

FOR OFFICIAL USE

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**X007/301**

Total for  
Sections  
B and C

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NATIONAL  
QUALIFICATIONS  
2004

WEDNESDAY, 19 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.

**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 and rough work 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.
- 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.



## SECTION A

### Read carefully

- 1 Check that the answer sheet provided is for Biology Higher (Section A).
- 2 Fill in the details required on the answer sheet.
- 3 In this section a question is answered by indicating the choice A, B, C or D by a stroke made in **ink** in the appropriate place in the answer sheet—see the sample question below.
- 4 For each question there is only **one** correct answer.
- 5 Rough working, if required, should be done only on this question paper—or on the rough working sheet provided—**not** on the answer sheet.
- 6 At the end of the examination the answer sheet for Section A **must** be placed inside the front cover of this answer book.

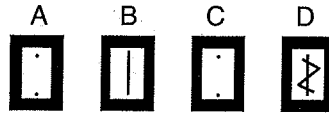
### Sample Question

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

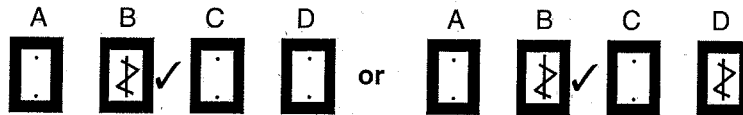
- A respirometer
- B calorimeter
- C klinostat
- D gas burette.

The correct answer is **B**—calorimeter. A **heavy** vertical line should be drawn joining the two dots in the appropriate box in the column headed **B** as shown in the example on the answer sheet.

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and put a vertical stroke in the box you now consider to be correct. Thus, if you want to change an answer D to an answer B, your answer sheet would look like this:



If you want to change back to an answer which has already been scored out, you should enter a tick (✓) to the **right** of the box of your choice, thus:



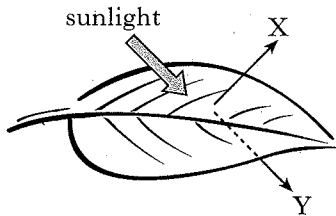
SECTION A

All questions in this section should be attempted.

Answers should be given on the separate answer sheet provided.

- Which of the following processes requires infolding of the cell membrane?
  - A Diffusion
  - B Phagocytosis
  - C Active transport
  - D Osmosis

- The diagram shows the fate of sunlight landing on a leaf.

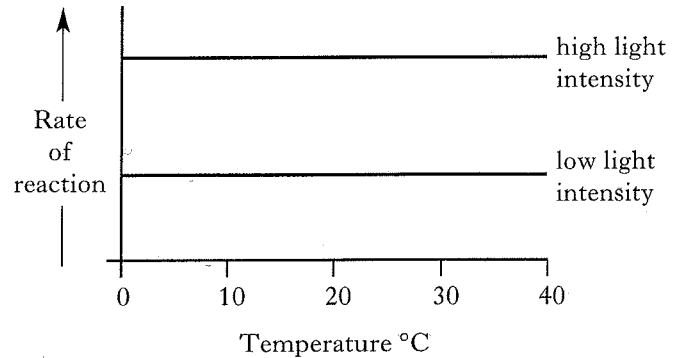


Which line in the table below identifies correctly the fate of sunlight represented by X and Y?

	X	Y
A	transmission	reflection
B	absorption	transmission
C	reflection	transmission
D	reflection	absorption

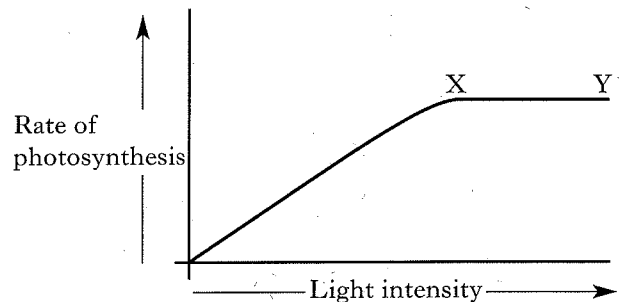
- Which of the following colours of light are mainly absorbed by chlorophyll a?
  - A Orange and violet
  - B Blue and red
  - C Blue and green
  - D Green and orange

- The graph shows the effect of temperature on the rate of reactions in the light dependent stage in photosynthesis.



From the graph, it may be deduced that

- A enzymes are not involved in controlling these reactions
  - B enzymes act most effectively at high intensities of light
  - C at the high intensity of light, carbon dioxide is the limiting factor
  - D the rate of the reaction increases with increase in temperature.
- The graph shows the effect of increasing light intensity on the rate of photosynthesis.



Two environmental factors which could limit the rate of photosynthesis between points X and Y are

- A light intensity and oxygen concentration
- B temperature and light intensity
- C temperature and carbon dioxide concentration
- D carbon dioxide concentration and light intensity.

6. In respiration, the sequence of reactions resulting in the conversion of glucose to pyruvic acid is called
- A the Krebs cycle
  - B the citric acid cycle
  - C glycolysis
  - D the cytochrome chain.

7. Which line in the table describes correctly both aerobic respiration and anaerobic respiration in human muscle tissue?

	<i>Aerobic Respiration</i>	<i>Anaerobic Respiration</i>
A	There is a net gain of ATP	Carbon dioxide is not produced
B	There is a net gain of ATP	Oxygen is required
C	Carbon dioxide is produced	There is a net loss of ATP
D	Lactic acid is formed	Ethanol is formed

8. Cyanogenesis in *Trifolium repens* is a defence mechanism against
- A water loss
  - B fungal infection
  - C bacterial invasion
  - D grazing.

9. A sex-linked gene carried on the X-chromosome of a man will be transmitted to
- A 50% of his male children
  - B 50% of his female children
  - C 100% of his male children
  - D 100% of his female children.

10. The inheritance of eye colour in *Drosophila* is sex-linked and the allele for red eyes (R) is dominant to the allele for white eyes (r).

The progeny of a cross were all red-eyed females and white-eyed males.

What were the genotypes of their parents?

- A  $X^rX^r$   $X^RY$
- B  $X^RX^r$   $X^RY$
- C  $X^RX^r$   $X^rY$
- D  $X^RX^R$   $X^rY$

11. Black coat colour in cocker spaniels is determined by a dominant gene (B) and red coat colour by its recessive allele (b). Uniform coat colour is determined by a dominant gene (F) and spotted coat colour by its recessive allele (f).

