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Total for
Sections B and C

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X007/201

NATIONAL
QUALIFICATIONS
2002

FRIDAY, 31 MAY
1.00 PM – 3.00 PM

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

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Number of seat

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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 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.
- 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.
- 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 Intermediate 2 (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.

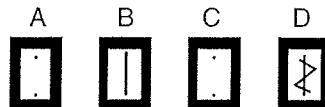
Sample Question

Which of the following lists all the elements that are present in every protein molecule?

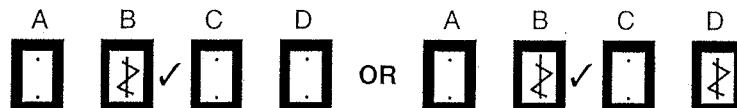
- A Carbon, oxygen, nitrogen
- B Carbon, hydrogen, oxygen, nitrogen
- C Carbon, hydrogen, oxygen, sulphur
- D Carbon, hydrogen, oxygen

The correct answer is B—Carbon, hydrogen, oxygen, nitrogen. 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:



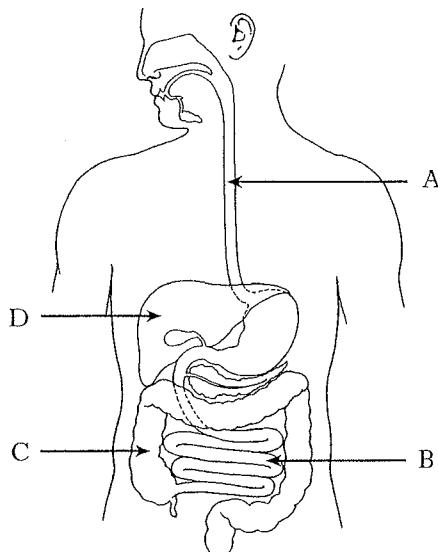
If you want to change back to an answer which has already been scored out, you should **enter a tick (✓)** to the **RIGHT** of the box of your choice, thus:



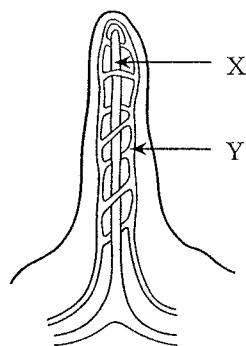
SECTION A

All questions in this Section should be attempted.

Questions 1 and 2 refer to the diagram of the digestive system below.



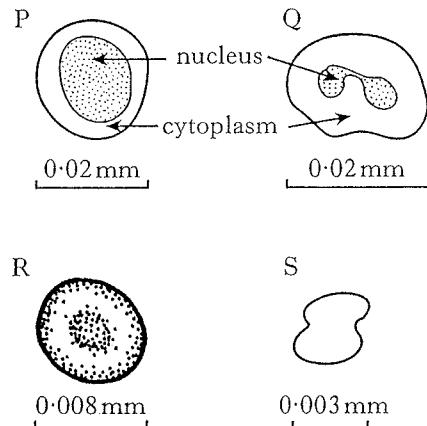
- Which labelled arrow identifies the small intestine?
- Which labelled arrow identifies where water is absorbed?
- The diagram below shows some structures in a villus.



Which line in the table below correctly identifies the products of digestion which pass into structures X and Y?

	X	Y
A	glucose	amino acids
B	glycerol	fatty acids
C	amino acids	glycogen
D	fatty acids	glucose

- The key below can be used to identify four components of blood, P, Q, R and S.



- Nucleus present..... go to 2
Nucleus absent..... go to 3
- Large volume of cytoplasm present .. macrophage
Small volume of cytoplasm present .. lymphocyte
- Diameter greater than 0.005 mm red blood cell
Diameter less than 0.005mm platelet

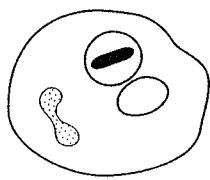
Which line in the table correctly identifies the blood components?

	P	Q	R	S
A	lymphocyte	red blood cell	platelet	macrophage
B	macrophage	lymphocyte	red blood cell	platelet
C	platelet	macrophage	red blood cell	lymphocyte
D	lymphocyte	macrophage	red blood cell	platelet

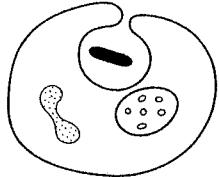
[Turn over

5. The diagrams below show stages in the process of phagocytosis as carried out by a macrophage.

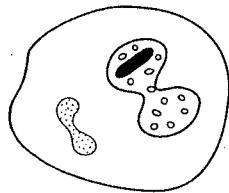
1. The bacterium is trapped in the vacuole.



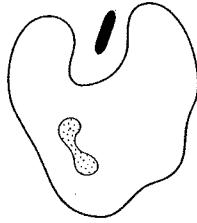
2. A vacuole forms in the macrophage.



3. The bacterium is digested by enzymes.



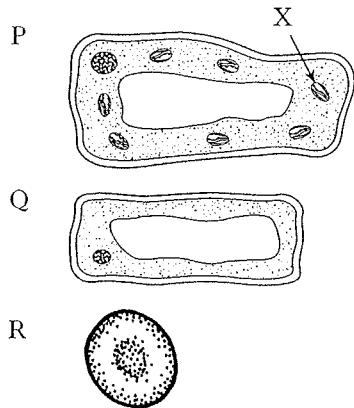
4. The macrophage engulfs the bacterium.



The correct order for these stages is

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

Questions 6 and 7 refer to the diagrams of cells below.



6. Which cells are plant cells?

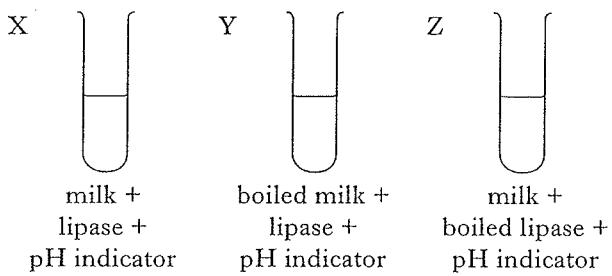
- A P only
- B P and Q
- C P and R
- D R only

7. The function of structure X is to

- A control all cell activities
- B keep the cell turgid
- C produce glucose using light energy
- D release energy from glucose.

8. Lipase is an enzyme found in the small intestine. Lipase speeds up the breakdown of fat. Full cream milk contains a high proportion of fat.

Three test tubes were set up as shown in the diagrams below.

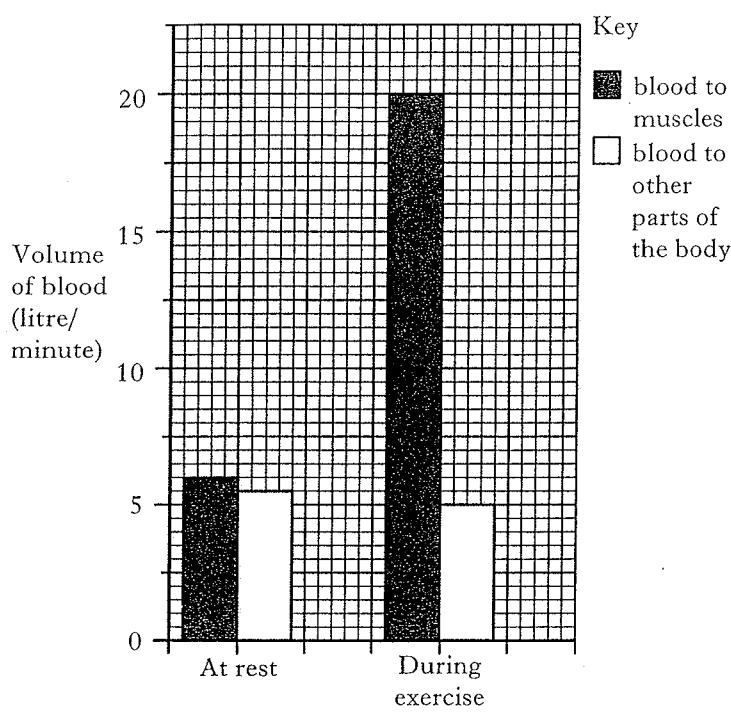


The pH of the contents of each test tube was recorded at the start and again 15 minutes later.

