FOR OFFICIAL USE

Total for Sections B and C

X007/201

NATIONAL QUALIFICATIONS 2005

WEDNESDAY, 18 MAY
9.00 AM – 11.00 AM

BIOLOGY
INTERMEDIATE 2

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 (25 marks)

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

SECTIONS B AND C (75 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.

SCOTTISH QUALIFICATIONS AUTHORITY

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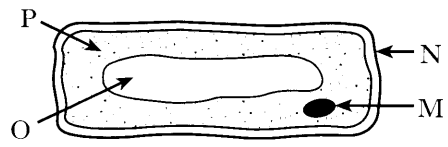
SECTION A

All questions in this Section should be attempted.

1. The diagram below represents a plant cell.



Which of the labelled parts of the cell are also found in an animal cell?

A M and N

B N and O

C M and P

D M, N, O and P

2. Which line in the table below describes correctly the functions of the cell wall and chloroplasts in plant cells?

	Function of cell wall	*Function of chloroplast*
A	prevents cell bursting	respiration
B	controls entry of substances	respiration
C	prevents cell bursting	photosynthesis
D	controls entry of substances	photosynthesis

3. When animal cells are placed in a hypotonic solution they

A remain unchanged

B burst

C plasmolyse

D become turgid.

4. A piece of potato was cut from a potato tuber and weighed. It was placed in pure water for an hour then removed, dried and weighed again. Finally, it was placed in a concentrated sugar solution for an hour, removed, dried and weighed again.

Which line in the table records the results most likely obtained by this treatment?

	First weighing	*Second weighing*	*Third weighing*
A	5 g	6 g	4 g
B	5 g	4 g	6 g
C	6 g	5 g	4 g
D	5 g	4 g	3 g

5. The anaerobic respiration of one molecule of glucose results in the net gain of

A 2 molecules of ATP

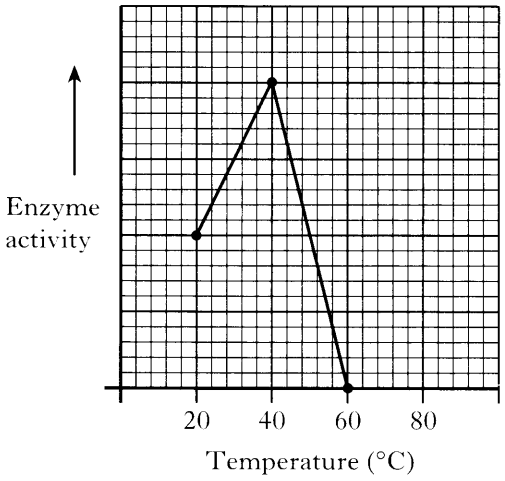
B 2 molecules of ADP

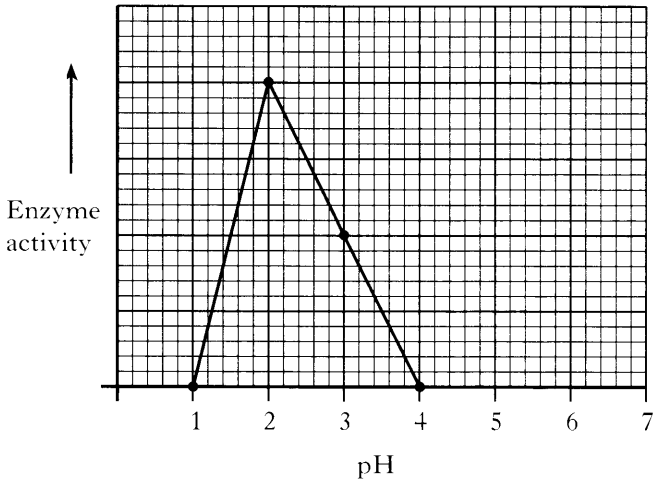
C 38 molecules of ATP

D 38 molecules of ADP.

[Turn over

6. The graphs below show the effects of temperature and pH on the activity of an enzyme.

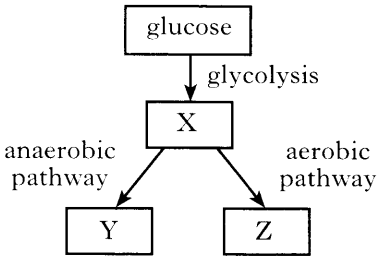




Which line in the table identifies correctly the conditions at which the enzyme is most active?

	Temperature	*pH*
A	40	2
B	40	4
C	50	2
D	60	4

7. The diagram below shows the respiratory pathway in an animal cell.



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

	X	*Y*	*Z*
A	lactic acid	pyruvic acid	carbon dioxide and water
B	carbon dioxide and water	pyruvic acid	lactic acid
C	pyruvic acid	carbon dioxide and water	lactic acid
D	pyruvic acid	lactic acid	carbon dioxide and water

8. Photolysis is the

A combining of water with carbon dioxide

B use of water by chlorophyll to split light

C release of energy from water using light energy

D splitting of water using light energy.

9. ATP synthesised during photolysis provides the carbon fixation stage of photosynthesis with

A glucose

B carbon dioxide

C energy

D hydrogen.