A male with a uniform black coat was mated to a female with a uniform red coat. A litter of six pups was produced, two of which had uniform black coat colour, two had uniform red coat colour, one had spotted black coat colour and one had spotted red coat colour.

The genotypes of the parents were

- A  $BBFf \times bbFf$
- B  $BbFf \times bbFF$
- C  $BbFf \times BbFf$
- D  $BbFf \times bbFf$ .

12. A tall plant with purple petals was crossed with a dwarf plant with white petals. The  $F_1$  generation were all tall plants with purple petals.

The  $F_1$  generation was self pollinated and produced 1600 plants.

Which line in the table identifies correctly the most likely phenotypic ratio in the  $F_2$  generation?

	<i>Tall purple</i>	<i>Tall white</i>	<i>Dwarf purple</i>	<i>Dwarf white</i>
A	870	325	305	100
B	870	0	0	730
C	400	400	400	400
D	530	260	270	540

13. The table below shows the percentage recombination frequencies for four genes present on the same chromosome.

<i>Gene pair</i>	<i>% recombination frequency</i>
P and Q	33
R and Q	40
R and S	32
P and R	7
Q and S	8

Which of the following represents the correct order of genes on the chromosome?

- A Q P S R  
 B P Q S R  
 C Q S P R  
 D P Q R S

14. Which of the following describes the term non-disjunction?

- A The failure of chromosomes to separate at meiosis.  
 B The independent assortment of chromosomes at meiosis.  
 C The exchange of genetic information at chiasmata.  
 D An error in the replication of DNA before cell division.

15. Which of the following is true of polyploid plants?

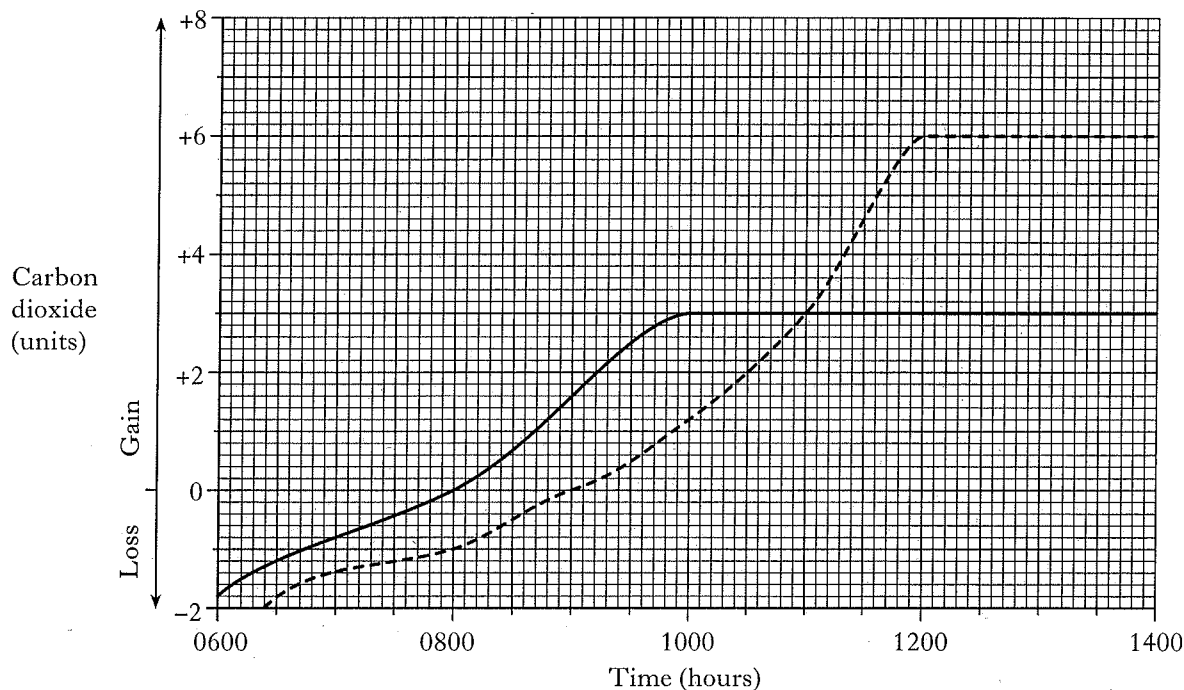
- A They have reduced vigour and the diploid chromosome number.  
 B They have increased vigour and the diploid chromosome number.  
 C They have reduced vigour and sets of chromosomes greater than the diploid chromosome number.  
 D They have increased vigour and sets of chromosomes greater than the diploid chromosome number.

16. Somatic fusion is a technique which is used to

- A fuse cells from different species of animal  
 B fuse cells from different species of plant  
 C transfer genetic information into a bacterium  
 D alter the genes carried on a plasmid.

[Turn over

17. The graph shows the carbon dioxide gain or loss in a shade plant and in a sun plant during part of a day in summer.



At what time does the shade plant reach compensation point?

- A 0800 hours
- B 0900 hours
- C 1000 hours
- D 1200 hours

18. The table shows water gain and loss in a plant on two consecutive days.

	Water gain (cm <sup>3</sup> )	Water loss (cm <sup>3</sup> )
First day	100	120
Second day	95	90

Conditions on the second day may have differed from conditions on the first day in some of the following ways.

- 1 Higher temperature
- 2 Lower windspeed
- 3 Lower humidity
- 4 Lower temperature

Which two conditions could account for the differences in water gain and loss from the first day to the second day?

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

19. Grass can survive despite being grazed by herbivores such as sheep and cattle. It is able to tolerate grazing because it

- A is a wind-pollinated plant
- B grows constantly throughout the year
- C possesses poisons which protect it from being eaten entirely
- D has very low growing points which send up new leaves when older ones are eaten.

20. When the intensity of grazing by herbivores increases in a grassland ecosystem, diversity of plant species may increase as a result.

Which statement explains this observation?

- A Few herbivores are able to graze on every plant species present.
- B Grazing stimulates growth in some plant species.
- C Vigorous plant species are grazed so weaker competitors can also thrive.
- D Plant species with defences against grazing are selected.
21. Which of the following describes an advantage of habituation to an animal?
- A The animal becomes very good at an action which is performed repeatedly.
- B An animal shows the same behaviour patterns as all those of the same species.
- C A particular response is learned very quickly.
- D Energy is not wasted in responding to harmless stimuli.
22. Which of the following examples of bird behaviour would result in reduced interspecific competition?
- A Great Tits with the widest stripe on their breast feed first when food is scarce.
- B Sooty Terns feed on larger fish than other species of tern which live in the same area.
- C Pelicans searching for food form a large circle round a shoal of fish, then dip their beaks into the water simultaneously.
- D Predatory gulls have difficulty picking out an individual puffin from a large flock.

