FOR OFFICIAL USE

Total for Sections B and C

X007/301

NATIONAL QUALIFICATIONS 2009

THURSDAY, 28 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 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

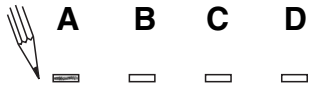
A calorimeter

B respirometer

C klinostat

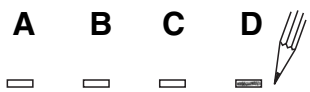
D gas burette.

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 of the following is **not** surrounded by a membrane?

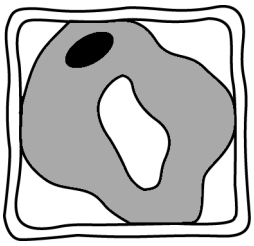
A Nucleus

B Ribosome

C Chloroplast

D Mitochondrion

2. The diagram below shows a plant cell which has been placed in a salt solution.



Which line in the table describes correctly the salt solution and the state of the plant cell?

	Salt solution	*State of cell*
A	hypertonic	plasmolysed
B	hypertonic	turgid
C	hypotonic	flaccid
D	hypotonic	plasmolysed

3. Thin sections of beetroot and rhubarb tissue were immersed in the same sucrose solution for the same time. This resulted in the plasmolysis of 0% of the beetroot cells and 20% of the rhubarb cells.

Which of the following statements can be deduced from these results?

A The sucrose solution was hypertonic to the beetroot cells.

B The sucrose solution was hypotonic to the rhubarb cells.

C The contents of the beetroot cells were hypotonic to the contents of the rhubarb cells.

D The contents of the rhubarb cells were hypotonic to the contents of the beetroot cells.

4. The total sunlight energy landing on an ecosystem is 4 million kilojoules per square metre (kJm^{-2}). Four percent of this is fixed during photosynthesis and five percent of this fixed energy is passed on to the primary consumers. What is the energy intake of the primary consumers?

A 800 kJm^{-2}

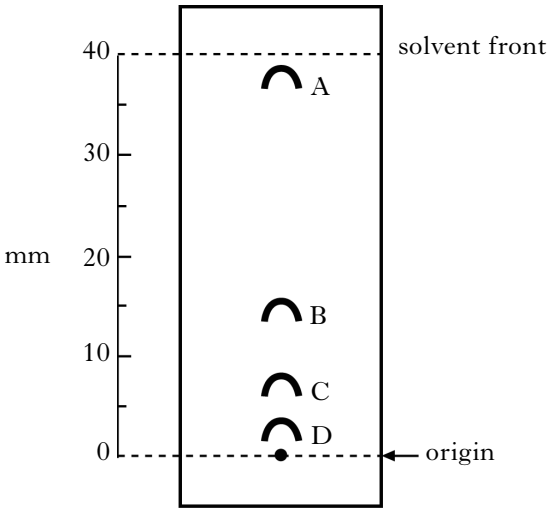
B 8000 kJm^{-2}

C 20 000 kJm^{-2}

D 360 000 kJm^{-2}

5. The diagram below shows a chromatogram of four plant pigments.

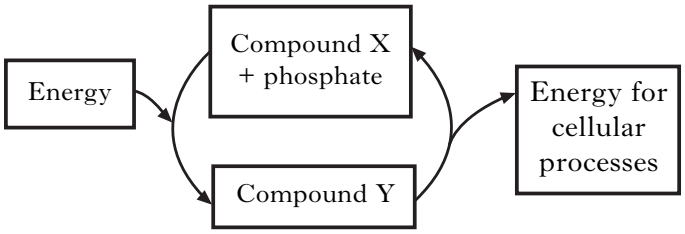
The R_f value of each is calculated by dividing the furthest distance the pigment has moved, by the distance the solvent has moved from the origin.



Which pigment has an R_f value closest to 0·4?

[Turn over

6. The diagram below shows energy transfer within a cell.



Which line in the table below identifies correctly compounds X and Y?

	X	*Y*
A	glucose	ATP
B	glucose	ADP
C	ADP	ATP
D	ATP	glucose

7. Which line in the table below shows correctly the sites of stages in aerobic respiration?

	Glycolysis	*Krebs Cycle*	*Cytochrome System*
A	Cristae of Mitochondrion	Matrix of Mitochondrion	Cytoplasm
B	Cytoplasm	Cristae of Mitochondrion	Matrix of Mitochondrion
C	Cytoplasm	Matrix of Mitochondrion	Cristae of Mitochondrion
D	Matrix of Mitochondrion	Cytoplasm	Cristae of Mitochondrion

8. Which of the following is **not** composed of amino acids?

A Glucagon

B Collagen

C Amylase

D Cellulose

9. The table below refers to the mass of DNA in certain human body cells.

Cell type	*Mass of DNA in cell* ($\times 10^{-12}$ g)
liver	6·6
lung	6·6
P	3·3
Q	0·0

Which of the following is most likely to identify correctly cell types P and Q?

	P	*Q*
A	kidney cell	sperm cell
B	sperm cell	mature red blood cell
C	mature red blood cell	sperm cell
D	nerve cell	mature red blood cell

10. Which line in the table below identifies correctly cellular defence mechanisms in plants which protect them against micro-organisms and herbivores?

	Defence against micro-organisms	*Defence against herbivores*
A	antibodies	resins
B	tannins	cyanide
C	spines	cyanide
D	resins	antibodies

11. In poultry, males have two X chromosomes and females have one X chromosome and one Y chromosome.

The gene for feather-barring is sex-linked.

The allele for barred feathers is dominant to the allele for non-barred feathers.

A non-barred male is crossed with a barred female.

What ratio of offspring would be expected?

A 1 barred male : 1 barred female

B 1 non-barred male : 1 non-barred female

C 1 barred male : 1 non-barred female

D 1 non-barred male : 1 barred female

12. The table below shows some genotypes and phenotypes associated with a form of anaemia.

Genotype	*Phenotype*
AA	Unaffected
AS	Sickle cell trait
SS	Acute sickle cell anaemia

A person with sickle cell trait and an unaffected person have a child together.

What are the chances of the child having acute sickle cell anaemia?

A none

B 1 in 4

C 1 in 2

D 1 in 1

13. Which of the following statements refers to a gene mutation?

A A change in the chromosome number caused by non-disjunction.

B A change in the number of genes on a chromosome caused by duplication.

C A change in the structure of a chromosome caused by translocation.

D A change in the base sequence of DNA caused by substitution.

14. Polyploidy in plants may result from

A total spindle failure during meiosis

B hybridisation between varieties of the same species

C homologous chromosomes binding at chiasmata

D the failure of linked genes to separate.

15. Which of the following is an example of artificial selection?

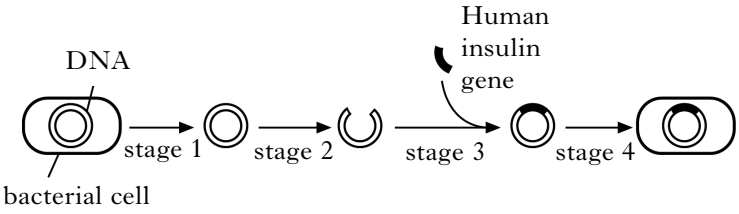
A Industrial melanism in moths

B DDT resistance in mosquitoes

C Increased milk yield in dairy cattle

D Decreasing effect of antibiotics on bacteria

16. The diagram below shows stages involved in the genetic engineering of bacteria to produce human insulin.



Which line in the table below shows the stages of this process in which endonuclease and ligase are involved?

	Stage involving endonuclease	*Stage involving ligase*
A	2	4
B	2	3
C	3	2
D	4	3

[Turn over

17. The statements below describe methods of maintaining a water balance in fish.

1 Salts actively absorbed by chloride secretory cells

2 Salts actively secreted by chloride secretory cells

3 Low rate of kidney filtration

4 High rate of kidney filtration

Which of these are used by **freshwater** bony fish?

