FOR OFFICIAL USE

Total for Sections B and C

X007/12/02

NATIONAL QUALIFICATIONS 2013

WEDNESDAY, 15 MAY
1.00 PM – 3.30 PM

BIOLOGY
HIGHER

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

Scottish candidate number

Number of seat

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)

1 (a) All questions should be attempted.

(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.

2 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**.

3 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.

4 The numbers of questions must be clearly inserted with any answers written in the additional space.

5 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.

6 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 examination, 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. Plant cell walls are composed mainly of

A cellulose

B phospholipid

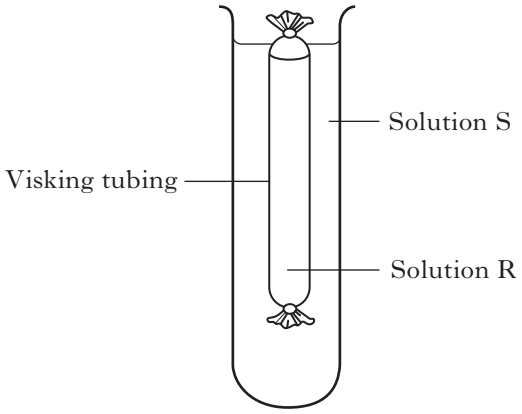
C collagen

D starch.

2. Visking tubing is selectively permeable. In the experiment shown below to demonstrate osmosis, the following results were obtained.

Initial mass of Visking tubing + contents = 10·0 g

Mass of Visking tubing + contents after experiment = 11·8 g



The results shown could be obtained when

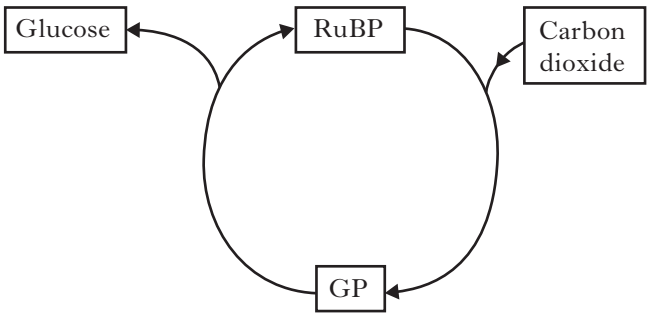
A R is a 5% salt solution and S is a 10% salt solution

B R is a 10% salt solution and S is a 5% salt solution

C R is water and S is a 10% salt solution

D R is water and S is a 5% salt solution.

3. 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

[Turn over

4. Which of the following must be present in a living cell for glycolysis to occur?

A Glucose and ATP

B Pyruvic acid and oxygen

C Glucose and oxygen

D Pyruvic acid and ATP

5. Which of the following chemical changes in cells results in the synthesis of most ATP?

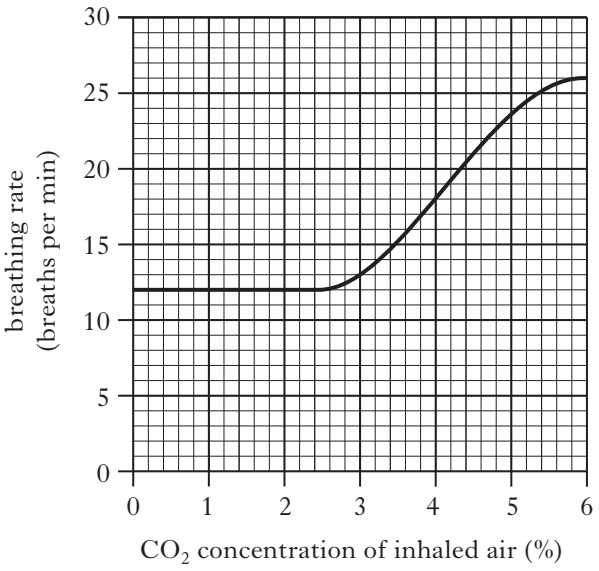
A Glucose to pyruvic acid

B Pyruvic acid to lactic acid

C Pyruvic acid to acetyl group

D Pyruvic acid to carbon dioxide and water

6. The graph below shows the effect of the carbon dioxide concentration of inhaled air on the breathing rate of an individual.



If the volume of one breath is 0·5 litre, what volume of air will be breathed in one minute when the CO_2 concentration is 4%?

A 6 litres

B 9 litres

C 18 litres

D 36 litres

7. If ten percent of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

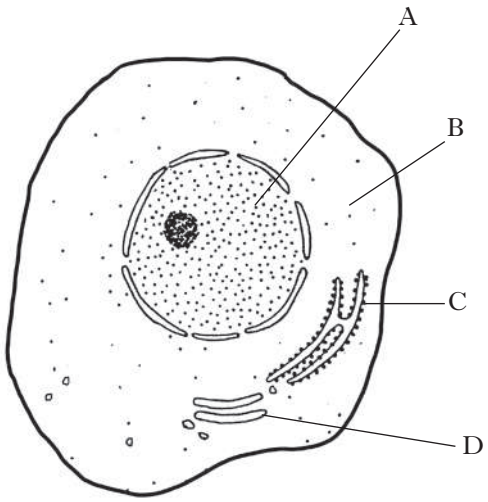
A 1:1

B 1:2

C 1:3

D 1:4

8. The diagram below shows some structures within an animal cell.



Where does synthesis of messenger RNA take place?

9. The processing of proteins prior to secretion takes place in the

A endoplasmic reticulum

B Golgi apparatus

C ribosomes

D vesicles.

10. Phagocytes contain lysosomes that

A recognise foreign antigens on bacteria

B produce antibodies to destroy viruses

C surround and engulf invading viruses

D contain enzymes which destroy bacteria.

11. In garden pea plants the genes for height and flower colour are on different chromosomes. The allele **T** (tall) is dominant to the allele **t** (dwarf) and the allele **R** (purple flowers) is dominant to the allele **r** (white flowers).

A true-breeding tall plant with purple flowers was crossed with a dwarf plant with white flowers.

The F_1 generation were self-pollinated and 64 plants were obtained in the F_2 generation.

How many of the F_2 generation would be expected to be tall with white flowers?

A 36

B 16

C 12

D 4

12. Which line in the table correctly shows characteristics of mutant alleles?

	Frequency	*Occurrence*
A	high	random
B	high	non-random
C	low	random
D	low	non-random

13. Which of the following has occurred as a result of natural selection?

A Modern varieties of potato have been produced from wild varieties.

B Ayrshire cows have been bred to increase milk yield.

C Bacteria have developed resistance to some antibiotics.

D Some tomato plants produced by somatic fusion have resistance to fungal diseases.

14. The dark variety of the peppered moth became common in industrial areas of Britain following the increase in production of soot during the Industrial Revolution.

The increase in the dark form was due to

A dark moths migrating to areas which offered the best camouflage

B a change in the prey species taken by birds

C an increase in the mutation rate

D a change in selection pressure.

15. An eel was transferred from salt water to fresh water.

The table shows how the drinking rate of the eel changed in the six hour period after transfer.

Time after transfer (hours)	*Drinking rate* (cm^3 per kg body mass per hour)
0	20
1	17
2	15
3	12
4	10
5	8
6	2

What is the average hourly decrease in drinking rate over the six hour period after transfer?

