

--	--	--	--	--	--

Total for
Sections B and C

X007/201

NATIONAL
QUALIFICATIONS
2001

MONDAY, 21 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 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?

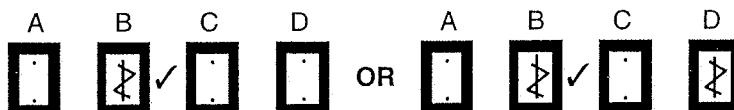
- A Carbon, oxygen, nitrogen
- B Carbon, hydrogen, oxygen, nitrogen
- C Carbon, hydrogen, oxygen, sulphur
- D Carbon, hydrogen, oxygen

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:



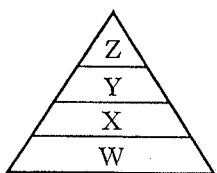
If you want to change back to an answer which has already been scored out, you should **enter a tick (✓)** to the **RIGHT** of the box of your choice, thus:



SECTION A

All questions in this Section should be attempted.

- Which term describes all the organisms living in the same area?
 A Food web
 B Ecosystem
 C Population
 D Community
- Which term describes an animal that eats other animals in a food web?
 A Prey
 B Predator
 C Producer
 D Primary consumer
- The diagram below shows a pyramid of biomass.

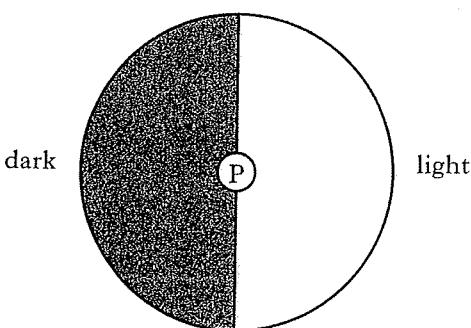


W represents the total mass of

- producers
- prey
- predators
- herbivores.

Questions 4, 5 and 6 refer to the diagram and the information below.

A choice chamber was set up to investigate the response of woodlice to an environmental condition.



Thirty woodlice were placed in the choice chamber at point P.

The woodlice distribution was noted every 2 minutes during a 10 minute period.

The results are shown in the table below.

Time (minutes)	Number of woodlice	
	In the dark	In the light
2	12	18
4	13	17
6	15	15
8	19	11
10	27	3

- The environmental condition being investigated is
 A temperature
 B number of woodlice
 C light
 D humidity.
- The simple whole number ratio of woodlice found in the dark to those found in the light after two minutes was
 A 2 : 3
 B 3 : 2
 C 6 : 9
 D 12 : 18.
- A possible conclusion from this investigation is
 A woodlice are more likely to be found in the light
 B woodlice are more likely to be found in the dark
 C woodlice cannot detect light
 D woodlice show no difference in their response to light and dark.

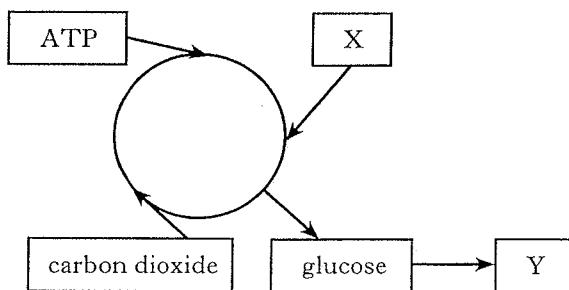
7. What must be present in leaf cells for photosynthesis to take place?

- Carbon dioxide and water
- Oxygen and water
- Carbon dioxide and oxygen
- Oxygen and hydrogen

8. Products of the photolysis stage of photosynthesis are

- glucose and hydrogen
- carbon dioxide and hydrogen
- water and oxygen
- hydrogen and oxygen.

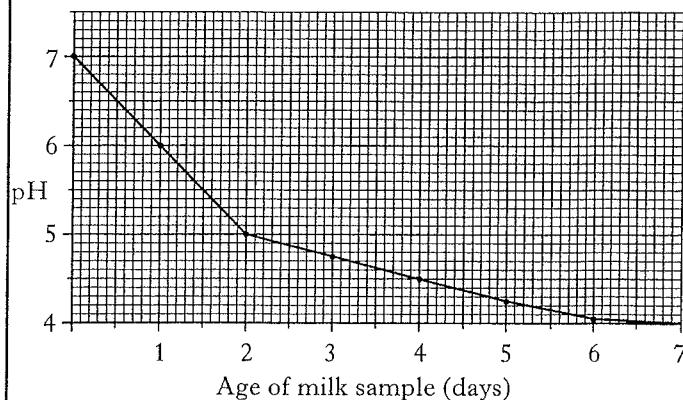
9. The diagram below shows the carbon fixation stage of photosynthesis.



Which line in the table correctly identifies X and Y?

	X	Y
A	hydrogen	starch
B	starch	ADP
C	starch	oxygen
D	water	starch

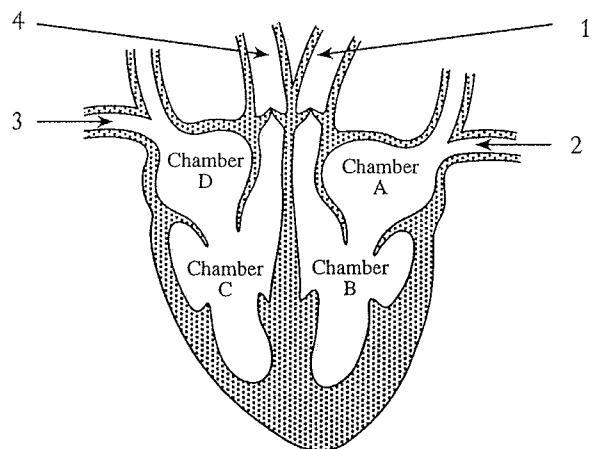
10. The graph below shows the changing pH of a sample of milk over a seven day period.