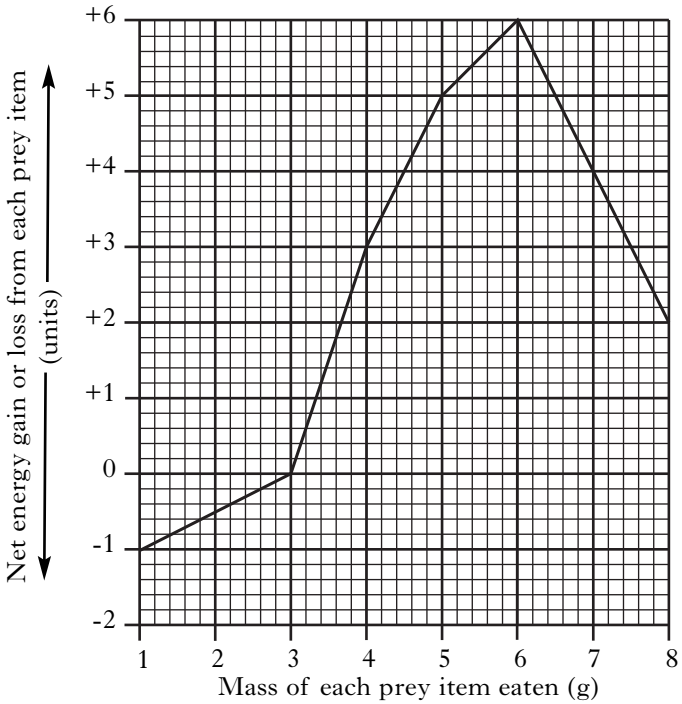
A 1 and 3 only

B 2 and 4 only

C 1 and 4 only

D 2 and 3 only

18. The graph below shows the net energy gain or loss from hunting and eating prey of different masses.



It can be concluded from the graph that

A prey between 1 g and 3 g are rarer than prey between 3 g and 6 g

B hunting and eating prey above 6 g involves a net energy loss

C prey of 8 g contain less energy than prey of mass 6 g

D hunting and eating prey below 3 g involves a net energy loss.

19. Which of the following statements about habituation is correct?

A It is a temporary change in behaviour.

B It occurs only in young animals.

C It is a social mechanism for defence.

D It is a permanent change in behaviour.

20. Some animal species live in social groups for defence.

Which of the following statements describes a change which could result from an increase in the size of such a social group?

A Individuals are able to spend less time feeding.

B There are fewer times when more than one animal is looking for predators.

C Each animal can spend more time looking for predators than foraging.

D Individuals are able to spend less time looking for predators.

21. Phenylketonuria is a condition that results from

A differential gene expression

B chromosome non-disjunction

C a vitamin deficiency

D an inherited gene mutation.

22. The plant growth substance indole acetic acid (IAA) is of benefit to humans because it can function

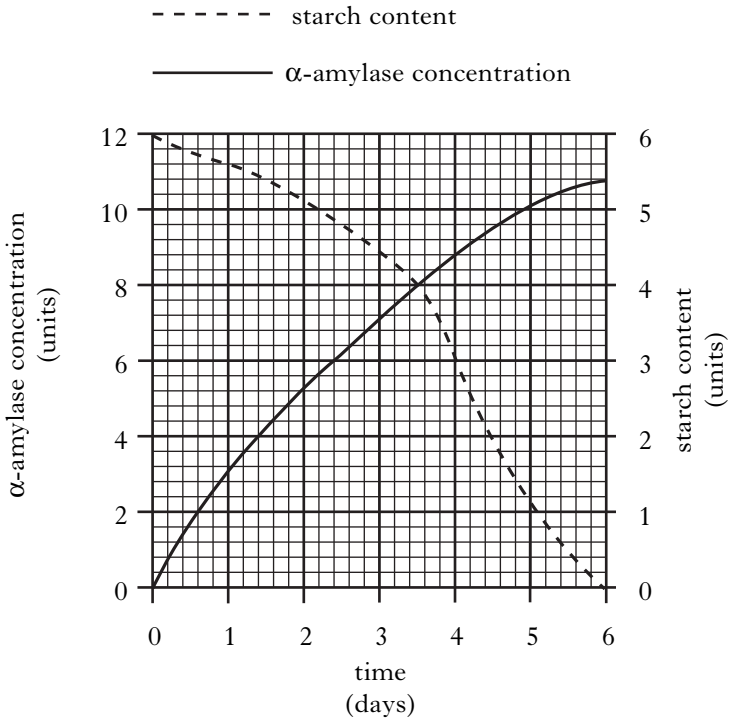
A as a herbicide and to break dormancy

B as a herbicide and as a rooting powder

C in the germination of barley and to break dormancy

D as a rooting powder and in the germination of barley.

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



What is the α-amylase concentration when the starch content has decreased by 50%?

A 4·4 units

B 6·0 units

C 8·2 units

D 8·8 units

24. A species of plant was exposed to various periods of light and dark, after which its flowering response was observed.

The results are shown below.

Light period (hours)	*Dark period* (hours)	*Flowering response*
4	12	flowering
4	10	flowering
6	18	maximum flowering
14	10	flowering
18	9	no flowering
18	6	no flowering
18	10	flowering

What appears to be the critical factor which stimulates flowering?

A A minimum dark period of 10 hours

B A light/dark cycle of at least 24 hours

C A light period of less than 18 hours

D A dark period which exceeds the light period

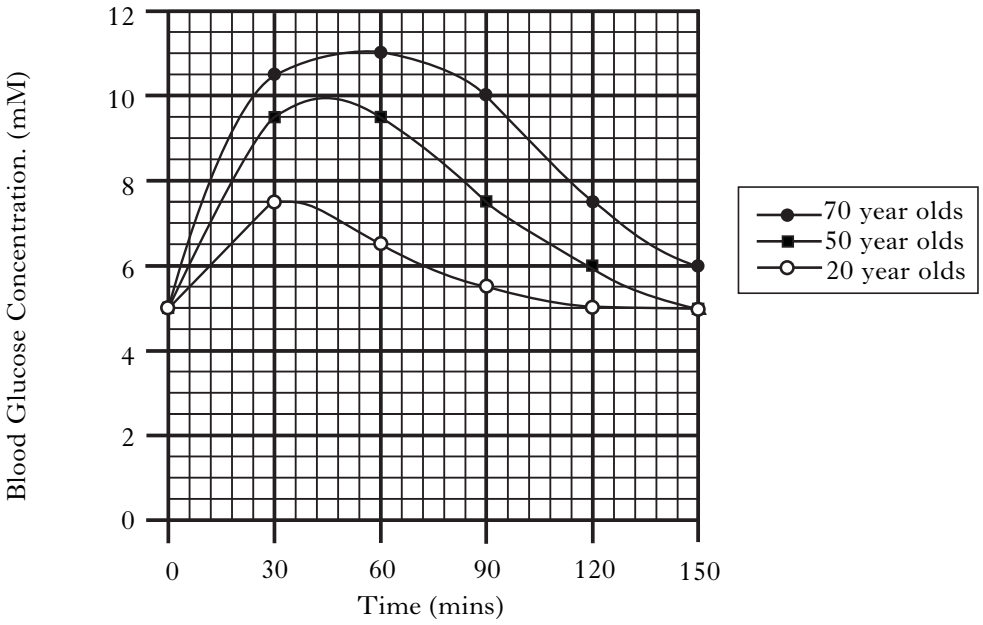
25. When there is a decrease in the water concentration of the blood, which of the following series of events shows the negative feedback response of the body?

	Concentration of ADH	*Permeability of kidney tubules*	*Volume of urine*
A	increases	increases	increases
B	decreases	decreases	increases
C	increases	increases	decreases
D	decreases	increases	decreases

[Turn over

26. High levels of blood glucose can cause clouding of the lens in the human eye. Concentrations above 5·5 mM are believed to put the individual at a high risk of lens damage.