23. The table shows the relative percentages by mass of the major chemical groups in a sample of human tissue.

The remaining percentage is made up of water.

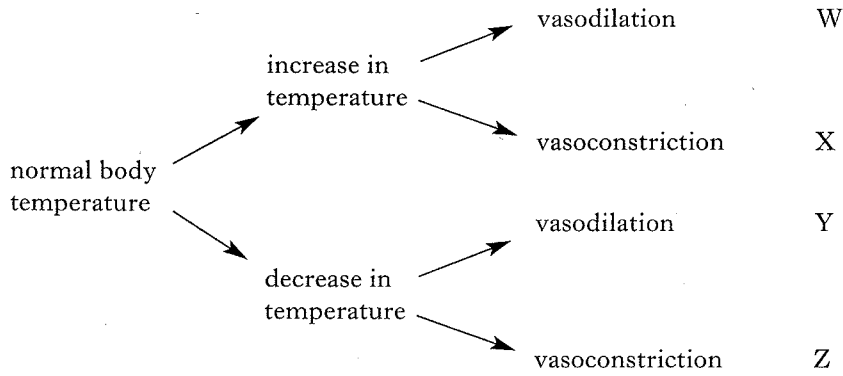
<i>Chemical group</i>	<i>%</i>
Carbohydrate	5
Protein	18
Lipid	10
Other organic material	2
Inorganic material	1

What mass of water is present in a 250 g sample of this tissue?

- A 64 g
- B 36 g
- C 90 g
- D 160 g

[Turn over

24. The diagram below shows the human body's responses to temperature change.



Which letters indicate negative feedback control of body temperature?

- A W and Y
- B W and Z
- C X and Y
- D X and Z

25. Muscle cells differ from nerve cells because
- A they contain different genes
  - B different genes are switched on during development
  - C the genetic code is different in each cell
  - D they have different chromosomes.
26. A deficiency of Vitamin D in humans leads to rickets as a result of poor absorption of
- A nitrate
  - B calcium
  - C iron
  - D phosphate.

27. Which line of the table identifies correctly the hormones which stimulate the inter-conversion of glucose and glycogen?

	<i>glucose → glycogen</i>	<i>glycogen → glucose</i>
A	insulin	glucagon and adrenaline
B	glucagon and insulin	adrenaline
C	adrenaline and glucagon	insulin
D	adrenaline	glucagon and insulin

28. Which line in the table describes body temperature in endotherms and ectotherms?

	<i>Regulated by metabolism</i>	<i>Regulated by behaviour</i>	<i>Varies with the environmental temperature</i>
A	ectotherm	endotherm	ectotherm
B	endotherm	ectotherm	endotherm
C	endotherm	ectotherm	ectotherm
D	ectotherm	endotherm	endotherm

29. Chlorophyll contains the metal ion

- A iron
- B copper
- C magnesium
- D calcium.



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

The results are shown below.

<i>Light period</i> (hours)	<i>Dark period</i> (hours)	<i>Response</i> <i>of plant</i>
4	20	Maximum 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 and dark cycle of at least 14 hours
- C A maximum dark period of 10 hours
- D A dark period of at least 20 hours

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

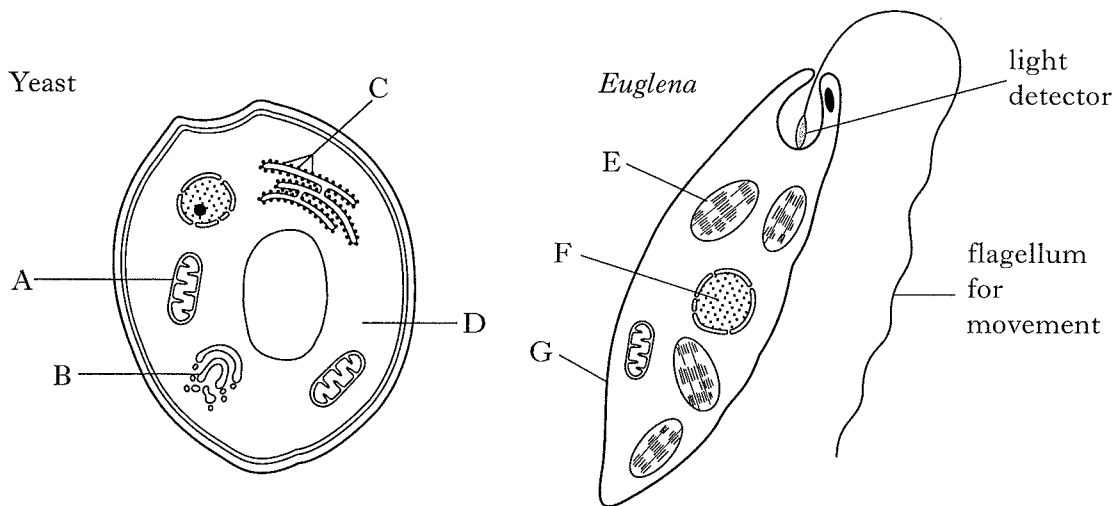
**[Turn over**

Marks

SECTION B

All questions in this section should be attempted.

1. Two magnified unicellular organisms are shown in the diagrams.



(a) (i) Name the **two** chemical components of structure G.

1 \_\_\_\_\_

2 \_\_\_\_\_

1

(ii) Complete the table by inserting letters from the diagrams to show where each process takes place.

Process	Letter
Glycolysis	
Transcription	

2

1. (continued)

Marks

(b) What evidence from the diagram supports the statement that yeast cells secrete enzymes?