10. Which of the following describes a community?

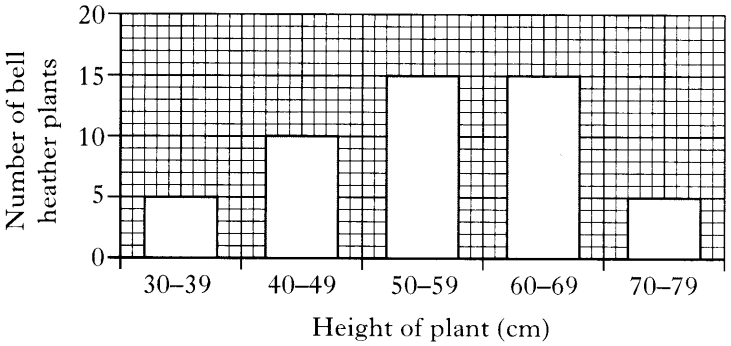
A The total number of one species present

B All the living organisms and the non-living parts

C All the living organisms

D All the plants

11. The bar chart shows the results of a survey into the heights of bell heather plants on an area of moorland.



The percentage of plants with a height greater than 59 cm is

A 15%

B 20%

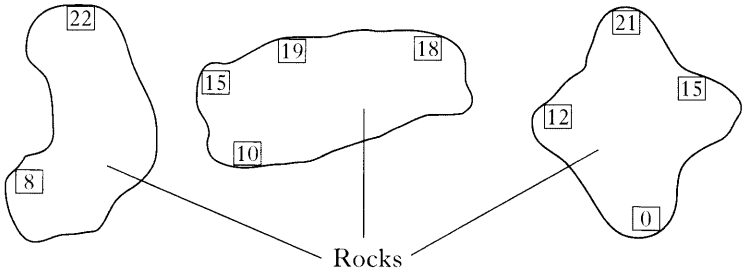
C 30%

D 40%.

12. A survey was carried out on numbers of mussels attached to rocks on a sea shore.

Squares measuring 10 cm × 10 cm were used in the survey.

The positions of the squares and the number of mussels in each square are shown below.



How could the results have been made more valid?

A Sample only one rock

B Use bigger squares

C Note all species present

D Count each at the same time of day

13. Plants convert 1% of the light energy they receive into new plant material.

In the food chain below, plant plankton receive 100 000 units of light energy.

plant plankton → animal plankton → sprats → mackerel

How much of this energy is converted into new plant material?

A 10 000 units

B 1000 units

C 100 units

D 10 units

14. The DNA of a chromosome carries information which determines the structure and function of

A fats

B bases

C carbohydrates

D proteins.

[Turn over

15. A true breeding red bull is mated with a true breeding white cow. The offspring are all intermediate in colour (roan).

This type of inheritance is

A polygenic

B recessive

C co-dominant

D dominant.

16. In 1997, the USA planted 8·2 million hectares of land with genetically engineered crops. By 1998, this had increased to 20·5 million hectares.

What was the percentage increase in the area sown between 1997 and 1998?

A 12·3%

B 66%

C 150%

D 166·7%

17. In tomato plants, the allele for red fruit is dominant to the allele for yellow fruit.

If a heterozygous tomato plant is crossed with a plant which produces yellow fruit, the expected phenotype ratio of the offspring would be

A 3 red : 1 yellow

B 1 red : 3 yellow

C 1 red : 2 yellow

D 1 red : 1 yellow.

18. *Achoo syndrome* is a dominant characteristic in humans which causes the sufferer to sneeze in response to bright light.

A woman who is homozygous for the syndrome and a man who is unaffected have children.

What proportion of their children would be expected to have *Achoo syndrome*?

A 0%

B 25%

C 50%

D 100%

19. Genetic engineering can be used to alter bacterial cells in order to produce human insulin.

The stages in the process are:

1 insulin gene extracted from a human cell

2 bacteria divide and produce large quantities of human insulin

3 plasmid is removed from bacterial cell and "cut" open

4 insulin gene is inserted into bacterial plasmid.

The correct sequence of these stages is

A 1, 3, 4, 2

B 1, 3, 2, 4

C 3, 4, 2, 1

D 3, 1, 2, 4.

20. Food tests were carried out on different food samples. The results are shown below.

	Food Tests			
Food sample	*Starch*	*Glucose*	*Protein*	*Fat*
A	positive	negative	positive	positive
B	negative	positive	positive	positive
C	positive	negative	negative	positive
D	positive	positive	negative	negative

Which food sample left a translucent spot on filter paper and also turned brick red when heated with Benedicts solution?

21. Which food group contains the most energy per gram?

A Carbohydrate

B Protein

C Fat

D Vitamins

22. Stomach muscles relax and contract in order to

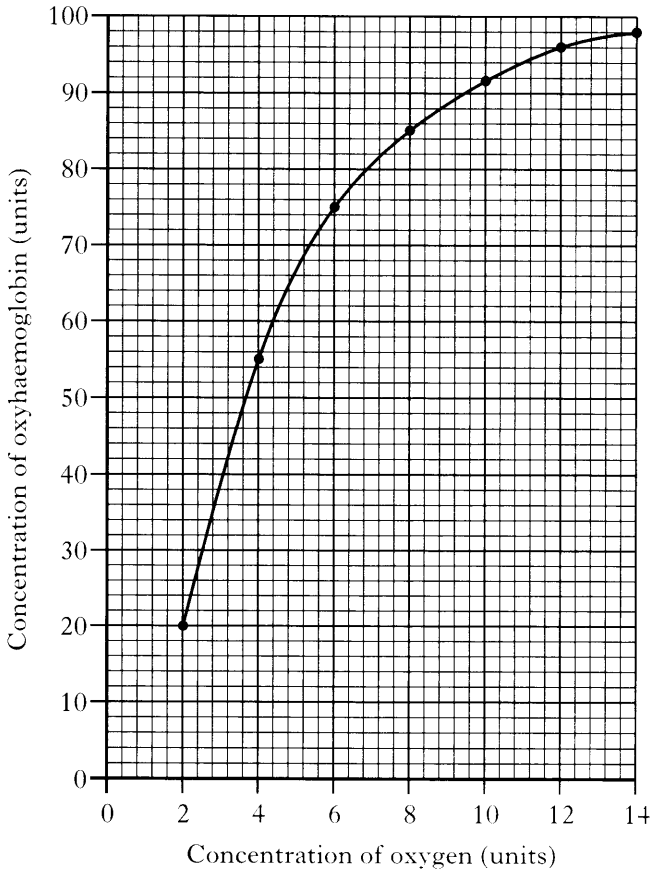
A release enzymes

B aid absorption of digested products

C release mucus and acid

D mix food with digestive juices.