The changes in pH are due to

- lactic acid in the milk destroying the bacteria
- enzymes in the milk being denatured
- bacteria in the milk causing the production of lactic acid
- bacteria in the milk producing carbon dioxide.

Questions 11 and 12 refer to the diagram below which shows a section through a mammalian heart.

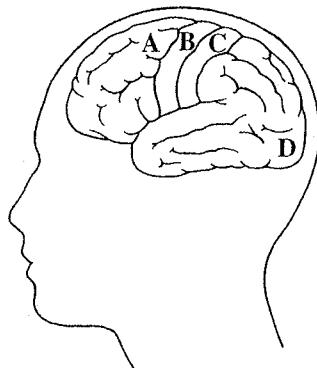


11. Which arrow identifies the vena cava?

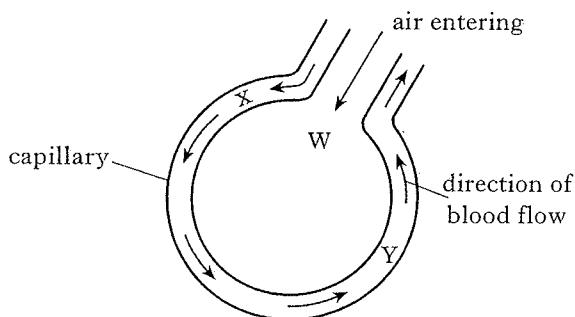
- 1
- 2
- 3
- 4

12. Which heart chamber pumps blood to the lungs?

13. Which letter correctly identifies the location of the sensory strip of the cerebrum?



14. The diagram below shows a site of gas exchange in the lungs.

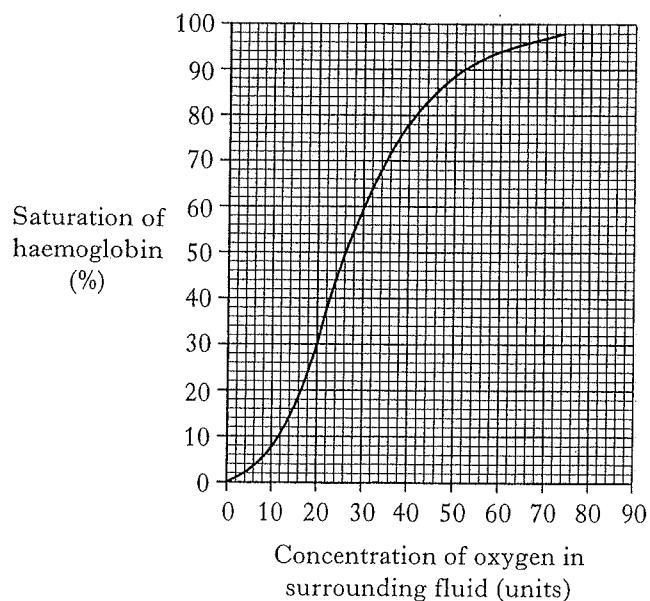


Which line in the table shows the correct relative concentrations of oxygen?

Concentration of oxygen			
	at W	at X	at Y
A	high	low	high
B	low	high	low
C	low	high	high
D	high	high	low

Questions 15 and 16 refer to the graph below.

The graph shows the percentage saturation of haemoglobin at different oxygen concentrations.



15. What is the percentage saturation of haemoglobin with oxygen when the oxygen concentration of the surroundings is 60 units?

A 30
B 90
C 92
D 94

16. What is the increase in percentage saturation of haemoglobin with oxygen as the oxygen concentration of the surroundings increases from 20 to 40 units?

A 20
B 30
C 48
D 78

17. Digestion takes place in animals

A and allows insoluble molecules to pass directly through the wall of the small intestine
B as enzymes cannot act on insoluble molecules
C and makes insoluble molecules soluble to allow absorption
D and allows food to be passed along the gut by peristalsis.

18. The hepatic portal vein transports

A glucose from the large intestine to the liver
B amino acids from the small intestine to the liver
C fats from the lacteal to the liver
D urea from the kidneys to the liver.

19. Which substances are normally excreted in urine?

A Protein and urea
B Urea and salts
C Glucose and salts
D Protein and salts

[Turn over

20. The table below shows water gained and lost by the body over a 24 hour period.

Method of water gain	Volume of water gained (cm ³)	Method of water loss	Volume of water lost (cm ³)
food	800	exhaled breath	
drink	1000	sweating	500
metabolic water	350	urine	1250
		faeces	100

What volume of water is lost in exhaled breath?

- A 100 cm³
- B 200 cm³
- C 300 cm³
- D 500 cm³

21. After running a race an athlete experienced muscle fatigue.

Which of the following increased in the muscles?

- A Glucose
- B Oxygen
- C ATP
- D Lactic acid

22. During aerobic respiration in muscle cells oxygen will combine with

- A hydrogen to form water
- B pyruvic acid to form lactic acid
- C pyruvic acid to form ethanol
- D glucose to form pyruvic acid.

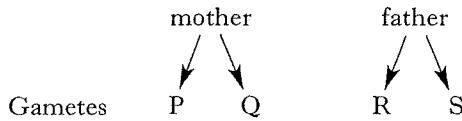
23. Which of the following is a correct description of a chromosome?

- A A chain of DNA bases
- B A chain of RNA bases
- C A chain of amino acids
- D A chain of sugar molecules

24. If an inherited characteristic is controlled by alleles of more than one gene, then the type of inheritance is called

- A true breeding
- B polygenic
- C co-dominant
- D monohybrid.

