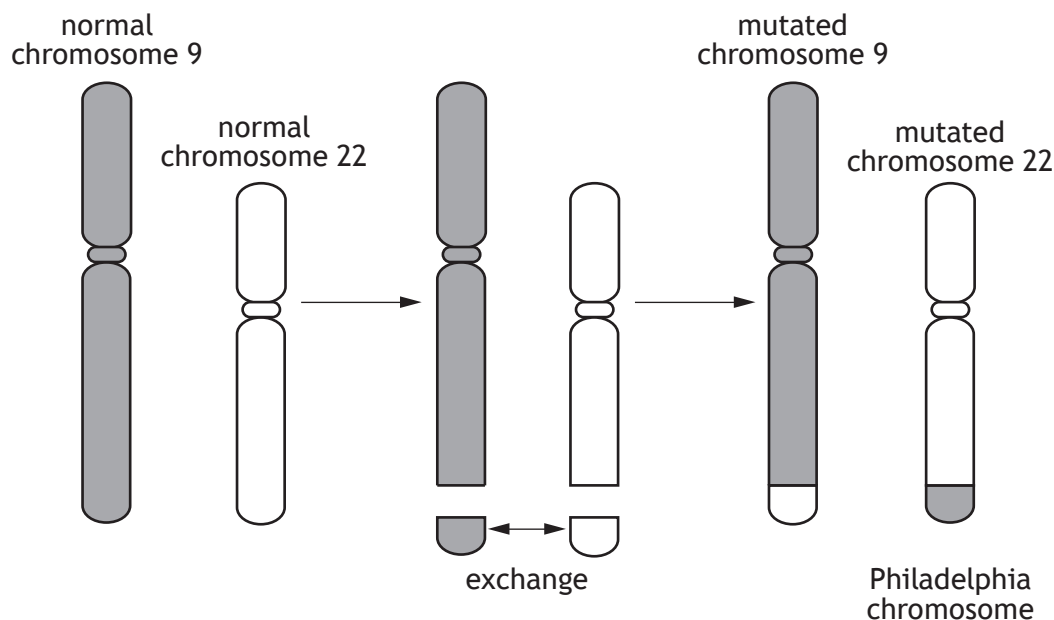
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* S 8 0 7 7 6 0 1 0 5 *

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.



- (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 binding at 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 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.

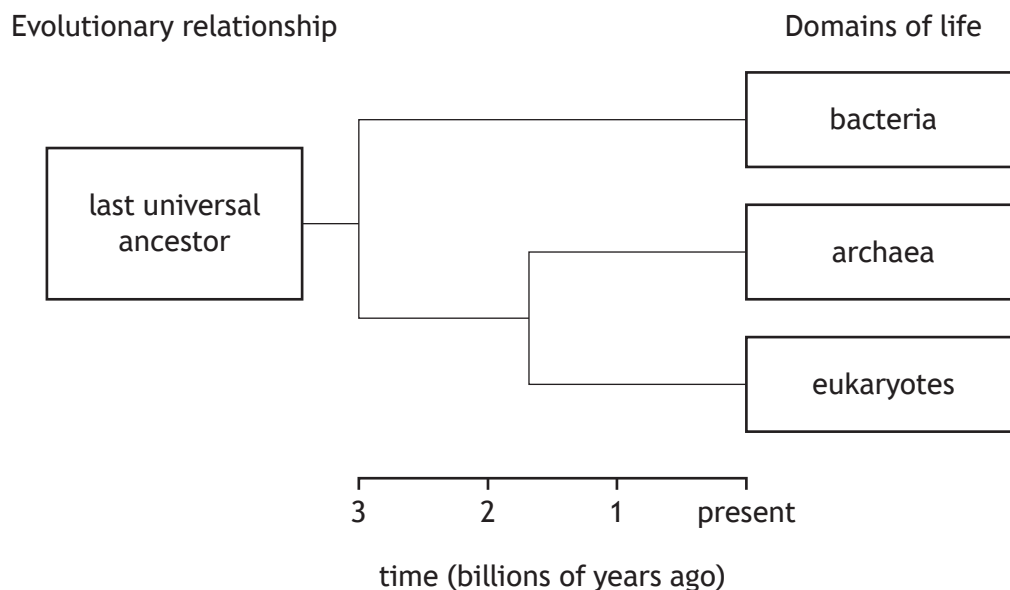
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* S 8 0 7 7 6 0 1 0 7 *