23. The graph below shows the relationship between oxygen concentration and the concentration of oxyhaemoglobin.



What is the percentage increase in the concentration of oxyhaemoglobin when the concentration of oxygen increases from 6 units to 12 units?

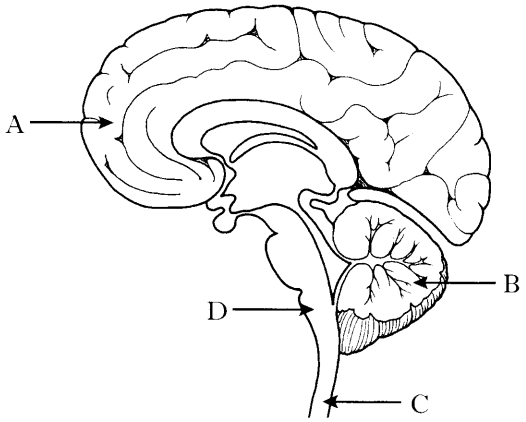
A 6

B 21

C 28

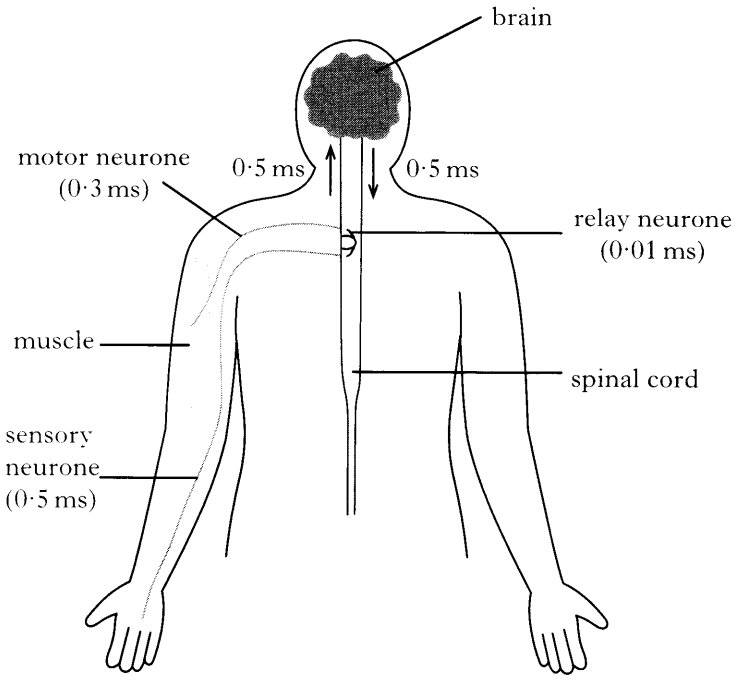
D 96

24. The diagram below shows a human brain.



Which letter indicates the site of memory and conscious responses?

25. The diagram below shows the times taken in milliseconds (ms) for nerve impulses to travel along parts of the nervous system.



The time taken for a reflex response involving the nerves above is

A 0·81 ms

B 1·01 ms

C 1·80 ms

D 1·81 ms.

Candidates are reminded that the answer sheet for Section A MUST be placed INSIDE the front cover of this answer book.

[Turn over for Section B on *Page eight*

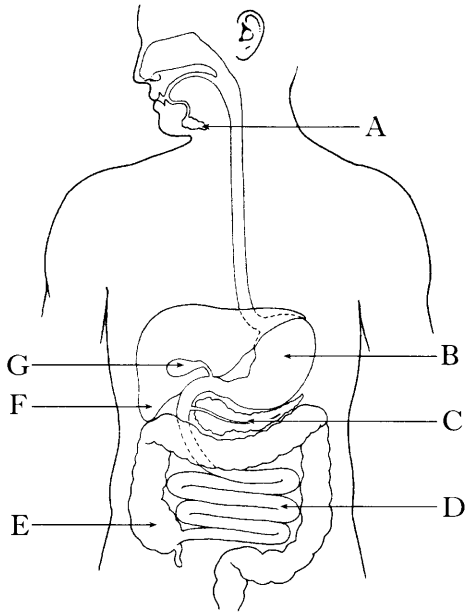
DO NOT WRITE IN THIS MARGIN

SECTION B

All questions in this section should be attempted.

Marks

1. The diagram below shows the human alimentary canal.



(*a*) Name the following labelled parts.

Letter	*Name*
A	
G	
E	

2

(*b*) Use a letter from the diagram to identify where each of the following secretions are **produced**.

Secretion	*Letter*
bile	
hydrochloric acid	
lipase	

3

(*c*) Excess glucose in the diet is converted into an insoluble compound which is stored in the liver. Name this compound.

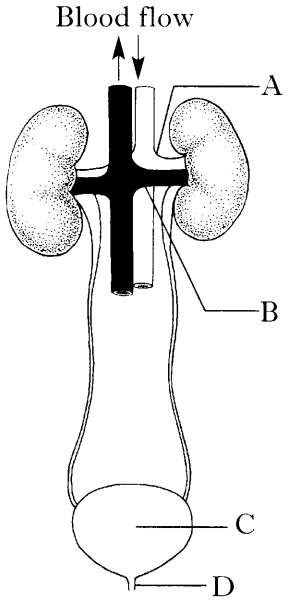
_____

1

DO NOT WRITE IN THIS MARGIN

Marks

2. (*a*) The diagram below shows part of the human urinary system.