\_\_\_\_\_

1

(c) *Euglena* lives in pond water. Explain how the structure of *Euglena* shown in the diagram allows it to photosynthesise efficiently.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

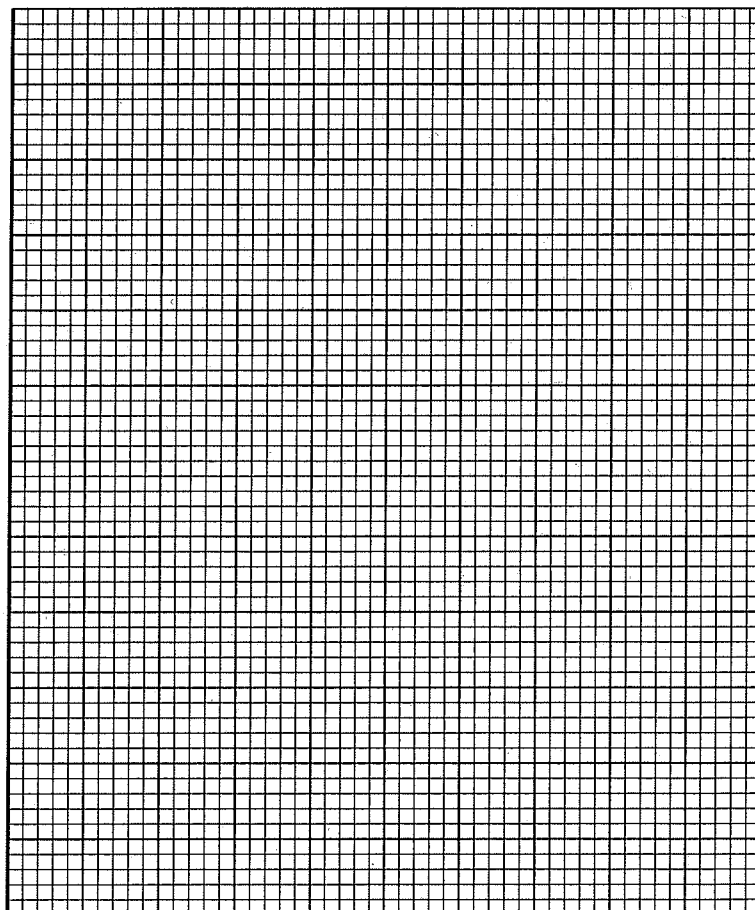
[Turn over

Marks

2. An investigation was carried out into the effects of osmosis on beetroot tissue. Pieces of beetroot were immersed in salt solutions of different concentration for one hour. The results are shown in the table.

<i>Concentration of salt solution (M)</i>	<i>Mass of beetroot at start (g)</i>	<i>Mass of beetroot after 1 hour (g)</i>	<i>Percentage change in mass (%)</i>
0.05	4.0	4.8	+20
0.10	3.5	4.2	+20
0.20	4.4	4.7	+7
0.25	3.7	3.7	0
0.35	3.9	3.4	-13
0.40	3.5	2.8	-20

- (a) On the grid, plot a line graph to show the percentage change in mass of the beetroot pieces against concentration of salt solution.  
(Additional graph paper, if required, may be found on page 36.)



2. (continued)

Marks

- (b) (i) Identify a concentration of salt solution used in the investigation that is hypertonic to the beetroot cell sap.

Explain your choice.

\_\_\_\_\_ M

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1

- (ii) What term describes the condition of a plant cell after immersion for one hour in a 1.0 M salt solution?

\_\_\_\_\_

1

- (c) From the information given, why was it good experimental practice to use percentage change in mass when comparing results?

\_\_\_\_\_

\_\_\_\_\_

1

- (d) Predict the percentage change in mass of a piece of beetroot immersed in 0.45 M salt solution for one hour.

\_\_\_\_\_ %

1

- (e) In setting up this investigation, variables were controlled to ensure that the results obtained would be valid.

Identify **one** variable related to the salt solutions and **one** variable related to the beetroot tissue which must be controlled.

Salt solutions \_\_\_\_\_

1

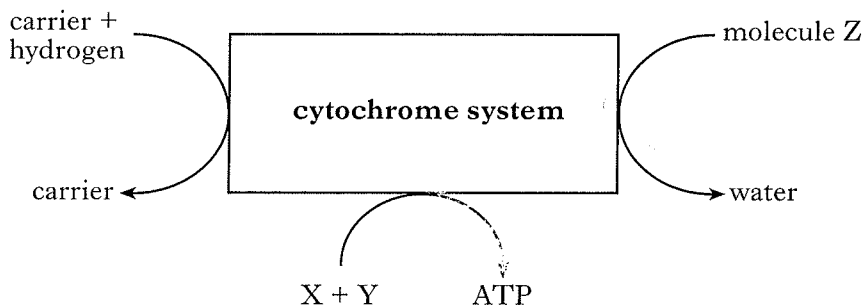
Beetroot tissue \_\_\_\_\_

1

[Turn over

3. (a) The diagram shows the role of the cytochrome system in aerobic respiration.

Marks



(i) State the exact location of the cytochrome system in a cell.

\_\_\_\_\_

1

(ii) Name the carrier that brings the hydrogen to the cytochrome system.

\_\_\_\_\_

1

(iii) Name molecules X, Y and Z.

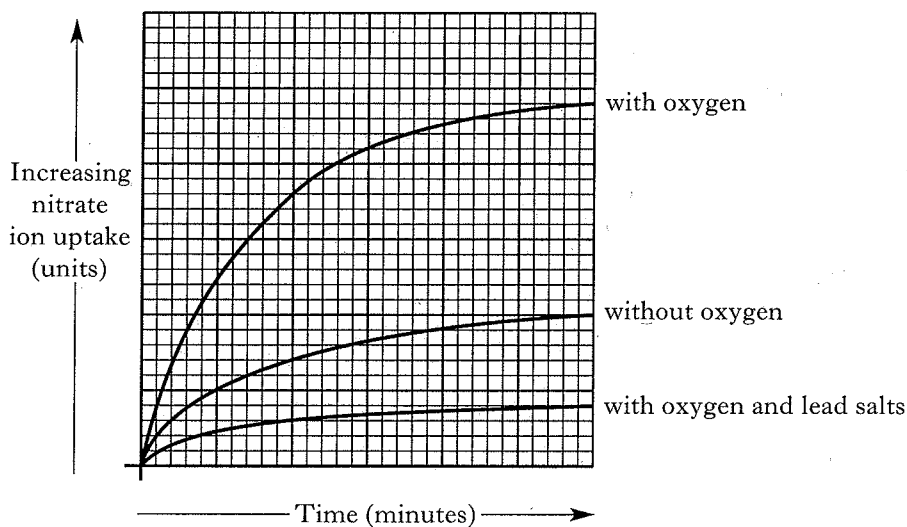
X \_\_\_\_\_ Y \_\_\_\_\_

1

Z \_\_\_\_\_

1

(b) The graph shows the effect of different conditions on the uptake of nitrate ions by barley roots.



(i) State the importance of nitrate for the growth of barley plants.