What changes in pH took place?

- A The pH decreased in each test tube.
- B The pH increased in each test tube.
- C The pH decreased in tubes X and Y and did not change in tube Z.
- D The pH increased in tubes Y and Z and did not change in tube X.

Questions 9 and 10 refer to the bar chart below. The bar chart shows the volume of blood supplied per minute to the skeletal muscles and to other parts of the body of a healthy male at rest and during strenuous exercise.



9. There is a difference in the volume of blood supplied per minute to the muscles and to other parts of the body **at rest**.

Which statement below is correct?

- A 0.5 litre more blood is supplied to the muscles than to other parts of the body.
- B 1.0 litre less blood is supplied to the muscles than to other parts of the body.
- C 0.5 litre less blood is supplied to the muscles than to other parts of the body.
- D 1.0 litre more blood is supplied to the muscles than to other parts of the body.

10. During **exercise**, the ratio of blood supplied to the muscles to blood supplied to other parts of the body is

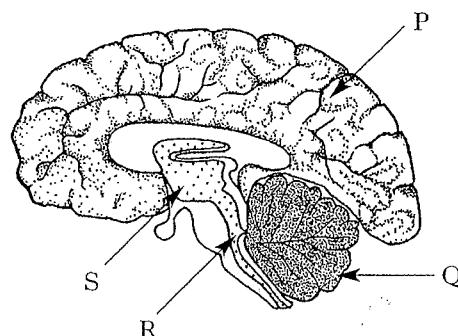
- A 1 : 4
- B 4 : 1
- C 6 : 5
- D 10 : 3.

11. Haemoglobin combines with oxygen to form oxy-haemoglobin.

Which of the following statements is correct?

- A At low oxygen levels oxy-haemoglobin releases oxygen in the lungs.
- B At high oxygen levels oxy-haemoglobin releases oxygen in the tissues.
- C At low oxygen levels oxy-haemoglobin releases oxygen in the tissues.
- D At high oxygen levels oxy-haemoglobin releases oxygen in the lungs.

Questions 12 and 13 refer to the diagram of the brain below.



12. The part labelled **P** is the

- A cerebrum
- B cerebellum
- C medulla
- D hypothalamus.

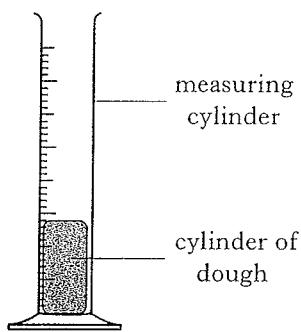
13. The hypothalamus

- A is responsible for conscious responses
- B co-ordinates activities in all parts of the body
- C detects changes in the water content of the blood
- D controls the heart and breathing rates.

[Turn over

14. Dried yeast was mixed with flour and sugar solution to make dough.

The dough was put into a measuring cylinder as shown in the diagram below.



The volume of dough was measured over a 40 minute period.

The results are shown in the table below.

Time (minutes)	0	10	20	30	40
Volume of dough (cm ³)	25	27	31	37	40

The percentage increase in the volume of the dough from the start to the end of the period was

- A 15
- B 37.5
- C 60
- D 62.5.

15. Which of the following statements is correct?

- A Anaerobic respiration produces 38 molecules of ATP from each glucose molecule.
- B Anaerobic respiration produces twice as much energy as aerobic respiration.
- C Aerobic respiration produces 38 molecules of ATP from each glucose molecule.
- D Aerobic respiration produces 2 molecules of ATP from each glucose molecule.

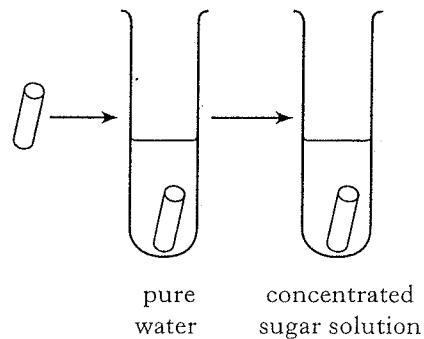
16. Which of the following is a **reversible** reaction in anaerobic respiration?

- A The conversion of pyruvic acid to ethanol and carbon dioxide
- B The conversion of glucose to pyruvic acid
- C The conversion of pyruvic acid to carbon dioxide and water
- D The conversion of pyruvic acid to lactic acid

17. A piece of potato was cut from a potato tuber, blotted dry and weighed.

It was placed in pure water for an hour and then removed, dried and re-weighed.

It was then placed in concentrated sugar solution for an hour, removed, dried and re-weighed.

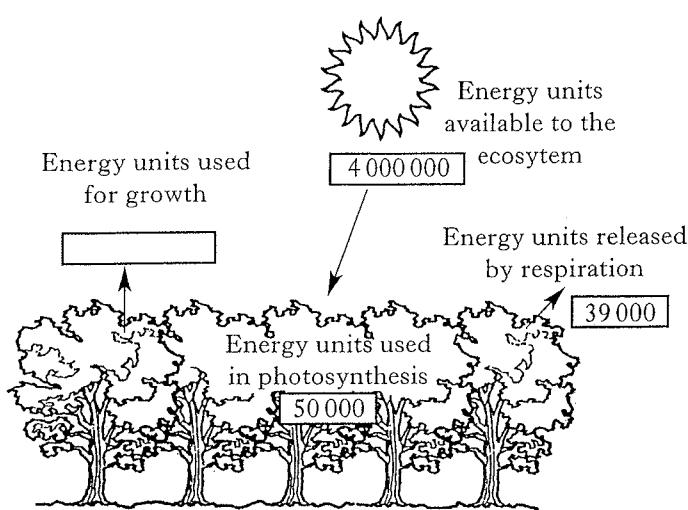


Which line in the table shows the results most likely to be obtained?

	First weight (g)	Second weight (g)	Third weight (g)
A	5	6	4
B	5	4	6
C	5	7	9
D	5	4	3

Questions 18 and 19 refer to the diagram below.

The diagram represents energy flow in a woodland ecosystem.



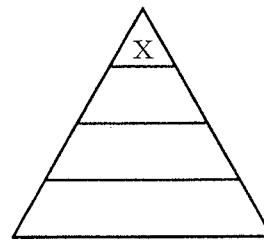
18. The number of energy units used for growth is

- A 11 000
- B 89 000
- C 3 950 000
- D 3 961 000.

19. The percentage of the energy from sunlight absorbed by trees and used for photosynthesis is

- A 1.25
- B 12.5
- C 98.75
- D 8000.

20. The diagram below shows the pyramid of energy for a food chain.



There is less energy at level X in the pyramid because

- A energy is stored in each level and not passed on
- B energy is lost at each level in a food chain
- C the energy is concentrated in fewer organisms
- D organisms in level X are very small.

21. The table below shows the relationship between planting density and the mass of seed harvested for a trial cereal crop.