In an investigation, people of different ages each drank a glucose solution. The concentration of glucose in their blood was monitored over a number of hours. The results are shown in the graph below.



For how long during the investigation did 20 year olds remain above the high risk blood glucose concentration?

A 84 mins

B 90 mins

C 120 mins

D 148 mins

27. Which of the following shows correct responses to changes in sugar concentration in the blood?

	Sugar concentration in blood	*Glucagon secretion*	*Insulin secretion*	*Glycogen stored in liver*
A	increases	decreases	increases	increases
B	increases	decreases	increases	decreases
C	decreases	increases	decreases	increases
D	decreases	decreases	increases	decreases

28. A person produces 0·75 litres of urine in 24 hours. This urine contains 18 g of urea.

What is the concentration of urea in this urine?

A $1{\cdot}0\ g/100\ cm^3$

B 2·4 g/litre

C $2{\cdot}4\ g/100\ cm^3$

D $3{\cdot}6\ g/100\ cm^3$

29. The list below describes changes involved in temperature regulation.

List

1 Increased vasodilation

2 Decreased vasodilation

3 Hair erector muscles contract

4 Hair erector muscles relax

Which of these are responses to cooling in mammals?

A 1 and 3 only

B 1 and 4 only

C 2 and 3 only

D 2 and 4 only

30. Which line in the table below shows correctly the main source of body heat and the method of controlling body temperature in an ectotherm?

	Main source of body heat	*Method of controlling body temperature*
A	Respiration	Physiological
B	Respiration	Behavioural
C	Absorbed from environment	Physiological
D	Absorbed from environment	Behavioural

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

[Turn over

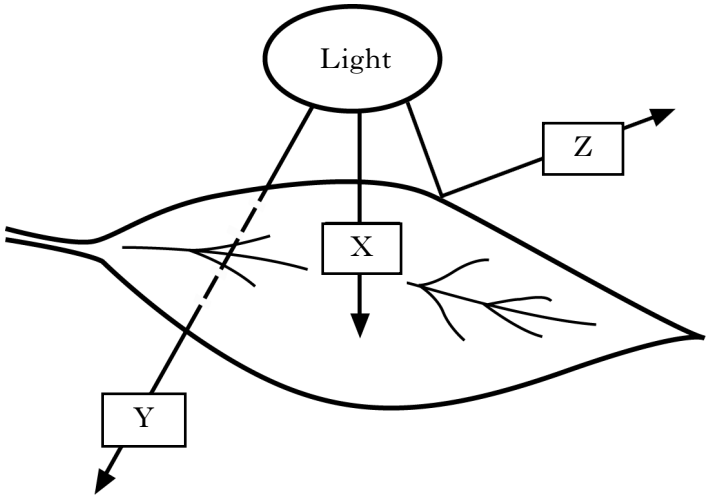
Marks

SECTION B

All questions in this section should be attempted.

All answers must be written clearly and legibly in ink.

1. (*a*) The diagram below shows light striking a green leaf.



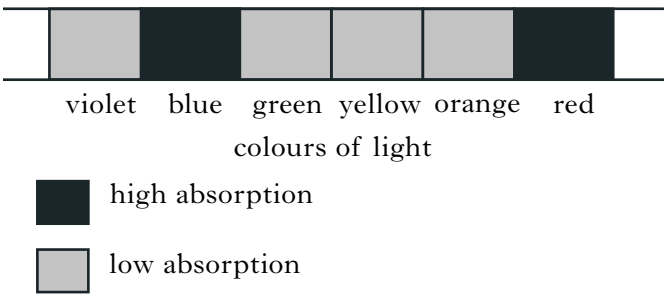
Arrow X shows light being absorbed.

State the terms used to describe what is happening to light at Y and Z.

Y _____

Z _____ **1**

(*b*) The diagram below represents the absorption of different colours of light by a photosynthetic pigment.



(i) Name this photosynthetic pigment.

_____ **1**

(ii) State the role of accessory pigments in photosynthesis.

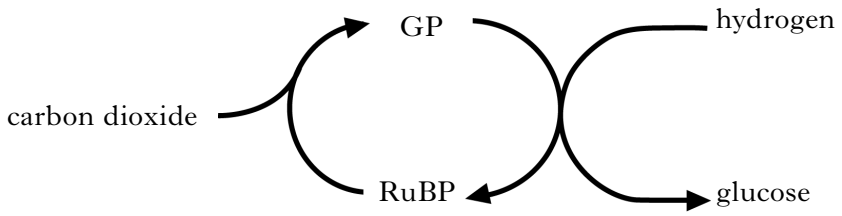
_____

_____ **1**

Marks

1. (continued)

(*c*) The diagram below shows an outline of the carbon fixation stage of photosynthesis.



(i) State the exact location of this stage in a plant cell.

_____ **1**

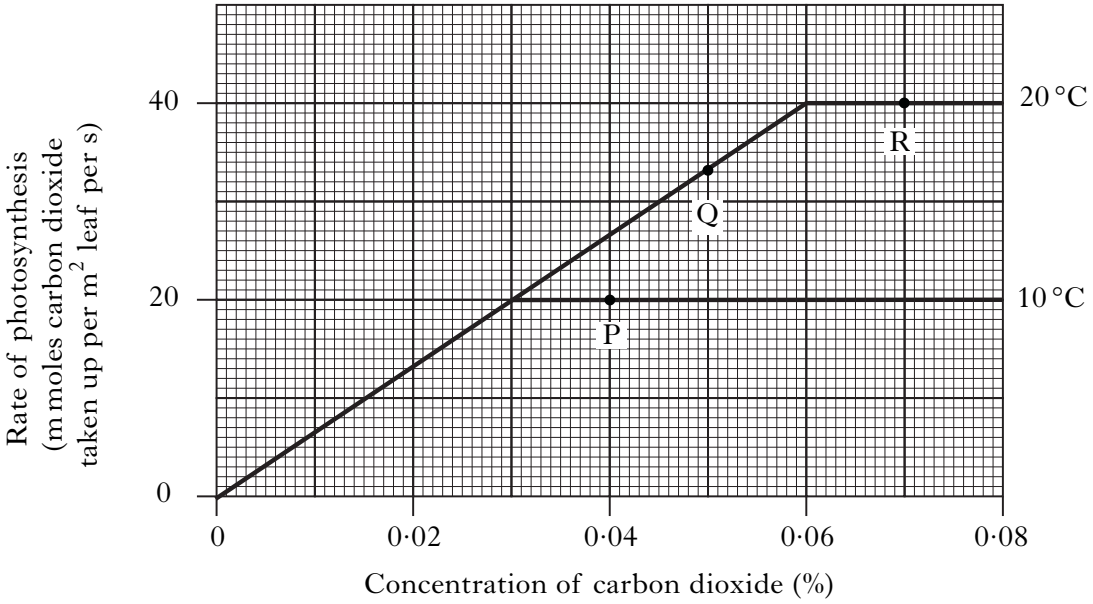
(ii) Describe the role of hydrogen in the carbon fixation stage.

_____

_____ **1**

(*d*) The graph below shows the effect of increasing the concentration of carbon dioxide on the rate of photosynthesis by a plant at different temperatures.

Light intensity was kept constant.



Using the information in the graph, identify the factor which is limiting the rate of photosynthesis at each of the points P, Q and R.

