

FOR OFFICIAL USE

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**X007/301**

Total for  
Sections  
B and C

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NATIONAL  
QUALIFICATIONS  
2007

MONDAY, 21 MAY  
1.00 PM – 3.30 PM

**BIOLOGY  
HIGHER**

**Fill in these boxes and read what is printed below.**

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

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**SECTION A—Questions 1–30 (30 marks)**

Instructions for completion of Section A are given on page two.

For this section of the examination you must use an **HB pencil**.

**SECTIONS B AND C (100 marks)**

- (a) All questions should be attempted.  
(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.
- The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, **and must be written clearly and legibly in ink**.
- Additional space for answers will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this book.
- The numbers of questions must be clearly inserted with any answers written in the additional space.
- Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written. If further space is required a supplementary sheet for rough work may be obtained from the invigilator.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.



### Read carefully

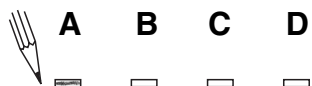
- 1 Check that the answer sheet provided is for **Biology Higher (Section A)**.
- 2 For this section of the examination you must use an **HB pencil**, and where necessary, an eraser.
- 3 Check that the answer sheet you have been given has **your name, date of birth, SCN** (Scottish Candidate Number) and **Centre Name** printed on it.  
Do not change any of these details.
- 4 If any of this information is wrong, tell the Invigilator immediately.
- 5 If this information is correct, **print** your name and seat number in the boxes provided.
- 6 The answer to each question is **either** A, B, C or D. Decide what your answer is, then, using your pencil, put a horizontal line in the space provided (see sample question below).
- 7 There is **only one correct** answer to each question.
- 8 Any rough working should be done on the question paper or the rough working sheet, **not** on your answer sheet.
- 9 At the end of the exam, put the **answer sheet for Section A inside the front cover of this answer book**.

### Sample Question

The apparatus used to determine the energy stored in a foodstuff is a

- A calorimeter
- B respirometer
- C klinostat
- D gas burette.

The correct answer is **A**—calorimeter. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).



### Changing an answer

If you decide to change your answer, carefully erase your first answer and using your pencil fill in the answer you want. The answer below has been changed to **D**.

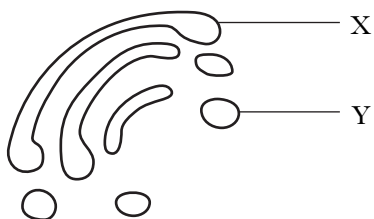


SECTION A

All questions in this section should be attempted.

Answers should be given on the separate answer sheet provided.

1. Which line in the table identifies correctly the two cell structures shown in the diagram?



	X	Y
A	Golgi body	Vesicle
B	Golgi body	Ribosome
C	Endoplasmic reticulum	Vesicle
D	Endoplasmic reticulum	Ribosome

2. The phospholipid molecules in a cell membrane allow the

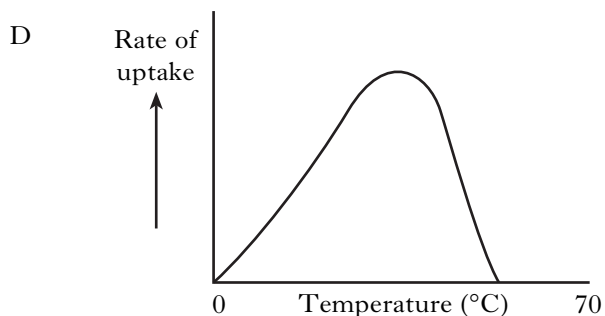
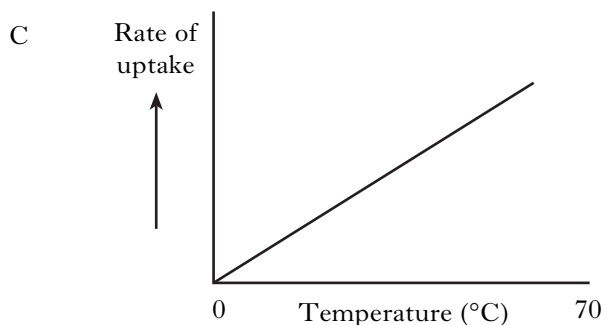
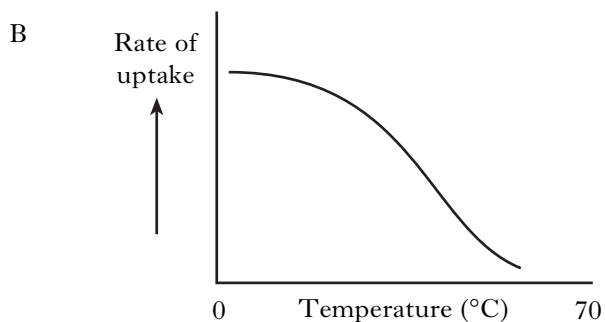
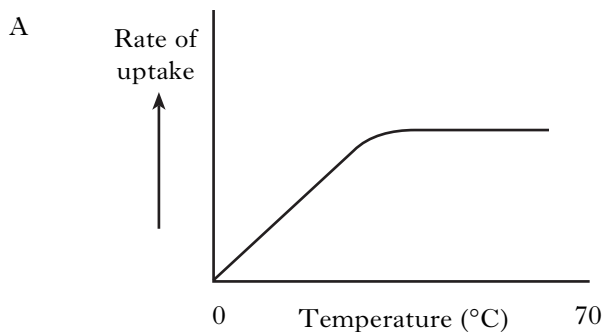
- A free passage of glucose molecules
- B self-recognition of cells
- C active transport of ions
- D membrane to be fluid.

3. Red blood cells have a solute concentration of around 0.9%.

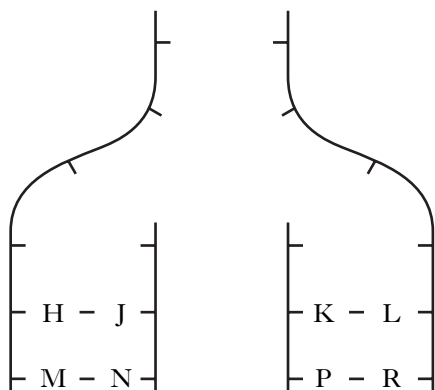
Which of the following statements correctly describes the fate of these cells when immersed in a 1% salt solution?

- A The cells will burst.
- B The cells will shrink.
- C The cells will expand but not burst.
- D The cells will remain unaffected.

4. Which graph best illustrates the effect of increasing temperature on the rate of active uptake of ions by roots?

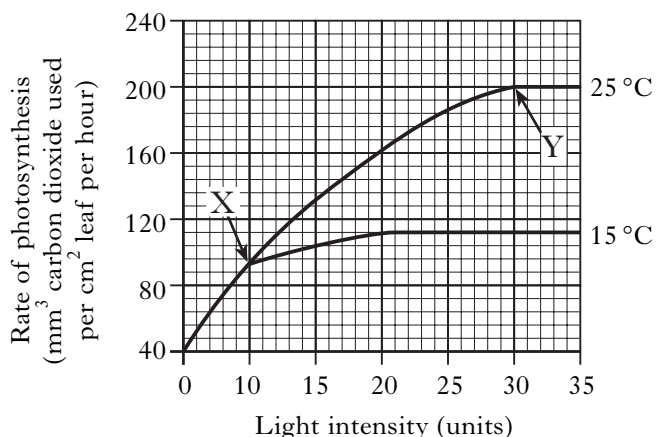


5. Which substances must be provided by host cells for the synthesis of viruses?
- A Proteins and nucleotides  
 B Amino acids and DNA  
 C Proteins and DNA  
 D Amino acids and nucleotides
6. The action spectrum of photosynthesis is a measure of the ability of plants to
- A absorb all wavelengths of light  
 B absorb light of different intensities  
 C use light to build up foods  
 D use light of different wavelengths for synthesis.
7. The diagram shows DNA during replication. Base H represents thymine and base M represents guanine. Which letters represent the base cytosine?