25. The diagram below represents the transmission of sex determining chromosomes from parents to offspring.



Which line in the table below correctly identifies the sex chromosomes for the gametes P, Q, R and S?

	Gamete P	Gamete Q	Gamete R	Gamete S
A	XX	XX	XY	XY
B	X	X	X	Y
C	XX	XY	XX	XY
D	X	Y	X	Y

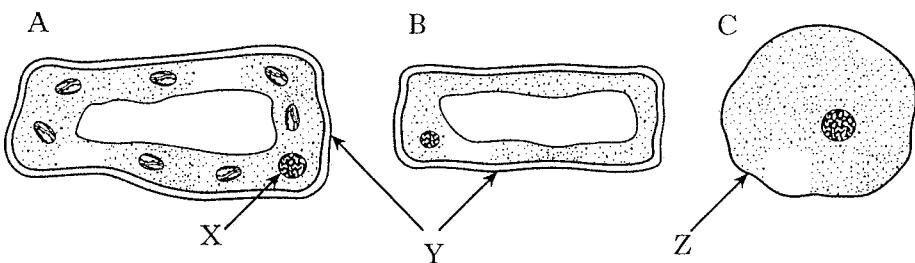
Candidates are reminded that the answer sheet for Section A MUST be placed inside the front cover of this answer book.

SECTION B

All questions in this section should be attempted.

Marks

1. The diagrams below show sections of three different cell types.
They are not drawn to the same scale.



(a) (i) Complete the table below to show the name and function of the parts labelled X, Y and Z.

Part of cell	Name	Function
X		
Y		
Z		

2

(ii) Cells A and B are plant cells and cell C is an animal cell.
Describe **two** features, shown in the diagrams, that support this statement.

2

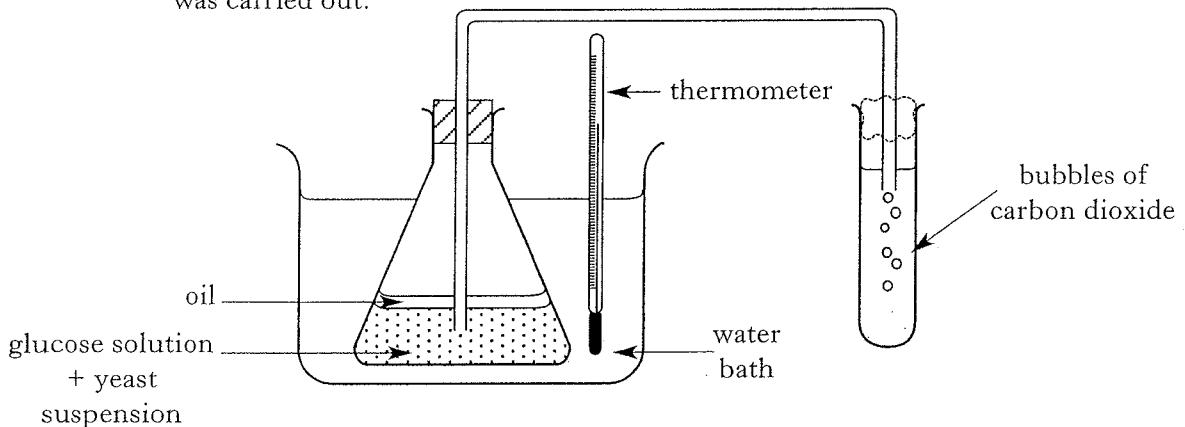
(b) Name a substance produced by cell type A that can be used by cell types B and C.

1

[Turn over

Marks

2. (a) An investigation into the effect of temperature on anaerobic respiration in yeast was carried out.



1. A glucose solution was boiled and cooled and poured into a conical flask.
2. A yeast suspension was added to the glucose solution.
3. Oil was poured over the surface of the liquid.
4. The number of bubbles of carbon dioxide produced in one minute was counted.
5. The procedure was repeated at a range of temperatures.

(i) In this investigation temperature was the only variable altered.

State **two** variables that should be kept constant when setting up this investigation.

1 _____

2 _____

2

(ii) Explain the purpose of the layer of oil.