(i) Complete the table below to name the labelled parts and give their functions.

Letter	*Name*	*Function*
A	Renal artery	
C		
D		Carries urine out of the body.

3

(ii) Give **one** difference between the composition of blood in vessels A and B.

_____

1

(*b*) Glucose is present in the blood entering the kidney. Explain why glucose does not normally appear in the urine.

_____

_____

1

(*c*) (i) Name the hormone which is produced in response to a reduction in water concentration of the blood.

_____

1

(ii) State the effect this hormone has on the kidney tubules.

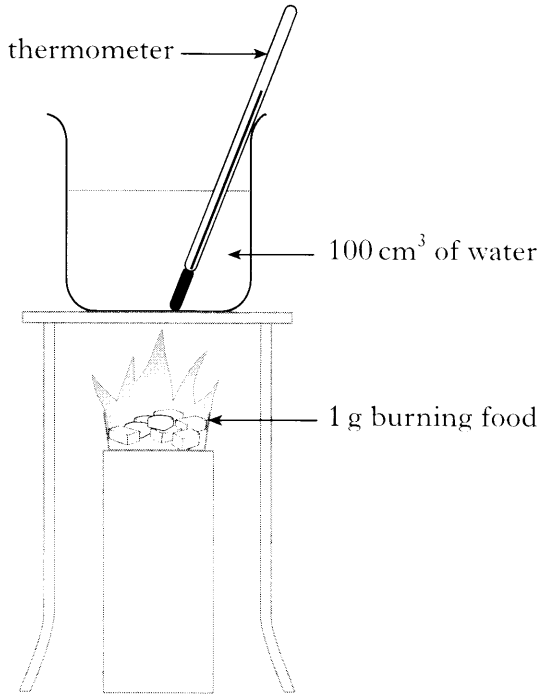
_____

1

DO NOT WRITE IN THIS MARGIN

Marks

3. The diagram below shows the apparatus used to investigate the energy content of different foods. One gram of each food was burned under a beaker containing 100 cm^3 of water.



The temperature rise for each food was recorded.
The energy content of the foods was calculated using the following equation.

energy content = temperature rise × 420 (joules/g)

The table below shows the results for the investigation.

Food	*Energy Content* (joules/g)
butter	10 500
chicken	4200
bread	3400
margarine	10 500

(*a*) Calculate the **simple whole number ratio** of the energy content of chicken to that of butter.
Space for calculation

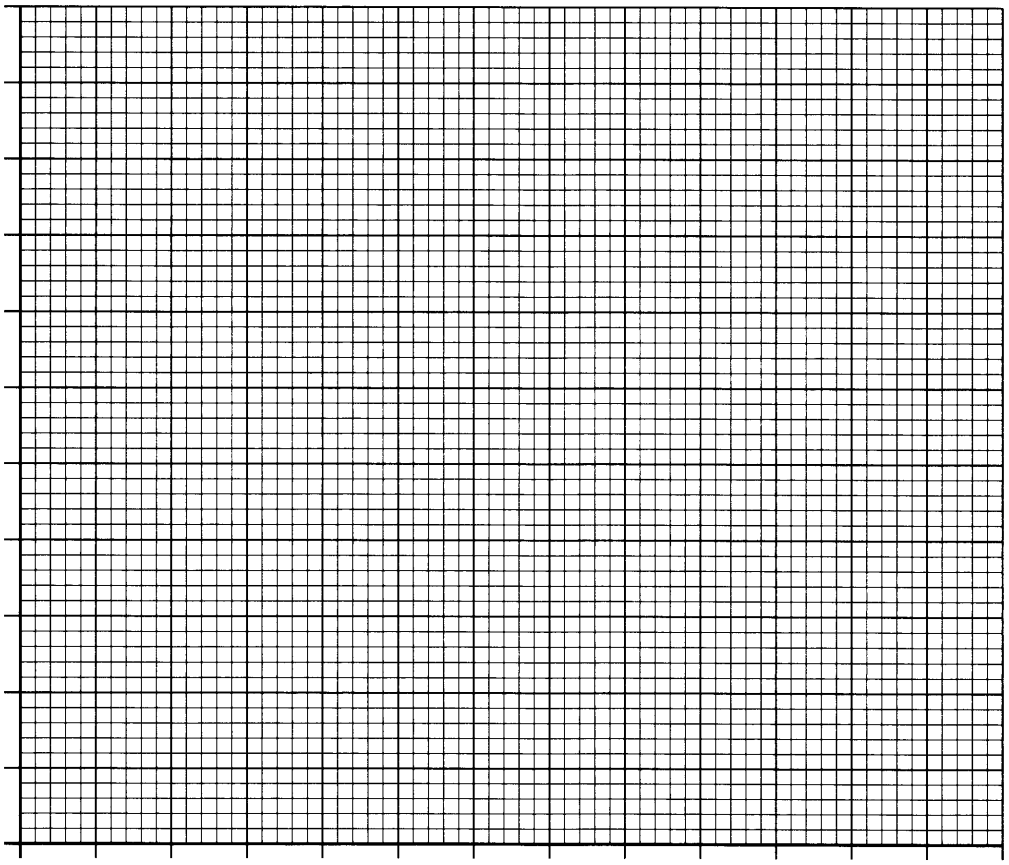
_____ : _____ **1**
chicken butter

DO NOT WRITE IN THIS MARGIN

Marks

3. (continued)

(*b*) Construct a bar graph of the results given in the table.
(Additional graph paper, if required, will be found on page 26.)