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

1

3. (b) (continued)

Marks

(ii) Explain why the uptake of nitrate ions is greater when oxygen is present.

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2

(iii) Explain the effect of lead salts on nitrate ion uptake.

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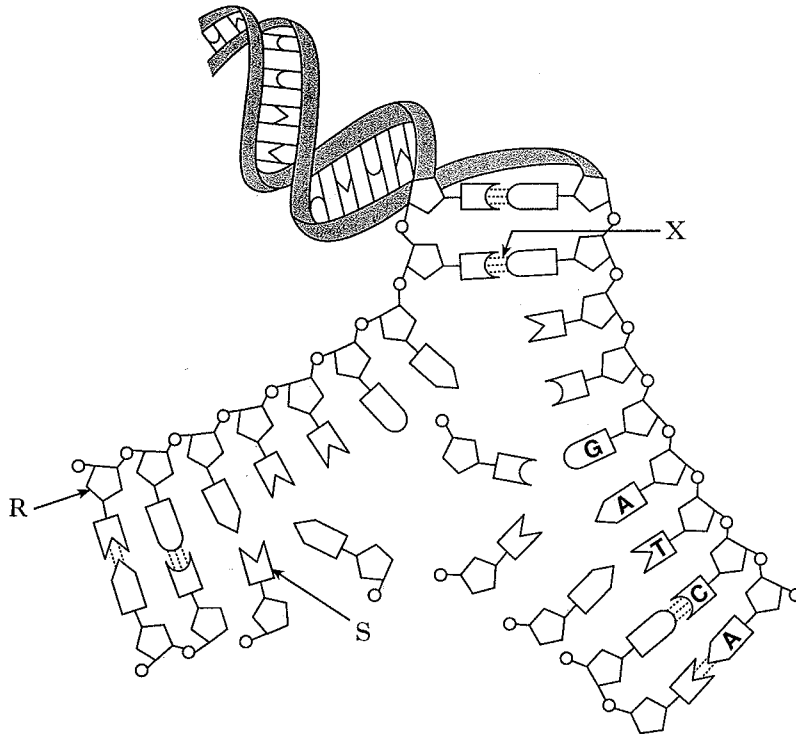
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2

**[Turn over**

4. (a) The replication of part of a DNA molecule is represented in the diagram.

Marks



(i) Name the nucleotide component R and the base S.

R \_\_\_\_\_

1

S \_\_\_\_\_

1

(ii) Name the type of bond labelled X.

X \_\_\_\_\_

1

(b) Explain why DNA replication must take place before a cell divides.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

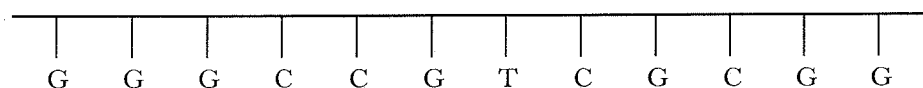
1



Marks

4. (continued)

- (c) Part of one strand of a DNA molecule used to make mRNA contains the following base sequence.



The table shows the names of six amino acids together with some of their mRNA codons.

<i>Amino acid</i>	<i>mRNA codon (s)</i>
Glycine	GGG GGC
Serine	UCG AGC
Proline	CCG CCC
Arginine	CGG
Alanine	GCC
Threonine	ACG

- (i) Use the information to give the order of amino acids coded for by the DNA base sequence.

\_\_\_\_\_ 1

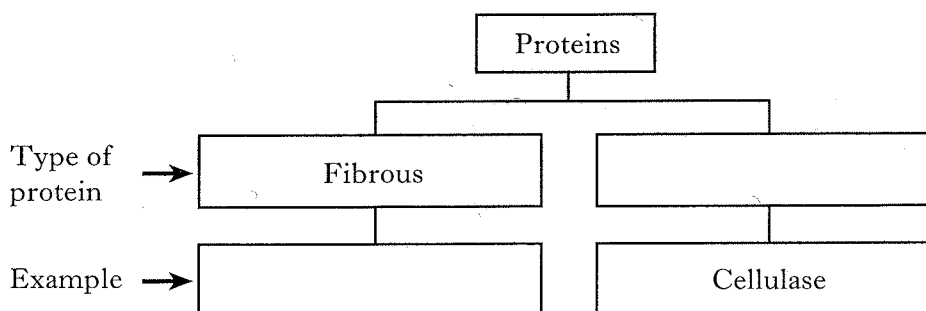
- (ii) What name is given to a part of a DNA molecule which carries the code for making **one** protein?

\_\_\_\_\_ 1

- (d) Name the molecules that transport amino acids to the site of protein synthesis.

\_\_\_\_\_ 1

- (e) Complete the diagram below which shows information about protein classification.

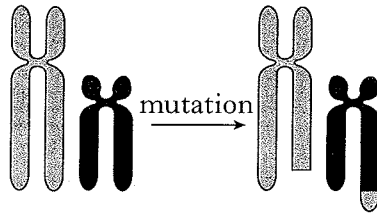


1

[Turn over

Marks

5. (a) The diagram shows two chromosomes and their appearance after a mutation has occurred.



- (i) Name this type of chromosome mutation.

\_\_\_\_\_ 1

- (ii) Name a mutagenic agent which could have caused this mutation.

\_\_\_\_\_ 1

- (b) Individuals with Down's Syndrome have 47 chromosomes in each cell instead of 46.

How does this change in chromosome number arise?

\_\_\_\_\_ 1

- (c) The diagram shows part of the normal amino acid sequence of an enzyme involved in a metabolic pathway. It also shows the altered sequence obtained after a gene mutation had occurred.

Normal amino acid sequence — His — Leu — Val — Glu — Ala — Leu — Tyr — Phe —

Altered amino acid sequence — His — Leu — Met — Tyr — Met — Cys — Ileu — Ser —

- (i) Name a type of gene mutation which could have produced this altered amino acid sequence.

\_\_\_\_\_ 1

- (ii) Explain the effect this gene mutation would have on the metabolic pathway in which this enzyme is involved.

\_\_\_\_\_ 1

- (d) The DNA in one cell consists of 40 000 genes. During DNA replication, random mutations occur at the rate of one altered gene in every 625.

Calculate the average number of mutations which will occur during the full replication of this cell's DNA.