A 3 cm^3 per kg body mass per hour

B 12 cm^3 per kg body mass per hour

C 14 cm^3 per kg body mass per hour

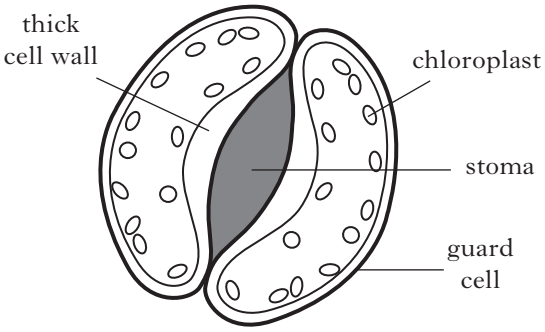
D 18 cm^3 per kg body mass per hour

[Turn over

16. Which line in the table below describes the action of chloride secretory cells in the gills and the glomerular filtration rate of a salmon living in sea water?

	Action of chloride secretory cells in the gills	*Glomerular filtration rate*
A	excretes salts	high
B	excretes salts	low
C	absorbs salts	low
D	absorbs salts	high

17. The diagram below shows a stoma and its guard cells in the lower epidermis of a leaf.



Which line of the table below describes the conditions which result in the stoma being fully open as shown in the diagram?

	Lighting conditions	*Condition of guard cells*
A	light	flaccid
B	dark	flaccid
C	light	turgid
D	dark	turgid

18. The Soft Brome grass and the Storksbill are species of plant which grow in the grasslands of California. The Storksbill has a more extensive root system, but does not grow as tall as the Soft Brome grass.

From this information, in which of the following conditions would the Storksbill be expected to survive better than Soft Brome grass?

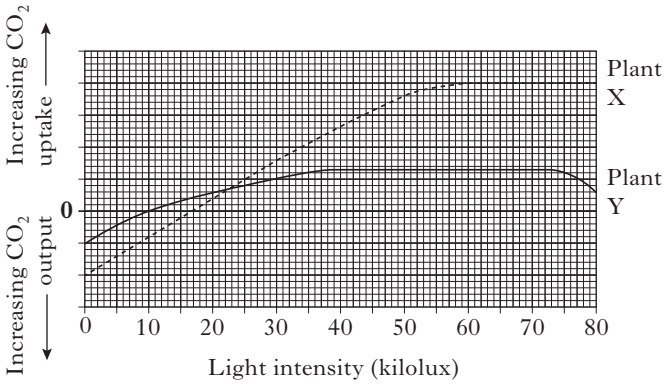
A Drought

B High soil moisture levels

C High light intensity

D Shade

19. Two plants of different species had their carbon dioxide (CO_2) uptake and output measured in relation to light intensity. The results are shown below.



Which line in the table below is a correct interpretation of the graph?

	Type of plant	*Light intensity at which compensation point is reached*
A	X is a shade plant	17 kilolux
B	X is a sun plant	60 kilolux
C	Y is a shade plant	10 kilolux
D	Y is a sun plant	40 kilolux

20. A substitution mutation in a gene results in a triplet of bases TTC being changed to TCC. The amino acid lysine is coded for by TTC and arginine is coded for by TCC.

The effect of this mutation on the resulting protein would be that

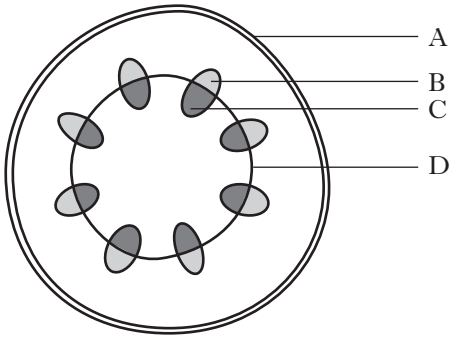
A all lysine molecules would be replaced by arginine molecules throughout the protein

B one lysine molecule would replace arginine at one point in the protein

C all arginine molecules would be replaced by lysine molecules throughout the protein

D one arginine molecule would replace lysine at one point in the protein.

21. The diagram below shows a section through a young plant stem. In which region would a meristem be found?



22. The ability of a plant to replace damaged parts through new growth is called

A abscission

B regeneration

C differentiation

D apical dominance.

23. Which of the following statements best defines the term population density?

A The number of individuals of a species present per unit area of a habitat.

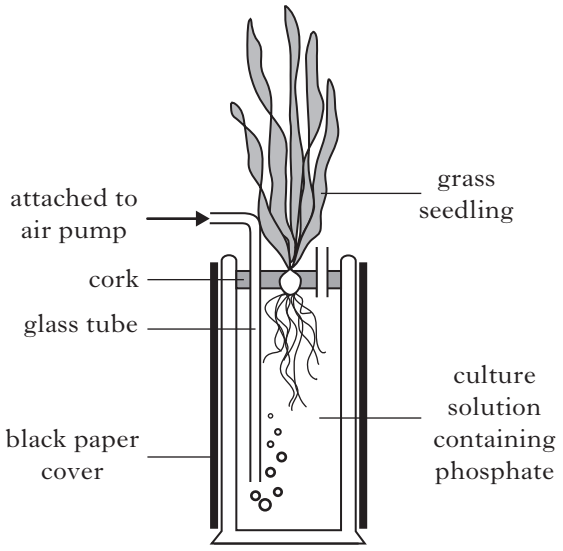
B The number of individuals of all species present in a habitat.

C The maximum number of individuals of all species which the resources of a habitat can support.

D The maximum number of individuals of a species which the resources of a habitat can support.

24. The apparatus shown below was used to investigate the effects of phosphate on the growth of grass seedlings.

The experiment was repeated using different concentrations of phosphate and the height of the seedlings was recorded after 6 weeks of growth.



Two variables that must be kept the same are

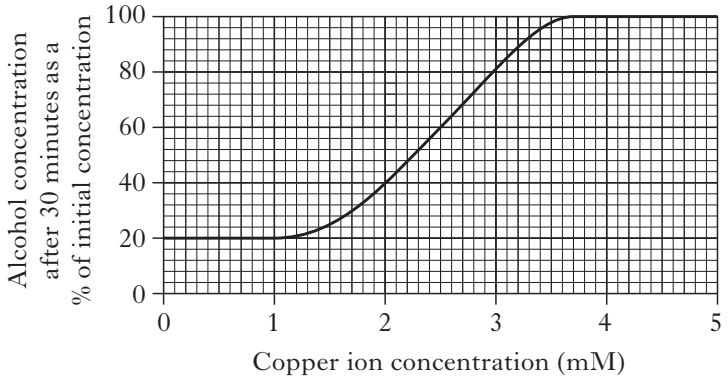
A temperature and concentration of phosphate in the culture solution

B concentration of phosphate in the culture solution and light intensity

C light intensity and temperature

D temperature and the height of the seedlings.

25. Liver tissue contains an enzyme which breaks down alcohol. The graph below shows the effect of different concentrations of copper ions on the breakdown of alcohol by this enzyme over a 30 minute period.



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

A 4·5 mM copper has no effect on enzyme activity.

B 2·5 mM copper halves the enzyme activity.

C 0·5 mM copper completely inhibits enzyme activity.

D Enzyme activity increases when copper concentration is increased from 1 mM to 2 mM.

26. Which line in the table below correctly identifies the substances required for normal blood-clotting and for the prevention of rickets?

	Normal blood-clotting	*Prevention of rickets*
A	calcium	vitamin D
B	vitamin D	calcium
C	iron	vitamin D
D	calcium	iron

27. Nicotine is a chemical which may affect fetal development.

The diagram shows the stages of development when major and minor malformations of organs may occur if there is exposure to nicotine during the first twelve weeks of pregnancy.