3

(*c*) One gram of fish was also burned. The temperature rise was 7·5 °C. Calculate the energy content for fish using the equation above.
Space for calculation

Energy content = _____ joules/g **1**

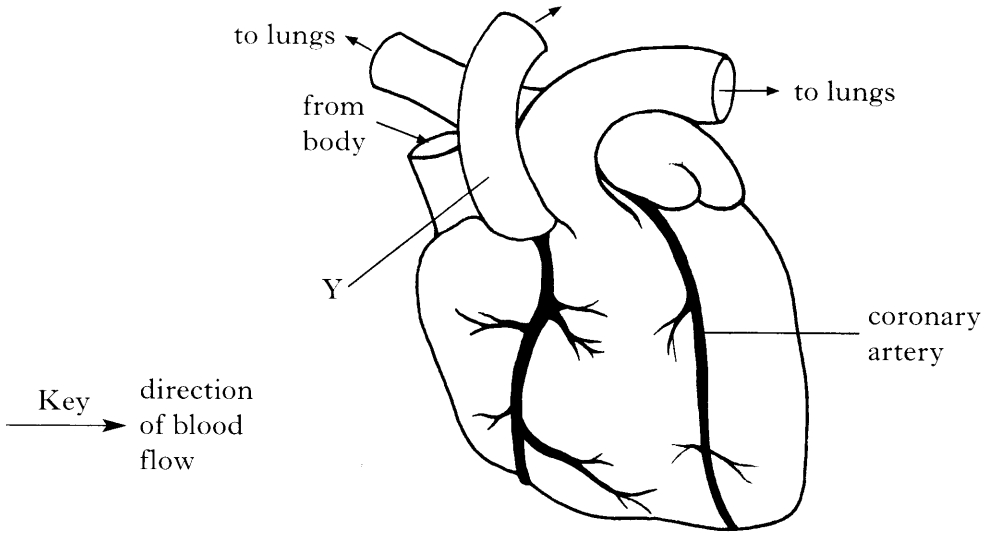
(*d*) Slimmers may be advised to use margarine instead of butter. Use the data in the table to suggest why this would not aid weight loss.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

4. (*a*) The diagram below shows a surface view of the human heart.



(i) Name blood vessel Y.

_____ **1**

(ii) Name the blood vessel which carries blood to the lungs.

_____ **1**

(iii) If the coronary artery is blocked, the heart cannot function efficiently.

Name **two** essential substances carried by the blood which would be prevented from reaching the heart muscle.

1 _____

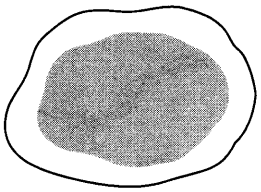
2 _____ **2**

DO NOT WRITE IN THIS MARGIN

Marks

4. (continued)

(*b*) The diagram below shows a type of blood cell which produces antibodies against disease-causing organisms.



(i) Name this type of blood cell.

_____ **1**

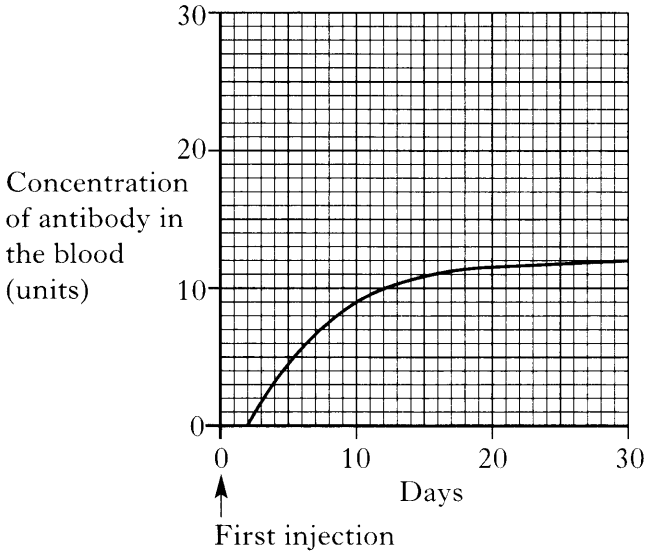
(ii) Explain why each antibody is effective against only one type of disease-causing organism.

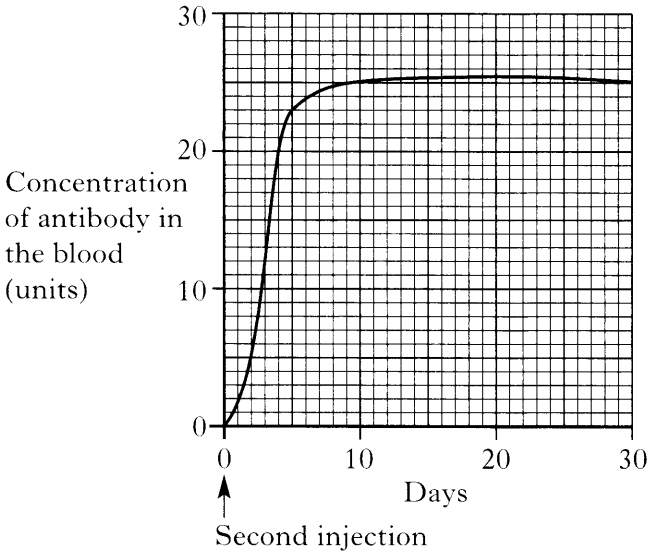
_____

_____ **1**

(iii) These blood cells produce antibodies when injections are given to protect against disease such as tetanus. Two injections may be given several weeks apart.