Planting density (number of plants per square metre)	Mass of seed harvested (grammes per square metre)
4	60
8	86
16	104
32	77
128	22

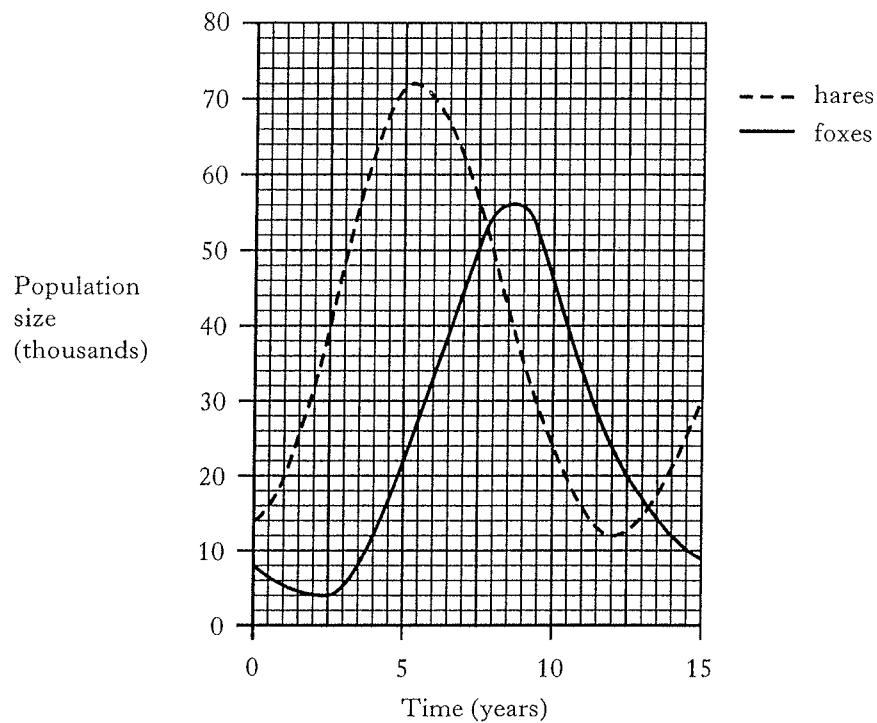
The reason a low mass of seed was harvested when the planting density was 128 plants per square metre was

- A less disease at high planting densities
- B more nutrients available
- C more competition for light and nutrients
- D less space for weeds.

[Turn over

Questions 22 and 23 refer to the graph below.

The graph shows the variations in the populations of arctic hares and their predators, foxes, in an area.



22. What is the difference in the population sizes of the hares and foxes when both populations are at their maximum?

A 3 000
B 16 000
C 52 000
D 58 000

23. What could be the reason for the decline in number of foxes after 9 years?

A The food available decreased.
B The numbers of prey increased.
C There is less disease in both populations.
D The food available increased.

24. The table below gives information about chromosomes in some human cells.

Which line in the table is correct?

	Cell	Number of chromosome sets	Number of chromosomes
A	nerve	2	23
B	egg	1	23
C	lymphocyte	1	46
D	sperm	2	23

25. When a plant with red flowers was crossed with a plant with white flowers, the F_1 plants had pink flowers.

The F_1 plants were then self-fertilised.

What ratio of flower colours would be found in the F_2 generation?

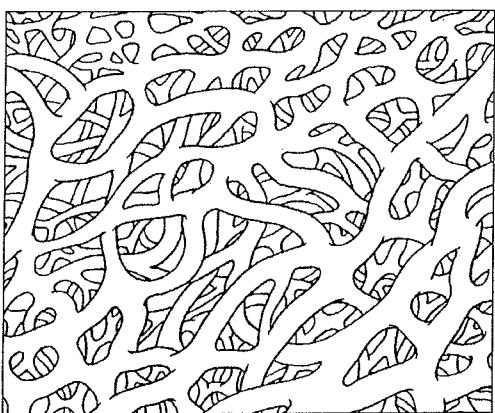
A 1 red : 2 white
B 1 white : 2 pink
C 1 red : 2 pink : 1 white
D 1 red : 1 pink : 1 white

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

SECTION B

All questions in this section should be attempted.

1. (a) The diagram below shows a capillary network similar to that found surrounding air sacs in the lungs.



State **two** features of the **capillary network** in the lungs that allow efficient gas exchange to take place.

Explain how each feature improves gas exchange.

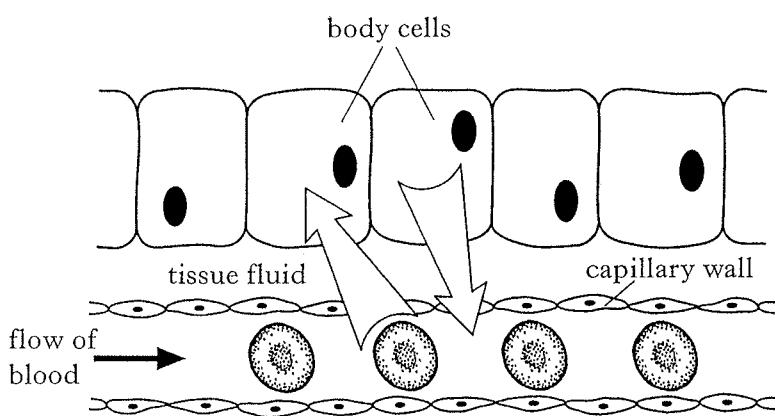
Feature 1 _____ 1

Explanation _____ 1

Feature 2 _____ 1

Explanation _____ 1

(b) The diagram below shows gas exchange taking place in the tissues.

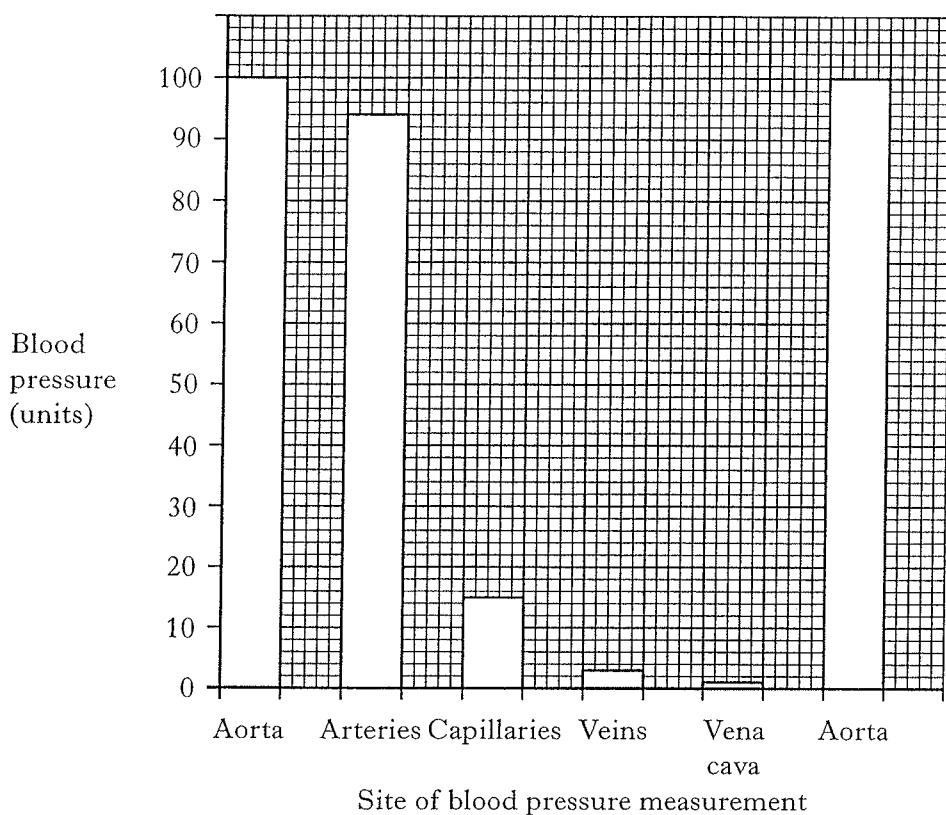


Name the process by which gases pass between capillaries and body cells.

1

Marks

2. The bar graph below shows average blood pressure measurements in different blood vessels for a healthy individual.



(a) Calculate the **simple whole number ratio** of the blood pressure in the aorta to the blood pressure found in the capillaries.

Space for calculation

_____ : _____

1

(b) Calculate the **percentage decrease** in blood pressure when blood moves from a capillary to a vein.

Space for calculation

_____ %

1

(c) Explain what brings about the large increase in blood pressure between the vena cava and the aorta.

1

(d) The blood pressure in veins is very low.