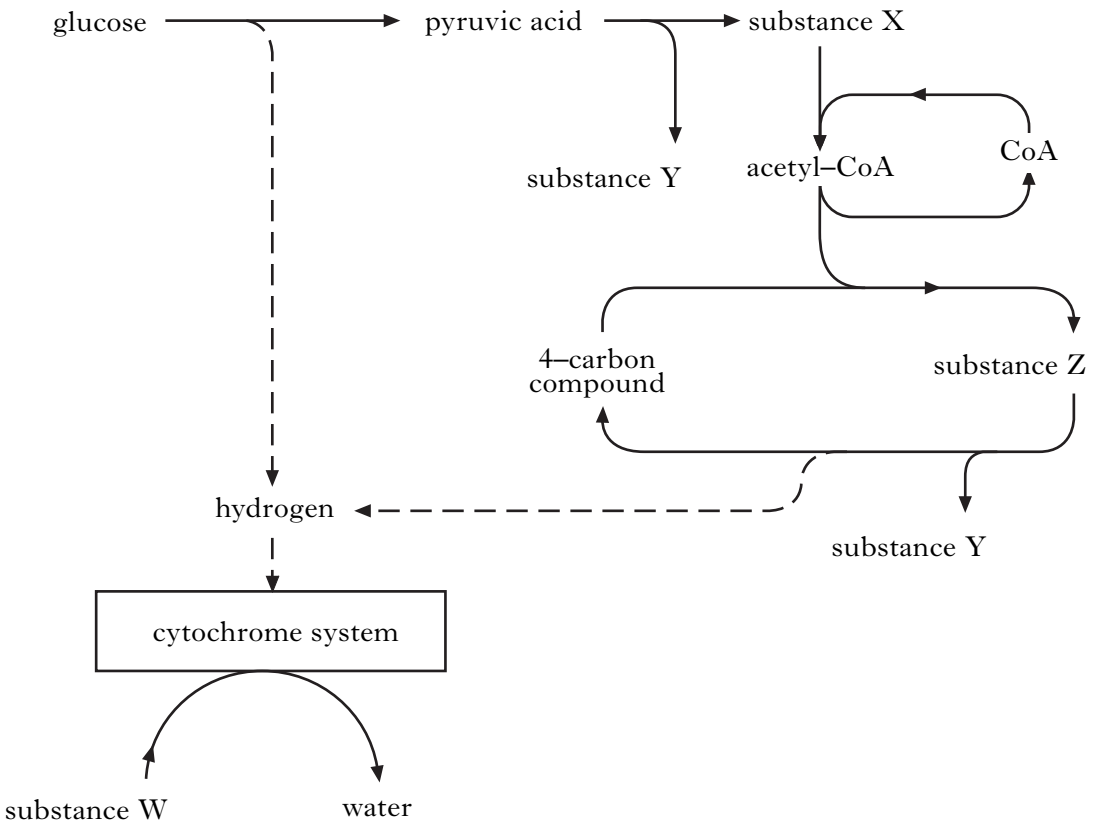
P _____

Q _____

R _____ **2**

Marks

2. (*a*) The diagram below shows some of the steps in respiration.



(i) Complete the table below by naming substances W, X and Y.

Substance	*Name*
W	
X	
Y	

2

(ii) State the number of carbon atoms present in a molecule of substance Z.

_____

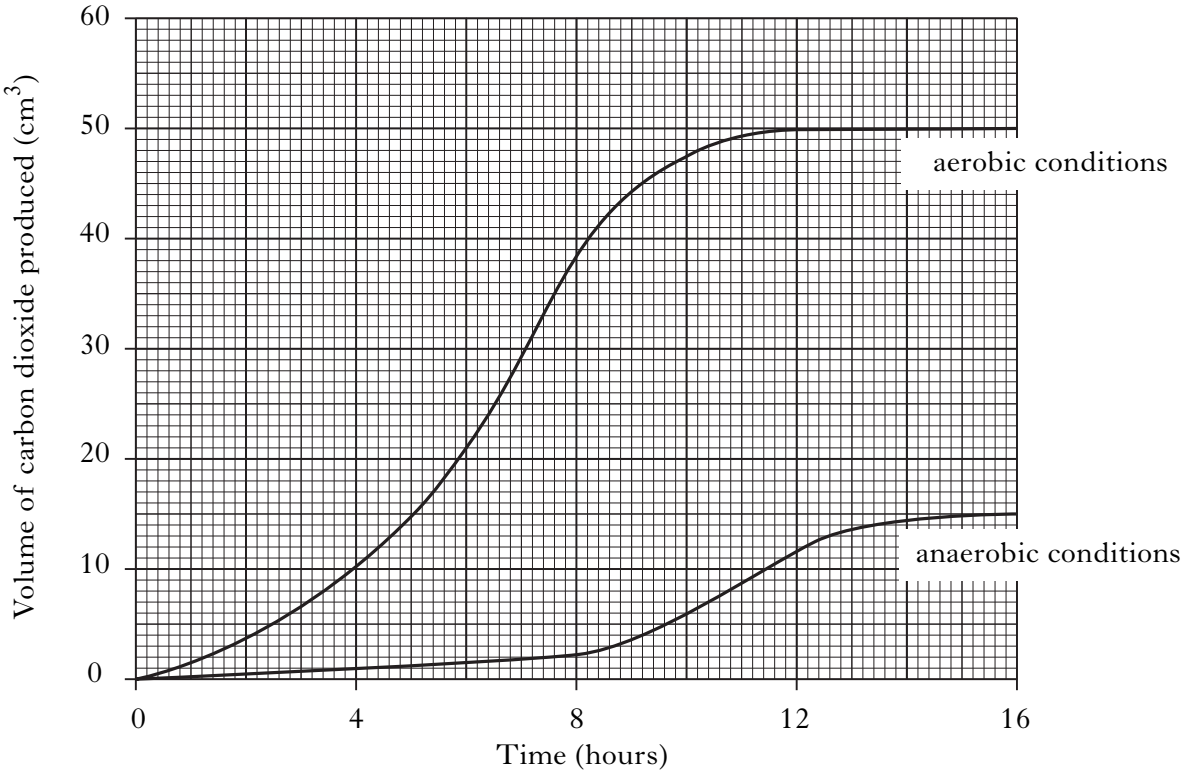
1

Marks

2. (continued)

(*b*) Yeast cells were grown in both aerobic and anaerobic conditions and the volume of carbon dioxide produced was measured.

The results are shown in the graph below.



(i) At which time is there the greatest difference between the volumes of carbon dioxide produced in aerobic and anaerobic conditions?

Tick (✓) the correct box.

☐ 8 hours ☐ 10 hours ☐ 12 hours ☐ 14 hours ☐ 16 hours **1**

(ii) Calculate the average rate of carbon dioxide production per hour over the first 6 hours in aerobic conditions.

Space for calculation

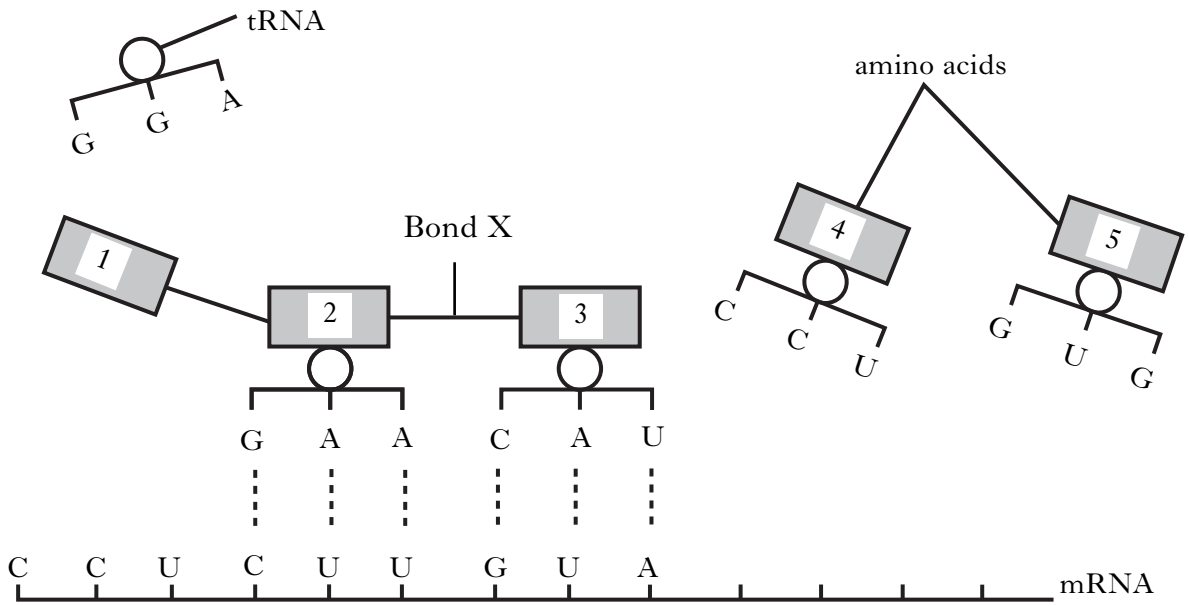
_____ cm^3 per hour **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

3. (*a*) The diagram below shows one stage in the synthesis of a protein at a ribosome.