Key major malformation
minor malformation

Organ	*Stage of development* (weeks of pregnancy)											
	1	2	3	4	5	6	7	8	9	10	11	12
brain			■	■	■	■	■	■	■	■	■	■
ear				■	■	■	■	■	■	▒	▒	▒
limbs					■	■	■	■	▒			
genitalia							■	■	▒	▒	▒	▒

For how many weeks during pregnancy is there a possibility of major malformations to organs during development?

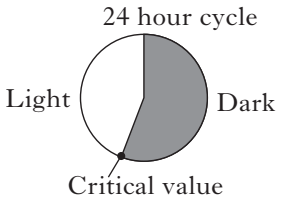
A 6

B 7

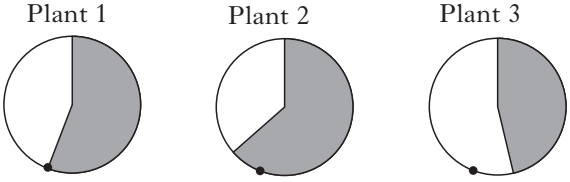
C 9

D 14

28. A species of short-day plant only flowers if the number of hours of continuous darkness in its 24 hour cycle is at least at the critical value shown in the chart below.



Three plants of this species were exposed to different photoperiods as shown below.



Which plant(s) would be expected to flower?

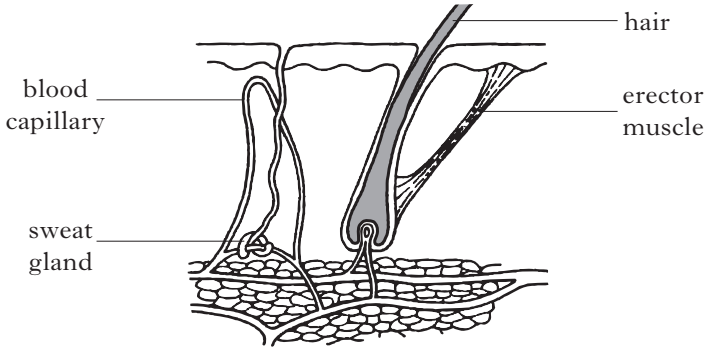
A 1 only

B 2 only

C 1 and 2 only

D 2 and 3 only

29. The diagram below shows a section through the skin of a mammal.



Which line in the table below correctly identifies the state of the erector muscle and the change in blood flow in the capillary which would be expected if the skin was exposed to low temperature?

	State of erector muscle	*Change to blood flow in capillary*
A	contracted	increase
B	contracted	decrease
C	relaxed	increase
D	relaxed	decrease

30. Which of the following factors influencing population change in an animal species is density-independent?

A Disease

B Food availability

C Temperature

D Predation

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*

DO NOT WRITE IN THIS MARGIN

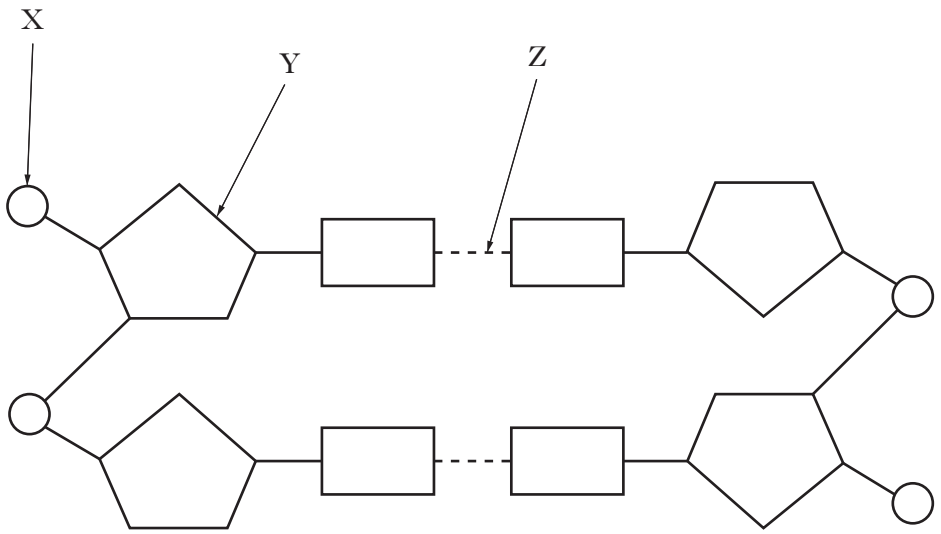
SECTION B

All questions in this section should be attempted.

All answers must be written clearly and legibly in ink.

Marks

1. (*a*) The diagram below shows part of a DNA molecule.



(i) Name components X and Y.

X _____

Y _____ **1**

(ii) Name the type of bond shown at Z.

_____ **1**

Marks

1. (continued)

(*b*) (i) The flowchart below describes steps in the process of DNA replication. Complete the boxes to describe what happens at **Step 2** and **Step 4**.

Step 1	Original DNA double helix unwinds.
⇩	
Step 2	
⇩	
Step 3	Free DNA nucleotides bond with complementary nucleotides on the original DNA strands.
⇩	
Step 4	
⇩	
Step 5	Double strands twist and two new DNA double helices are formed.

2

(ii) Other than the original DNA strand and free DNA nucleotides, give **one** substance needed for DNA replication.

_____ **1**

(iii) State the importance of DNA replication to cells.