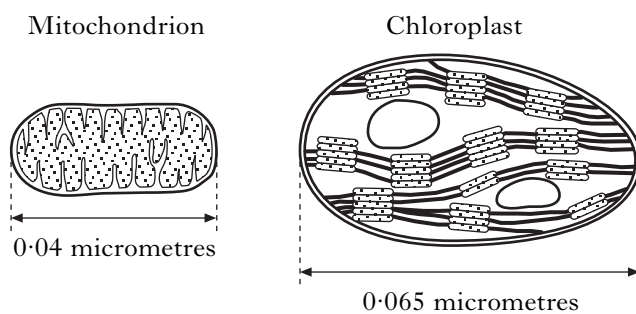
- A J and K  
 B J and L  
 C N and P  
 D N and R

8. The graph below shows the effect of light intensity on the rate of photosynthesis at different temperatures.



Which of the following conclusions can be made from the above data?

- A Only at light intensities greater than 20 units does temperature affect the rate of photosynthesis.  
 B At point Y, the rate of photosynthesis is limited by the light intensity.  
 C Temperature has little effect on the rate of photosynthesis at low light intensities.  
 D At point X, temperature limits the rate of photosynthesis.
9. The cell structures shown below have been magnified ten thousand times.



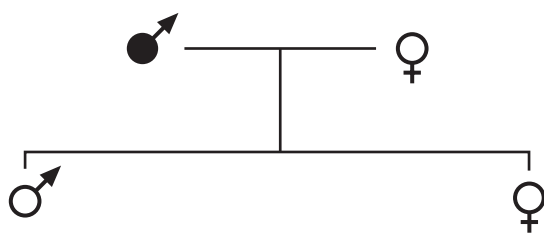
Expressed as a simple whole number ratio, the length of the mitochondrion compared to that of the chloroplast is


- A 8 : 13  
 B 13 : 8  
 C 40 : 65  
 D 65 : 40.

10. A section of a DNA molecule contains 300 bases. Of these bases, 90 are adenine. How many cytosine bases would this section of DNA contain?
- A 60  
B 90  
C 120  
D 180


11. What information can be derived from the recombination frequencies of linked genes?
- A The mutation rate of the genes  
B The order and location of genes on a chromosome  
C Whether genes are recessive or dominant  
D The genotype for a particular characteristic


12. The diagram shows a family tree for a family with a history of red-green colour deficiency.



 Unaffected male

 Affected male

 Unaffected female

 Affected female

The allele for red-green colour deficiency is sex-linked.

Which of the following statements is true?

- A Only the son is a carrier.  
B Only the daughter is a carrier.  
C Both son and daughter are carriers.  
D Neither son nor daughter is a carrier.

13. Apple crop yields have been increased by plant breeders selecting for
- A disease resistance  
B flavour  
C resistance to bruising  
D sugar content.

14. Human insulin can be produced by the bacterium *E. coli* using the following steps.

- 1 Culture large quantities of *E. coli* in vats of nutrients.
- 2 Insert human insulin gene into *E. coli* plasmid DNA.
- 3 Cut insulin gene from human chromosome using enzymes.
- 4 Extract insulin from culture vats.

The correct order for these steps is

- A 3, 2, 1, 4  
B 3, 1, 2, 4  
C 1, 4, 3, 2  
D 1, 2, 3, 4.

15. In a desert mammal, which of the following is a physiological adaptation which helps to conserve water?

- A Nocturnal foraging  
B Breathing humid air in a burrow  
C Having few sweat glands  
D Remaining underground by day

16. The following factors affect the transpiration rate in a plant.

- 1 increasing wind speed
- 2 decreasing humidity
- 3 rising air pressure
- 4 falling temperature

Which two of these factors would cause an increase in transpiration rate?

- A 1 and 2  
B 1 and 3  
C 2 and 4  
D 3 and 4

[Turn over

17. When first exposed to a harmless stimulus, a group of animals responded by showing avoidance behaviour. When the stimulus was repeated the animals became habituated to it.

What change in response would have shown that habituation was taking place?

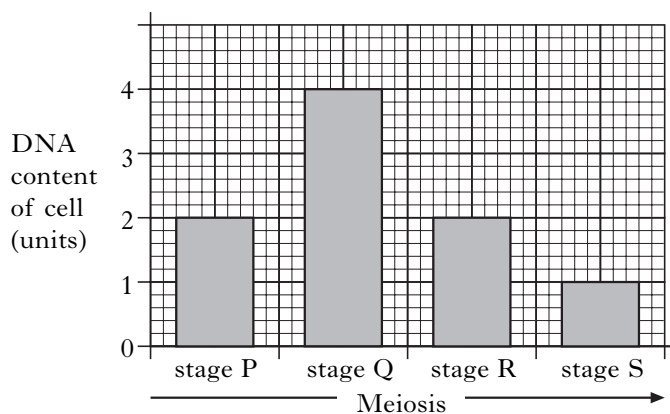
- A An increase in the length of the response
- B A decrease in the time taken to respond
- C An increase in response to other stimuli
- D A decrease in the percentage of animals responding

18. In tomato plants, the allele for curled leaves is dominant over the allele for straight leaves. The allele for hairy stems is dominant over the allele for hairless stems. The genes for curliness and hairiness are located on different chromosomes.

If plants heterozygous for both characteristics were crossed, what ratio of phenotypes would be expected in the offspring?

- A All curly and hairy
- B 3 curly and hairy: 1 straight and hairless
- C 9 curly and hairy: 3 curly and hairless: 3 straight and hairy: 1 straight and hairless
- D 1 curly and hairy: 1 curly and hairless: 1 straight and hairy: 1 straight and hairless

19. The bar graph below shows changes in the DNA content per cell during stages of meiosis.



When do the homologous pairs of chromosomes separate?

- A Before the start of stage P
- B Between stages P and Q
- C Between stages Q and R
- D Between stages R and S

20. The genes for two different characteristics are located on separate chromosomes.

In a cross between individuals with the genotypes AaBb and aabb, what is the chance of any one of the offspring having the genotype aabb?

- A 0
- B 1 in 2
- C 1 in 4
- D 1 in 8

21. Which line in the table identifies correctly the main source of body heat and the method of controlling body temperature in an endotherm?

	<i>Main source of body heat</i>	<i>Principal method of controlling body temperature</i>
A	Respiration	Behavioural
B	Respiration	Physiological
C	Absorbed from environment	Behavioural
D	Absorbed from environment	Physiological

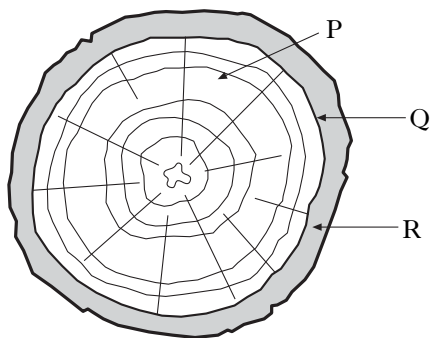
22. The following four statements relate to meristems.

- 1 Some provide cells for increase in diameter in stems
- 2 Some produce growth substances
- 3 They are found in all growing organisms
- 4 Their cells undergo division by meiosis

Which of the above statements are true?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 2 and 4 only

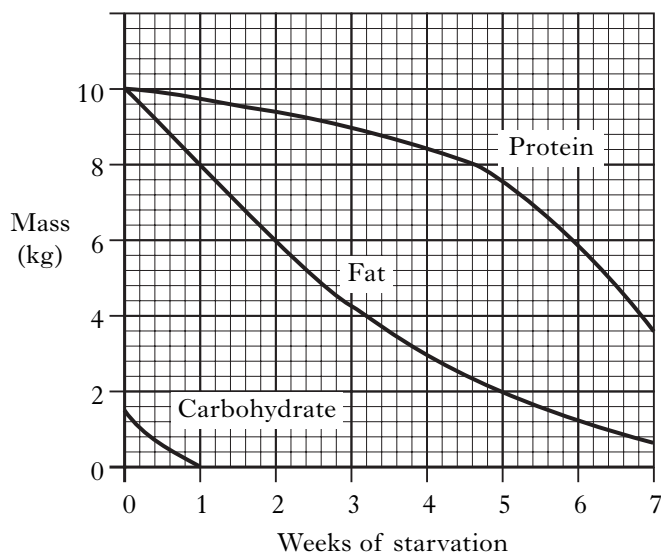
23. The diagram below shows a transverse section of a woody stem.