(i) Name this stage in protein synthesis.

_____ **1**

(ii) Name bond X.

_____ **1**

(iii) The table below shows five codons and their corresponding amino acids.

Codon	*Amino acid*
CUU	leucine
GGA	glycine
CAA	glutamic acid
GUA	valine
CCU	proline

Use information from the table to identify amino acids 1 and 4.

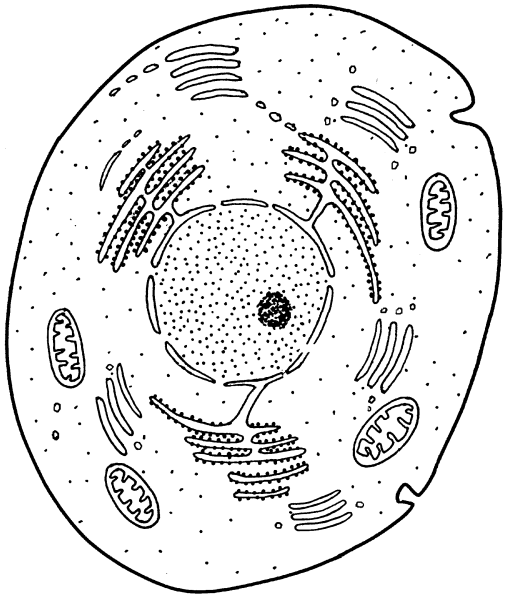
1 _____

4 _____ **1**

3. (continued)

Marks

(*b*) The diagram below shows a cell from the pancreas.

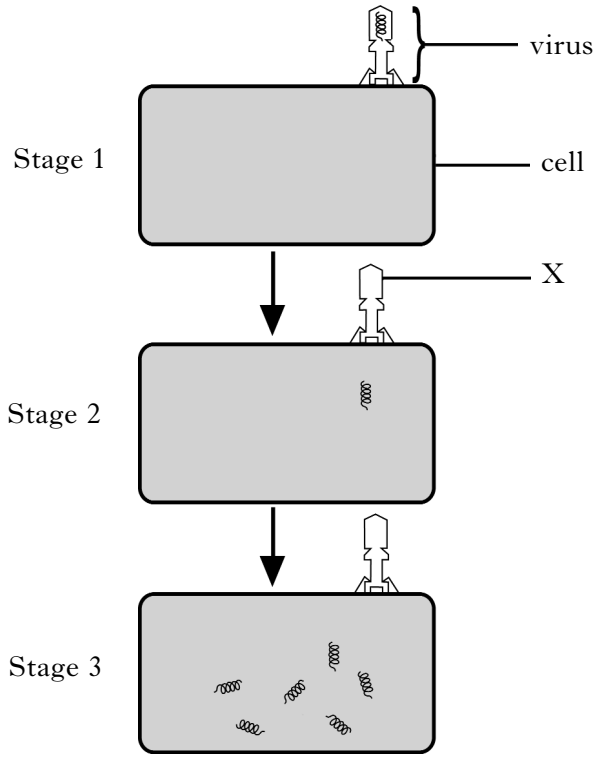


What feature of this cell shows that it is involved in the secretion of protein?

_____ **1**

[Turn over

4. (*a*) The diagram below shows some stages during the invasion of a cell by a virus. *Marks*



(i) Name the substance of which part X is composed.

_____ **1**

(ii) Describe what happens in the cell between stage 2 and stage 3 to allow the viral nucleic acid to replicate.

_____

_____ **1**

(iii) Describe **two** events which occur between stage 3 and the bursting of the cell to release new viruses.

1 _____

_____

2 _____

_____ **2**

4. (continued)

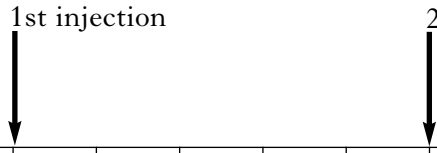
Marks

(*b*) The presence of viruses in the human body triggers antibody production by lymphocytes.

(i) What name is given to any substance that triggers this response?

_____ **1**

(ii) A person was injected with a vaccine on day 1 and again on day 36 of a 70 day study. The table below shows the concentration of antibodies to this vaccine in this person's blood at the end of each 7 day period during the study.



Day	7	14	21	28	35	42	49	56	63	70
Concentration of antibody (mg/100 ml blood)	3	15	28	32	10	80	102	112	120	118

1 How many times greater was the maximum antibody concentration following the second injection compared with the maximum concentration following the first?

Space for calculation

_____ times **1**

2 The second injection caused a higher concentration of antibody to be produced than the first injection.

Identify **two** other differences in the response to the second injection.