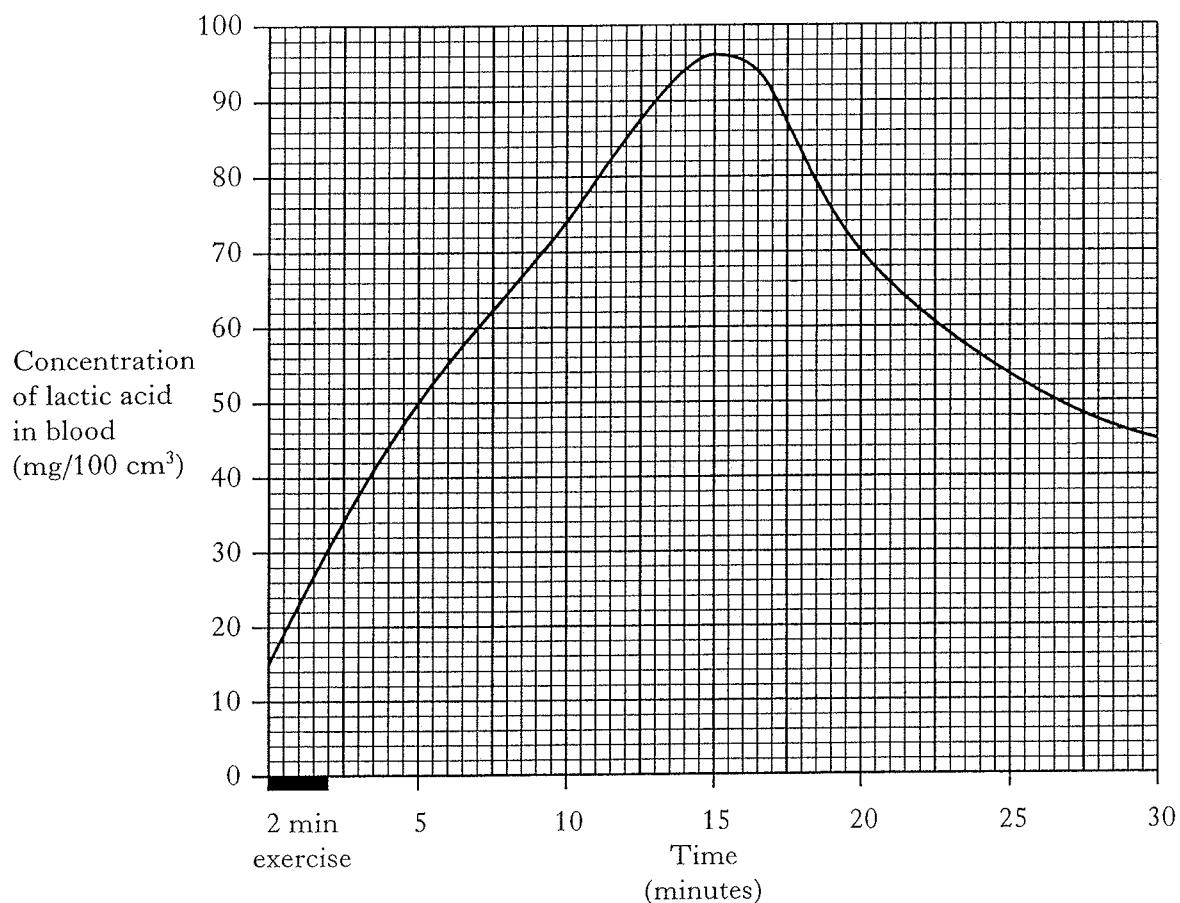
Name the structures in veins that prevent blood flowing backwards.

1

Marks

3. An investigation was carried out into the concentration of lactic acid in the blood before, during and after a two minute period of strenuous exercise.

The results are shown in the graph below.



(a) What was the concentration of lactic acid in the blood ten minutes after the start of the exercise?

_____ mg/100 cm³

1

(b) Explain why the concentration of lactic acid in the blood increased during and immediately after the strenuous exercise.

1

(c) What caused the lactic acid concentration to decrease 15 minutes after the start of the exercise?

1

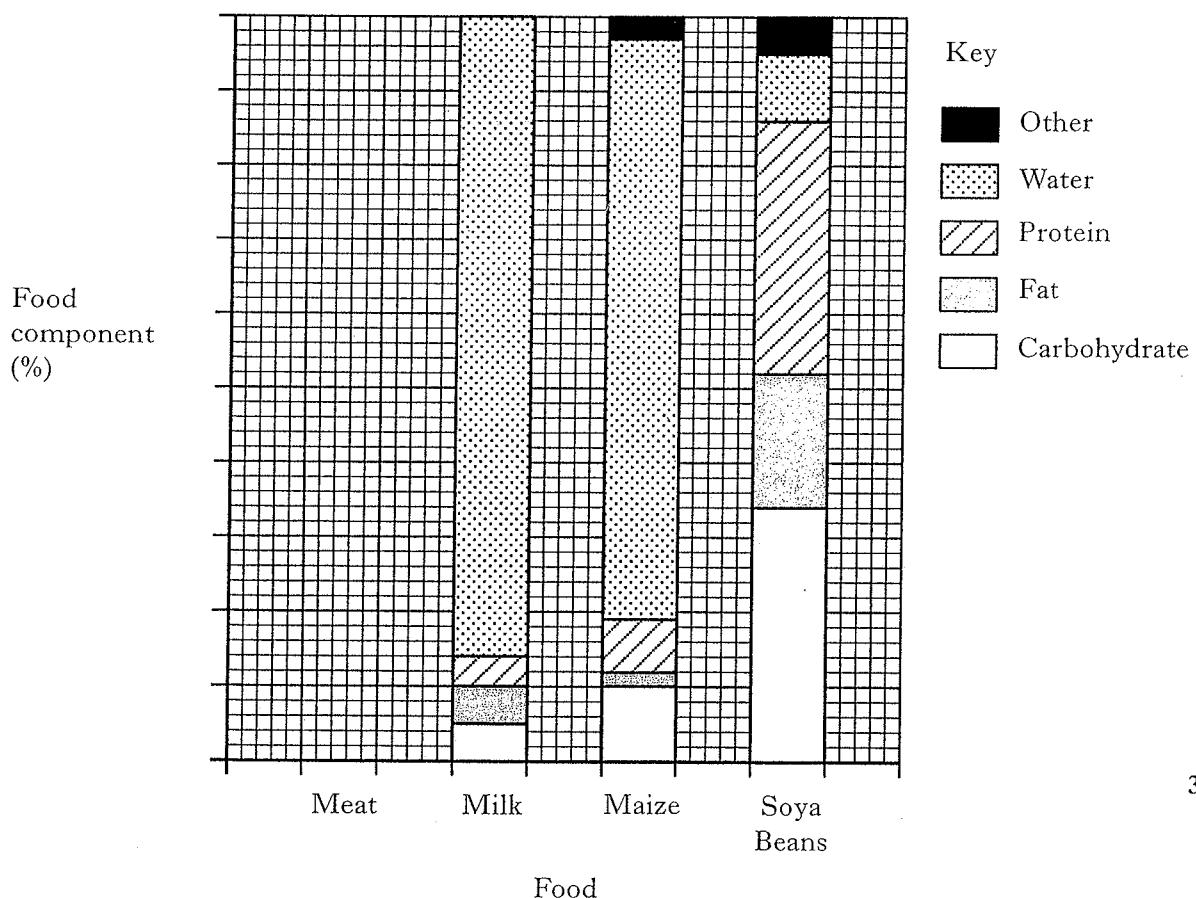
4. (a) The table below shows the composition of four foods.

Food	Food Components				
	Carbohydrate %	Fat %	Protein %	Water %	Other %
Meat	0	18	18	62	2
Milk	5	5	4	86	0
Maize	10	2	7	78	3
Soya Beans	34	18	34	9	5

(i) Complete the bar graph by

1. putting a scale on the vertical axis
2. adding the bar to show all the components of meat.

(Additional graph paper, if required, will be found on page 32.)



4. (a) (continued)

(ii) The final column in the table has been headed "other".