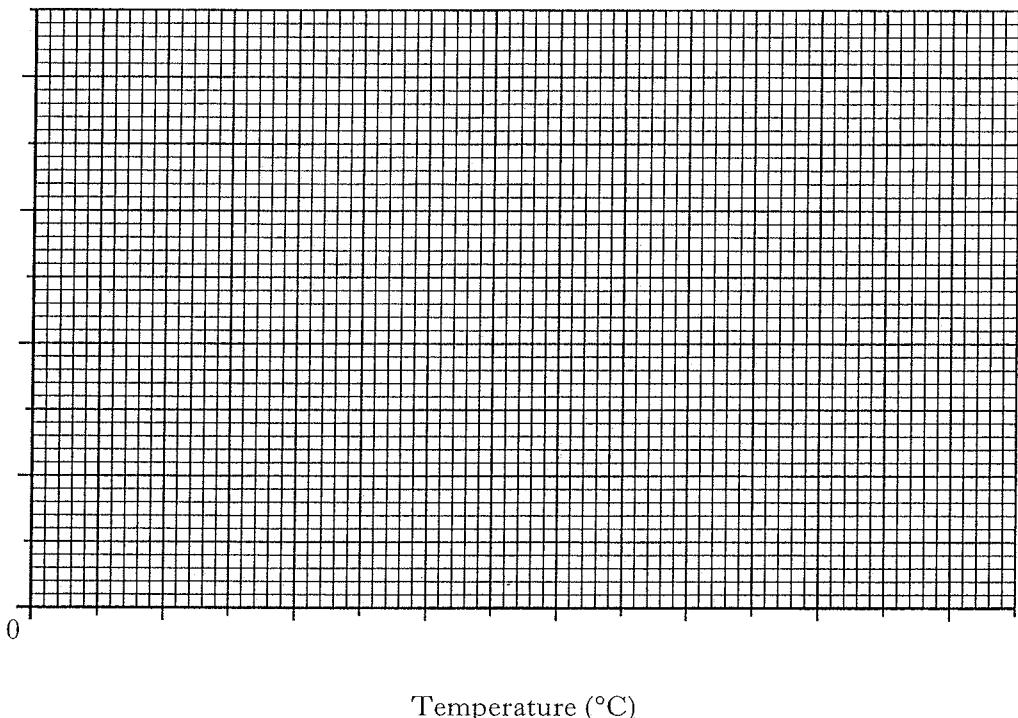
1

(iii) The results are shown in the table below.

Temperature (°C)	Bubbles of carbon dioxide (number/minute)
4	0
20	3
35	6
45	22
50	20
70	0

2. (a) (continued)

Present the results in a suitable format on the grid below.
(Additional graph paper, if required, will be found on page 28.)



3

(iv) From the results, describe the effect of temperature on anaerobic respiration in yeast.

2

(v) Suggest **one** way in which the reliability of the results could be improved.

1

(vi) In addition to carbon dioxide, what will be produced in the flask during the investigation?

1

(vii) Explain why no carbon dioxide is produced when the temperature is 70 °C.

1

(b) Yeast is a micro-organism used in the production of bread.

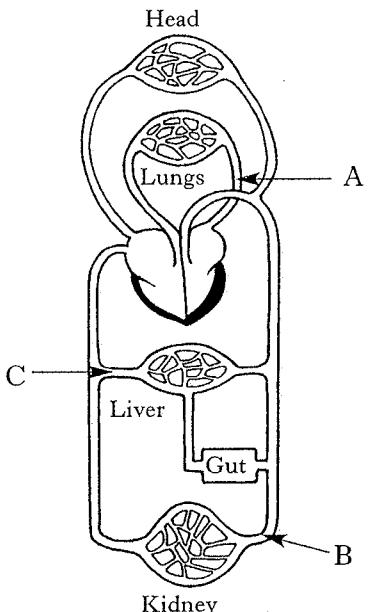
Name **one** other type of micro-organism and an associated product.

_____ used to produce _____.

1

Marks

3. The diagram below shows part of the human circulatory system.



(a) Name the blood vessels labelled A, B and C in the diagram.

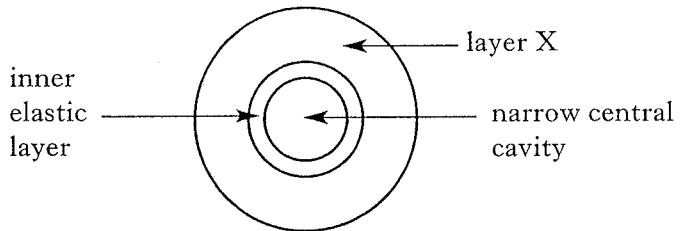
A _____

B _____

C _____

3

(b) The diagram below shows a cross section through an artery.



(i) Describe layer X.

1

(ii) Describe how the structure of layer X is related to its function.

1

(iii) The pulse beat can be felt in an artery.

What causes the pulse beat?

1

Marks

4. (a) (i) Describe **two** features of the lungs which make them efficient gas exchange surfaces.

1 _____

2 _____

2

(ii) Name the structures in the lungs through which oxygen diffuses from the air into the blood capillaries.

1

(b) The table below shows the rates of oxygen intake and energy release during various activities.

<i>Activity</i>	<i>Rate of oxygen intake (cm³/second)</i>	<i>Rate of energy release (joules/second)</i>
Resting	3.5	70
Playing golf	20	400
Playing tennis	25	500
Playing football	30	600

Describe the relationship between oxygen intake and energy release.

1

[Turn over

Marks															
5.	(a) Some information on digestion and absorption of the main food groups is given in Table 1 below.														
	Table 1														
	<table border="1"><thead><tr><th><i>Food group</i></th><th><i>Product(s) of digestion</i></th><th><i>Use after absorption</i></th></tr></thead><tbody><tr><td>Carbohydrate</td><td></td><td>Energy production</td></tr><tr><td>Protein</td><td></td><td>Making new proteins for growth and repair</td></tr><tr><td>Fat</td><td>Fatty acids and glycerol</td><td></td></tr></tbody></table>	<i>Food group</i>	<i>Product(s) of digestion</i>	<i>Use after absorption</i>	Carbohydrate		Energy production	Protein		Making new proteins for growth and repair	Fat	Fatty acids and glycerol			
<i>Food group</i>	<i>Product(s) of digestion</i>	<i>Use after absorption</i>													
Carbohydrate		Energy production													
Protein		Making new proteins for growth and repair													
Fat	Fatty acids and glycerol														
(i)	Complete the table to show the products of digestion and their uses after absorption.														
2															
(ii)	Name the chemical elements present in fat molecules.														
1	_____														
(b)	The nutritional information for 100 g of a breakfast cereal is shown in Table 2 below.														
	Table 2														
	<table border="1"><thead><tr><th colspan="2"><i>Each 100g of cereal provides</i></th></tr></thead><tbody><tr><td>Energy</td><td>1440 kJ</td></tr><tr><td>Protein</td><td>11.2 g</td></tr><tr><td>Carbohydrate</td><td>67.6 g</td></tr><tr><td>Fat</td><td>2.7 g</td></tr><tr><td>Vitamins</td><td>18.0 mg</td></tr><tr><td>Fibre</td><td>10.5 g</td></tr></tbody></table>	<i>Each 100g of cereal provides</i>		Energy	1440 kJ	Protein	11.2 g	Carbohydrate	67.6 g	Fat	2.7 g	Vitamins	18.0 mg	Fibre	10.5 g
<i>Each 100g of cereal provides</i>															
Energy	1440 kJ														
Protein	11.2 g														
Carbohydrate	67.6 g														
Fat	2.7 g														
Vitamins	18.0 mg														
Fibre	10.5 g														