The following graphs show the antibody production in response to the two injections.





Give **two** differences in the antibody production in response to the two injections.

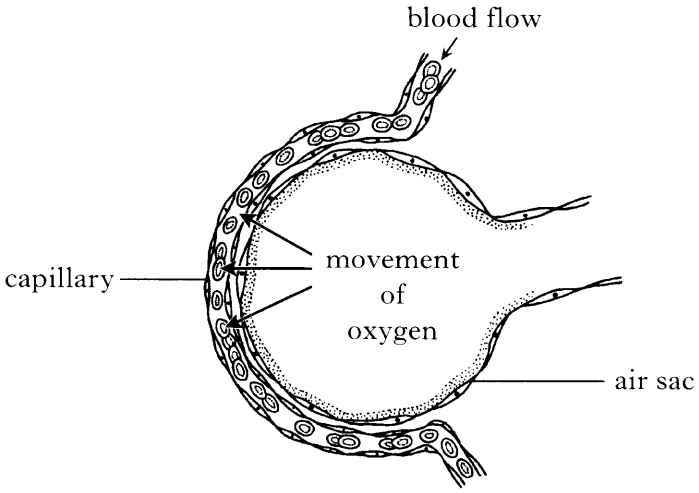
1 _____

2 _____ **2**

DO NOT WRITE IN THIS MARGIN

Marks

5. (*a*) The diagram below shows an air sac and a capillary in the lungs.



(i) Name the process by which oxygen moves from the air sac into the capillary.

_____ **1**

(ii) Why is oxygen required by an organism?

_____ **1**

(iii) Complete the following sentence using the words "high" or "low".

Oxygen is moving from a _____ concentration in the air sac to a _____ concentration in the capillary. **1**

(iv) Name a substance which moves from the capillary into the air sac.

_____ **1**

(*b*) Give **two** features of the air sacs which make them efficient gas exchange surfaces.

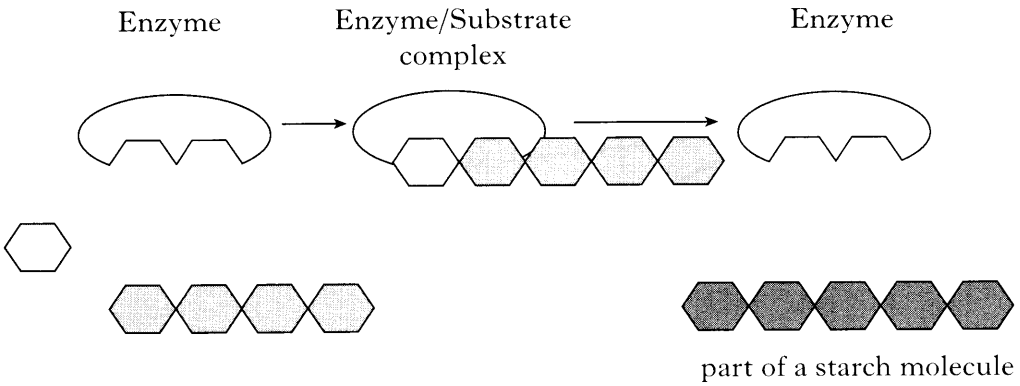
Feature 1 _____ **1**

Feature 2 _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

6. (*a*) Enzymes are involved in synthesis or degradation chemical reactions. The diagram below represents an example of one of these types of reactions.



(i) Name the type of chemical reaction and the enzyme shown in the diagram.

Type of chemical reaction _____

The enzyme _____ **2**

(ii) Place an X on the diagram to show the position of an active site. **1**

(*b*) What type of molecule are all enzymes made of?

_____ **1**

(*c*) What happens to the active site when an enzyme is denatured?

_____ **1**

(*d*) State the effect of an enzyme on the energy input needed for a chemical reaction.

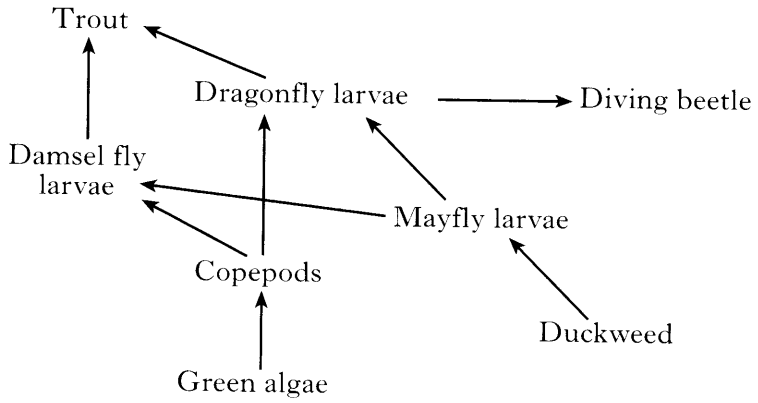
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

7. (*a*) The diagram below shows part of a food web in a freshwater ecosystem.



(i) Use **four** organisms from the food web to construct a food chain below.

_____ → _____ → _____ → _____ **1**

(ii) Identify **all** the primary consumers in this food web.

_____ **1**

(iii) Draw and label a pyramid of numbers from the food web.

1

(*b*) What is meant by the term omnivore?