_____

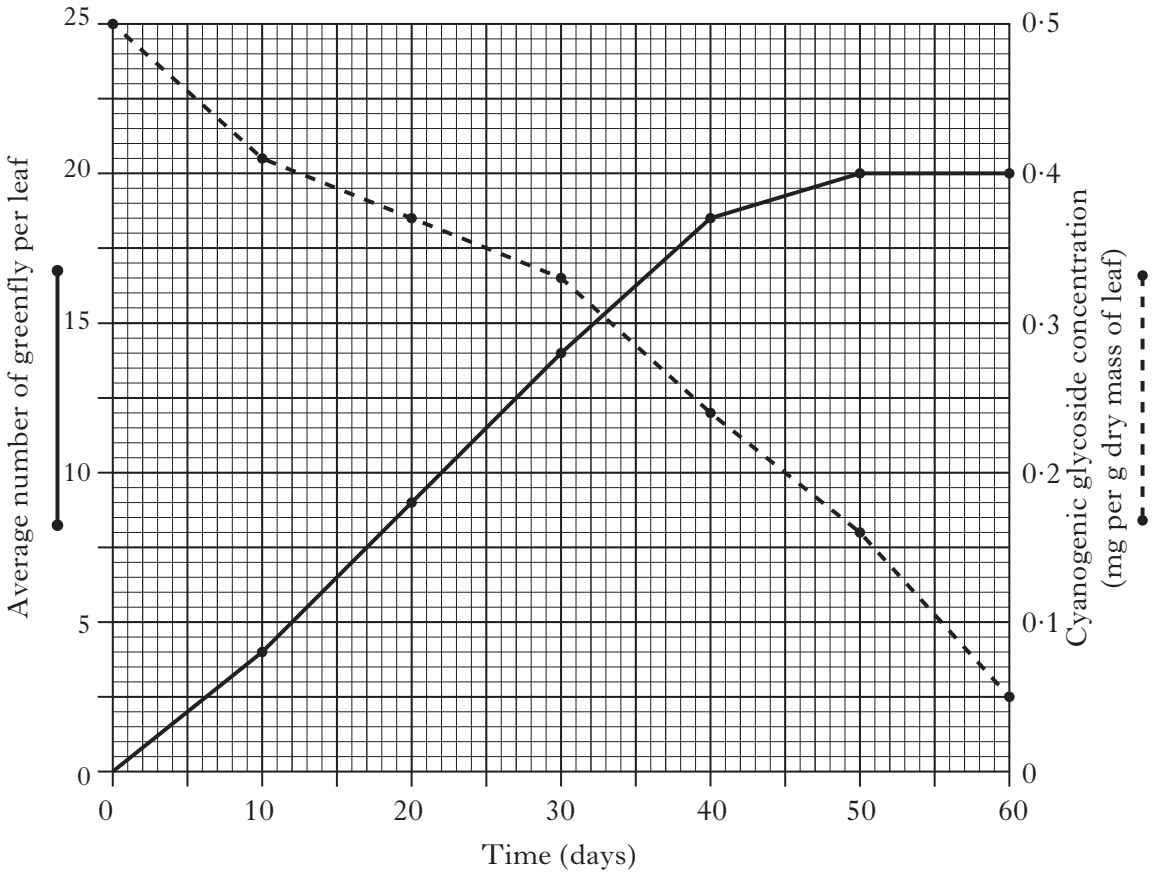
_____

_____ **1**

Marks

2. (*a*) Cherry tree leaves are attacked by greenfly. The leaves contain cyanogenic glycosides which are broken down to release cyanide when greenfly damage them. The cyanide acts as a defence against **most** greenfly species.

The graph below shows the average number of individuals of a species of greenfly per leaf and the concentration of cyanogenic glycosides in the leaves of a cherry tree over a 60 day period.



(i) Explain how changes in the population of greenfly account for the fall in the cyanogenic glycoside concentration throughout the period.

2

(ii) What evidence is there that this greenfly species is resistant to the effects of cyanide?

1

DO NOT WRITE IN THIS MARGIN

Marks

2. (*a*) (continued)

(iii) Calculate the average increase **per day** in the number of greenfly per leaf between day 10 and day 50.

Space for calculation

Average increase per day _____ **1**

(iv) State the cyanogenic glycoside concentration when the average number of greenfly per leaf was 14.

_____ mg per gram dry mass of leaf **1**

(*b*) Some plants secrete sticky resin in response to damage.

Explain how resin protects the plants.

_____

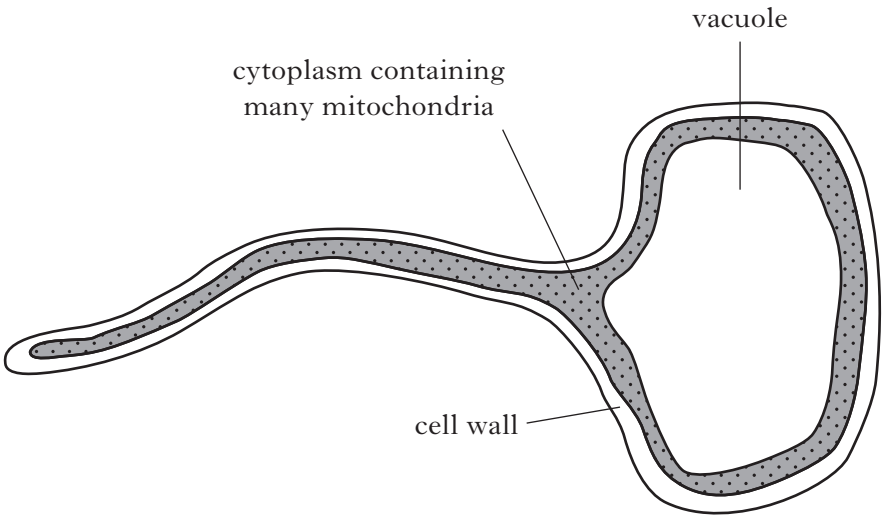
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

3. The diagram shows a cell from the root epidermis of the Spanish reed.



(*a*) Name this type of cell and describe how it is adapted for the absorption of water from the soil.

Type of cell _____ **1**

Description _____

_____ **1**

(*b*) The Spanish reed is adapted to grow in soil with high salt concentration. Salt enters the plant due to its high concentration in the soil. In order to survive, the plant must remove the excess salt from its cells.

Name the process by which the salt is removed and describe the role of mitochondria in this process.

Process _____ **1**

Role of mitochondria in this process _____

_____

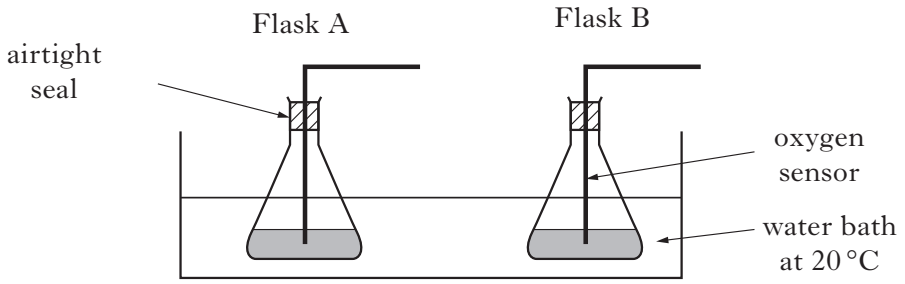
_____ **1**

[Turn over for Question 4 on *Page sixteen*

4. In an investigation into the effect of lead ion concentration on respiration in yeast, two flasks were set up as described below. *Marks*

Flask	*Contents*
A	200 cm^3 glucose solution + 5 cm^3 0·2% lead nitrate solution
B	200 cm^3 glucose solution + 5 cm^3 1·0% lead nitrate solution

The flasks were placed in a water bath at 20 °C for 10 minutes. After this time 2·5 cm^3 of yeast suspension was added to each and oxygen sensors fitted as shown in the diagram below.



The flasks were left for a **further** 10 minutes and then oxygen concentration was measured in each flask every 20 seconds for 2 minutes.

The results are shown in the table below.

Time (s)	*Oxygen concentration* (mg per litre)	
	Flask A *0·2% lead nitrate*	*Flask B* *1·0% lead nitrate*
0	10·2	10·8
20	8·4	9·3
40	6·1	7·6
60	3·8	6·2
80	1·7	5·1
100	0·2	4·0
120	0·0	3·2

(*a*) (i) Identify **one** variable, not already mentioned, which would have to be kept constant so that valid conclusions could be drawn.

_____ **1**

(ii) Explain why the flasks were left for 10 minutes **before** the yeast suspension was added.

_____

_____ **1**

4. (*a*) (continued)

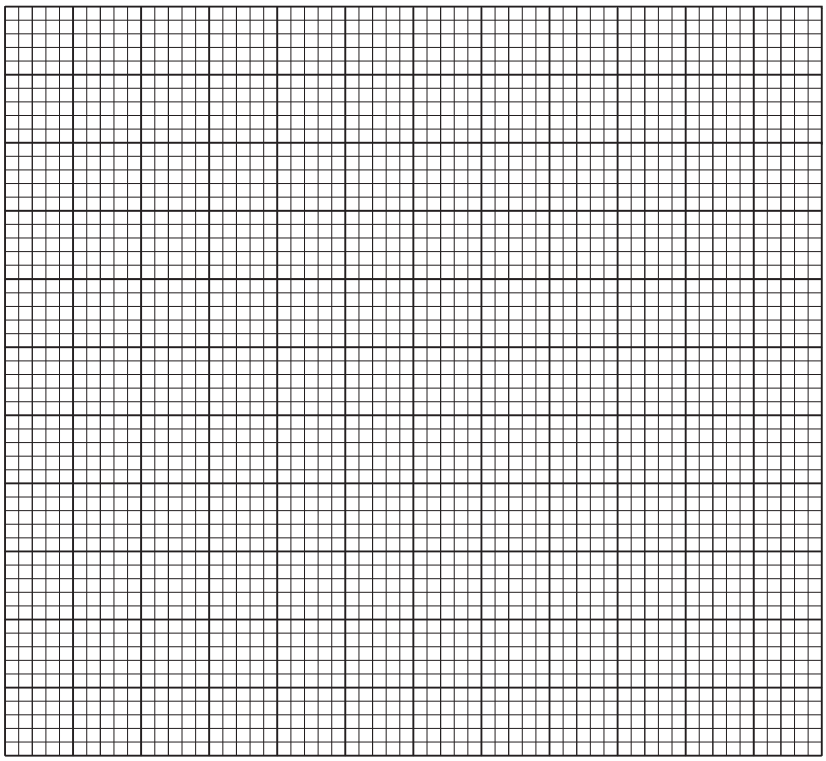
Marks

(iii) Explain why the flasks were left for a **further** 10 minutes after the yeast suspensions were added before measurement of oxygen concentrations were taken.