Which line of the table identifies correctly the tissues P, Q and R?

	P	Q	R
A	cambium	xylem	phloem
B	phloem	xylem	cambium
C	xylem	phloem	cambium
D	xylem	cambium	phloem

24. The graph below shows changes which occur in the masses of protein, fat and carbohydrate in a girl's body during seven weeks of starvation.



The girl weighs 60 kg at the start. Predict her weight after two weeks without food.

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

25. Which of the following is triggered by the hypothalamus in response to an increase in the temperature of the body?

- A Contraction of the hair erector muscles and vasodilation of the skin capillaries  
B Relaxation of the hair erector muscles and vasodilation of the skin capillaries  
C Contraction of the hair erector muscles and vasoconstriction of the skin capillaries  
D Relaxation of the hair erector muscles and vasoconstriction of the skin capillaries

26. Plants require macro-elements for the synthesis of various compounds. Identify which macro-elements are required for synthesis of the compounds shown in the table below.

	Chlorophyll	Protein	ATP
A	phosphorus	magnesium	nitrogen
B	phosphorus	nitrogen	magnesium
C	magnesium	nitrogen	phosphorus
D	magnesium	phosphorus	nitrogen

27. The following are events occurring during germination in barley.

- The embryo produces gibberellic acid (GA)
- $\alpha$ -amylase is produced
- Gibberellic acid (GA) passes to the aleurone layer
- $\alpha$ -amylase converts starch to maltose
- Maltose is used by the embryo

Which of the following indicates the correct sequence of events?

- A 1 2 4 5 3  
B 1 3 2 4 5  
C 3 2 1 4 5  
D 5 1 3 2 4

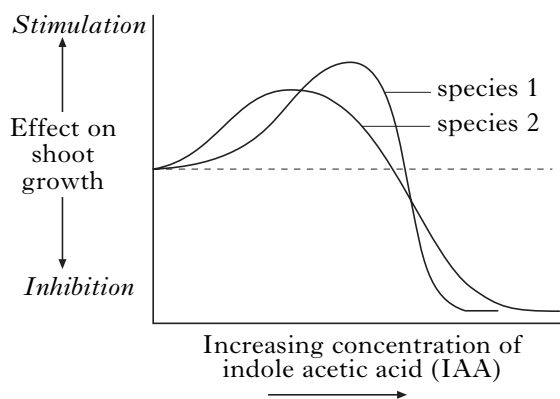
[Turn over

28. The table shows the masses of various substances in the glomerular filtrate and in the urine over a period of 24 hours.

Which of the substances has the smallest percentage of reabsorption from the glomerular filtrate?

	<i>Substance</i>	<i>Mass in glomerular filtrate (g)</i>	<i>Mass in urine (g)</i>
A	Sodium	600.0	6.0
B	Potassium	35.0	2.0
C	Uric acid	8.5	0.8
D	Calcium	5.0	0.2

29. An investigation was carried out into the effect of indole acetic acid (IAA) concentration on the shoot growth of two species of plant. The graph below shows a summary of the results.



Which one of the following conclusions is justified?

- A Species 1 shows its maximum stimulation at a lower IAA concentration than species 2.
- B Species 2 is more inhibited by the highest concentrations of IAA than species 1.
- C Species 2 is stimulated over a greater range of IAA concentrations than species 1.
- D Species 1 is stimulated by some IAA concentrations which inhibit species 2.

30. An enzyme and its substrate were incubated with various concentrations of either copper or magnesium salts.

The time taken for the complete breakdown of the substrate was measured.

The results are given in the table.

	<i>Salt Concentration (M)</i>	<i>Time needed to break down substrate (s)</i>	
		<i>Copper salts</i>	<i>Magnesium salts</i>
increasing concentration ↓	0	39	39
	$1 \times 10^{-8}$	42	21
	$1 \times 10^{-6}$	380	49
	$1 \times 10^{-4}$	1480	286

From the data, it may be deduced that

- A high concentrations of copper salts promote the activity of the enzyme
- B high concentrations of copper salts inhibit the activity of the enzyme
- C low concentrations of magnesium salts inhibit the activity of the enzyme
- D high concentrations of magnesium salts promote the activity of the enzyme.

**Candidates are reminded that the answer sheet MUST be returned INSIDE the front cover of this answer book.**



**[Turn over for Section B on *Page ten***

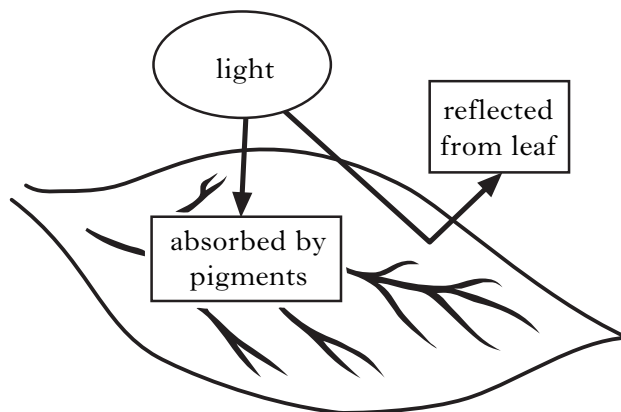
Marks

**SECTION B**

**All questions in this section should be attempted.**

**All answers must be written clearly and legibly in ink.**

1. (a) The diagram contains information about light striking a leaf.



- (i) Apart from being absorbed or reflected, what can happen to light which strikes a leaf?

\_\_\_\_\_

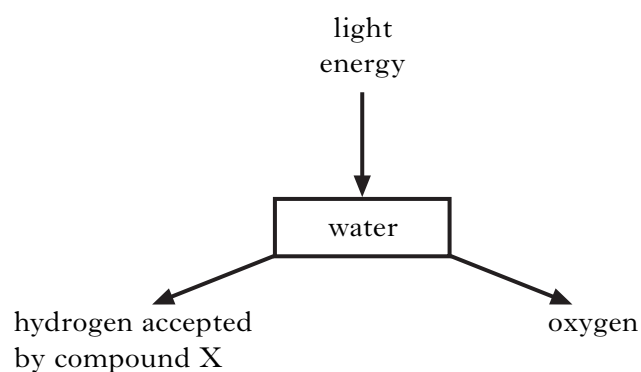
1

- (ii) Pigments that absorb light are found within leaf cells.  
State the exact location of these pigments.

\_\_\_\_\_

1

- (b) The diagram below shows part of the light dependent stage of photosynthesis.



- (i) Name this part of the light dependent stage.

\_\_\_\_\_

1

- (ii) Name compound X.

\_\_\_\_\_

1

**1. (continued)***Marks*

- (c) The following sentences describe events in the carbon fixation stage of photosynthesis.

**Underline** one alternative in each pair to make the sentences correct.

The  $\left\{ \begin{array}{l} \text{three} \\ \text{five} \end{array} \right\}$  carbon compound ribulose biphosphate (RuBP) accepts

$\left\{ \begin{array}{l} \text{carbon dioxide} \\ \text{hydrogen} \end{array} \right\}$ .