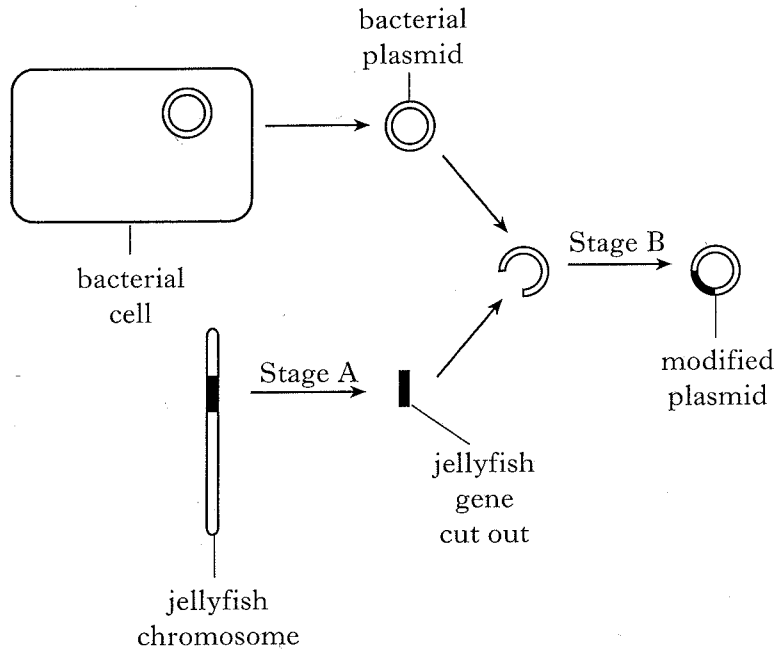
*Space for working*

\_\_\_\_\_ 1

Marks

6. (a) A gene from a jellyfish can be inserted into a bacterial plasmid using a genetic engineering procedure.

Some of the stages involved are shown in the diagram.



- (i) Give **one** method which could be used for locating the gene in the jellyfish chromosome.

\_\_\_\_\_ 1

- (ii) Name the enzymes involved in the following stages of the genetic engineering procedure.

1 Cutting the jellyfish gene out of its chromosome (Stage A).

\_\_\_\_\_ 1

2 Sealing the jellyfish gene into the bacterial plasmid (Stage B).

\_\_\_\_\_ 1

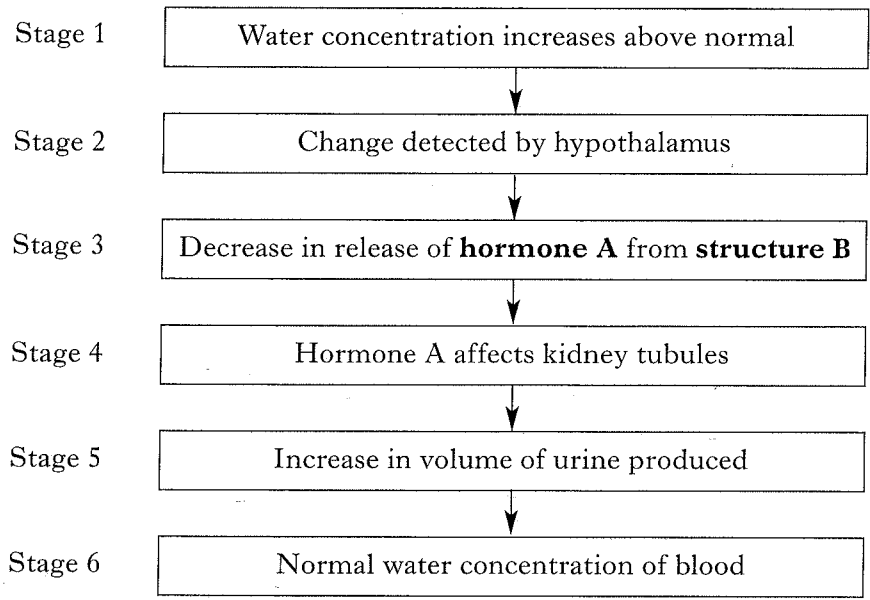
- (b) Name **one** human hormone that is manufactured by genetically engineered bacteria.

\_\_\_\_\_ 1

[Turn over

Marks

7. (a) The flow diagram shows some stages in the regulation of water concentration of blood in mammals.



- (i) Give **one** reason why the water concentration of the blood could increase above normal at stage 1.  
 \_\_\_\_\_ 1
- (ii) 1 Name hormone A \_\_\_\_\_ 1
- 2 Name structure B \_\_\_\_\_ 1
- (iii) Describe how hormone A is transported to the kidney tubules.  
 \_\_\_\_\_ 1
- (iv) Describe the effect of hormone A on the kidney tubules.  
 \_\_\_\_\_  
 \_\_\_\_\_ 1
- (v) What would be the effect of a decrease in hormone A on the concentration of salts in the urine?  
 \_\_\_\_\_ 1

Marks

7. (continued)

(b) Salmon migrate between sea water and fresh water.

The table contains statements about osmoregulation in salmon.

For each statement, tick (✓) **one** box to show whether the statement is true for a salmon living in sea water or in fresh water.

<i>Statement</i>	<i>Sea water</i>	<i>Fresh water</i>
Salmon drinks a large volume of water		
Salmon produces a large volume of urine		
Chloride secretory cells pump out ions		
Salmon gains water by osmosis		