_____

_____ **1**

(*b*) On the grid provided, draw a line graph to show the oxygen concentration in **Flask A** against time. Use an appropriate scale to fill most of the grid. (Additional graph paper, if required, will be found on Page forty.)



2

(*c*) Using information from the table, state the effect of increasing lead ion concentration on the aerobic respiration of yeast.

_____

_____ **1**

(*d*) Bubbles of gas appeared in both flasks throughout the investigation.

(i) Name this gas.

_____ **1**

(ii) Explain why this gas continued to be produced in **Flask A** at 120s.

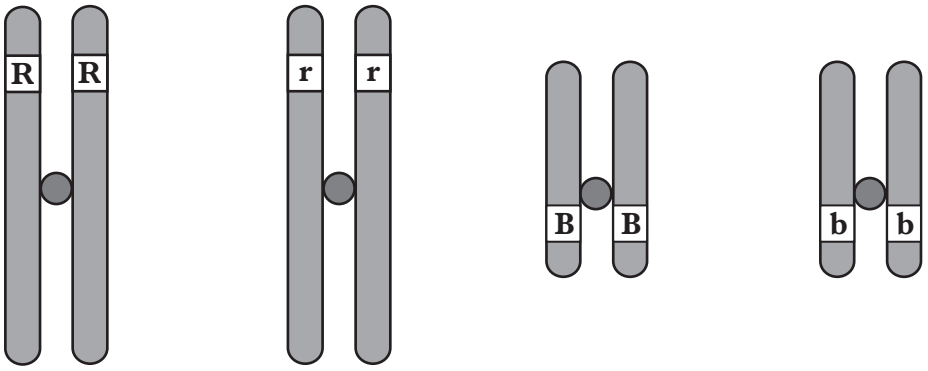
_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. (*a*) The diagram below shows two pairs of homologous chromosomes from a cell dividing by meiosis in a flowering plant. The letters represent alleles.



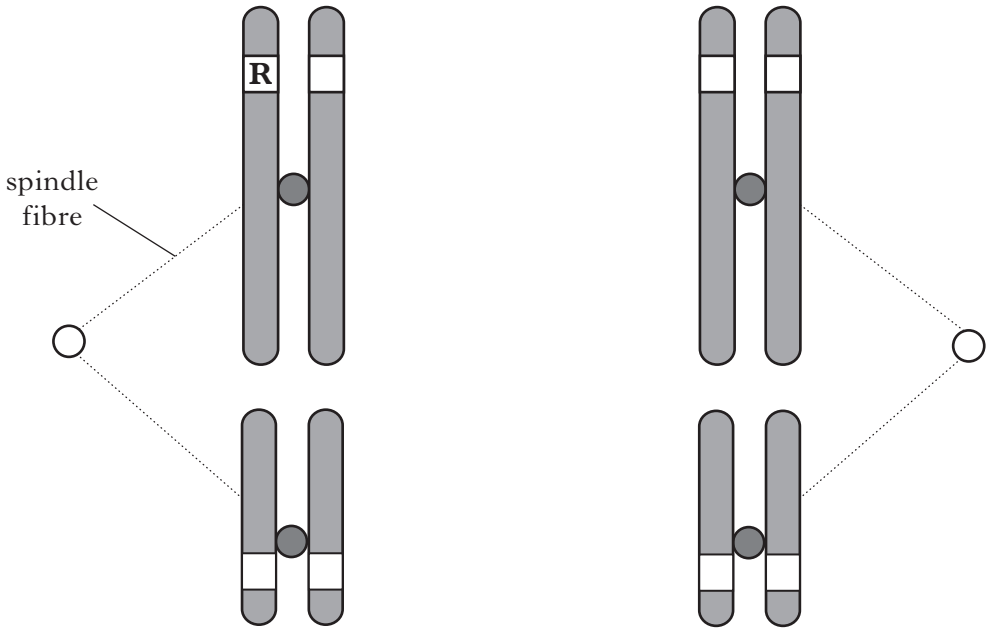
(i) Use letters from the diagram to give the genotypes of all four possible gametes which could be produced by this plant.

_____ _____ _____ _____ **1**

(ii) The diagram below shows the same pairs of homologous chromosomes separating during the first meiotic division.

The position of **one** of the alleles is shown.

Complete the diagram by adding letters to the remaining boxes to show the positions of the alleles that would result in the production of a gamete with the genotype **Rb**.



1

DO NOT WRITE IN THIS MARGIN

Marks

5. (*a*) (continued)

(iii) The chromosomes shown have two copies of each gene.

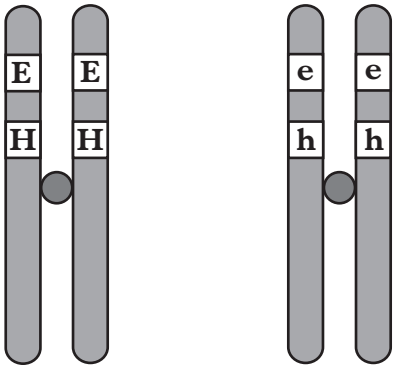
Describe what occurs during the second meiotic division which results in every gamete produced having only one copy of each gene.

_____

_____ **1**

(*b*) The diagram below shows another pair of homologous chromosomes from the same plant cell.

The letters for the alleles of two linked genes are shown.



(i) The grid below shows the genotypes of the possible gametes produced by this cell following meiosis.

Complete the grid by ticking (✓) the boxes to show which of the gametes produced are recombinants.

Genotype of gametes	EH	Eh	eH	eh
Recombinant gametes				

1

(ii) Name the process that occurs during meiosis that results in the production of recombinant gametes.

State the importance of this process to the plant species.