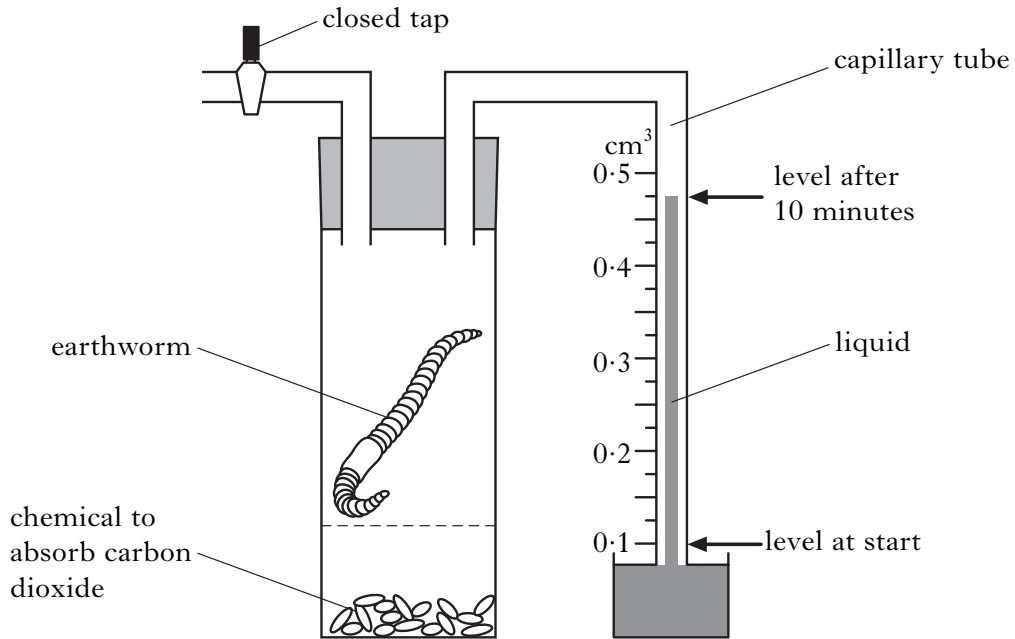
$\left\{ \begin{array}{l} \text{Carbon dioxide} \\ \text{Hydrogen} \end{array} \right\}$  is accepted by the  $\left\{ \begin{array}{l} \text{three} \\ \text{five} \end{array} \right\}$  carbon compound

glycerate phosphate (GP).

**2****[Turn over**

2. The diagram shows apparatus set up to investigate the rate of respiration in an earthworm. After 10 minutes at 20 °C the level of liquid in the capillary tube had changed as shown.

Marks



- (a) (i) What volume of oxygen is used by the earthworm during the 10 minute period?

\_\_\_\_\_ cm<sup>3</sup> **1**

- (ii) Describe a suitable control for this experiment.

\_\_\_\_\_  
\_\_\_\_\_ **1**

- (b) In a second experiment, a worm of 5 grams used 0.5 cm<sup>3</sup> of oxygen in 10 minutes.

Calculate its rate of respiration in cm<sup>3</sup> per minute per gram of worm.

*Space for calculation*

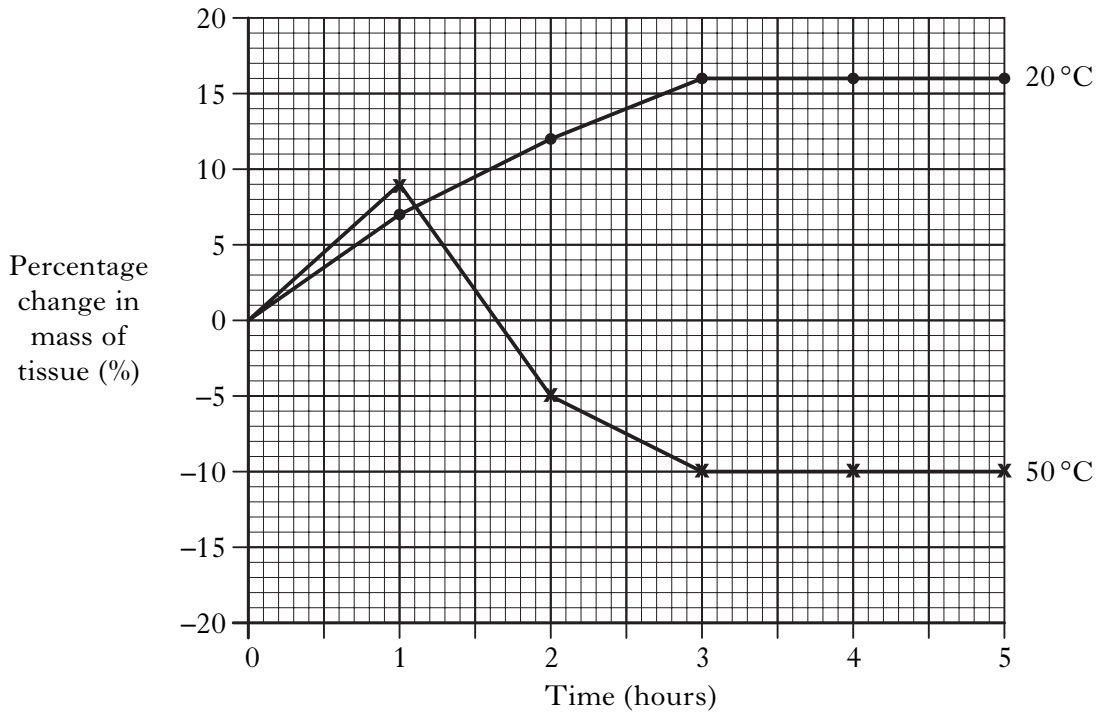
\_\_\_\_\_ cm<sup>3</sup> per minute per gram of worm **1**

**[Turn over for Question 3 on *Page fourteen***

Marks

3. (a) Samples of carrot tissue were immersed in a hypotonic solution at two different temperatures for 5 hours. The mass of the tissue samples was measured every hour and the percentage change in mass calculated.

The results are shown on the graph.



- (i) Explain the results obtained at 20°C from 0 to 3 hours and from 3 hours to 5 hours.

0 to 3 hours \_\_\_\_\_

\_\_\_\_\_

1

3 to 5 hours \_\_\_\_\_

\_\_\_\_\_

1

- (ii) Explain the change in mass of the carrot tissue between 1 and 3 hours at 50°C.

\_\_\_\_\_

\_\_\_\_\_

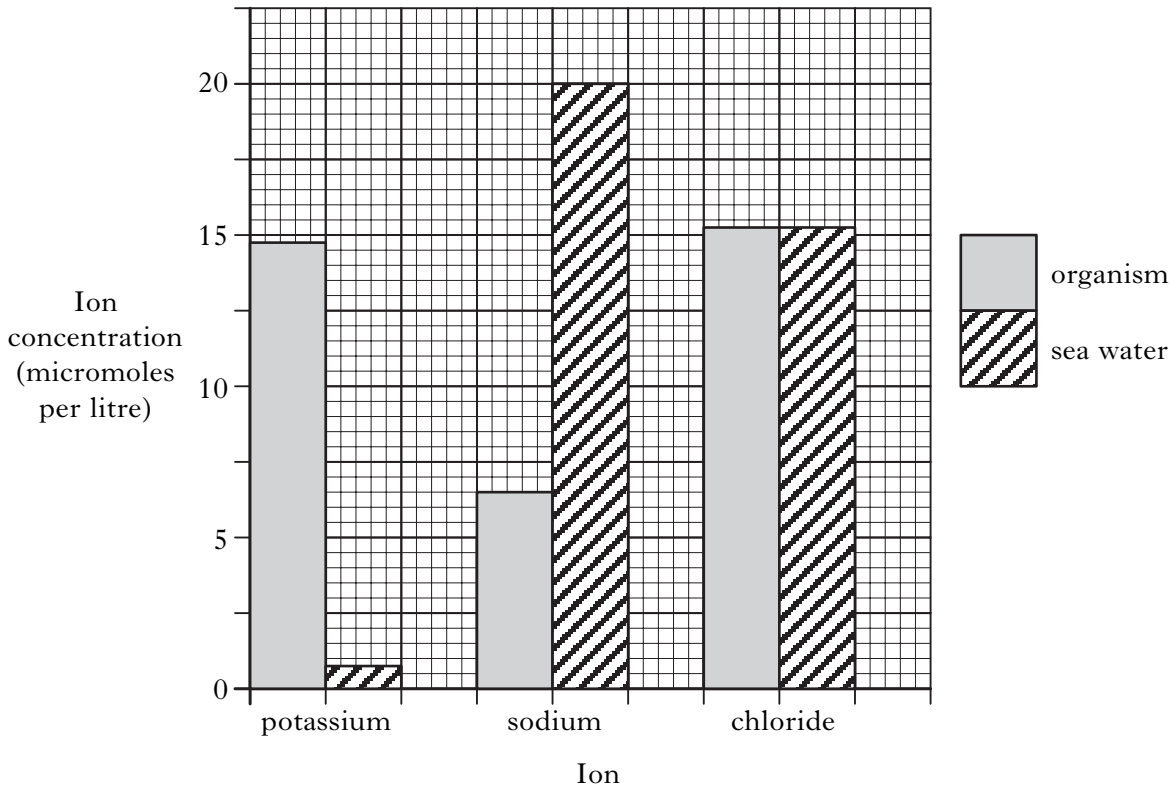
\_\_\_\_\_

2

3. (continued)

Marks

(b) The chart shows the concentration of ions within a unicellular organism and in the sea water surrounding it.