1 _____

2 _____ **1**

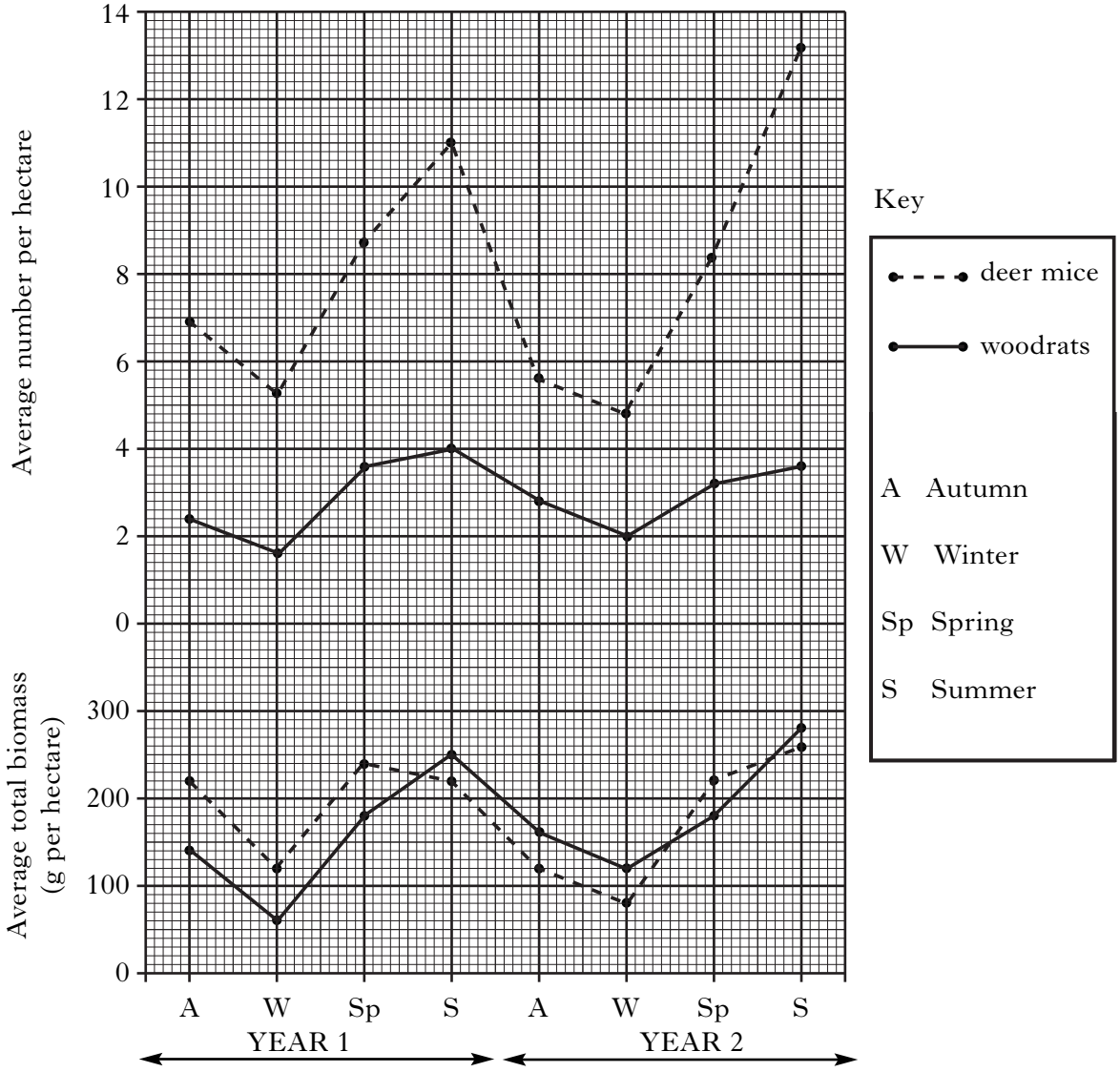
[Turn over

5. Mexican spotted owls are territorial and prey on several species of small mammal. Three pairs of owls were studied over a two year period. *Marks*

The table below shows the number of each prey species eaten by each pair of owls.

Prey species	*Number of each prey species eaten by each pair of owls*		
	Owl pair A	*Owl pair B*	*Owl pair C*
deer mouse	484	528	515
woodrat	29	144	141
brush mouse	15	114	118
rock squirrel	22	24	23

The graph below shows the average number and average total biomass of deer mice and woodrats living in the study area in different seasons.



(*a*) (i) What percentage of the total number of prey eaten by owl pair A were deer mice?

Space for calculation

_____ % **1**

5. (*a*) (continued)

Marks

(ii) Express as the simplest whole number ratio the numbers of deer mice, brush mice and rock squirrels eaten by owl pair B.

Space for calculation

deer mice	:	brush mice	:	rock squirrels	
_____	:	_____	:	_____	**1**

(*b*) Use evidence from the table to identify the owl pair that foraged in a different habitat to the other two pairs of owls.

Justify your answer.

Pair _____

Justification _____

_____

_____ **1**

(*c*) (i) **Use values from the graph** to describe the change in average number of woodrats per hectare from spring of Year 1 until spring of Year 2.

_____

_____ **2**

(ii) Calculate the percentage decrease in the average total biomass of woodrats between summer of Year 1 and winter of Year 2.

Space for calculation

_____ % **1**

(*d*) Calculate the average biomass of one deer mouse in summer of Year 1.

Space for calculation

_____ g **1**

(*e*) The size of the territory of a pair of Mexican spotted owls is different in winter and summer. Give an explanation of this observation which can be supported by evidence from the graph.

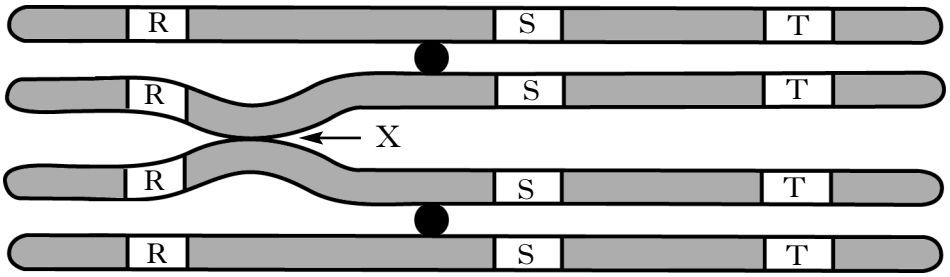
_____

_____

_____ **1**

Marks

6. The diagram below shows a pair of homologous chromosomes in a mouse cell during meiosis. The positions of three genes R, S and T are also shown.



(*a*) Name an organ in mice where meiosis occurs.

_____ **1**

(*b*) (i) Name point X where crossing over may occur.

_____ **1**

(ii) Crossing over leads to recombination of genes.

Between which two genes in the diagram would the greatest frequency of recombination take place?

_____ and _____ **1**

(iii) Crossing over is a source of genetic variation.

Name **one** other feature of meiosis which leads to genetic variation.

_____ **1**

(*c*) A mouse egg contains 20 chromosomes.

State the number of chromosomes present in a mouse gamete mother cell.

_____ chromosomes **1**

Marks

7. In Labrador dogs, the alleles **B** and **b** and alleles **E** and **e** are involved in the determination of coat colour.

- Labradors with alleles **B** and **E** are always black.
- Labradors with alleles **bb** and **E** are always chocolate coloured.
- Labradors with alleles **ee** are always yellow.

(*a*) A male black Labrador of genotype **BbEe** was crossed with a yellow female of the genotype **bbee**.

(i) Complete the table below to show the genotypes of the gametes of the male.

Genotypes of male gametes			

1

(ii) Give the expected phenotype ratio of the offspring from this cross.

Space for calculation

_____ Black : _____ Chocolate :_____ Yellow **1**

(*b*) Give the genotype of a male Labrador which could be crossed with a female of genotype **bbee** to ensure that **all** the offspring produced would be chocolate coloured.

Space for calculation

Genotype _____ **1**

[Turn over

Marks

8. Cuticles are waxy layers on the surfaces of the leaves of many plant species.

The table below shows the average cuticle thickness of the leaves of five plant species and the rates of water loss through their cuticles at 20 °C with no air movement.

Species	*Average cuticle thickness* (micrometres)	*Rate of water loss through cuticle* (cubic micrometres per cm^2 per hour)
A	1·4	36·7
B	2·8	25·8
C	4·2	18·1
D	5·6	8·5
E	7·0	8·4

(*a*) (i) Describe the relationship between average cuticle thickness and rate of water loss through the cuticles in these plant species.

_____

_____

_____ **2**

(ii) Leaves lose most water through their open stomata.

Give the term used to describe the condition of the guard cells when stomata are open.

_____ **1**

(iii) State **two** changes to environmental conditions which could lead to an increase in water loss from leaves.

1 _____

2 _____ **1**

Marks

8. (continued)

(*b*) Plants which grow in extremely dry conditions have leaf adaptations which reduce water loss.

(i) Complete the table below to explain how each leaf adaptation reduces water loss.

Leaf adaptation	*Explanation of how the adaptation reduces water loss from leaves*
Presence of hairs on leaf surface	
Leaves small and few in number	

2

(ii) What term describes plants that have adaptations to reduce water loss?