3. The phylogenetic tree 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 in the phylogenetic tree.

1

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

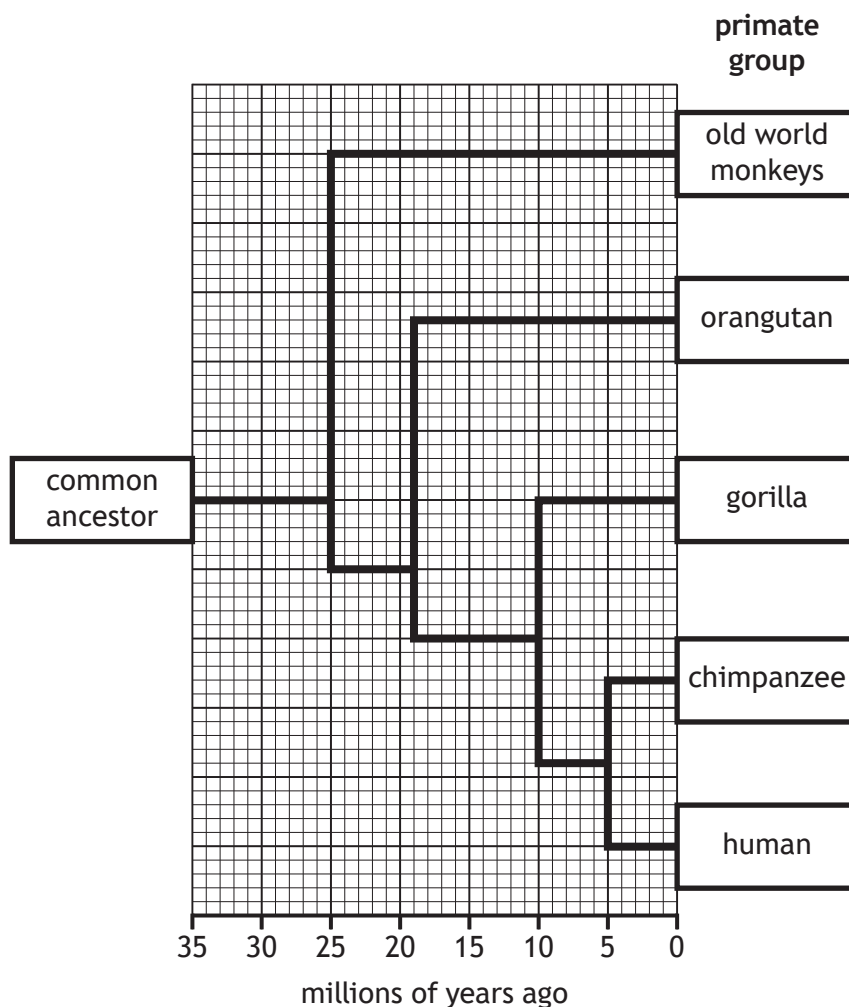
Give the term that describes this form of gene transfer.

1



3. (continued)

- (c) The phylogenetic tree 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

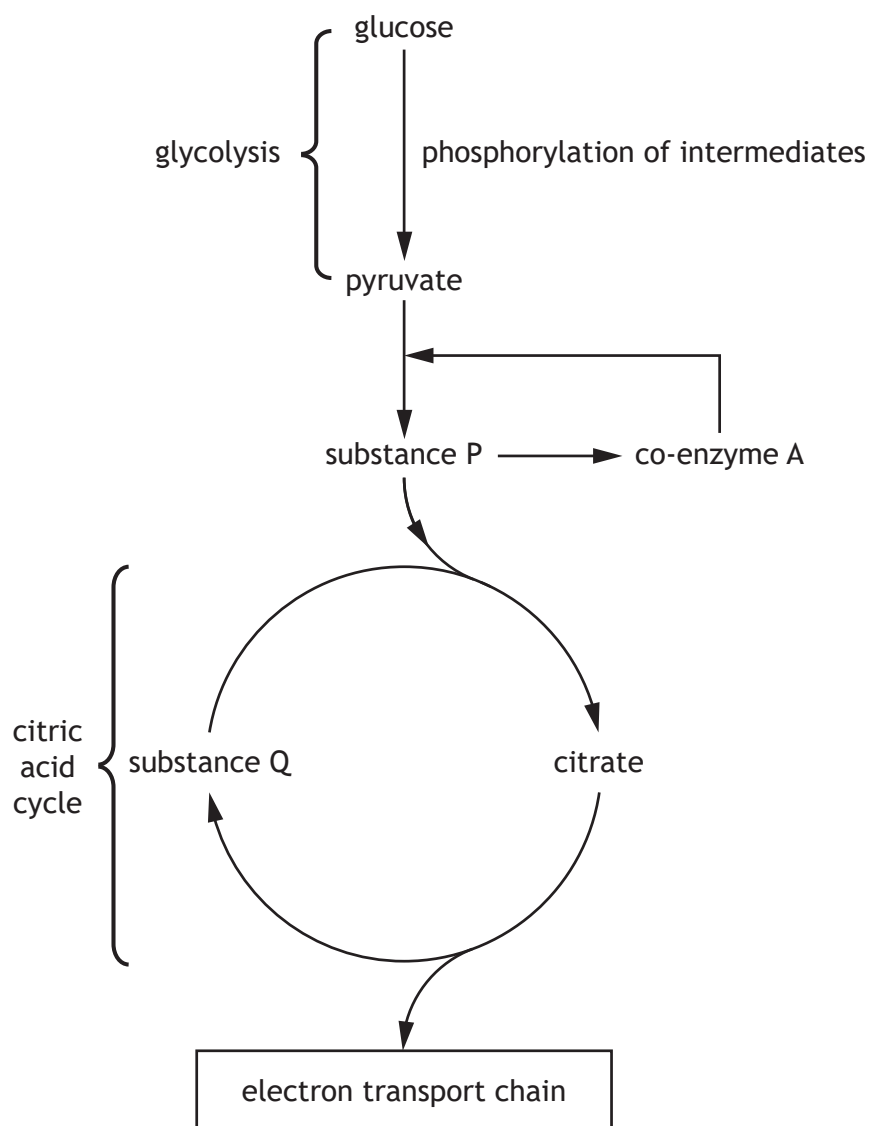
- (ii) Humans are more closely related to chimpanzees than to orangutans.