(i) From the information given, identify the ion which appears to move between the organism and the sea water by diffusion.

Justify your choice.

Ion \_\_\_\_\_

Justification \_\_\_\_\_

1

(ii) When oxygen was bubbled through a tank of sea water containing these organisms, the potassium ion concentration within the organisms increased.

Explain this effect.

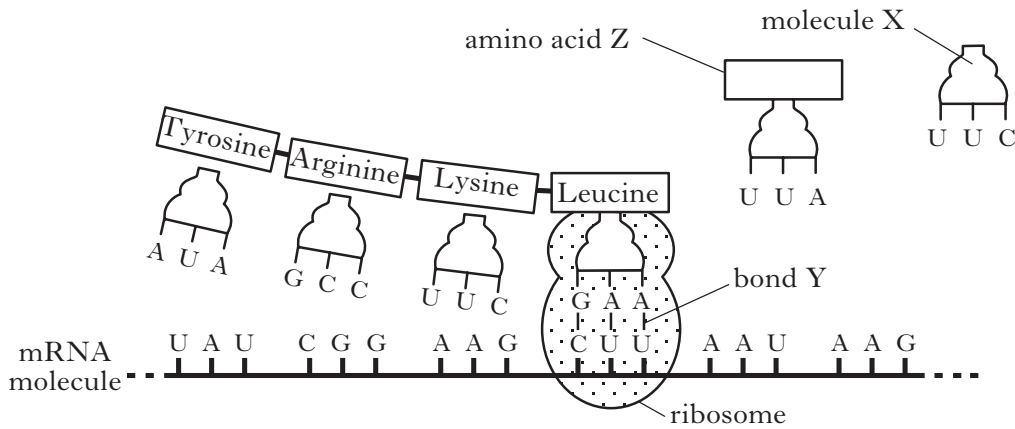
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2

[Turn over

4. The diagram shows events occurring during the synthesis of a protein that is secreted from a cell.

Marks



- (a) (i) Name molecule X. \_\_\_\_\_ **1**
- (ii) Name bond Y. \_\_\_\_\_ **1**
- (b) What name is given to a group of three bases on mRNA that codes for an amino acid?  
\_\_\_\_\_ **1**
- (c) Give the sequence of DNA bases that codes for amino acid Z.  
\_\_\_\_\_ **1**
- (d) Describe the roles of the endoplasmic reticulum and the Golgi apparatus between the synthesis of the protein and its release from the cell.
- Endoplasmic reticulum \_\_\_\_\_ **1**
- \_\_\_\_\_ **1**
- Golgi apparatus \_\_\_\_\_ **1**
- \_\_\_\_\_ **1**
- (e) The table contains some information about the structure and function of proteins.  
Add information to the boxes to complete the table.

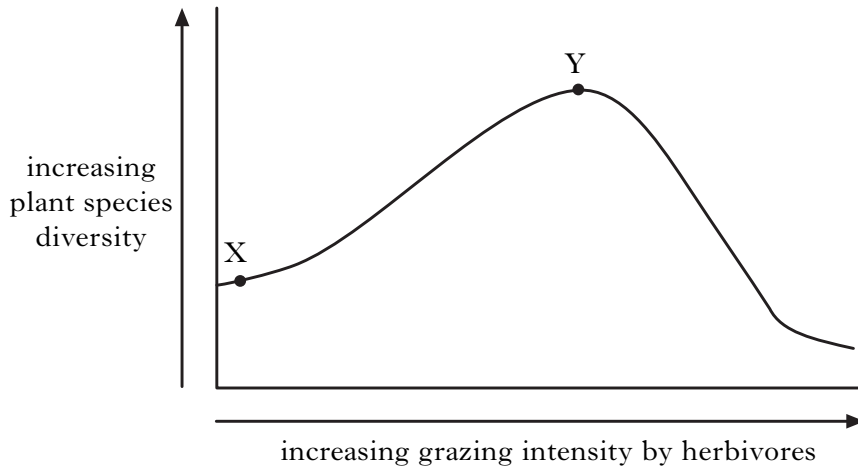
<i>Protein</i>	<i>Structure (Globular or Fibrous)</i>	<i>Function</i>
Cellulase		
Collagen		Structural protein in skin

**2**



Marks

5. (a) The graph shows the relationship between plant species diversity in grassland and grazing intensity by herbivores.



- (i) Explain the effect on plant species diversity of increased grazing intensity by herbivores between X and Y on the graph.

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2

- (ii) What evidence is there that grassland contains plant species tolerant of grazing?

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1

- (b) State **one** feature of some plant species that allows them to tolerate grazing by herbivores.

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1

[Turn over

6. Norway Spruce (*Picea abies*) is an evergreen species of tree with needle-like leaves, found in regions with extremely cold winters.

The rate of photosynthesis of the species is at its maximum during spring then decreases from June to December.

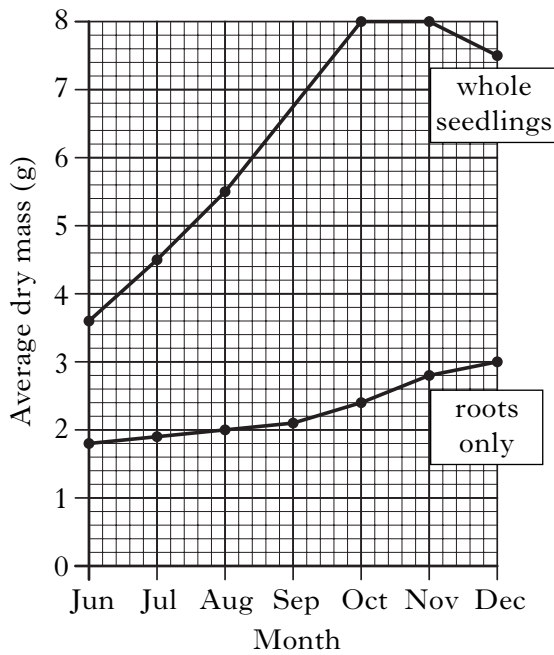
In an investigation, a sample of one-year-old seedlings was collected in each month from June to December.

For each sample of seedlings, the following measurements were made and averages calculated.

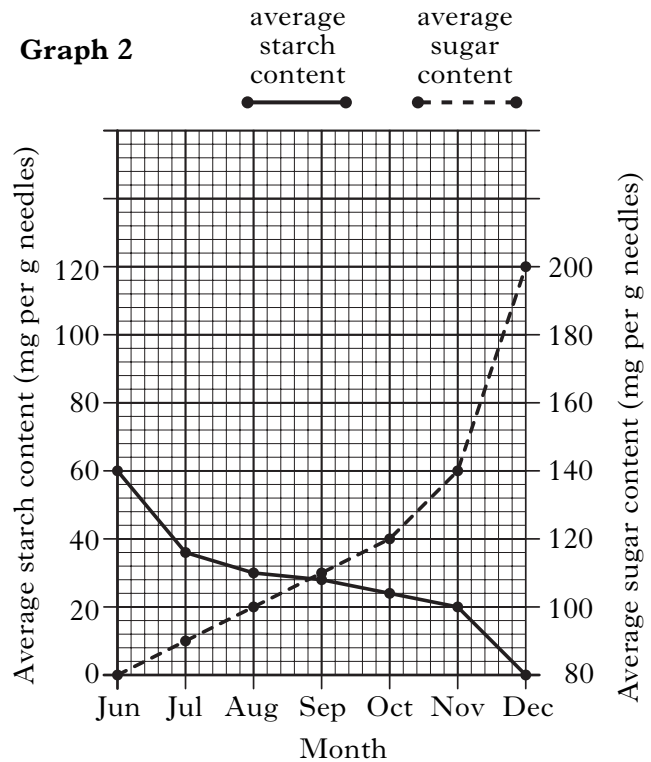
- Dry mass of whole seedlings
- Dry mass of roots only
- Starch content in needles
- Sugar content in needles

The results are shown in **Graphs 1** and **2**.