Process _____ **1**

Importance _____

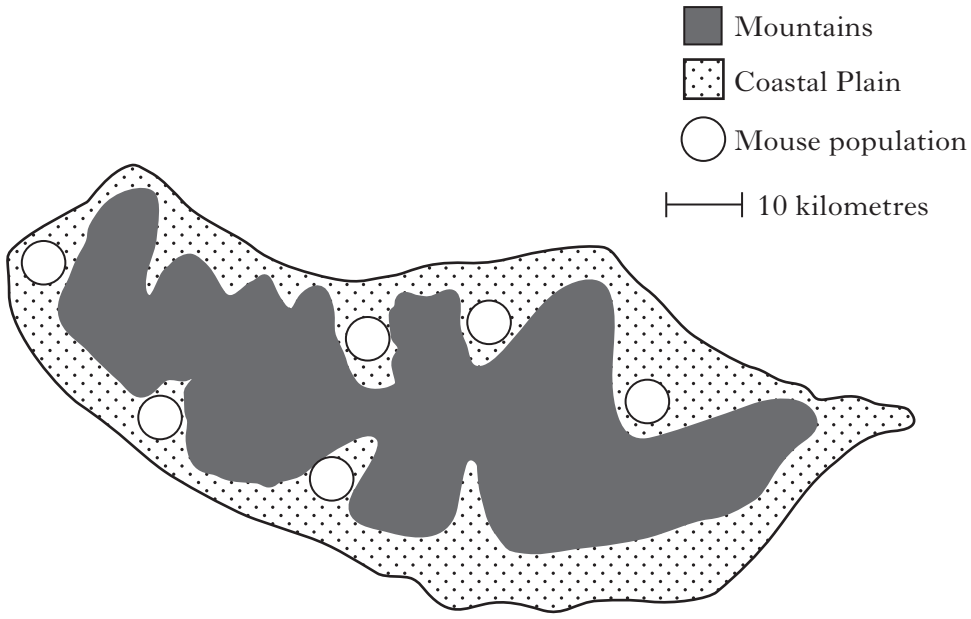
_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

6. (*a*) The map below shows the locations of six populations of the house mouse on the island of Madeira.

Studies on the mice have shown that speciation is occurring.



(i) Using information in the diagram, name the isolating mechanism involved in speciation of the mice.

_____ **1**

(ii) Explain the importance of isolating mechanisms in the evolution of a new species.

_____

_____ **1**

(iii) Describe evidence which would confirm that the populations of mice had evolved to become separate species.

_____

_____ **1**

Marks

6. (continued)

(*b*) **Diagram A** shows a bacterial plasmid containing genes for resistance to the antibiotics tetracycline and ampicillin.

Diagram B shows this plasmid after it had been genetically engineered by inserting a human blood-clotting gene.

Diagram A

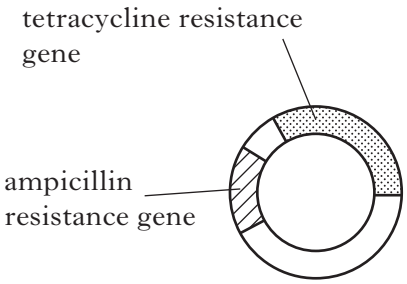
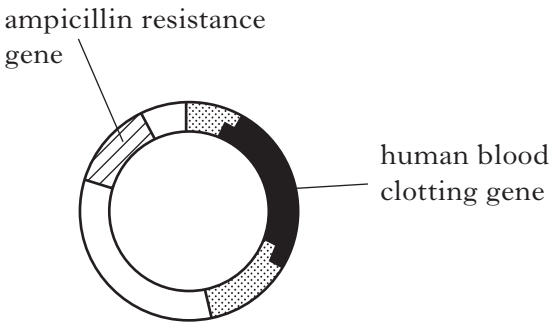


Diagram B



(i) Give a technique which could be used to locate the position of the blood-clotting gene on a human chromosome.

_____ **1**

(ii) Two different enzymes are used to produce the genetically engineered plasmid.

Complete the table to show the function of each enzyme.

Enzyme	*Function*
endonuclease	
ligase	

2

(iii) The genetically engineered plasmids were inserted into bacteria.

Using information from the diagrams, explain why these bacteria were **not** resistant to tetracycline.

_____

_____

_____ **2**

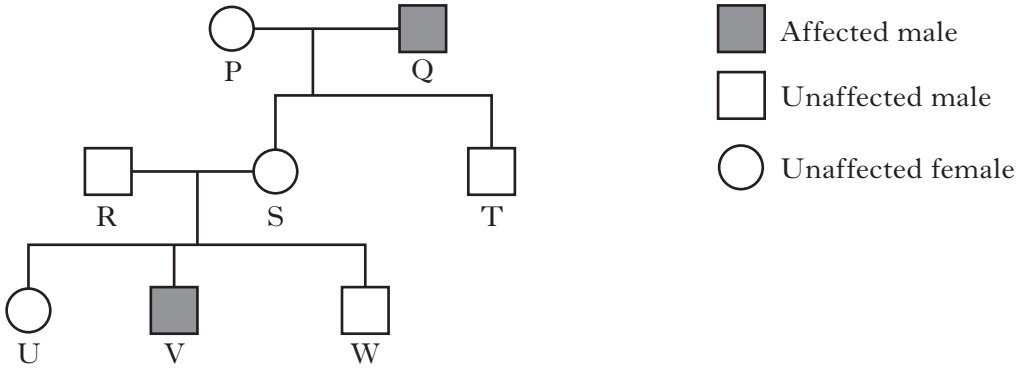
DO NOT WRITE IN THIS MARGIN

Marks

7. Red-green colour deficiency in humans is caused by a mutation in the gene coding for one of the proteins needed for normal colour vision.

This gene is sex-linked and the allele for colour deficiency **d** is recessive to the allele for normal colour vision **D**.

The diagram below shows inheritance of red-green colour deficiency in a family.



(*a*) Give the genotype of each of the following individuals.

Q _____

S _____

W _____ **2**

(*b*) Explain how information from the diagram confirms that the allele causing red-green colour deficiency is recessive.

_____

_____

_____ **1**

(*c*) Explain why males are more likely to be affected by red-green colour deficiency than females.

_____

_____

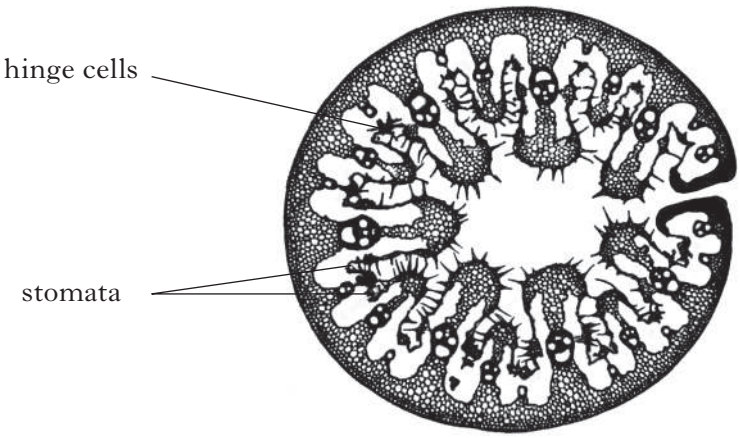
_____ **1**

Marks

8. (*a*) Marram grass is adapted to reduce water loss. Its leaves contain hinge cells which let them curl when the soil in which the plant grows is dry.

When the soil is moist, the hinge cells make the leaves uncurl.

The diagram below shows a section through a **curled** leaf of marram grass.



(i) Explain how curling of the leaves helps to reduce water loss from marram grass.

2

(ii) The rate of photosynthesis in marram grass leaves increases when the soil is moist.

Explain how the action of the hinge cells contributes to this increase.

2

(iii) Give the term used to describe a plant which has adaptations to reduce water loss.

1

Marks

8. (continued)

(*b*) The table below shows features found in plants adapted to grow in water. Explain the advantages of each feature to the plants by completing the table.