<i>Marks</i>	

5. (b) (continued)

(i) The total daily energy requirement for a sixteen year old girl is 9600 kJ.
Calculate the percentage of her daily total energy requirement that would be provided by a 50 g portion of breakfast cereal each day.

Space for calculation

_____ %

1

(ii) Which food group is missing from Table 2?

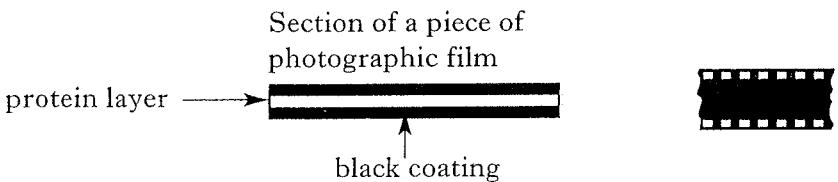
1

[Turn over

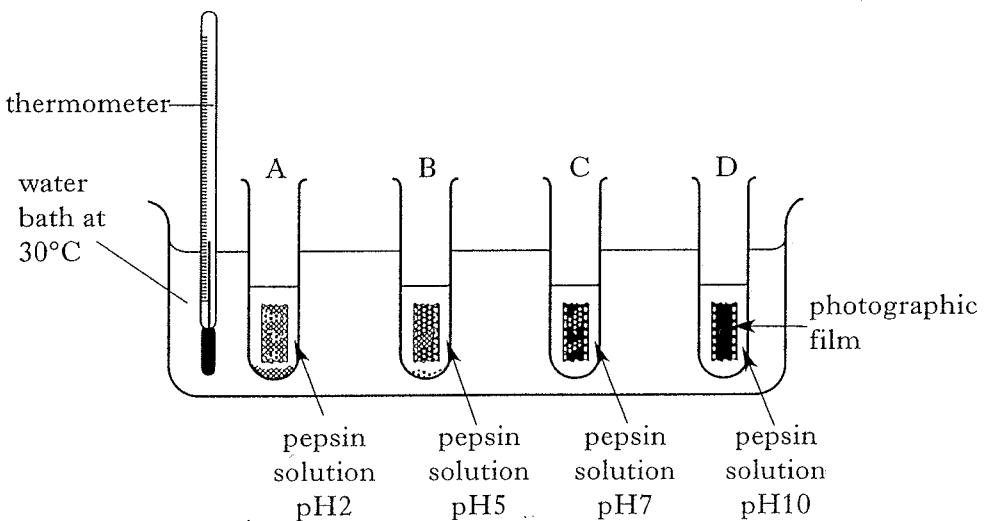
Marks

6. (a) Pepsin is an enzyme that breaks down protein.

Photographic film that has been exposed and developed has a black coating that is held on by a protein layer.



The diagram below shows the results of an investigation into the activity of the enzyme pepsin.



(i) Name the variable studied in this investigation.

1

(ii) Explain why most protein was broken down in Tube A.

1

(iii) Describe suitable controls to show that the enzyme is causing the observed effects.

1

(b) Pepsin is the enzyme produced by secretory cells in the stomach.

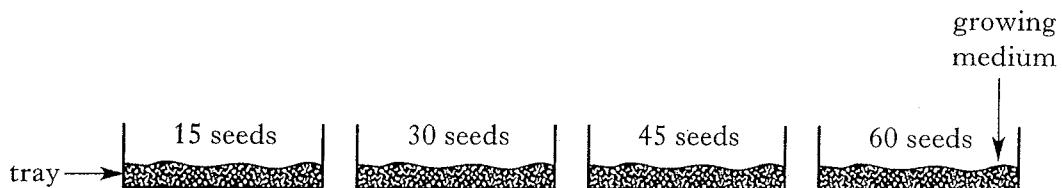
Describe the function of the mucus also produced in the stomach.

1

Marks

7. (a) Groups of students carried out an investigation into the effects of competition.

Trays containing seeds were set up as shown below.



The trays were watered regularly to allow germination to take place.

After several days the seedlings were observed and the number with healthy green leaves was noted.

The results are shown in the table below.

<i>Number of seeds in each tray</i>	<i>Number of seedlings with healthy green leaves</i>	<i>Percentage of seedlings with healthy green leaves</i>
15	12	80
30	18	60
45	23	51
60	24	40

(i) Predict the percentage of seedlings with healthy green leaves if 75 seeds were sown in a seed tray.

1

(ii) State **two** factors for which the seedlings could be competing in this investigation.

1 _____

2 _____

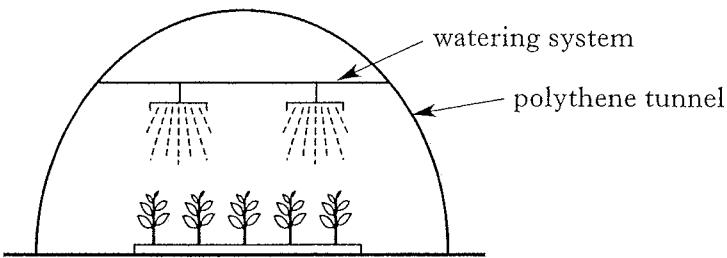
1

[Turn over

Marks

7. (continued)

(b) A horticulturist grew a crop of peas in a polythene tunnel.