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

1



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



- (a) Name substances P and Q.

2

Substance P _____

Substance Q _____

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

2



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

4. (continued)

- (c) Describe the role of the co-enzyme NAD.

1

- (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.

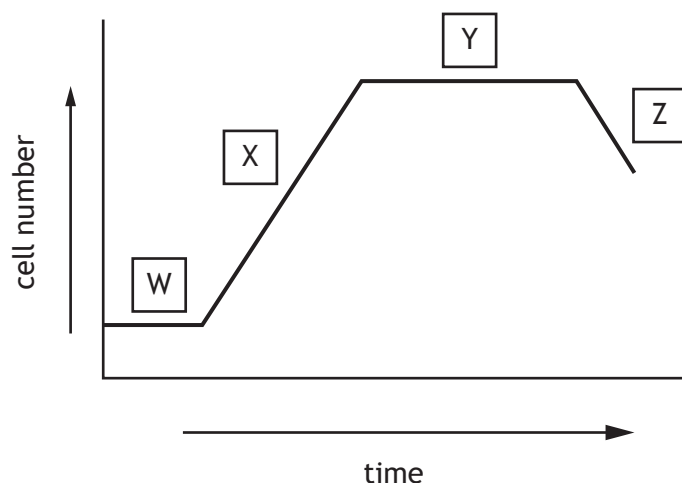
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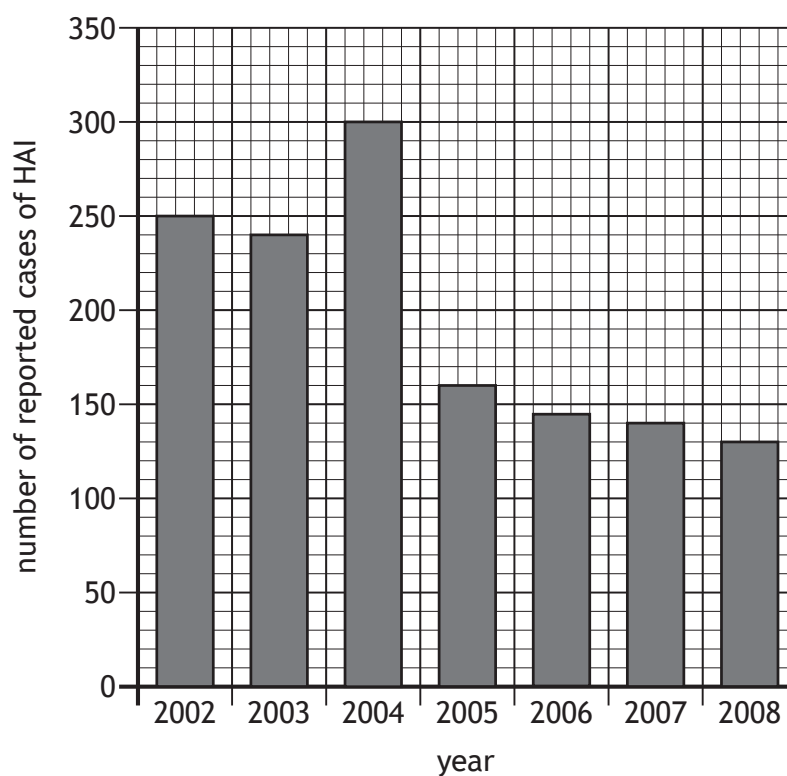
* S 8 0 7 7 6 0 1 1 1 *

5. A growth curve in a culture of bacteria is shown in the diagram.



- (a) (i) Name the phase in which secondary metabolites such as antibiotics are produced.
Describe the ecological advantage of this to bacteria in the wild. 2
- Phase _____
- Advantage _____
- (ii) State the letter which indicates a region of the graph in which most enzymes are being induced to metabolise the available substrate. 1
- Letter _____
- (iii) State **one** reason for the decrease in number of cells at phase Z. 1
- _____
- (b) In culturing bacteria it is important to control the culture conditions in the growth medium. 1
- Name one condition which should be controlled.
- _____
- (c) Give an example of a complex molecule required for biosynthesis which may be included in the growth medium. 1
- _____

6. The graph 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

[Turn over



* S 8 0 7 7 6 0 1 1 3 *

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.

Tick (✓) **one** box and give a reason for your choice.

1

☐ increase ☐ decrease ☐ no change

Reason _____

- (c) The table 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
<i>Clostridium</i>	32	30	30	51	54	57	59
<i>Staphylococcus</i>	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) It was concluded that the handwashing procedure was effective.
Use information from the graph and table to justify this statement.