Name **one** of the food groups which is included under this heading.

1

(iii) Which component of food is needed to produce enzymes?

1

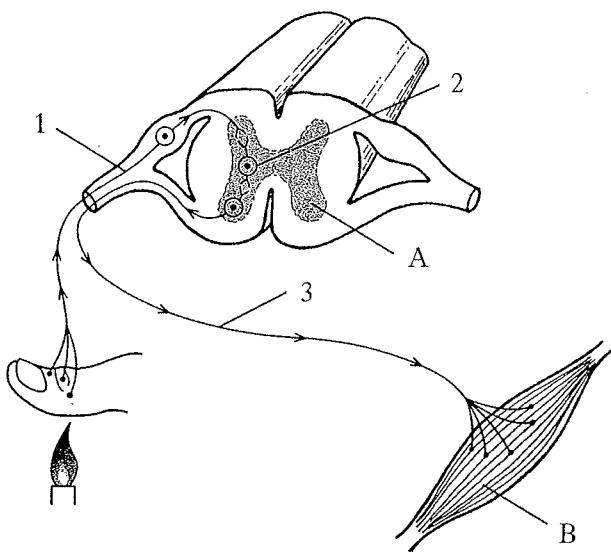
(b) Name the **three** elements common to carbohydrate, protein and fat.

1

[Turn over

Marks

5. The diagram below shows some of the structures involved in a reflex action.



(a) The neurones labelled 1, 2 and 3 form a reflex arc.

Name each of these neurones.

1 _____

2 _____

3 _____

2

(b) Some neurones found in area A may transmit impulses to another part of the Central Nervous System (CNS).

Name the part of the CNS which receives these impulses.

1

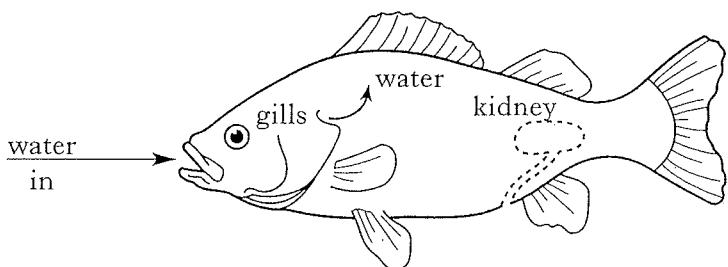
(c) Describe the response that occurs at B.

1

(d) What is the function of reflex actions?

1

6. (a) A freshwater fish is hypertonic to its environment.



Underline one option in each set of brackets to make the sentences below correct.

The gills of this fish $\left\{ \begin{array}{l} \text{take in} \\ \text{give out} \end{array} \right\}$ salts.

The kidneys produce a $\left\{ \begin{array}{l} \text{large} \\ \text{small} \end{array} \right\}$ volume of $\left\{ \begin{array}{l} \text{dilute} \\ \text{concentrated} \end{array} \right\}$ urine.

2

(b) (i) Name the hormone that acts on the kidney to maintain water balance in humans.

1

(ii) Name the part of the kidney nephron on which the hormone has its effect.

1

(iii) When the concentration of water in the blood increases, the hormone acts to return the water concentration to normal.

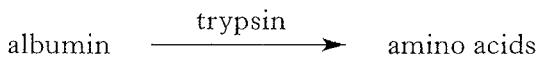
What term is used to describe this mechanism?

1

[Turn over

Marks

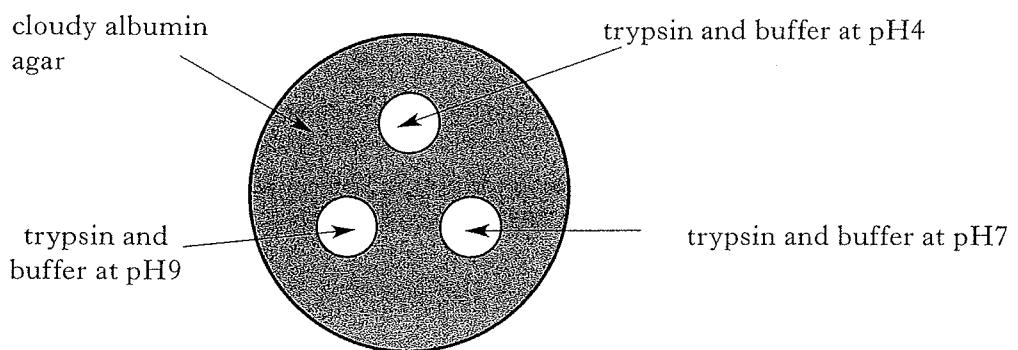
7. Albumin is a protein which can be broken down by the enzyme trypsin. When albumin is added to agar the agar becomes cloudy. When the albumin is broken down by trypsin the agar becomes clear.



Groups of students carried out an investigation to find the effect of pH on the activity of the enzyme trypsin.

Each group carried out the following procedure.

1. A petri dish containing cloudy albumin agar was collected.
2. Three wells were cut out of the agar.
3. Drops of trypsin and buffer solution of different pH were added to the wells, as shown in the diagram below.



4. The dishes were incubated at 37 °C for 24 hours.
5. The diameter of the clear zone around each well was measured.

(a) State **one** variable that should have been kept constant when the dishes were set up.

1

7. (continued)

(b) The results from each group are given in the table below.

<i>pH</i>	<i>Diameter of the clear area (mm)</i>				
	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Average</i>
4	1	2	0	3	1.5
7	6	9	8	11	
9	21	23	20	24	22

(i) Complete the table by calculating the average diameter of the clear area for pH7.

Space for calculation

1

(ii) Explain why the results for all groups were collected and averages calculated.

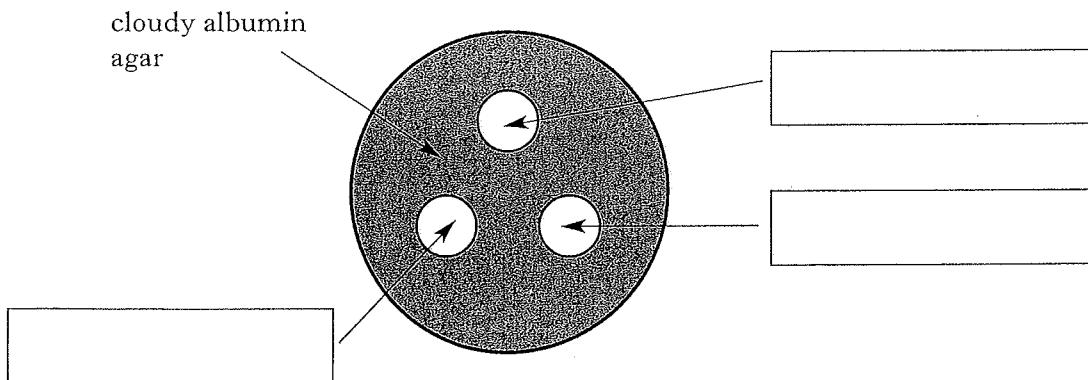
1

(iii) From the results, describe the effect of pH on the activity of trypsin.

1

(c) One group suggested setting up a control to show that the enzyme caused the observed effects.

Complete the labels on the diagram below to show the content of the wells for the control.