_____ **1**

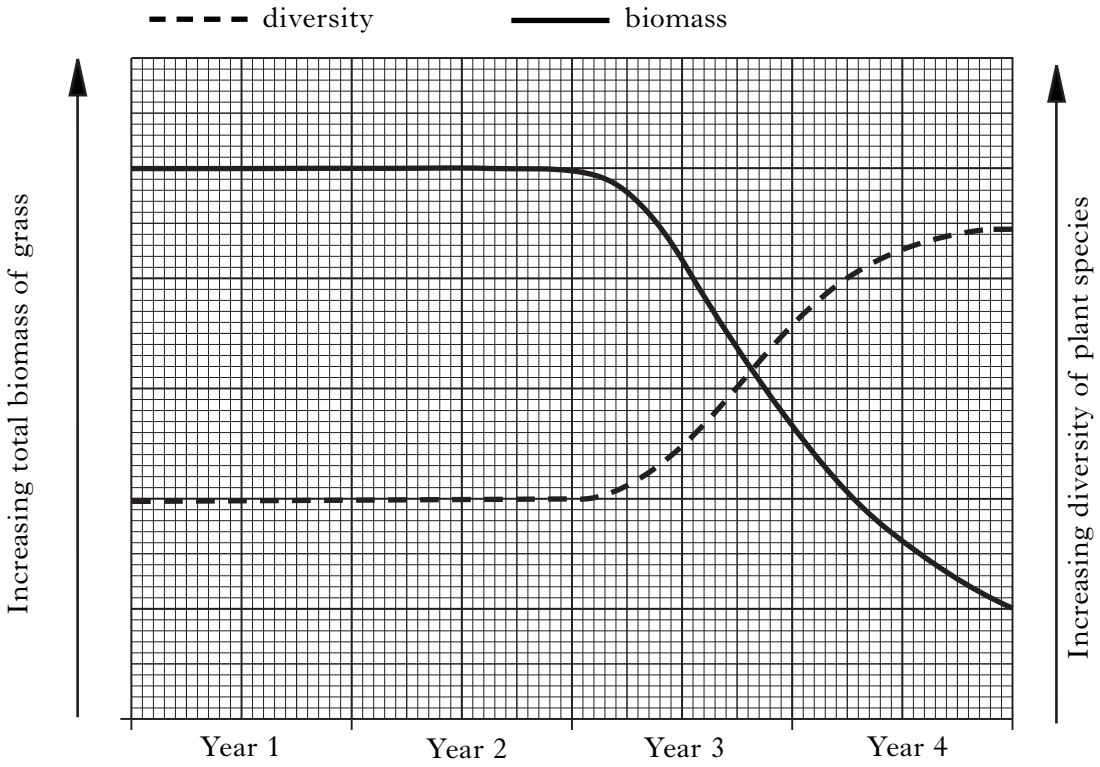
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

9. (*a*) In an investigation into the effects of grazing, the total biomass of grass species and the diversity of all plant species in a field was monitored over a period of four years. The field was not grazed in years 1 and 2. Sheep grazed the field in years 3 and 4.

The results are shown on the graph below.



(i) Explain the effects of grazing by sheep on the total biomass of grass species and the diversity of plant species during year 3.

Total biomass of grass species.

_____ **1**

Diversity of all plant species

_____

_____ **1**

(ii) The number of sheep grazing the field was increased after year 4. Suggest how this would affect the diversity of plant species in the field.

Justify your answer.

Effect on diversity

_____

Justification

_____

_____ **1**

Marks

9. (continued)

(*b*) The table below contains statements describing plant adaptations.

Complete the table by ticking (✓) the boxes to show the adaptations that help the plants tolerate the effects of grazing.

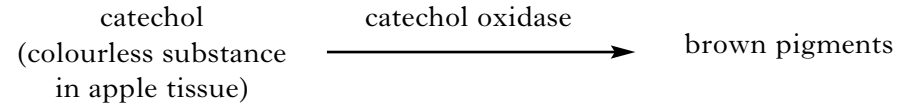
Plant adaptation	*Tick* (✓)
Dandelions have deep roots	
Wild roses have thorns	
Couch grass has underground stems	
Nettles have stings	
Tobacco plants produce nicotine	

2

[Turn over

Marks

10. Catechol oxidase is an enzyme found in apple tissue. It is involved in the reaction which produces the brown pigment that forms in cut or damaged apples.



The effect of the concentration of lead ethanoate on this reaction was investigated.

10 g of apple tissue was cut up, added to 10 cm^3 of distilled water and then liquidised and filtered. This produced an extract containing both catechol and catechol oxidase.

Test tubes were set up as described in **Table 1** and kept at 20 °C in a water bath.

Table 1

Tube	*Contents of tubes*
A	sample of extract + 1 cm^3 distilled water
B	sample of extract + 1 cm^3 0·01% lead ethanoate solution
C	sample of extract + 1 cm^3 0·1% lead ethanoate solution

Every 10 minutes, the tubes were placed in a colorimeter which measured how much brown pigment was present.

The more brown pigment present the higher the colorimeter reading.

The results are shown in **Table 2**.

Table 2

Time (minutes)	*Colorimeter reading* (units)		
	Tube A	*Tube B*	*Tube C*
	sample of extract + distilled water	*sample of extract + 0·01% lead ethanoate*	*sample of extract + 0·1% lead ethanoate*
0	1·6	1·8	1·6
10	7·0	5·0	2·0
20	9·0	6·0	2·2
30	9·6	6·4	2·4
40	10·0	7·0	2·4
50	10·0	7·6	2·4
60	10·0	7·6	2·4

(*a*) (i) Identify **two** variables not already mentioned that would have to be kept constant.

1 _____ **1**

2 _____ **1**

10. (*a*) (continued)

Marks

(ii) Describe how tube A acts as a control in this investigation.

_____

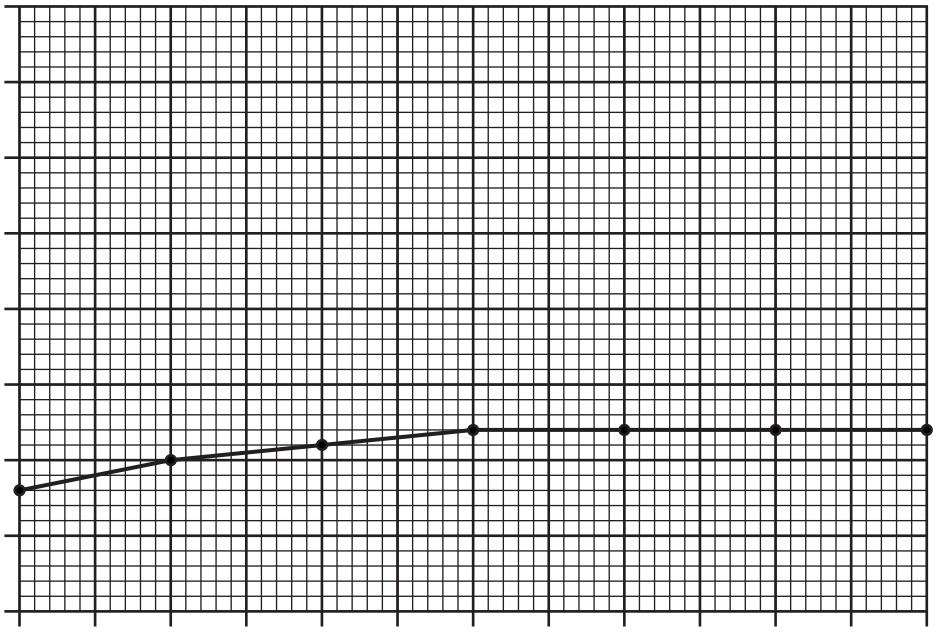
_____ **1**

(*b*) Explain why the initial colorimeter readings were not 0·0 units.

_____

_____ **1**

(*c*) The results for the extract with 0·1% lead ethanoate are shown in the graph below.



Use information from **Table 2** to complete the graph by:

(i) adding the scale and label to each axis; **1**

(ii) presenting the results for the extract + 0·01% lead ethanoate solution **and** labelling the line. **1**

(Additional graph paper, if required, will be found on page 40.)

(*d*) State the effect of the concentration of lead ethanoate solution on the activity of catechol oxidase.

_____

_____ **1**

(*e*) The experiment was repeated with the 0·1% lead ethanoate solution at 60 °C. Predict the colorimeter reading at 10 minutes and justify your answer.

Prediction _____ units

Justification _____

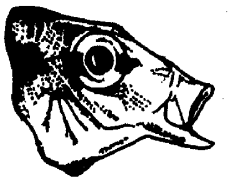
_____ **1**

Marks

11. Many species of cichlid fish are found in Lake Malawi in Africa.

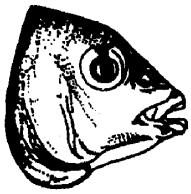
The diagram below shows the heads of three different cichlid fish and gives information on their feeding methods.