1



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

MARKS

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7. Attempt **either A or B**. Write your answer in the space below.

A Describe how animals survive adverse conditions.

4

OR

B Describe recombinant DNA technology.

4

You may use labelled diagrams where appropriate.



* S 8 0 7 7 6 0 1 1 5 *

8. Nettles are plants which often grow below trees. Their leaves contain photosynthetic pigments X and Y. The table shows the percentage of light of different wavelengths absorbed by these pigments.

Wavelength of light (nm)	Colour of light	Light absorbed (%)	
		Pigment X	Pigment Y
400	violet	40	20
440	blue	60	30
550	green	5	60
680	red	50	5

- (a) State what else can happen to light striking the leaves of plants, apart from it being absorbed.

1

- (b) Identify which of the pigments in the table, X or Y, is chlorophyll a. Explain your choice.

1

Pigment _____

Explanation _____

- (c) (i) Describe the relationship between the wavelength of light and the percentage of light absorbed by pigment Y.

2

- (ii) Describe how the presence of pigment Y in their leaves would benefit nettle plants growing below trees.

1



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

8. (continued)

- (d) Describe how the absorbed light leads to the production of ATP, which is required for carbon fixation.

2

[Turn over]



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

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.

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



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

9. (continued)

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

For your choice, state 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 F_2 offspring from crosses of F_1 hybrid Holstein $\times$ Scandinavian Red cattle will have less desirable milk-producing characteristics than their parents.

Give **one** reason for this.

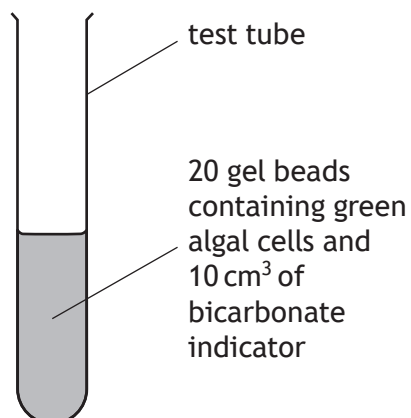
1

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* S 8 0 7 7 6 0 1 1 9 *

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 independent variable in **this** investigation.

1

- (b) Identify one variable, not already mentioned, that should be kept constant to allow a valid conclusion to be made.

1

- (c) Describe how the apparatus could be improved to ensure that temperature was kept constant.

1

- (d) Suggest why the tubes were left for 60 minutes before transferring the bicarbonate indicator solution to the colorimeter.

1

- (e) Describe how the experimental procedure could be improved to increase the reliability of the results.

1

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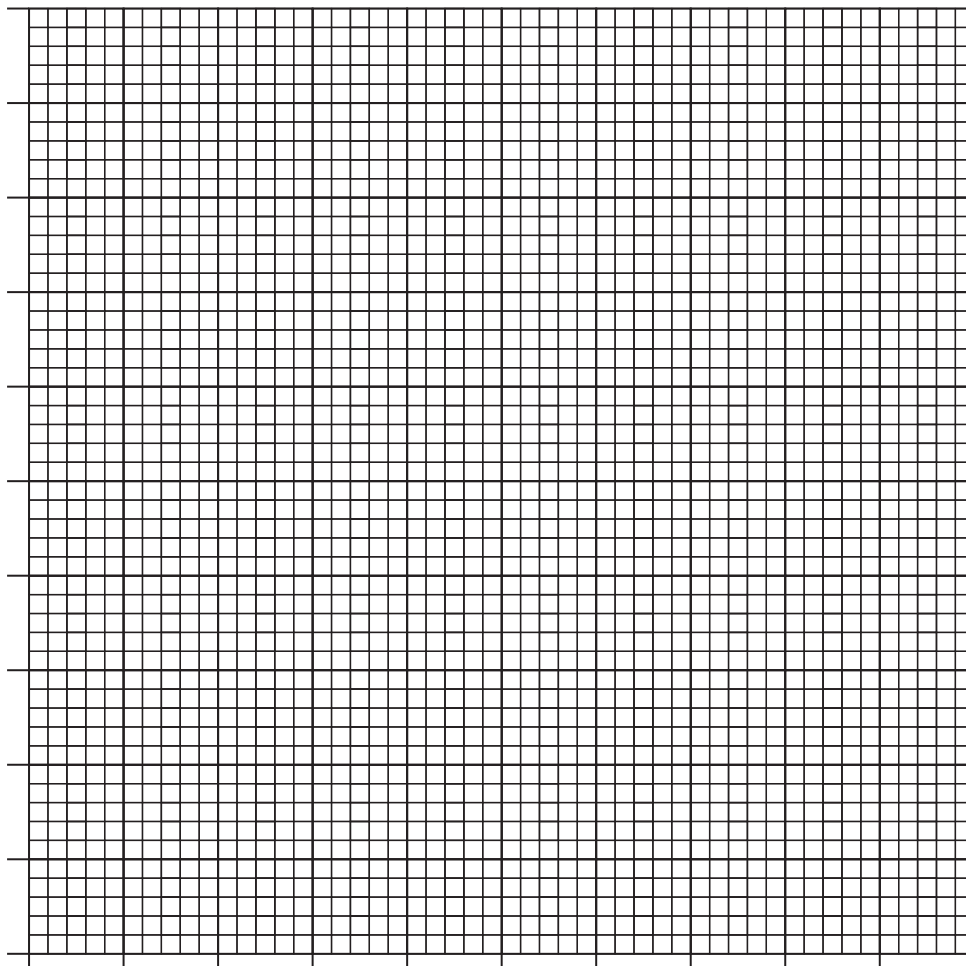


* S 8 0 7 7 6 0 1 2 1 *

10. (continued)

(f) On the grid, draw a line graph using the results in the table.