1

[Turn over

Marks

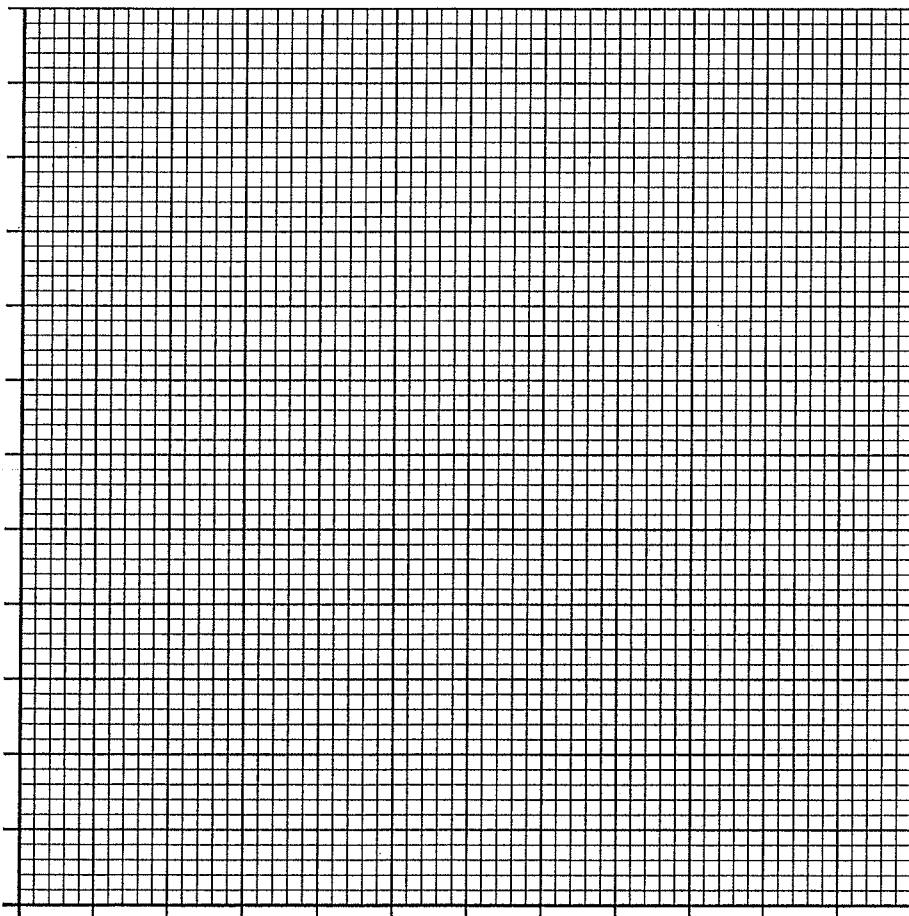
8. (a) A scientist grew some cereal plants in a field.

During the course of a day, she removed 2 plants every 4 hours and measured the concentrations of sugar in the leaves of the plants.

The results are shown in the table below.

Time of day (hours)	Sugar concentration (percentage of dry mass)		
	Sample 1	Sample 2	Average
0400	0.42	0.48	0.45
0800	0.58	0.62	0.60
1200	1.46	2.04	1.75
1600	1.57	2.43	2.00
2000	1.05	1.75	1.40
2400	0.49	0.51	0.50

Present the results in an appropriate format on the grid below.
(Additional graph paper, if required, will be found on page 33.)



3

	Marks
8. (continued)	
(b) The following word equation shows the first stage of photosynthesis.	
$\text{water} \xrightarrow{\text{light energy}} \text{oxygen} + \text{hydrogen} + \text{ATP}$	
(i) Name this stage of photosynthesis.	1

(ii) Describe what happens to each of the products.	1
Oxygen _____	

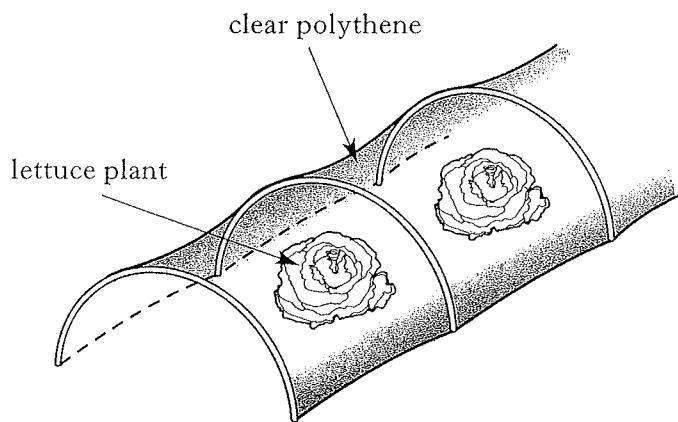
Hydrogen _____	1

ATP _____	1

[Turn over

Marks

9. (a) Lettuces may be grown in "tunnels" covered in clear polythene as shown in the diagram below.



(i) Give **two** reasons why the use of clear polythene may result in the lettuces being ready for cropping earlier.

1 _____

2 _____

2

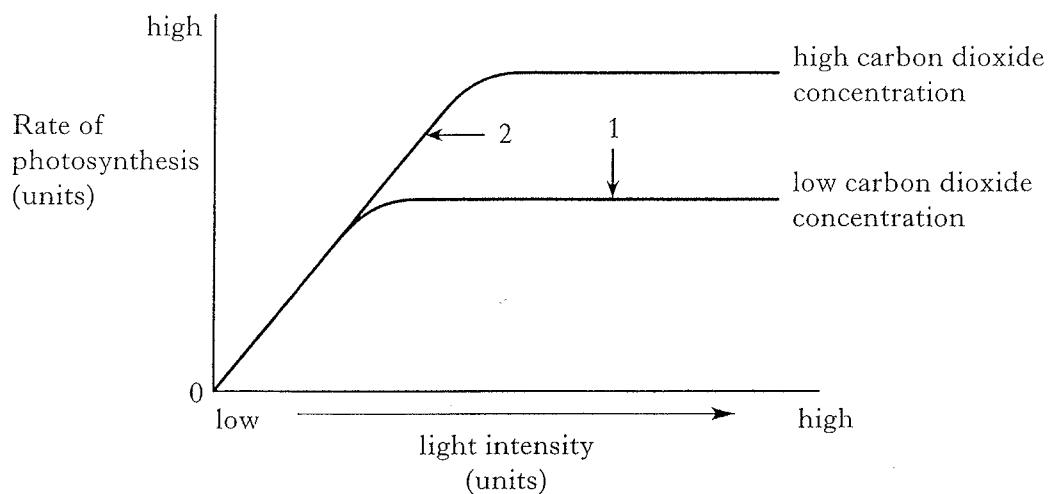
(ii) Air rich in carbon dioxide can be passed through these tunnels.

Explain how this would make the lettuces grow faster.

1

9. (continued)

(b) The graph below shows how the rate of photosynthesis is affected by light intensity at different concentrations of carbon dioxide.



(i) What factor was limiting the rate of photosynthesis at points 1 and 2?

Point 1 _____ 1

Point 2 _____ 1

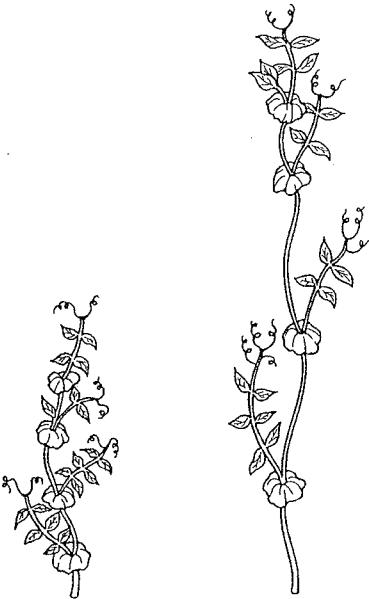
(ii) Name **one** other factor that may limit the rate of photosynthesis.

_____ 1

[Turn over

Marks

10. (a) In peas the height of the plant is controlled by one gene which has two alleles.
T represents the dominant allele for tall stems.
t represents the allele for short stems.



True breeding, tall-stemmed pea plants were crossed with short-stemmed pea plants to produce the F_1 generation.

(i) State the genotype of the parents.

_____ and _____

1

(ii) State the phenotypes of the F_1 plants.

1

(iii) Plants from the F_1 generation were crossed to produce the F_2 generation of plants.