These species have evolved from a single species.



Sucks in microscopic organisms from the water

Scrapes algae from the surfaces of rocks



Crushes snail shells and extracts flesh

(*a*) Describe how the information given about these fish illustrates adaptive radiation.

_____

_____

_____ **2**

(*b*) What evidence would confirm that the cichlids are different species?

_____

_____ **1**

(*c*) The evolution of these cichlid fish has involved geographical isolation.

(i) Name another type of isolating mechanism.

_____ **1**

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

_____

_____ **1**

Marks

12. Diagram A shows a section through a woody stem. Diagram B shows a magnified view of the area indicated on the section.

Diagram A

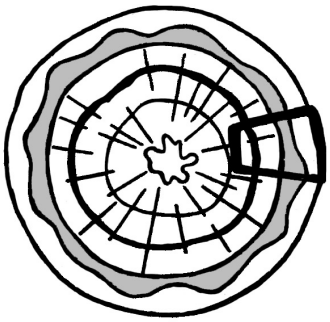
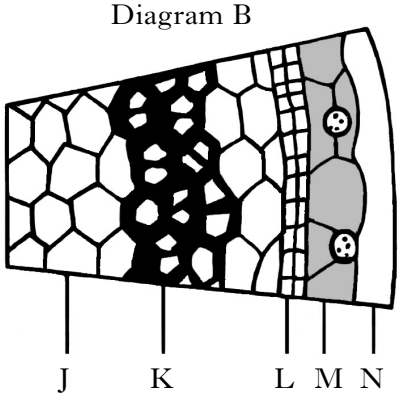


Diagram B



(*a*) Which letter on diagram B shows the position of a lateral meristem?

Letter _____ **1**

(*b*) Name the tissue of which annual rings are composed.

_____ **1**

(*c*) In which season was the woody stem cut?

Explain your choice.

Season _____ **1**

Explanation _____

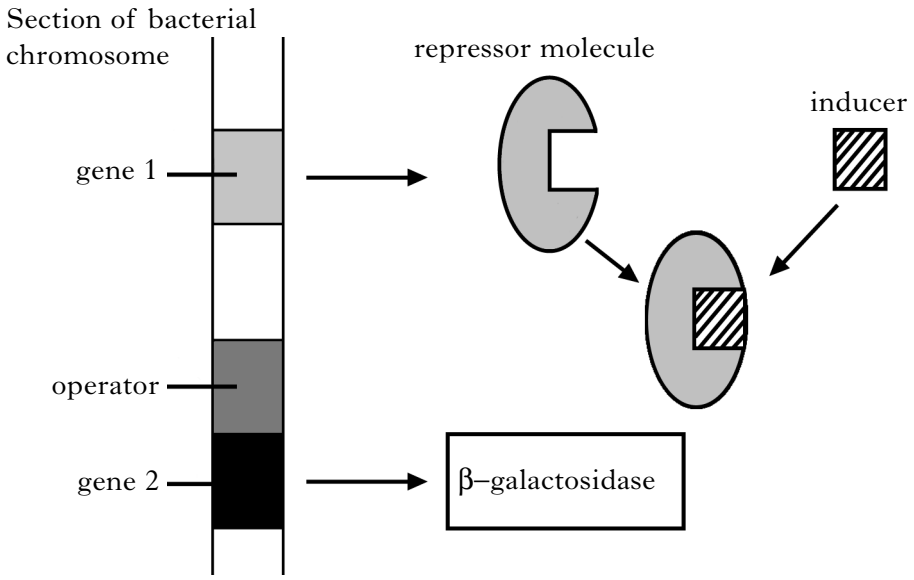
_____

_____ **1**

[Turn over

Marks

13. The diagram below shows information relating to the Jacob–Monod hypothesis of the control of gene action in the bacterium *Escherichia coli*.



(*a*) Name gene 1.

_____ **1**

(*b*) Name the substance which acts as the inducer.

_____ **1**

(*c*) (i) Describe the sequence of events that occurs in the **absence** of the inducer.

_____

_____

_____

_____ **2**

(ii) Explain why it is important for *E. coli* to control gene action.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

14. Environmental factors influence growth and development in animals.

(*a*) (i) Explain the importance of iron in the growth and development of humans.

_____

_____ **1**

(ii) Describe the effects of nicotine on growth and development of a human fetus.

_____

_____ **1**

(*b*) Breeding behaviour in red deer starts in autumn.

(i) Describe the environmental influence that triggers the start of breeding at this time of year.

_____

_____ **1**

(ii) Suggest an advantage to red deer of starting to breed at this time of year.

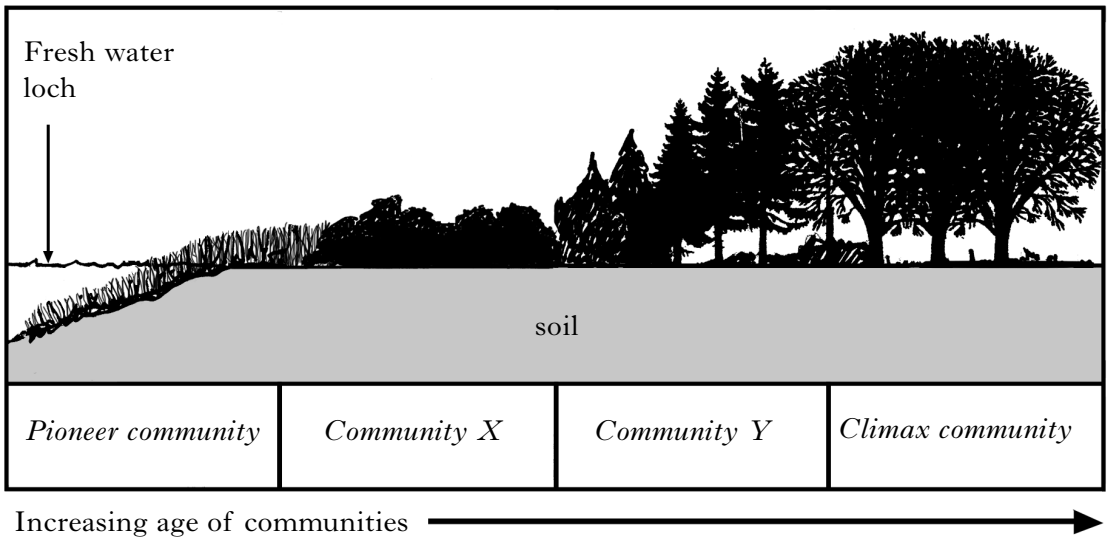
_____

_____ **1**

[Turn over

Marks

15. The diagram below shows the plant communities that have developed around a fresh water loch.



(*a*) What term describes the process of gradual formation of a climax community?

_____ **1**

(*b*) Suggest a modification that community X may make to its habitat which allows colonisation by community Y.

_____

_____ **1**

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

The complexity of the food web in the climax community will be

{ greater than / less than } that in the pioneer community.

Greater species diversity will exist in { community X / community Y } . **1**

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. Write notes on:

(i) structure of the plasma membrane; **4**

(ii) function of the plasma membrane in active transport; **3**

(iii) structure and function of the cell wall. **3**

(10)

OR

B. Write notes on :

(i) the structure of DNA; **6**

(ii) DNA replication and its importance. **4**

(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 importance of nitrogen, phosphorus and magnesium in plant growth and describe the symptoms of their deficiency. **(10)**

OR

B. Give an account of how animal populations are regulated by density-dependent and by density-independent factors. **(10)**

[*END OF QUESTION PAPER*]

[Turn over

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SPACE FOR ANSWERS

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ADDITIONAL GRAPH PAPER FOR QUESTION 10(*c*)