2

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

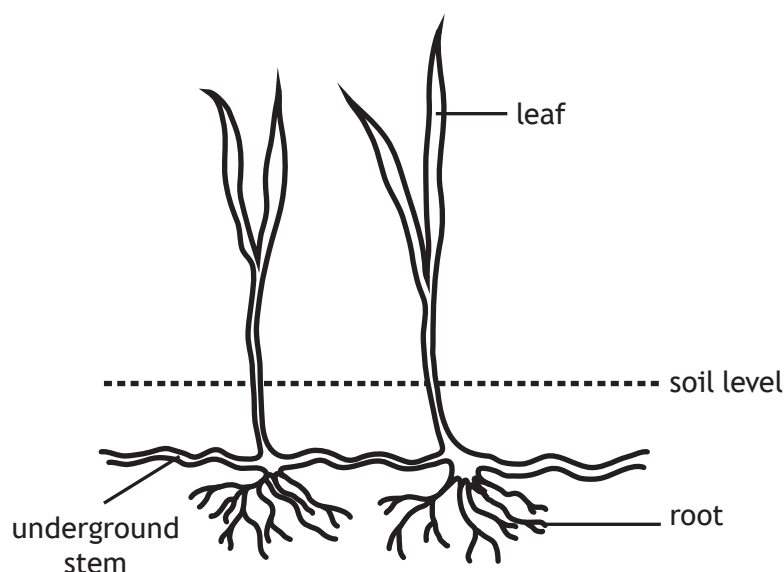
(g) From the results of this investigation, state a conclusion about the effect of light intensity on the rate of photosynthesis.

1



* S 8 0 7 7 6 0 1 2 2 *

11. African couch grass is a weed which spreads rapidly from branching underground stems as shown in the diagram. If the plant's leaves are damaged, new leaves can grow from the underground stems.



- (a) Tick (✓) one of the boxes to identify if this is a perennial or an annual weed and give a reason for your answer.

1

☐

perennial

☐

annual

Reason _____

- (b) (i) Explain why herbicide used in the control of this weed should be systemic.

1

- (ii) Give **one** disadvantage of using chemical herbicide.

1

[Turn over



11. (continued)

- (c) Explain why weeds are regarded as pests when they grow among crop plants.

2

- (d) Herbicides are sometimes used along with ploughing to control weeds. What name is given to this type of combined weed control?

1



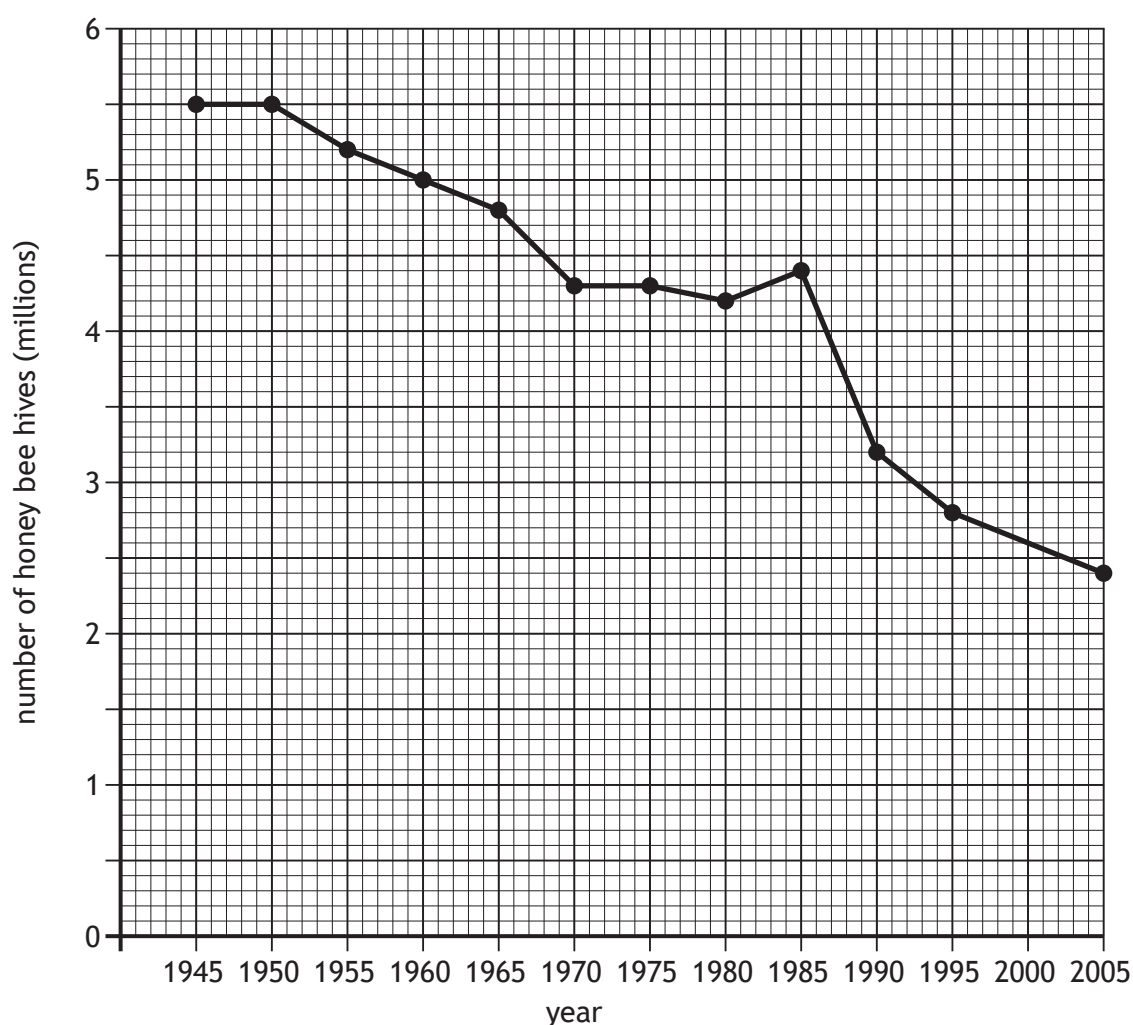
12. (a) The honey bee is a social insect that lives in colonies.