**Graph 1**



**Graph 2**



- (a) (i) Use values from **Graph 1** to describe the changes in average dry mass of whole seedlings from June to December.

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Marks

2

- (ii) Between which two months was there the greatest increase in average dry mass of the seedlings' roots only?

Tick (✓) **one** box.

Jun–Jul	Jul–Aug	Aug–Sept	Sept–Oct	Oct–Nov	Nov–Dec
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1

- (iii) From **Graph 2**, calculate the ratio of average starch content to average sugar content in the needles in November.

Space for calculation

\_\_\_\_\_ Starch: \_\_\_\_\_ Sugar

1

DO NOT  
WRITE IN  
THIS  
MARGIN

6. (a) (continued)

Marks

- (iv) **From Graph 2**, calculate the percentage decrease in average starch content in the needles between June and October.

*Space for calculation*

\_\_\_\_\_ % decrease **1**

- (b) Explain the decrease in average starch content in the needles between June and December.

\_\_\_\_\_  
\_\_\_\_\_ **1**

- (c) Raffinose is a sugar that prevents frost damage to needles.

The table shows the raffinose content of needles from the seedling samples.

<i>Month</i>	<i>Raffinose content (mg per g of needles)</i>
June	0
July	1
August	2
September	3
October	9
November	30
December	50

- (i) What evidence is there that raffinose is not the only sugar present in the needles of Norway Spruce?

\_\_\_\_\_  
\_\_\_\_\_ **1**

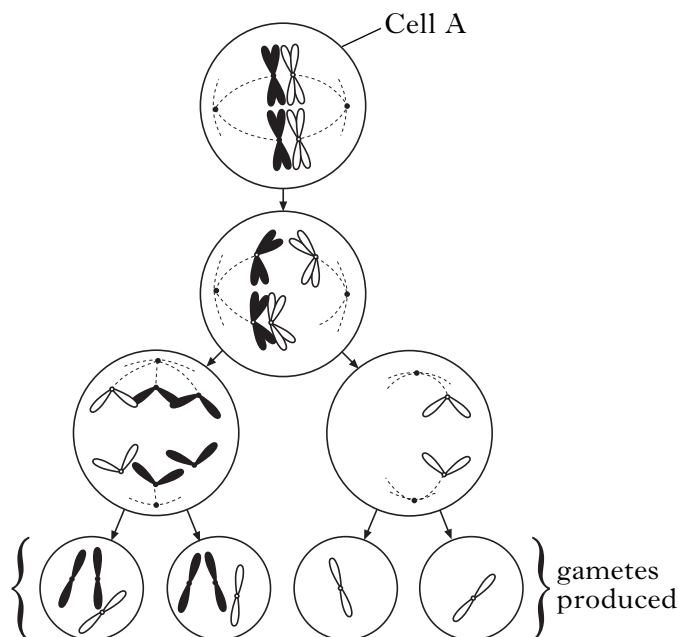
- (ii) Suggest how the changing raffinose content of needles from June to December is of survival value to Norway Spruce.

\_\_\_\_\_  
\_\_\_\_\_ **1**

**[Turn over**

Marks

7. The diagram shows stages in meiosis during which a mutation occurred and the effect of the mutation on the gametes produced.



- (a) (i) What name is given to cells such as cell A, that undergo meiosis?
- \_\_\_\_\_ 1
- (ii) Cell A contains two pairs of homologous chromosomes.  
Apart from size and shape, state **one** similarity between homologous chromosomes.
- \_\_\_\_\_ 1
- (iii) This mutation has resulted in changes to the chromosome numbers in the gametes.  
Name this type of mutation.
- \_\_\_\_\_ 1
- (iv) State whether the mutation has occurred in the first or second meiotic division and justify your choice.
- Meiotic division \_\_\_\_\_
- Justification \_\_\_\_\_
- \_\_\_\_\_ 1
- (v) State the expected haploid number of chromosomes in the gametes produced if this mutation **had not occurred**.
- \_\_\_\_\_ 1

7. (continued)

Marks

- (b) The diagram represents the sequence of bases on part of one strand of a DNA molecule.

Part of DNA molecule     T   G   A   A   C   T   G

The effects of two different gene mutations on the strand of DNA are shown below.

Gene mutation 1     T   T   G   A   A   C   T   G

Gene mutation 2     T   G   A   C   C   T   G

Complete the table by naming the type of gene mutation that has occurred in each case.

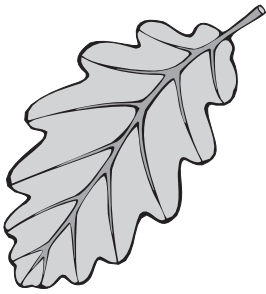
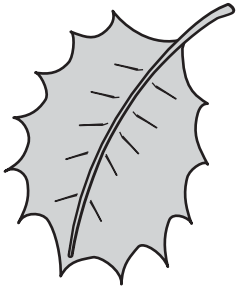
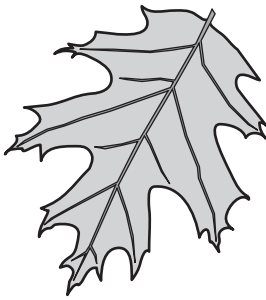
<i>Gene Mutation</i>	<i>Name</i>
1	
2	

2

[Turn over

Marks

8. The table shows information about three species of oak tree that have evolved from a common ancestor.

		<i>Oak Species</i>		
		Sessile Oak	Kermes Oak	Northern Red Oak
Leaf Shape		Rounded lobes	Sharp spines	Lobes with sharp spines
				
Growing Conditions		Mild and damp	Hot and dry	Cool and dry

- (a) (i) The Oak species have evolved in ecological isolation.

State the importance of isolating mechanisms in the evolution of new species.

\_\_\_\_\_

1

- (ii) Use the information to explain how the evolution of the Oak species illustrates adaptive radiation.

\_\_\_\_\_

\_\_\_\_\_

2

- (b) The Kermes Oak grows to a maximum height of one metre.

Explain the benefit to this species of having leaves with sharp spines.

\_\_\_\_\_

\_\_\_\_\_

1

- (c) To maintain genetic diversity, species must be conserved.

State **two** ways in which species can be conserved.

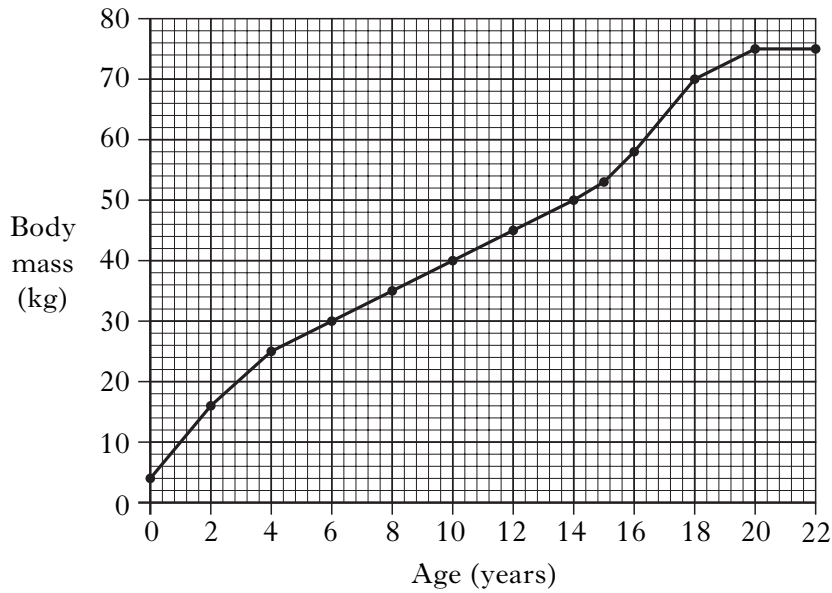
1 \_\_\_\_\_

2 \_\_\_\_\_

1

Marks

9. (a) The graph shows the body mass of a human male from birth until 22 years of age.