_____ **1**

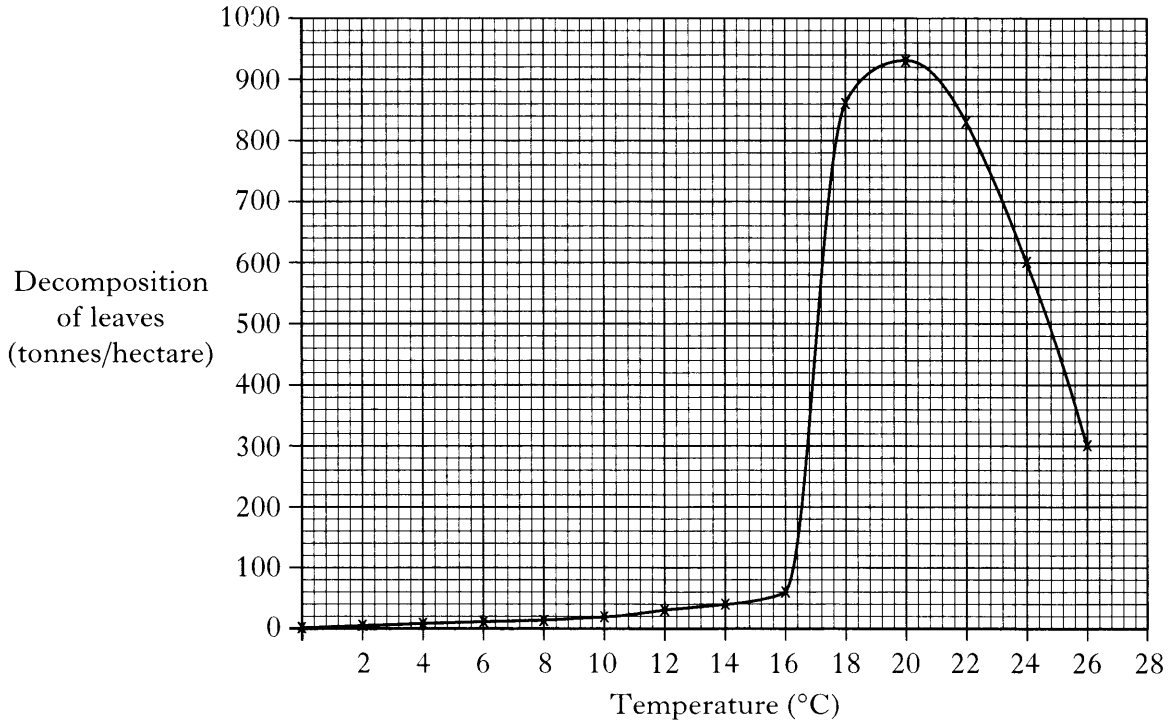
(*c*) What term is used to describe the variety of species within an ecosystem?

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

8. (*a*) The line graph below shows the decomposition of leaves in soil at different temperatures.



(i) How many times greater is the decomposition of leaves at 24 °C than at 14 °C?

_____ **1**

(ii) Describe the relationship between temperature and the decomposition of leaves.

_____

_____ **2**

(*b*) Explain why temperature has an effect on the decomposition of leaves.

_____

_____ **1**

(*c*) (i) Name **one** type of decomposer.

_____ **1**

(ii) Describe the role of decomposers in the soil.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

9. (*a*) The table below shows the results of a study into the phenotypes of two pairs of human adult identical twins. Identical twins were used in this study as they have the same genotype.

One pair of identical twins had been raised together since birth.

The second pair had been separated since birth and raised by different families.

Phenotype	*Appearance of twins raised together*		*Appearance of twins raised apart*	
	P	Q	R	S
Eye colour	blue	blue	brown	brown
Height (cm)	175	174	180	176
Blood group	A	A	O	O
Hand span (cm)	23	23·5	25	23

From the results, complete the following table by using tick(s) to show whether each phenotype was affected by genes, the environment or both.

Phenotype	*Affected by genes*	*Affected by environment*
Eye colour		
Height		
Blood group		
Hand span		

2

(*b*) In another study into plant phenotypes, leaf lengths were found to vary across a wide range.

What term is used to describe this type of variation?

_____

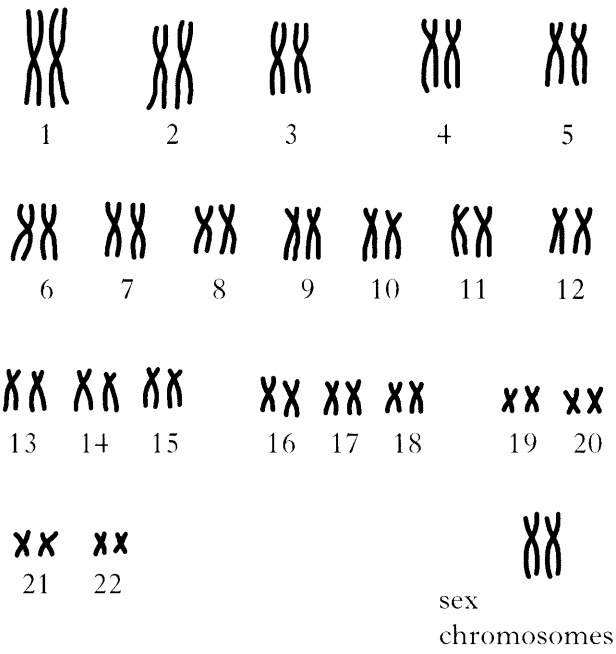
1

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*c*) The diagram below shows all the chromosomes found in a human skin cell.



Identify the sex of the person and give a reason for your answer.

Sex _____

Reason _____

_____ **1**

(*d*) Underline **one** option in each set of brackets to make the following sentences correct.