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 shows the changes in the number of honey bee hives kept by bee-keepers in the USA from 1945 to 2005.



[Turn over



* S 8 0 7 7 6 0 1 2 5 *

12. (b) (continued)

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

2

- (ii) Calculate the simplest whole number ratio of the number of beehives in 1965 to 1985 to 2005.

1

Space for calculation

_____ : _____ : _____
1965 1985 2005

- (c) Other than bees, name a type of social insect.

1



* S 8 0 7 7 6 0 1 2 6 *

13. Japanese knotweed 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) (i) When is an introduced species described as naturalised?

1

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

1

(b) Japanese knotweed has spread very rapidly in Britain.

Suggest a reason for this.

1

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

Describe **one** possible risk of introducing this insect into Britain.

1

[Turn over



* S 8 0 7 7 6 0 1 2 7 *

14. Attempt **either A or B**. Write your answer in the space below and on *pages 29* and 30.

A Describe DNA under the following headings.

(i) structure of DNA

5

(ii) replication of DNA

4

OR

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

(i) isolation and mutation

4

(ii) selection

5

You may use labelled diagrams where appropriate.



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SPACE FOR ANSWERS



* S 8 0 7 7 6 0 1 2 9 *

DO NOT
WRITE IN
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MARGIN

SPACE FOR ANSWERS

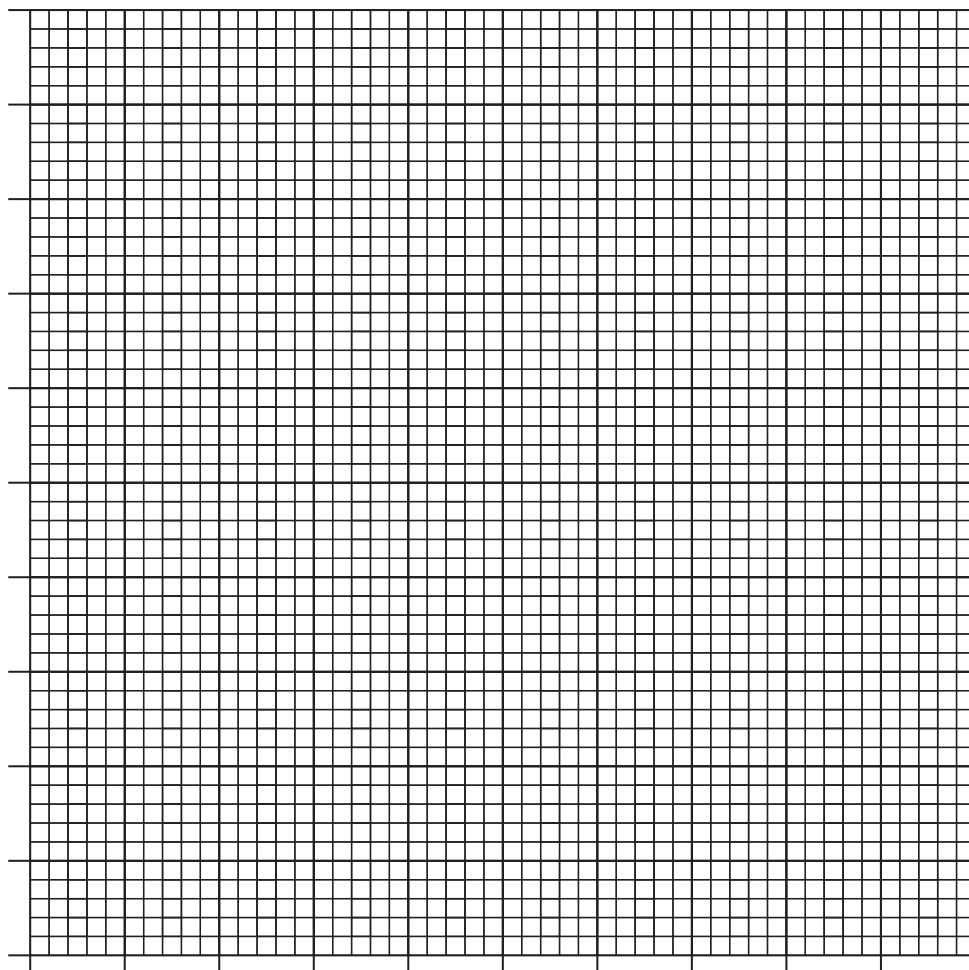
[END OF SPECIMEN QUESTION PAPER]