- (i) Calculate the average yearly increase in body mass between age 6 and age 14.

*Space for calculation*

\_\_\_\_\_ kg      **1**

- (ii) Explain how the activity of the pituitary gland could account for the growth pattern between 15 and 22 years of age shown on the graph.

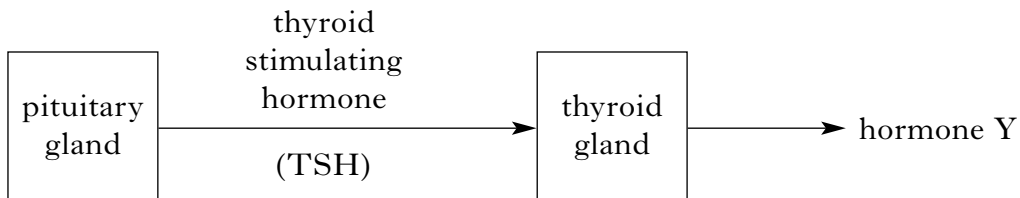
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2**

- (b) The diagram shows the role of the pituitary gland in the secretion of a hormone from the thyroid gland.



Name hormone Y and describe its role in the control of growth and development.

Hormone Y \_\_\_\_\_ **1**

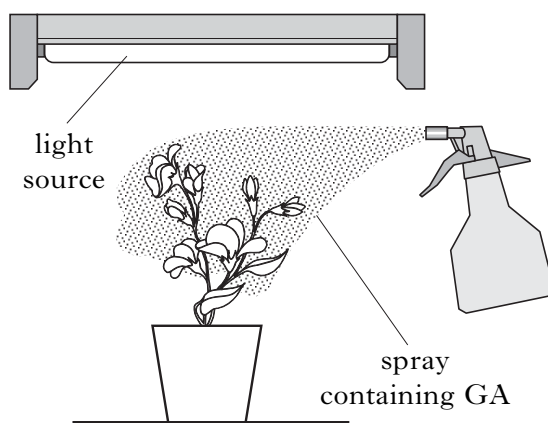
Role \_\_\_\_\_ **1**

Marks

10. An experiment was carried out to investigate the effect of gibberellic acid (GA) on the growth of dwarf pea plants. GA can be absorbed by leaves.

Six identical pea plants were placed in pots containing 100 g of soil. The leaves of each were sprayed with an equal volume of water containing a different mass of GA. The soil in each pot received 20 cm<sup>3</sup> water each day and the plants were continuously exposed to equal light intensity from above.

After seven days the stem height of each plant was measured and the percentage increase in stem height calculated.



- (a) (i) Identify **two** variables, not already mentioned, that should have been controlled to ensure the experimental procedure was valid.

Variable 1 \_\_\_\_\_

1

Variable 2 \_\_\_\_\_

1

- (ii) State **one** way in which the experimental procedure could be improved to increase the reliability of the results.

\_\_\_\_\_  
\_\_\_\_\_

1

- (b) The results of the experiment are shown in the table.

<i>Mass of GA applied (micrograms)</i>	<i>Percentage increase in stem height (%)</i>
0.01	90
0.03	120
0.05	160
0.08	240
0.10	320
0.11	350



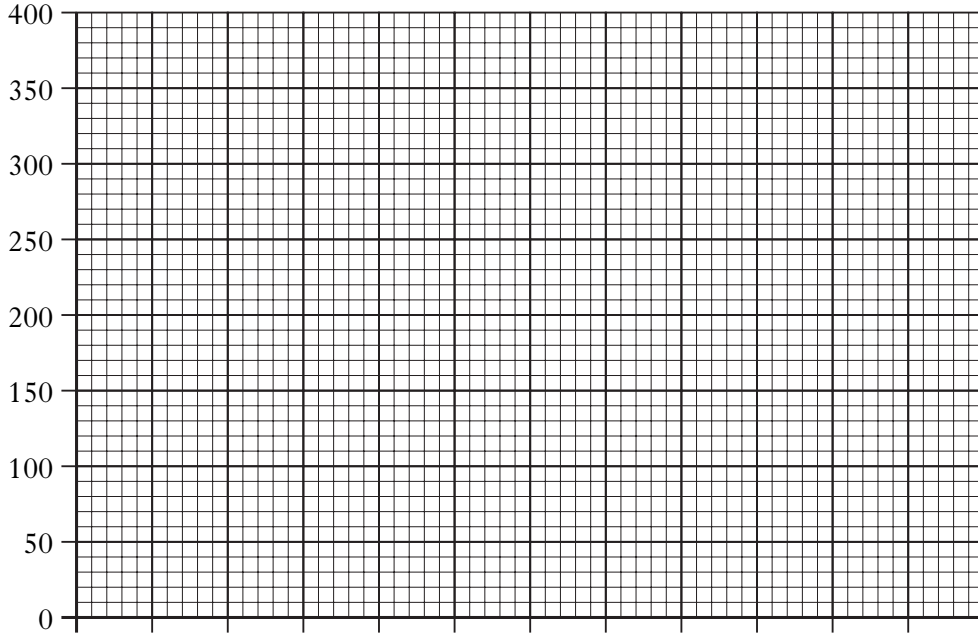
Marks

10. (b) (continued)

- (i) On the grid provided, complete the line graph to show the percentage increase in stem height against the mass of GA applied.

Use an appropriate scale to fill most of the grid.

(Additional graph paper, if required, will be found on page 36.)



2

- (ii) Another pea plant was treated in the same way, using a water spray containing 0.12 micrograms of GA. Predict the percentage increase in stem height of this plant after seven days.

\_\_\_\_\_ percentage increase

1

- (c) Explain why the method of application of GA could lead to errors in the results.

\_\_\_\_\_

\_\_\_\_\_

1

[Turn over

Marks

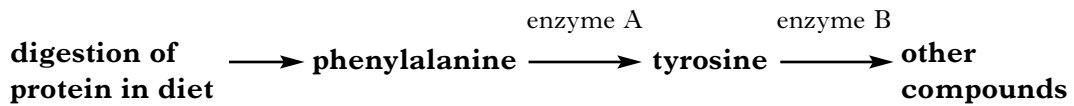
11. (a) The bacterium *Escherichia coli* can control its lactose metabolism.

Complete **all** boxes in the table to show whether each statement is true (T) or false (F) if lactose is present or absent in the medium in which *E. coli* is growing.

<i>Statement</i>	<i>Lactose present</i>	<i>Lactose absent</i>
Regulator gene produces the repressor molecule		
Repressor molecule binds to inducer		
Repressor molecule binds to operator		
Structural gene switched on	T	F

2

- (b) Part of a metabolic pathway involving the amino acid phenylalanine is shown in the diagram.



Phenylketonuria (PKU) is an inherited condition in which enzyme A is either absent or does not function.

- (i) Predict the effect on the concentrations of phenylalanine and tyrosine if enzyme A is absent.

Phenylalanine \_\_\_\_\_ 1

Tyrosine \_\_\_\_\_ 1

- (ii) PKU is caused by a mutation of the gene that codes for enzyme A.

Explain how a mutation of a gene can cause the production of an altered enzyme.