During meiosis, matching chromosomes pair and separate producing {gametes / body cells}

with {one set / two sets} of chromosomes. A zygote is produced from these cells

by {random assortment / fertilisation}. **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

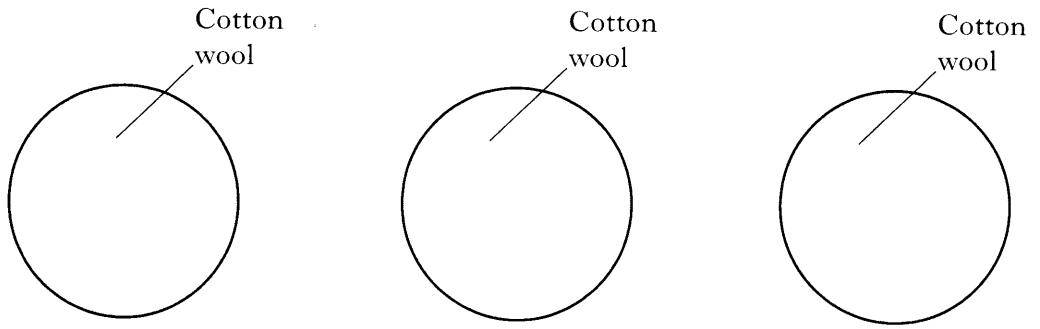
10. The leaves of black walnut trees produce a chemical which is released into the soil when the leaves fall. This chemical prevents the germination (growth) of other plant seeds. The chemical can be extracted from the leaves.

(*a*) A student carried out an investigation into the effect of this chemical on mung bean seeds. Leaf extracts containing different concentrations of the chemical were prepared.

The student was supplied with

30 mung bean seeds
3 identical petri dishes
cotton wool
a bottle of 0·1% leaf extract chemical
a bottle of 1% leaf extract chemical
a bottle of 10% leaf extract chemical

(i) Complete the diagrams below to show how the investigation should have been set up. Label the contents of each petri dish.



Petri dish 1 Petri dish 2 Petri dish 3 **2**

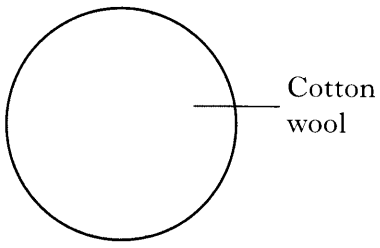
(ii) What observations and measurements should be taken to obtain results for this investigation?

_____

_____ **2**

(iii) A control petri dish should also have been set up to show that it was the leaf extract preventing the growth of the mung bean seeds.

Complete the diagram below to show the contents of the control petri dish.



Control petri dish **1**

(*b*) Explain why producing this chemical is an advantage to the black walnut trees.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. Charles Darwin visited the Galapagos Islands. He found different species of finch on the different islands.

The following gives information on the size and shape of beaks and the island habitats of two of the Galapagos finches.

Size and shape of beak	*Habitat*
Long and narrow	Rotting logs that provide food for insects
Short and wide	Trees and shrubs that provide seeds and nuts

Finch A

Finch B

(*a*) State which finch eats insects and give a reason for your answer.

Finch _____

Reason _____

_____ **1**

(*b*) Identify **two** ways in which competition between finch A and finch B is reduced.

_____

_____ **2**

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

DO NOT WRITE IN THIS MARGIN

SECTION C

Both questions in this section should be attempted.

Note that each question contains a choice.

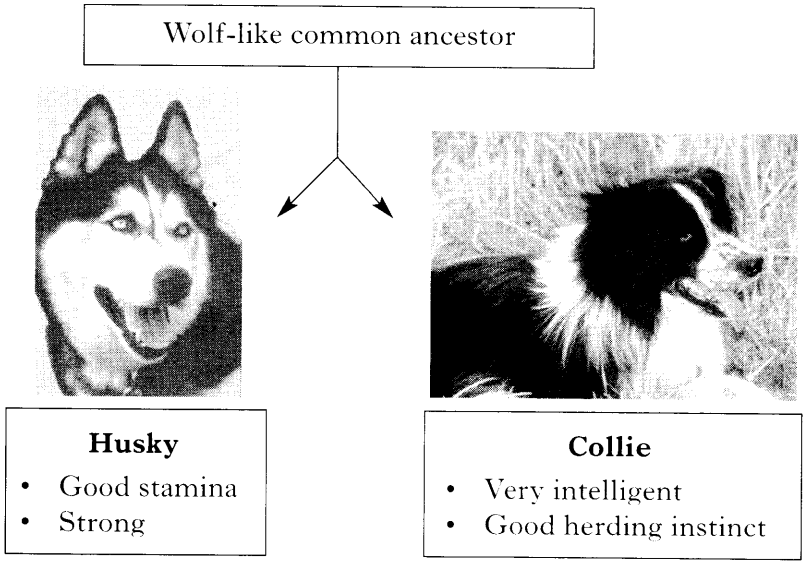
Questions 1 and 2 should be attempted on the blank pages which follow.

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

Marks

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

A. The diagram below shows some characteristics of two present day breeds of dog which descended from a wolf-like common ancestor.



Name and describe the process which humans have used to produce different breeds of dog. **5**

OR

B. The diagram below shows the two different forms of the peppered moth *Biston betularia* on the bark of a tree located in an unpolluted area.

Name and describe the process by which the black form of the moth became the most common form in polluted areas of Scotland. **5**

Question 2 is on *Page twenty-four*.

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

Labelled diagrams may be included where appropriate.

A. Describe how cells are used in the production of yoghurt and alternative fuel. Include in your answer for both, the type of cell used, the substrates and the products. **5**

OR

B. The rate of photosynthesis is limited by certain environmental factors.

Name **two** limiting factors and describe how the growth of greenhouse plants in winter can be increased. **5**

[END OF QUESTION PAPER]