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 10 (f)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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National
Qualifications
SPECIMEN ONLY

S807/76/01

Biology

Marking Instructions

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

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General marking principles for Higher Biology

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

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.
- (c) Do not award half marks.
- (d) Where a candidate makes an error in the first part of a question, award marks for subsequent answers that are correct with regard to this original error. Do not penalise candidates more than once for the same error.
- (e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final answer (including units, if appropriate) on its own.
- (f) Candidates should not use bulleted lists to answer extended-response questions. They must respond to the 'command' word as appropriate and provide extended answers to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.
- (g) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (h) In the detailed marking instructions, words separated by / are **alternatives**.
- (i) A correct response can be negated if the candidate includes:
 - an extra, incorrect, response
 - additional information that contradicts the correct response
- (j) Where the candidate is instructed to choose one question to answer but instead answers two questions, mark both responses and award the higher mark.
- (k) Unless otherwise required by the question, the use of abbreviations (for example DNA, ATP) or chemical formulae (for example CO₂, H₂O) are acceptable alternatives to naming.
- (l) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, do not penalise candidates repeatedly.
- (m) If incorrect spelling is given:
 - If the correct word is recognisable then award the mark.
 - If the word can easily be confused with another biological term then **do not** award the mark, for example glucagon and glycogen.

(n) **Presentation of data:**

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

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

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

Marking instructions for each question

Section 1

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

Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)		Intron/Intron1/Intron 2	1	
	(b)		(Alternative) RNA splicing	1	
	(c)		Different combinations of exons are retained/joined together. (1) Producing different mature transcripts. (1)	2	
2.	(a)		Translocation	1	
	(b)	(i)	Competitive	1	
		(ii)	95	1	
		(iii)	Drug was effective as white blood count reduced to normal. (1) Drug works by inhibiting the enzyme produced by Philadelphia chromosome. (1)	2	
3.	(a)		Sequence (data)	1	
	(b)		Horizontal	1	
	(c)	(i)	25	1	
		(ii)	Last common ancestor of humans and chimpanzees was more recent than humans and orangutans. OR Humans and chimpanzees diverged more recently than humans and orangutans.	1	

Question			Expected response	Max mark	Additional guidance
4.	(a)		P is Acetyl CoA/Acetyl co-enzyme A. (1)	2	
			Q is Oxaloacetate. (1)		
	(b)		ATP/Energy is required. (1) More ATP is produced. (1)	2	
	(c)		Carry hydrogen and electrons to the electron transport chain.	1	
	(d)		Less ATP is produced. ATP synthase/carrier proteins damaged. (1) OR Fewer hydrogen ions are pumped across the membrane/fewer electrons passed along electron transport chain. (1)	2	
5.	(a)	(i)	Phase - stationary (1) Advantage - allows them to out-compete other micro-organisms. (1) OR Kill other micro-organisms reducing competition. (1)	2	
		(ii)	W/Lag		
		(iii)	Cell number decreases in phase Z.		
		(b)	Sterility/oxygen/temperature/pH		
	(c)		Amino acids/vitamins/fatty acids	1	

Question			Expected response	Max mark	Additional guidance
6.	(a)		20	1	
	(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	
	(c)		<i>Clostridium</i> increases (1) <i>Staphylococcus</i> remains fairly constant. (1)	2	
	(d)		Although percentage of cases remains similar number of cases falls.	1	
7.	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	Award 1 mark for each correct description, up to a maximum of 4 marks. Check any diagram(s) for relevant information not present in text and award accordingly.
	B		1. plant/animal gene transferred into micro-organism that makes plant/animal protein 2. restriction endonuclease to cut gene out/cut plasmid 3. genes introduced to prevent microbe surviving in external environment 4. ligase seals gene into plasmid 5. recombinant yeast cells to overcome polypeptides being incorrectly folded 6. regulatory sequences in plasmids/artificial chromosomes to control gene expression	4	Award 1 mark for each correct description, up to a maximum of 4 marks. Check any diagram(s) for relevant information not present in text and award accordingly.