State **two** conditions that could limit the rate of photosynthesis in the pea plants.

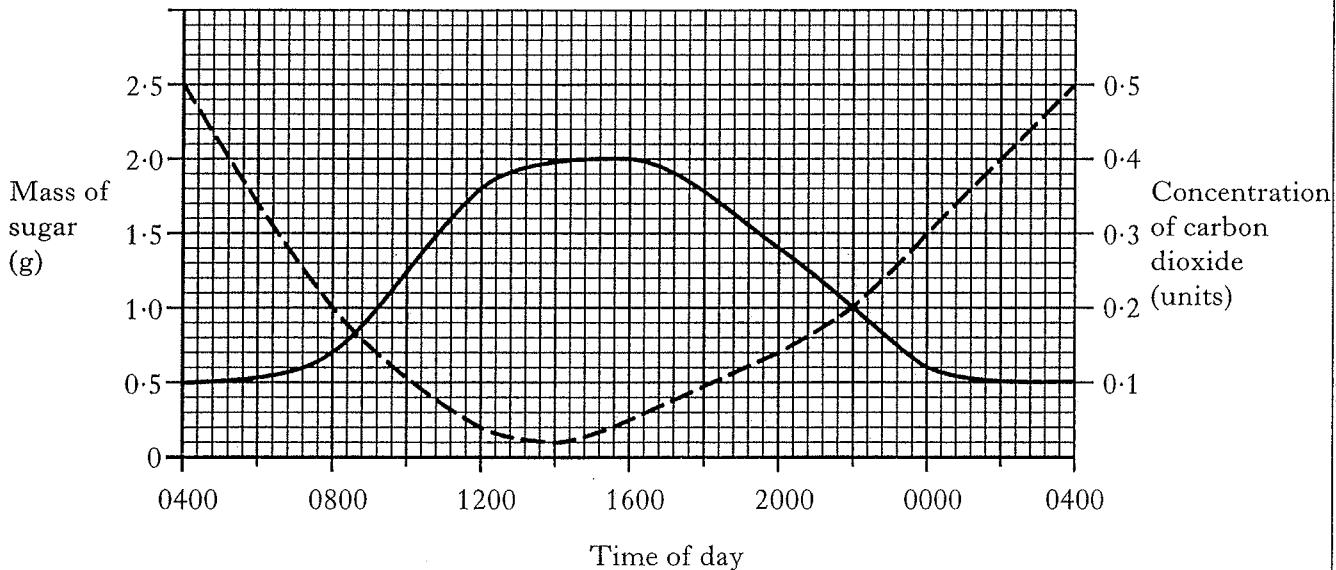
1 _____

2 _____

2

(c) The graph below shows the mass of sugar in the leaves and the concentration of carbon dioxide just above the leaves of pea plants at different times of the day.

— concentration of carbon dioxide above the leaves
— mass of sugar in the leaves



(i) For how many hours did the carbon dioxide concentration decrease?

_____ hours

1

Marks

7. (c) (continued)

(ii) Explain this decrease in carbon dioxide concentration.

1

(iii) Explain why the mass of sugar in the leaves is at its maximum at 1600.

1

(iv) Calculate the **percentage increase** in sugar in the leaves between 0400 and 1600.

Space for calculation

1

(v) Give **two** reasons why the mass of sugar decreases between 2000 and 0000.

1 _____

2 _____

2

[Turn over

Marks	
2	
1	
1	

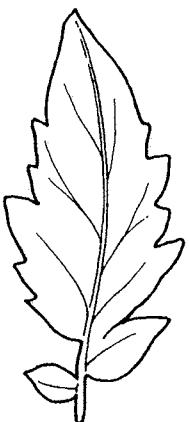
8. (a) Name the male gametes and their site of production in a flower.

Male gametes _____

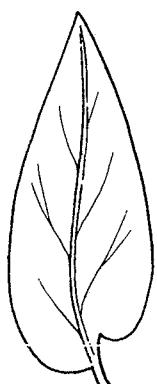
Site of production _____

(b) Tomato plants were used in an experimental monohybrid cross.

The parental phenotypes were cut leaf and potato leaf as shown in the diagrams below.



cut leaf



potato leaf

The parent plants were both true breeding.

The F_1 plants were self-pollinated.

The F_2 generation contained 80 plants with the cut leaf genotype and 20 plants with the potato leaf genotype.

(i) Explain what is meant by the term true breeding.

1

(ii) State which characteristic is dominant and give a reason.

Dominant characteristic _____

Reason _____

1

Marks

8. (b) (continued)

(iii) The results obtained in the F_2 generation differ from the expected results.

There were 100 plants in the F_2 generation.

Calculate the number of plants which would have been expected to have the cut leaf phenotype in the F_2 generation.

Space for calculation

_____ plants

1

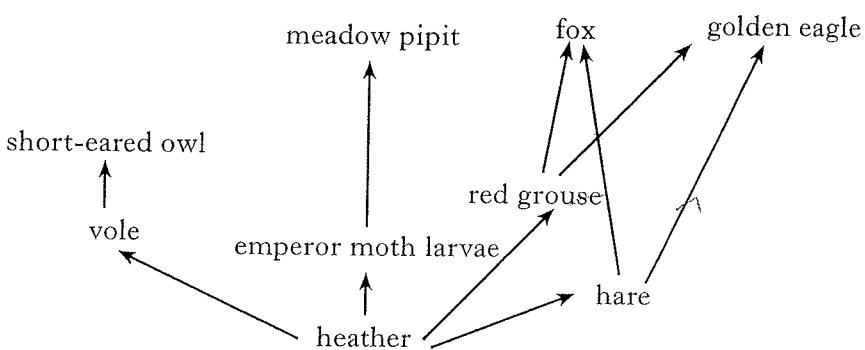
(iv) Suggest one reason why the results obtained differ from the expected results.