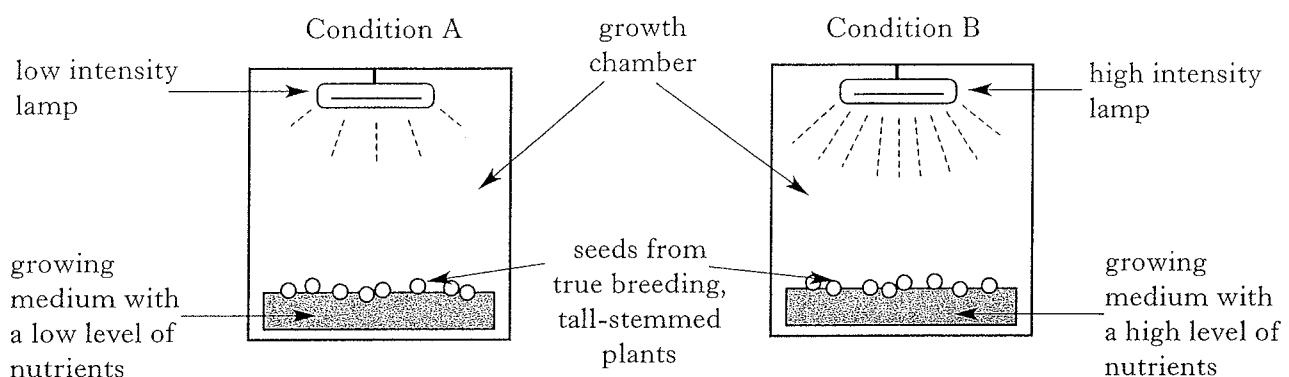
State the phenotypes and their expected ratio in the F_2 generation.

_____ : _____ plants

1

10. (continued)

(b) Seeds from true breeding, tall-stemmed pea plants were provided with different growing conditions as shown in the diagrams below.



(i) **Compare** the expected appearance of the plants in each group.

1

(ii) What term is used to describe the effect of different conditions on the phenotype of an organism?

1

[Turn over

Marks	
1	
1	
2	
1	
1	
1	
1	

11. The song thrush feeds on snails which it finds by sight in a variety of habitats. Snails are herbivores and feed only on grasses.

(a) (i) Present this feeding relationship as a food chain.

(ii) Use the information above to complete the table below.

<i>Term</i>	<i>Organism</i>
primary consumer	snail
predator	
prey	
producer	

(iii) Describe what is meant by a *habitat*.

(b) Name a decomposer and describe the role of decomposers in an ecosystem.

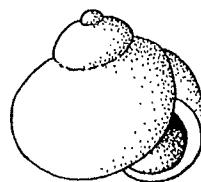
Decomposer _____

Role of decomposers _____

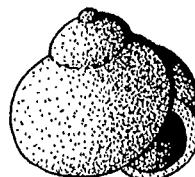
11. (continued)

(c) The snail *Cepea* shows variation in shell colour and different forms of shell are found.

Two of the forms are shown below.



Light form



Dark form

The table below shows the results of an investigation into the numbers of different forms of snails found in two habitats.

<i>Habitat</i>	<i>Light form</i>	<i>Dark form</i>	<i>Other forms</i>
dense woodland	14	64	22
open grassland	58	12	30

Explain how natural selection has resulted in the high numbers of the dark form of the shell in the **dense woodland**.

2

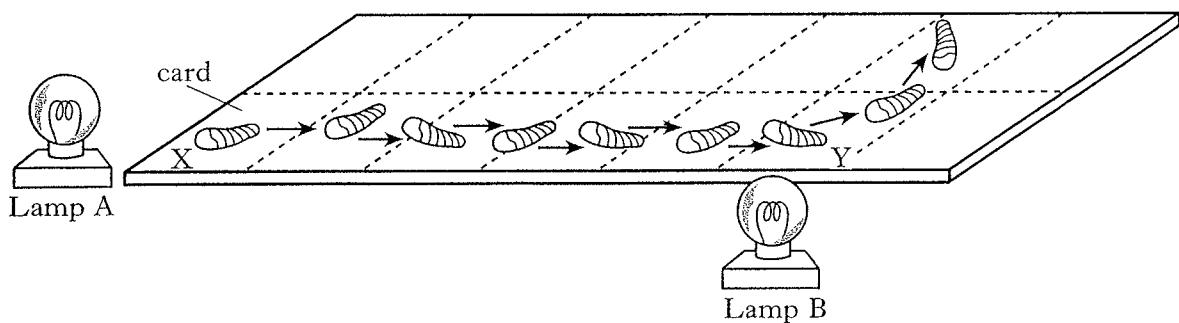
[Turn over

12. An investigation into the behaviour of blowfly larvae was carried out.

One blowfly larva was placed at X and then lamp A was switched on.

When the larva reached Y, lamp A was switched off and lamp B was switched on.

The path taken by the larva is shown in the diagram below.



(a) Describe the response of the larva to light.

1

(b) (i) Suggest **one** change to the apparatus that would confirm that the response was due to the light and not the heat from the lamp.

1

(ii) State **one** way in which the reliability of the result could be improved.

1

(c) (i) Name a stimulus, other than light, to which woodlice respond.

1

(ii) Describe the response of woodlice to this stimulus.

1

(iii) Explain the adaptive significance of this response in woodlice.

1

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

SECTION C

Both questions in this section should be attempted.

Marks

Note that each question contains a choice.

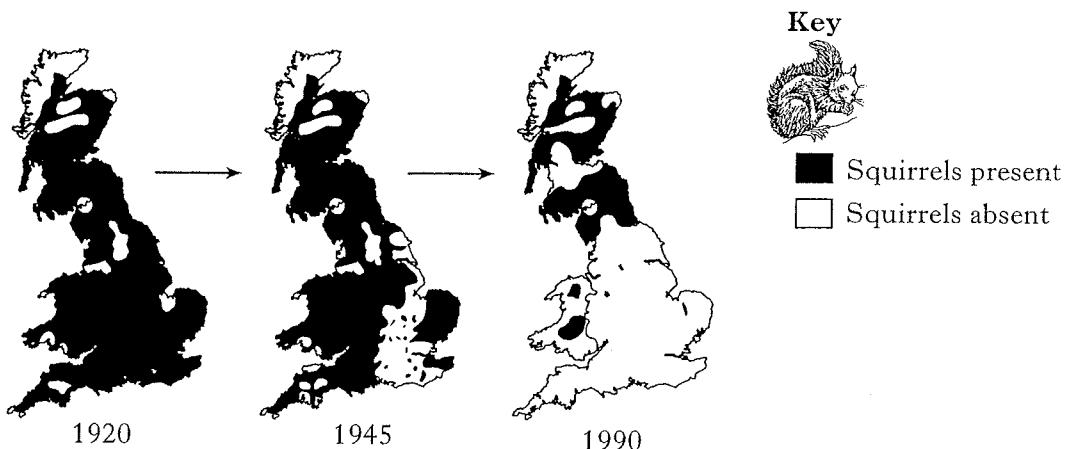
Questions 1 and 2 should be attempted on the blank pages which follow.

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

In question 1, ONE mark is available for coherence.

1. Answer either A or B.

A. The maps below show the changes in distribution of the red squirrel in the UK from 1920 to 1990.

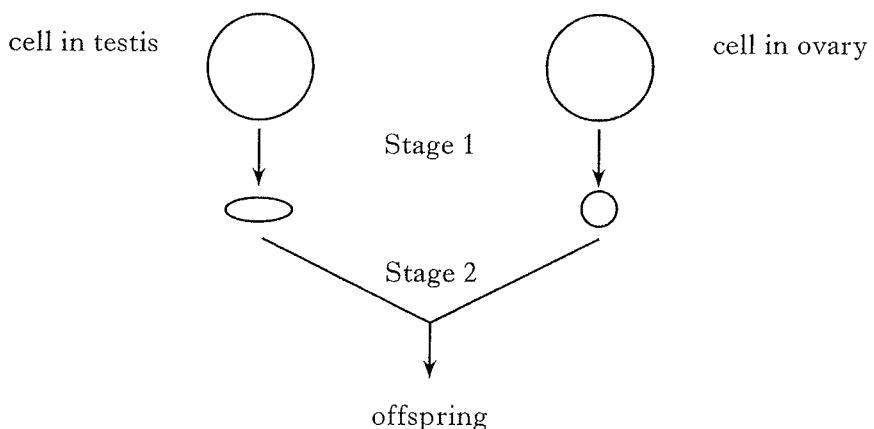


(a) Describe the change in distribution between 1920 and 1990.
(b) Suggest reasons for this change.
(c) Discuss the potential impact this could have on biodiversity.