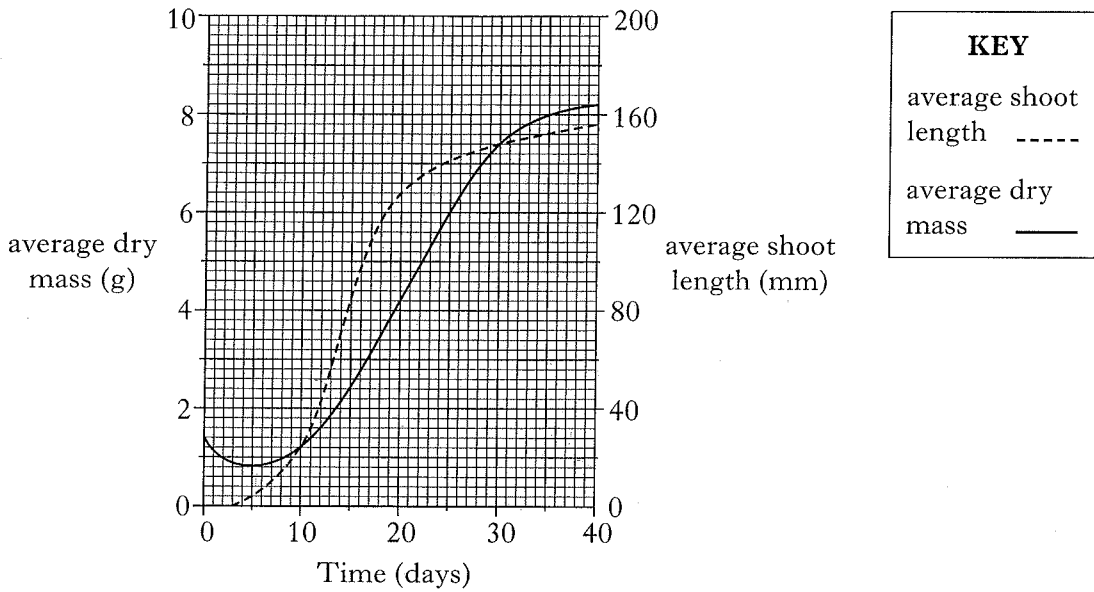
2

[Turn over

Marks

8. An experiment was carried out to investigate the growth of pea plants kept in a high light intensity following germination.

The graph shows the average dry mass and average shoot length of the pea plants.



- (a) (i) From the graph, how many days does it take for the shoot to emerge from the seed?

\_\_\_\_\_ days 1

- (ii) During which 5 day period is there the greatest increase in average shoot length? Tick (✓) one box.

Day 5–10	Day 10–15	Day 15–20	Day 20–25	Day 25–30
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1

- (iii) Explain the changes in average dry mass of the plants during the first fifteen days.

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2

- (iv) Explain why measurement of average shoot length alone may not provide a reliable estimate of plant growth.

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1

8. (a) (continued)

Marks

- (v) On day 30 the shoots made up 50% of the average dry mass of the plants. Calculate the average dry mass of the shoots per millimetre.

*Space for calculation*

\_\_\_\_\_ g per mm **1**

- (b) The experiment was repeated with pea plants kept in the dark.

Complete the following to show how the results on day 15 would compare with the results obtained from plants grown in the light.

In each case, underline one alternative and give a reason to justify your choice.

- (i) Average dry mass would be  $\left\{ \begin{array}{l} \text{greater.} \\ \text{less.} \\ \text{the same.} \end{array} \right\}$

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

- (ii) Average shoot length would be  $\left\{ \begin{array}{l} \text{greater.} \\ \text{less.} \\ \text{the same.} \end{array} \right\}$

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

- (c) The grid shows some of the effects of the plant growth substances Indole Acetic Acid (IAA) and Gibberellic Acid (GA) on the growth and development of plants.

A	stimulates $\alpha$ -amylase production in barley grains	B	promotes the formation of fruit	C	inhibits leaf abscission
D	causes apical dominance	E	involved in phototropism	F	breaks dormancy of buds

- (i) Use **all** the letters from the grid to complete the table to show which effects are caused by IAA and which are caused by GA.

<i>Effects caused by IAA</i>	<i>Effects caused by GA</i>

**3**

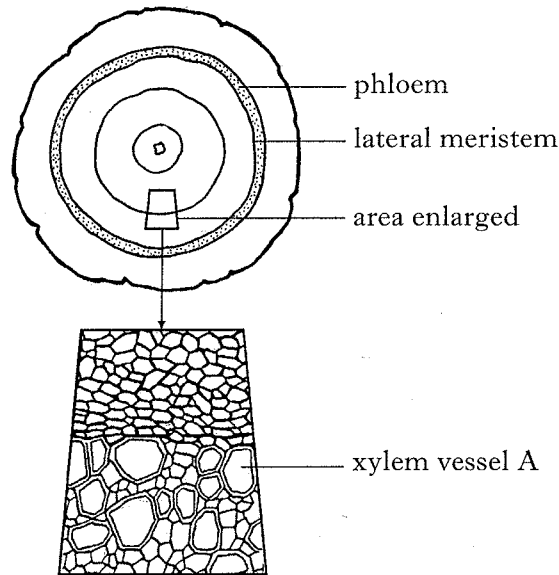
- (ii) Give **one** practical application of plant growth substances.

\_\_\_\_\_

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

Marks

9. The diagram represents a section through a woody twig with an area enlarged to show the xylem vessels present.



- (a) Name the lateral meristem shown in the diagram.

\_\_\_\_\_

1

- (b) Explain how the appearance of xylem vessel A indicates that it was formed in the spring.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1

- (c) What name is given to the area of the woody twig section that represents the xylem tissue growth occurring in one year?

\_\_\_\_\_

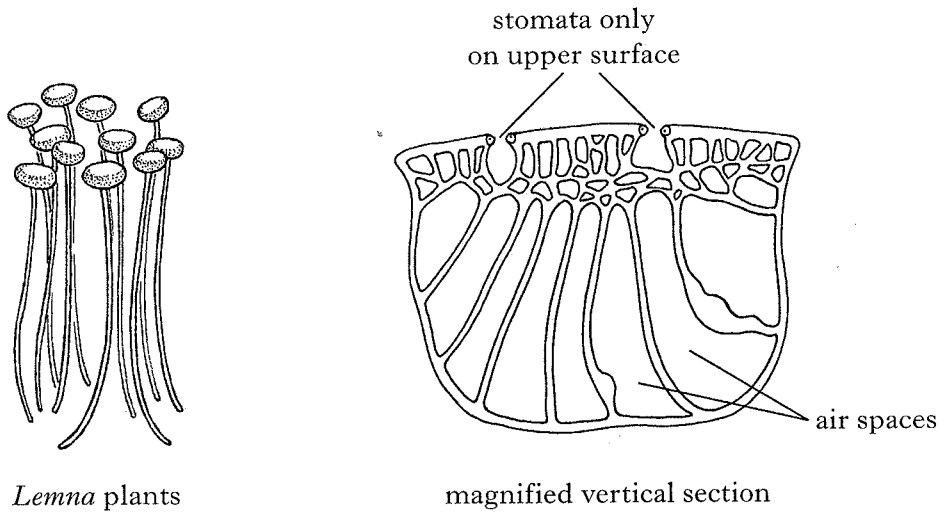
1



Marks

10. Duckweed (*Lemna*) is a hydrophyte that has leaf-like structures which float on the surface of pondwater.

Some *Lemna* plants are shown in the diagram together with a magnified vertical section through one of the floating leaf-like structures.



(a) Complete the table to describe the effect of each adaptation in *Lemna*.

<i>Adaptation</i>	<i>Effect</i>
Many large air spaces	
Stomata on upper surface	

1

1

(b) What term describes a plant that is adapted to live in a hot, dry habitat?