1

[Turn over

Marks	
2	
1	
1	
1	

9. (a) The diagram below shows part of a food web from a moorland ecosystem.



(i) Write each organism from the food web in the correct column in the table below.

Producer	Primary consumer	Secondary consumer

2

(ii) Describe **one** possible effect on the food web of a large increase in the grouse population.

1

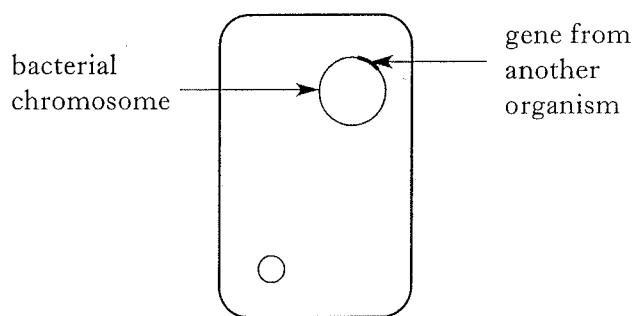
(iii) Human activities can affect the biodiversity of an ecosystem.
Explain the term "biodiversity".

1

(b) Give one characteristic of a **stable** ecosystem.

1

10. The diagram below shows a genetically-engineered bacterial cell.



(a) Name the type of molecule found in a bacterial chromosome.

1

(b) The bacterium was genetically engineered to produce a particular substance.

Name one example of a substance which can be produced in this way and describe its use.

Substance _____

Use _____

1

(c) Genetic engineering can produce new genotypes to provide better organisms for particular functions.

Give one advantage and one disadvantage of genetic engineering compared with selective breeding.

Advantage _____

1

Disadvantage _____

1

[Turn over

Marks

11. (a) In 1994 a survey of habitats was carried out in West Lothian.

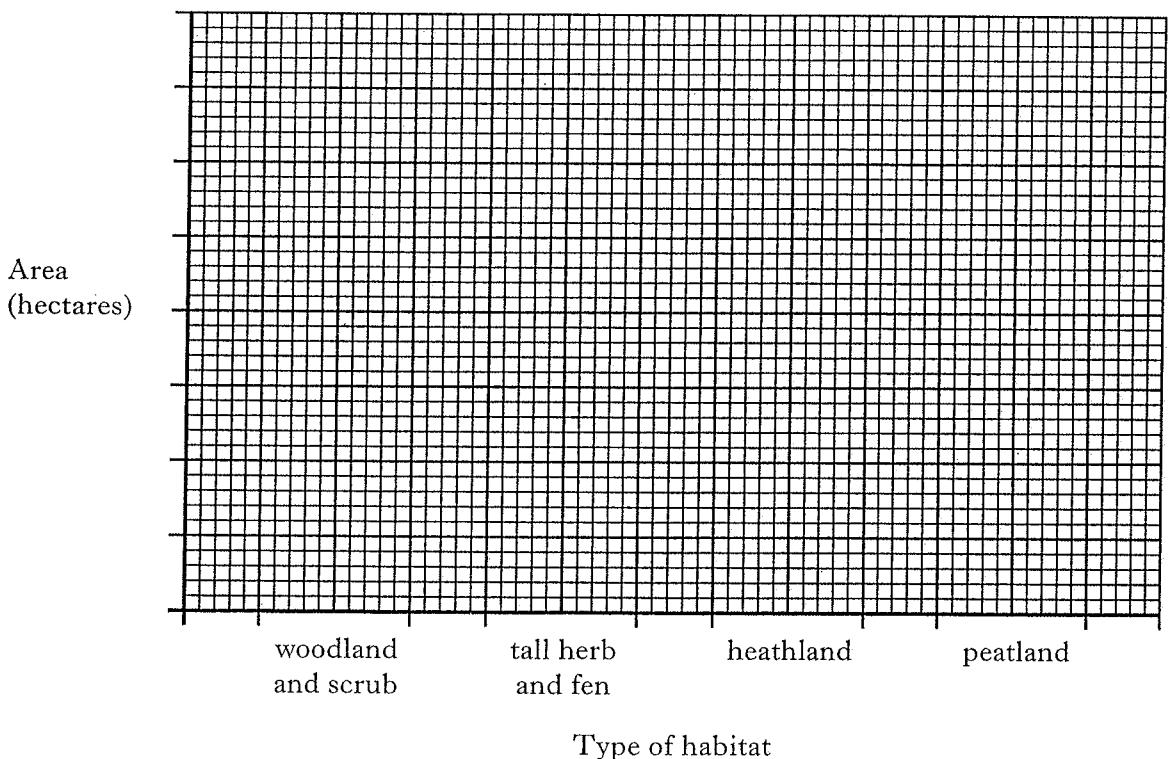
The table below shows the range of types of habitat in an area of 50 000 hectares.

The information was used to monitor the success of a biodiversity enhancement programme.

Type of habitat	Area (hectares)	Percentage cover
woodland and scrub	7 000	14·0
grassland	18 000	36·0
tall herb and fen	300	0·6
heathland	1 500	3·0
peatland	2 000	4·0
open water	500	
cultivated land	13 500	27·0
unsurveyed urban areas	6 600	13·2
others	600	1·2

(i) Complete the bar graph below to illustrate some of the information in the table.