5

OR

B. The diagram below shows the two stages that result in the formation of offspring in animals.



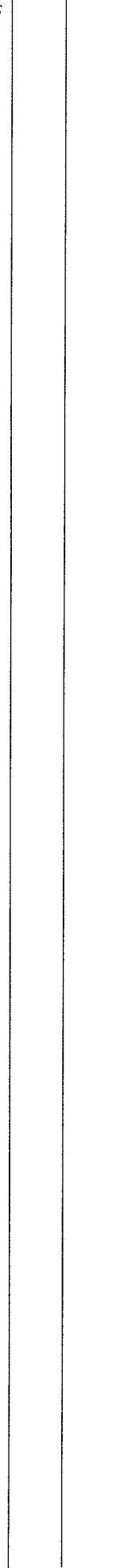
(a) Describe what happens at **each** stage.
(b) Explain how variation is brought about during **each** stage.

5

Question 2 is on Page thirty.

SPACE FOR ANSWER TO QUESTION 1

Marks



2. Answer either A or B.

Labelled diagrams may be included where appropriate.

A. Give an account of the properties of enzymes.

5

OR

B. Describe the stages in aerobic respiration.

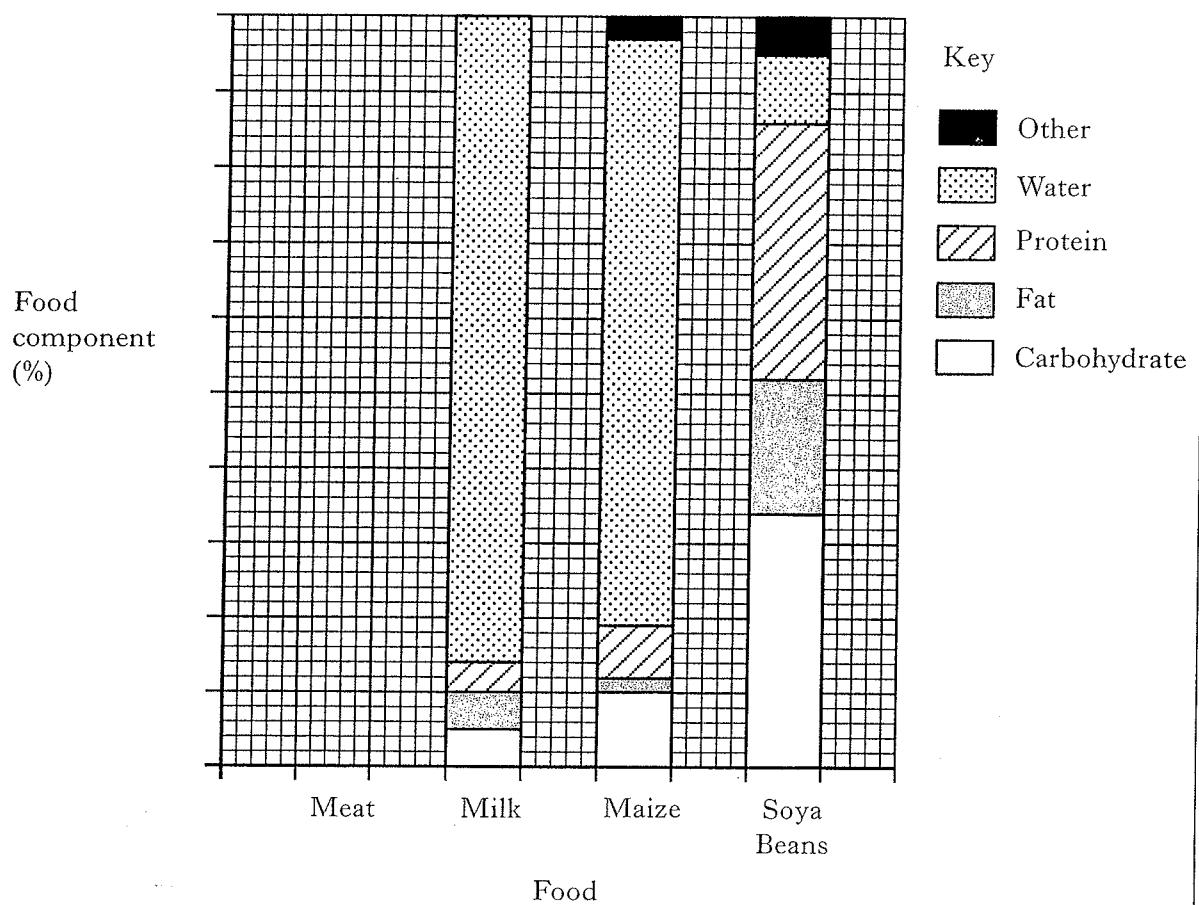
5

[END OF QUESTION PAPER]

SPACE FOR ANSWER TO QUESTION 2

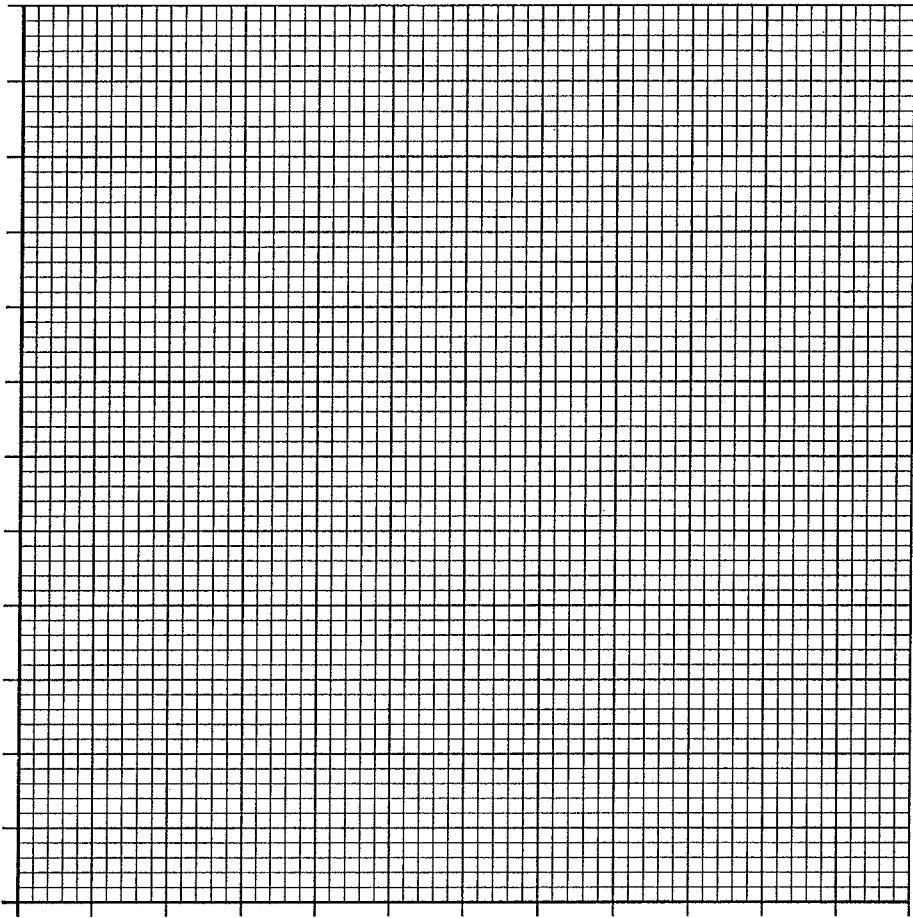
SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 4(a)(i)



SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 8(a)



SPACE FOR ANSWERS