\_\_\_\_\_

1

[Turn over

Marks

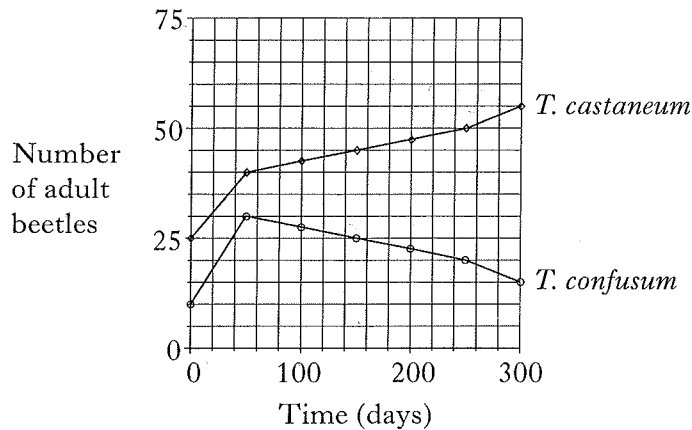
11. An investigation was carried out into the effects of competition when two species of flour beetle, *Tribolium confusum* and *Tribolium castaneum*, were kept together in a container with a limited food supply.

*Tribolium* beetles can be infected by a parasite which causes disease.

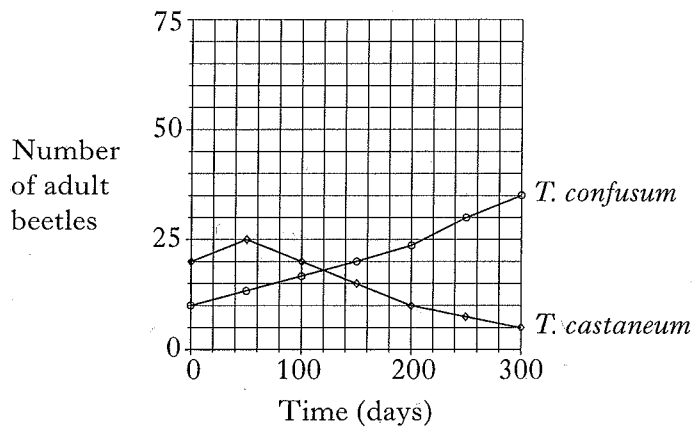
**Graph 1** shows the numbers of the two species over the period of time in the absence of the parasite.

**Graph 2** shows the effect of the presence of the parasite on the beetle numbers.

**Graph 1** Parasite absent



**Graph 2** Parasite present



- (a) Use values from **Graph 1** to describe how the numbers of *T. confusum* change over the period of the investigation.

---



---



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2

Marks

11. (continued)

- (b) From **Graph 1**, express as the simplest whole number ratio the population size of *T. confusum* to *T. castaneum* at 250 days.

*Space for calculation*

*T. confusum* : *T. castaneum* \_\_\_\_\_ : \_\_\_\_\_ 1

- (c) From **Graph 2**, calculate the percentage increase in the *T. confusum* population over the 300 days of the investigation.

*Space for calculation*

\_\_\_\_\_ % increase 1

- (d) Suggest an explanation for the improved growth of the *T. confusum* population in the presence of the parasite.

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---

2

- (e) From the information in the graphs, suggest an improvement to the design of the investigation.

---



---

1

- (f) Certain factors may affect the numbers of beetles in this investigation.

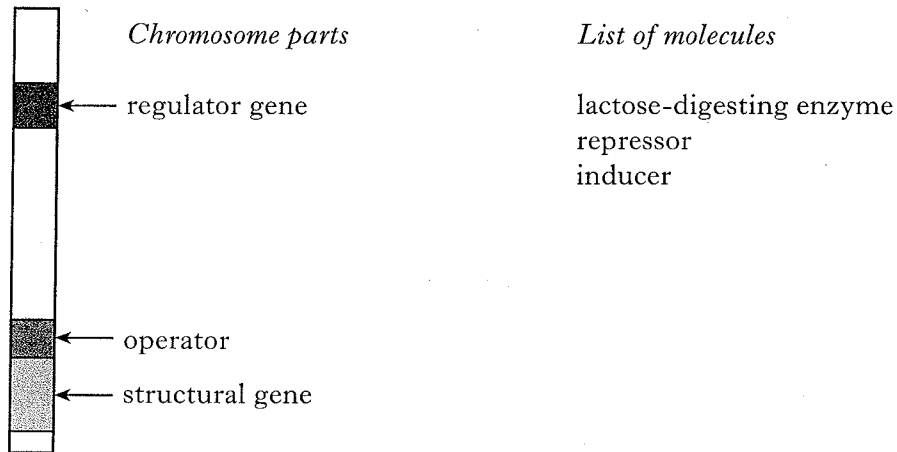
Place ticks in the table to show whether each factor would have a density-dependent effect or a density-independent effect.

<i>Factors</i>	<i>Density-dependent</i>	<i>Density-independent</i>
Presence of disease causing parasites		
Availability of food		
Extreme temperature		

2

Marks

12. The diagram shows parts of the chromosome in the bacterium *E. coli*. The list has three molecules involved in the genetic control of lactose metabolism.



- (a) Complete the table by writing **True** or **False** in each of the spaces provided.

<i>Statement</i>	<i>True/False</i>
The repressor can bind to the operator.	
The structural gene codes for the repressor.	
The inducer can bind to the repressor.	
The regulator gene codes for the lactose-digesting enzyme.	

2

- (b) Name the inducer molecule.

\_\_\_\_\_

1

- (c) Give **one** advantage to *E. coli* of having this type of genetic control system.

\_\_\_\_\_

\_\_\_\_\_

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.

Labelled diagrams may be used where appropriate.

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

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

- |                               |      |
|-------------------------------|------|
| (i) first meiotic division;   | 6    |
| (ii) second meiotic division; | 2    |
| (iii) importance of meiosis.  | 2    |
|                               | (10) |

OR

B. Give an account of the evolution of new species under the following headings:

- |  |      |
|--|------|
| (i) isolating mechanisms;                        | 4    |
| (ii) effects of mutations and natural selection. | 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 chloroplast structure in relation to the location of the stages of photosynthesis and describe the separation of photosynthetic pigments by chromatography. (10)

OR

B. Give an account of the nature of viruses and the production of more viruses. (10)

[END OF QUESTION PAPER]

**SPACE FOR ANSWERS**

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