\_\_\_\_\_

\_\_\_\_\_

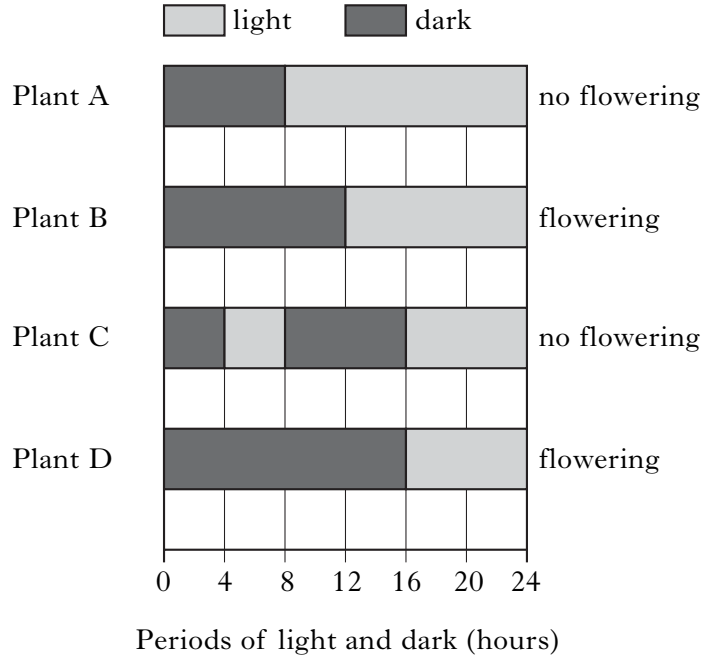
\_\_\_\_\_

2

Marks

12. An experiment was set up to investigate the effect of photoperiod on flowering in *Chrysanthemum* plants. Four plants A, B, C and D were exposed to different periods of light and dark in 24 hours. This was repeated every day for several weeks and the effects on flowering noted.

The periods of light and dark and their effects on flowering are shown in the diagram.



- (a) From the information given, identify the conditions required for flowering in *Chrysanthemum* plants. Justify your answer.

Conditions \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_ 1

- (b) Flowering in response to photoperiod ensures plants within a population flower at the same time. Explain how this enables genetic variation to be maintained.

\_\_\_\_\_

\_\_\_\_\_ 1

- (c) Mammals also show photoperiodism.

Describe how one type of mammal behaviour can be affected by photoperiod.

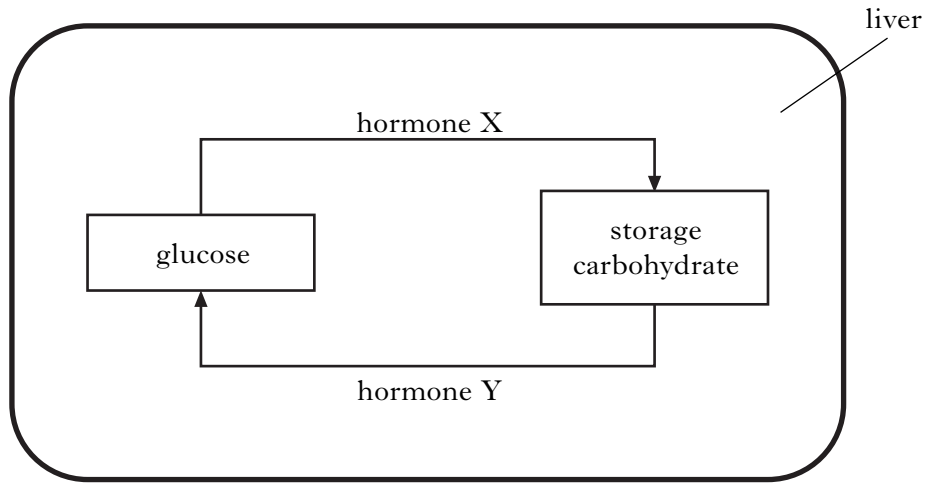
\_\_\_\_\_

\_\_\_\_\_ 1

[Turn over

Marks

13. The homeostatic control of blood glucose concentration carried out by the human liver is shown on the diagram.



- (a) Name the storage carbohydrate found in the liver.

\_\_\_\_\_

1

- (b) (i) Name hormones X and Y.

Hormone X \_\_\_\_\_

Hormone Y \_\_\_\_\_

1

- (ii) Name the organ that produces hormones X and Y.

\_\_\_\_\_

1

- (iii) Explain how negative feedback is involved in the homeostatic control of blood glucose concentration.

\_\_\_\_\_

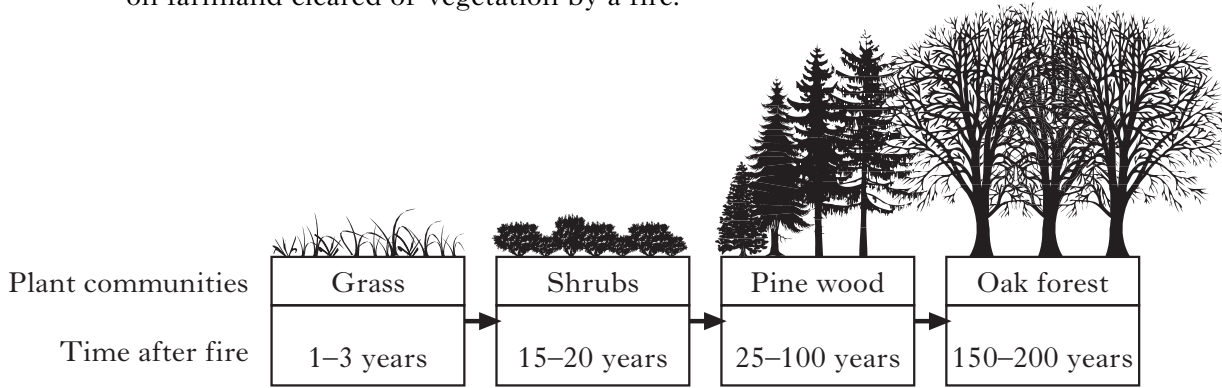
\_\_\_\_\_

\_\_\_\_\_

2

Marks

14. (a) The diagram shows some plant communities present at various time intervals on farmland cleared of vegetation by a fire.



- (i) State the term used to describe this sequence of plant communities.

\_\_\_\_\_ 1

- (ii) Give a reason to explain why the shrub community is able to replace the grass community after 15 years.

\_\_\_\_\_ 1

- (iii) Oak forest is the climax community in this sequence. Describe a feature of a climax community.

\_\_\_\_\_ 1

- (b) The grid shows factors that can influence population change.

<b>A</b>	competition	<b>B</b>	predation	<b>C</b>	rainfall
<b>D</b>	disease	<b>E</b>	temperature	<b>F</b>	food supply

- (i) Use **all** the letters from the grid to complete the table to show which factors are density dependent and which are density independent.

<i>Density dependent</i>	<i>Density independent</i>

2

- (ii) **Underline** one alternative in each pair to make the sentences correct.

As population density  $\left\{ \begin{array}{l} \text{increases,} \\ \text{decreases,} \end{array} \right\}$  the effect of density dependent factors increases.

As a result, the population density then  $\left\{ \begin{array}{l} \text{increases} \\ \text{decreases} \end{array} \right\}$ .

1

[Turn over for Section C on Page thirty

## SECTION C

Marks

Both questions in this section should be attempted.

Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.

Supplementary sheets, if required, may be obtained from the invigilator.

All answers must be written clearly and legibly in ink.

Labelled diagrams may be used where appropriate.

1. Answer **either A or B**.

A. Give an account of respiration under the following headings:

(i) glycolysis;

5

(ii) the Krebs (Citric acid) cycle.

5

**(10)****OR**

B. Give an account of cellular defence mechanisms in animals under the following headings:

(i) phagocytosis;

4

(ii) antibody production and tissue rejection.

6

**(10)**

In question 2, ONE mark is available for coherence and ONE mark is available for relevance.

2. Answer **either A or B**.

A. Give an account of the problems of osmoregulation in freshwater bony fish and outline their adaptations to overcome these problems.

**(10)****OR**

B. Give an account of obtaining food in animals by reference to co-operative hunting, dominance hierarchy, and territorial behaviour.

**(10)**

[END OF QUESTION PAPER]

**SPACE FOR ANSWERS**

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**SPACE FOR ANSWERS**

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**SPACE FOR ANSWERS**

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**SPACE FOR ANSWERS**

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**SPACE FOR ANSWERS**

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**SPACE FOR ANSWERS**

ADDITIONAL GRAPH PAPER FOR QUESTION 10(b)