Question			Expected response	Max mark	Additional guidance
8.	(a)		Reflected. OR Transmitted.	1	
	(b)		Pigment X Explanation: Absorbs in red and blue (light). Best/better/much more/mainly/at a higher percentage/greater/higher/more efficiently (than pigment Y/ than green). OR Converse for green.	1	Both pigment and explanation for 1 mark. Not acceptable: absorbs red and blue light alone/absorbs very little green light/high absorption of red and blue light
	(c)	(i)	As wavelength increases to 550 nm (percentage) absorption also increases (1) then decreases/as wavelength increases over 550 nm absorption decreases. (1)	2	Not acceptable: description of pigment X drops at 680 nm colours instead of wavelengths increases then decreases nm and 550 must be mentioned at least once for both marks to be awarded.
		(ii)	Would allow absorption/use of light/green light/wavelengths/ colours. Not absorbed by/reflected from/ transmitted through/not used by/ passing through/filtered through/ transmitted by larger plants/the canopy/trees/sun plants/higher leaves/leaves above.	1	Not acceptable: gets light absorbs green light alone blocked by by-passes shines through leaves alone plants alone
	(d)		To excite electrons (in pigment molecule). (1) Transfer of the electrons along/ through the electron transport chain releases energy. (1) ATP is generated by ATP synthase. (1) Any 2	2	

Question			Expected response	Max mark	Additional guidance
9.	(a)		15	1	
	(b)		413.44	1	
	(c)		Milk yield/fat content increased by crossbreeding. Protein content decreased by crossbreeding.	1	
	(d)		Inbreeding depression.	1	
	(e)		F ₂ has a variety of genotypes.	1	
10.	(a)		Colorimeter reading.	1	
	(b)		• type/species of algae • size of gel beads • temperature Any 1	1	
	(c)		Use a water bath.	1	
	(d)		To allow time for photosynthesis/for bicarbonate indicator to change colour.	1	
	(e)		Repeat at distance/light intensity.	1	
	(f)		Axes and labels. (1) Plotting and joined with a ruler. (1)	2	
	(g)		As light intensity increases rate of photosynthesis increases and then remains constant (1)	1	

Question			Expected response	Max mark	Additional guidance
11.	(a)		Perennial Reason: can grow from underground stems.	1	
	(b)	(i)	Will kill/destroy the whole plant/ roots/underground stems AND so avoid regeneration/regrowth/ coming back.	1	
		(ii)	May be toxic to animal species/ persist in the environment/can bio accumulate/biomagnify in food chains/may produce resistant populations.	1	
	(c)		Compete for water/nutrients/ light. (1) Reducing yield of crop. (1)	2	
	(d)		Integrated pest control.	1	
12.	(a)		Worker bees share genes with the queen's offspring. (1) So worker bees increase the survival chances of these genes by caring for the queen's young. (1)	2	
	(b)	(i)	Increase from 4.2 million (in 1980) to 4.4 million (in 1985) (1) then decrease to 2.8 million (in 1995). (1)	2	
		(ii)	12 : 11 : 6	1	
	(c)		Wasps/ants/termites	1	

Question			Expected response	Max mark	Additional guidance
13.	(a)	(i)	When it has become established in wild (communities).	1	
		(ii)	Invasive	1	
	(b)		Free of pathogens/parasites/competitors which were native to habitat.	1	
	(c)		May eat native plants. OR May become invasive.	1	

Question			Expected response	Max mark	Additional guidance
14.	A	(i)	1. double strand of nucleotides/ double helix 2. deoxyribose sugar, phosphate and base 3. sugar-phosphate backbone 4. complementary bases pair or A-T and C-G 5. hydrogen bonds between bases 6. antiparallel structure 7. deoxyribose and phosphate at 3' and 5' ends	5	Award 1 mark for each correct description. Award a maximum of 5 marks to answers from points 1 to 7.
		(ii)	1. DNA unwinds 2. hydrogen bonds between strands break 3. primer needed to start replication 4. DNA polymerase adds nucleotides to 3' end of primer/ 3' (deoxyribose) end of strand 5. one strand replicated continuously, the other in fragments 6. fragments joined by ligase	4	Award a maximum of 4 marks to answers from points 8 to 13. Check any diagram(s) for relevant information not present in text and award marks accordingly.

Question			Expected response	Max mark	Additional guidance
14.	B	(i)	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/provide selective advantage	4	Award 1 mark for each correct description. Award a maximum of 4 marks to answers from points 1 to 6.
		(ii)	1. natural selection is non-random increase in frequency of genetic sequences that increase survival 2. there are different selection pressures each side of the barrier 3. any 2 from disruptive/ directional/stabilising selection 4. third type of selection from 9 5. after many generations/long period of time 6. new species form 7. if populations can no longer interbreed to produce fertile young then different species	5	Award a maximum of 5 marks to answers from points 1 to 7. Check any diagram(s) for relevant information not present in text and award marks accordingly.

[END OF SPECIMEN MARKING INSTRUCTIONS]

Published: August 2026

Change since last published:

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