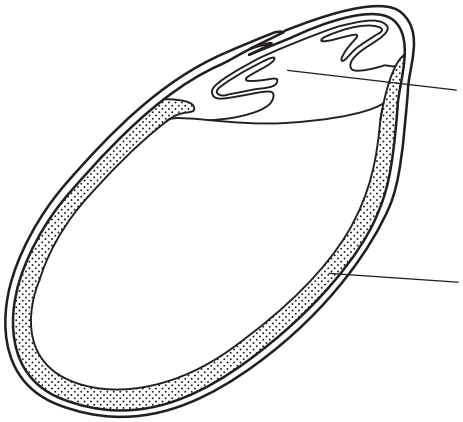
Feature	*Advantage to plant*
Large air spaces between leaf cells	
Flexible stems	

2

DO NOT WRITE IN THIS MARGIN

Marks

9. The diagram below shows a section through a barley grain and the location of events occurring during germination.



(*a*) Name growth substance P and the site of its production.

Name _____

Site of production _____ **1**

(*b*) Give the function of α-amylase and explain the importance of its action in the germination and early growth of barley grains.

Function _____ **1**

Importance _____

_____

_____ **1**

[Turn over

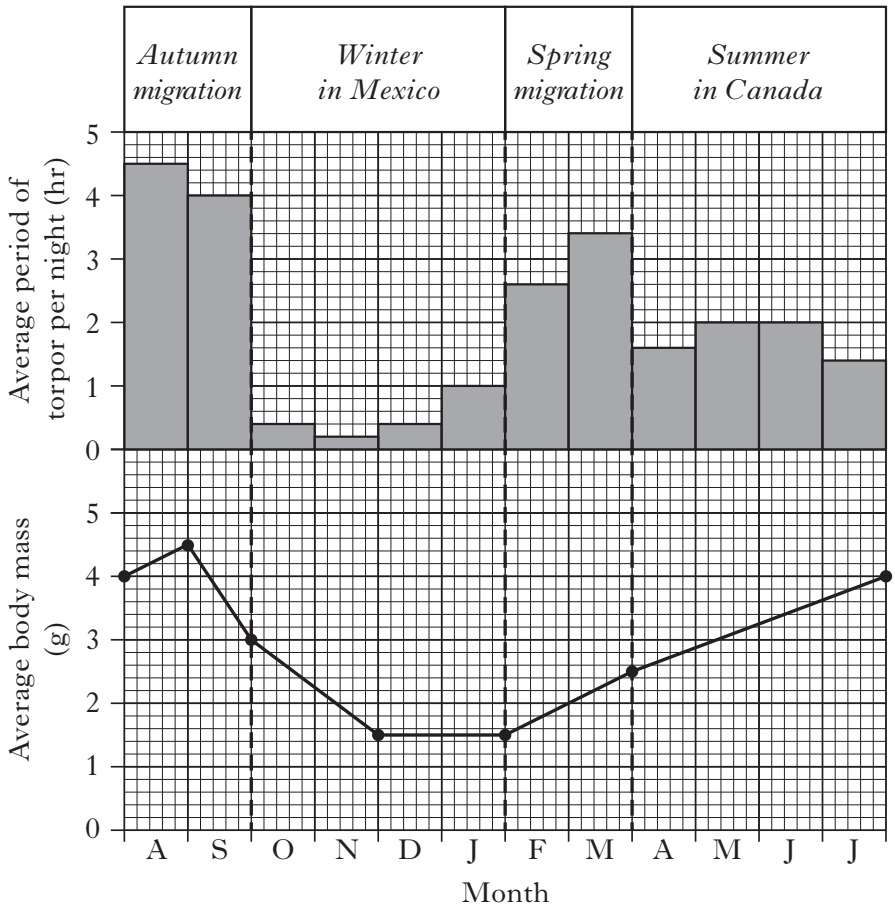
DO NOT WRITE IN THIS MARGIN

10. Rufous hummingbirds migrate thousands of kilometres each year between their summer breeding areas in Canada and their wintering areas in Mexico. *Marks*

They feed on nectar throughout the year and are strongly territorial even on migration.

The birds save energy at night by entering a temporary state known as torpor in which body temperature and respiration rate are greatly reduced.

The **chart** below shows the average body mass of the hummingbirds and the average number of hours per night spent in torpor throughout the year.



(*a*) (i) **Use values from the chart** to describe the changes in average body mass of the hummingbirds from the beginning of August until the end of January.

_____

_____

_____

_____ **2**

(ii) Calculate the percentage increase in average body mass during the summer in Canada.

Space for calculation

_____ % **1**

DO NOT WRITE IN THIS MARGIN

10. (*a*) (continued) *Marks*

(iii) Suggest **one** reason for the changes in average body mass of the birds during the summer in Canada.

_____

_____ **1**

(*b*) (i) Explain why the increased time spent in torpor during migration is an advantage to the birds.

_____

_____ **1**

(ii) Suggest a reason why the periods of torpor are longer in the summer than the winter.

_____

_____ **1**

(iii) Calculate the average period of torpor per month throughout the winter in Mexico.

Space for calculation

_____ hours per night **1**

(*c*) The **table** below shows how the average oxygen consumption of the birds at rest is affected by their body temperature.

Body temperature	*Average oxygen consumption at rest* (cm^3 per gram of body mass per hour)
Normal	15·0
Lowered during torpor	2·0

Using information from the **chart** and the **table**, calculate the average volume of oxygen consumed per hour by a hummingbird at the end of September at normal body temperature.

Space for calculation

_____ cm^3 **1**

(*d*) Give the advantage to rufous hummingbirds of territorial behaviour.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. At the start of an investigation, the blood glucose and insulin concentrations of a healthy adult human were measured and found to be normal. The individual then immediately drank a glucose drink and his blood glucose and insulin levels were re-measured at intervals over a period of 5 hours without further food or drink intake.

The results are shown in the table below.

Time after glucose drink was taken (hours)	*Glucose concentration* (mg per 100 cm^3)	*Insulin concentration* (units)
0 (start)	80	50
0·5	90	550
1	120	500
2	100	400
3	80	100
4	80	50
5	70	45

(*a*) Calculate the simplest whole number ratio of blood glucose concentration at the start to the maximum level recorded.

Space for calculation

_____ at start : _____ at maximum level **1**

(*b*) Calculate how long it took for blood insulin concentration to return to the start level from its maximum concentration.

Space for calculation

_____ hours **1**

(*c*) Give **two** reasons to account for the decrease in blood glucose concentration between 1 and 3 hours.

1 _____

_____

2 _____

_____ **2**

(*d*) Predict how the individual's blood glucagon concentration will change after 5 hours assuming no further intake of food or drink. Explain the importance of this.