(Additional graph paper, if required, will be found on page 28.)



2

11. (a) (continued)

(ii) Calculate the percentage of the area which is open water.

Space for calculation

_____ %

1

(b) Name **one** human activity which could affect biodiversity in the open water habitat.

1

[Turn over

SECTION C

Both questions in this section should be attempted.

Marks		
5		
5		

Note that each question contains a choice.

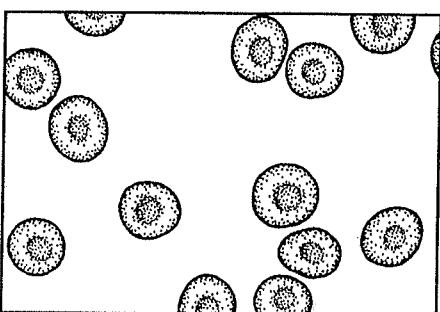
Supplementary sheets, if required, may be obtained from the invigilator.

Labelled diagrams may be included where appropriate.

In question 1, ONE mark is available for coherence.

1. Answer either A or B.

A. The diagram below shows the appearance of human red blood cells in an isotonic solution.

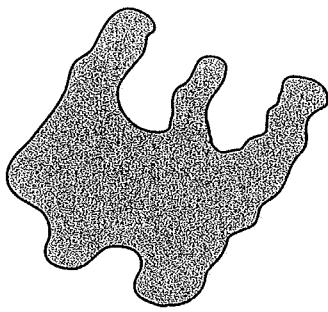


Describe and explain the events which would take place if these red blood cells were transferred to pure water.

5

OR

B. The diagram below represents an amylase molecule.



Describe and explain the events that take place when the enzyme is added to a starch suspension.

5

Question 2 is on *page twenty-six*.

Marks

SPACE FOR ANSWER TO QUESTION 1

[Turn over for Question 2 on *page twenty-six*

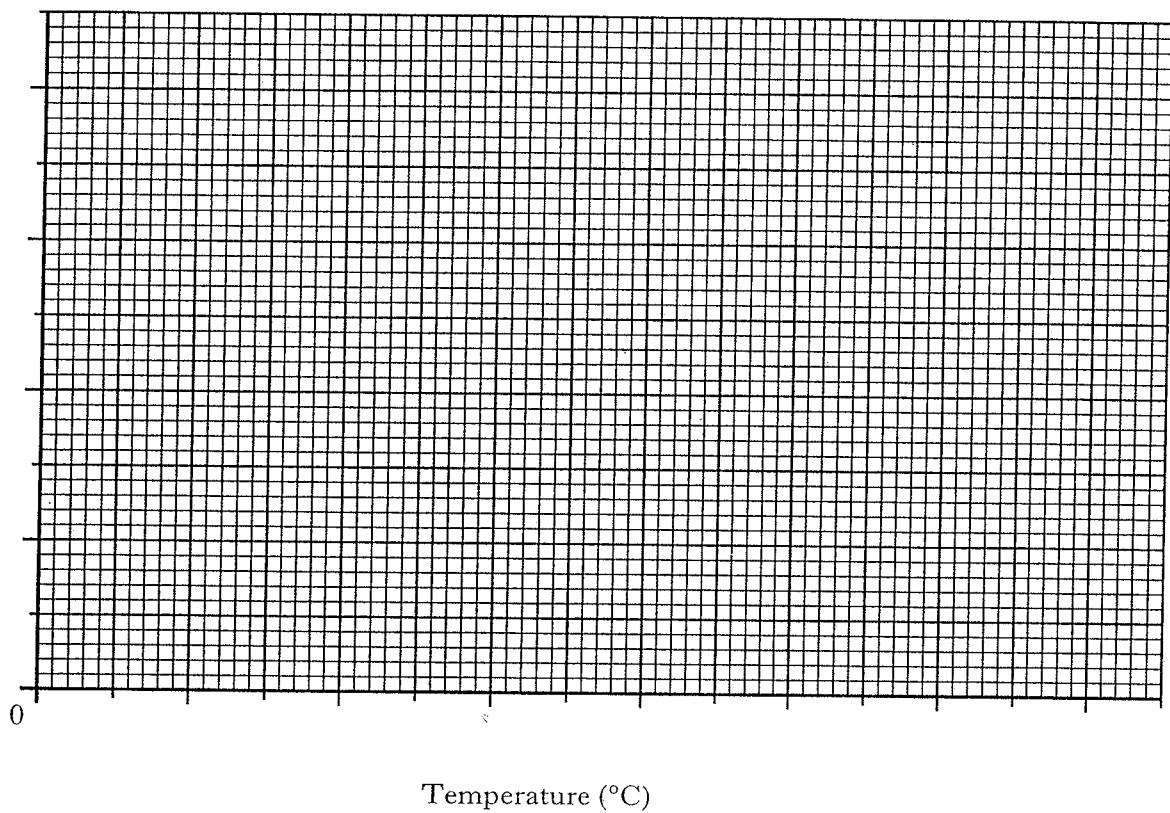
	<i>Marks</i>	
2. Answer either A or B.		
Labelled diagrams may be included where appropriate.		
A. Describe the functions of macrophages and lymphocytes in defence.	5	
OR		
B. Describe the functions of the hypothalamus and blood vessels in temperature regulation.	5	

[END OF QUESTION PAPER]

SPACE FOR ANSWER TO QUESTION 2

SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 2(a)



ADDITIONAL GRAPH PAPER FOR QUESTION 11(a)(i)