Prediction _____

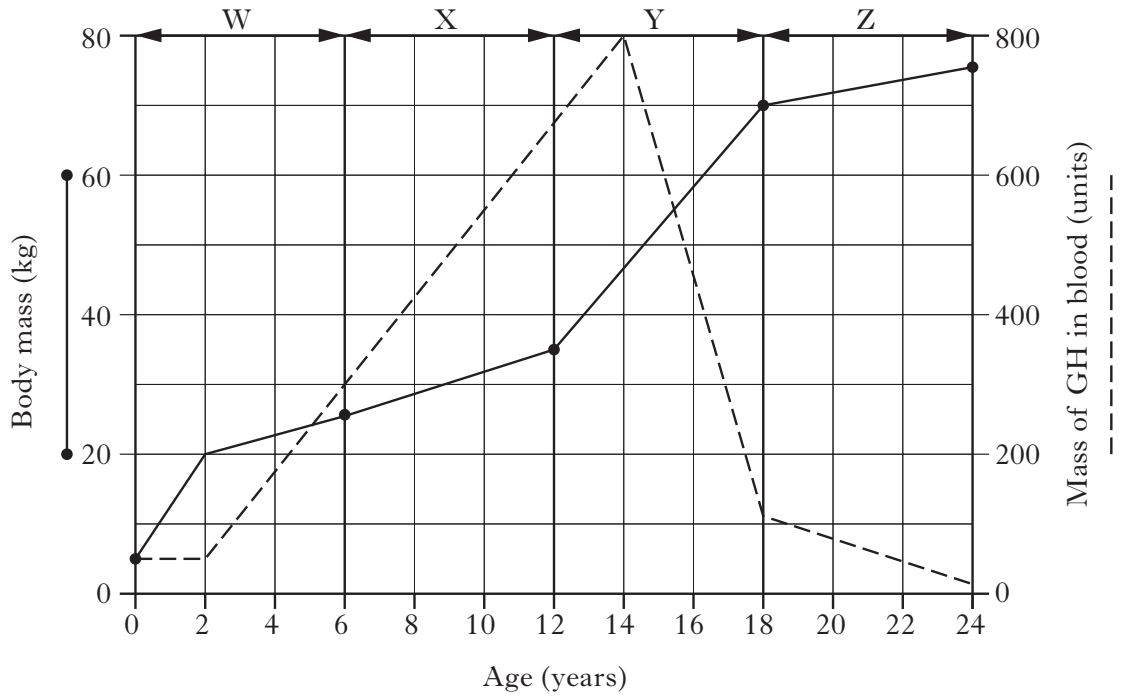
Explanation _____

_____ **2**

DO NOT WRITE IN THIS MARGIN

Marks

12. (*a*) The graph below shows the changes in body mass and mass of growth hormone (GH) in the blood of a human from birth to age 24 years.



(i) Tick (✓) the box to show the age range during which the most rapid increase in body mass occurred.

0–2 years	2–12 years	12–18 years	18–24 years
☐	☐	☐	☐

1

(ii) An increase in growth hormone (GH) causes an increase in mass of muscle and bone tissues.

Tick (✓) the box to show the region of the graph which **best** supports this statement.

W	X	Y	Z
☐	☐	☐	☐

1

(iii) Factors other than growth hormone (GH) are involved in increases in body mass in humans.

Describe how the graph supports this statement.

_____

_____ **1**

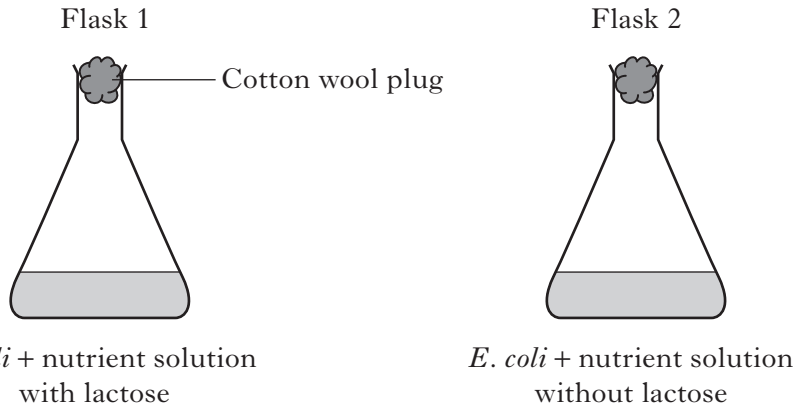
(*b*) Name the site of the production of growth hormone (GH) in humans.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

13. In an experiment to investigate the Jacob-Monod hypothesis of lactose metabolism in *E. coli*, flasks were set up as shown in the diagram below.



E. coli breaks down lactose using the enzyme β–galactosidase as shown.

$$\text{Lactose} \xrightarrow{\beta\text{–galactosidase}} \text{glucose + galactose}$$

(*a*) (i) β–galactosidase was produced in **Flask 1**.

Describe events which led to the production of this enzyme.

_____

_____

_____

_____ **2**

(ii) β–galactosidase was **not** produced in **Flask 2**.

Explain the advantage to *E. coli* of **not** producing the enzyme in this case.

_____

_____ **1**

(*b*) ONPG is a colourless substance which is converted to a yellow product by β–galactosidase.

Use this information to describe how ONPG could be used to show that *E. coli* only produced β–galactosidase in the presence of lactose.

_____

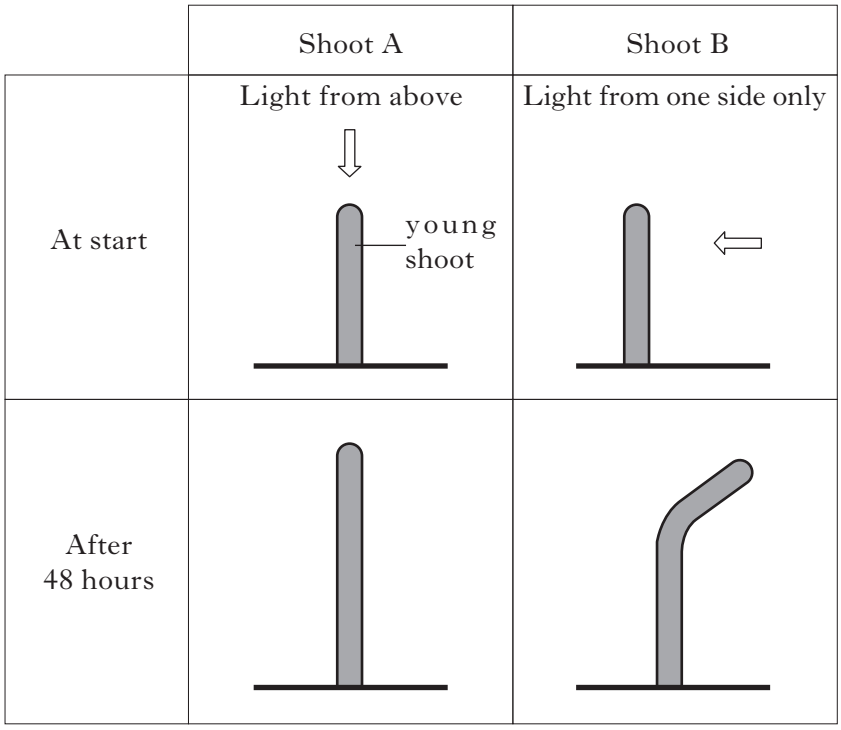
_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

14. In an investigation, young plant shoots were exposed to 48 hours of light from above or from one side only.

Their growth responses are shown in the diagrams below.



(*a*) Name the response shown by the shoots and explain the advantage of this response to the plants.

Name _____ **1**

Advantage _____

_____ **1**

(*b*) (i) Light from one side causes elongating cells to receive an uneven distribution of a growth substance produced by the shoot tip.

Use this information to explain the growth response of **shoot B** after 48 hours.

_____

_____

_____ **2**

(ii) Name the growth substance produced by the shoot tip which is involved in this growth response to light.

_____ **1**

[Turn over for SECTION C on *Page thirty-two*

Marks

SECTION C

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. Write notes on photosynthesis under the following headings:

(i) role of light and photosynthetic pigments; **4**

(ii) light dependent stage. **6**

(10)

OR

B. Write notes on proteins under the following headings:

(i) translation of mRNA in protein synthesis; **7**

(ii) the types and functions of protein. **3**

(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 regulation of blood water content in mammals following a decrease in blood water concentration. **(10)**

OR

B. Give an account of the process of succession in plant communities and the reasons for monitoring wild populations. **(10)**

[*END OF QUESTION PAPER*]

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SPACE FOR ANSWERS

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ADDITIONAL GRAPH PAPER FOR QUESTION 4 (*b*)