

FOR OFFICIAL USE

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C

KU PS

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Total Marks

0300/402

NATIONAL FRIDAY, 24 MAY
QUALIFICATIONS 10.50 AM - 12.20 PM
2002

BIOLOGY
STANDARD GRADE
Credit Level

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

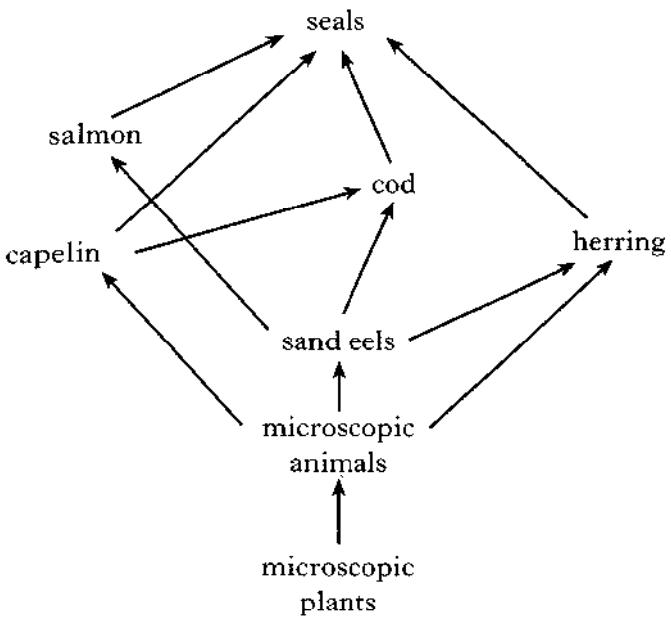
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- 1 All questions should be attempted.
- 2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- 3 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book. Additional spaces for answers and for rough work will be found at the end of the book. Rough work should be scored through when the fair copy has been written.
- 4 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.



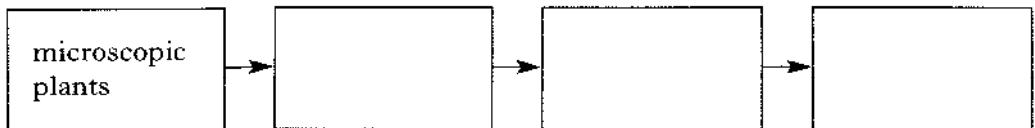
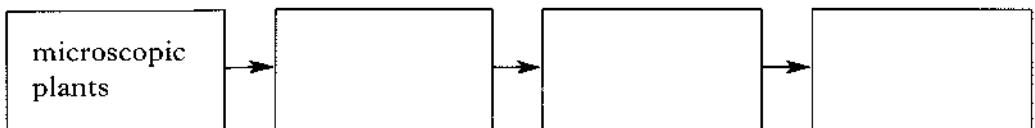
Marks	KU	PS

1. The diagram below shows part of a food web in the Irish Sea.



(a) Two food chains from the food web are made up of four populations of organisms.

Complete both of these food chains in the spaces below.



1

<i>Marks</i>	KU	PS
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n over		

1. (continued)

(b) Predict the effect on the population of (i) capelin, and (ii) seals if the sand eels were removed from this food web.

(i) Underline your prediction and explain your choice.

Capelin would $\left\{ \begin{array}{l} \text{increase} \\ \text{decrease} \\ \text{stay the same} \end{array} \right\}$.

Explanation _____

1

(ii) Underline your prediction and explain your choice.

Seals would $\left\{ \begin{array}{l} \text{increase} \\ \text{decrease} \\ \text{stay the same} \end{array} \right\}$.

Explanation _____

1

(c) (i) What term is used to describe a diagram that shows the total mass of organisms present at successive levels of a food chain?

— 1 —

1

(ii) Which of the following may **not** decrease at each successive level of some food chains?

Underline the correct answer.

energy numbers biomass

1

[Turn over

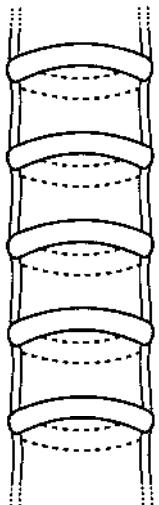
2. (a) Tropical rain forests are estimated to contain more than half of the Earth's existing species of plants and animals, many of which have not yet been studied.

Rain forests are being destroyed, leading to a reduction in the number of species. This has possible consequences for humans and other animals.

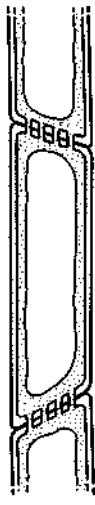
Describe **one** such possible consequence for humans.

1

(b) The diagrams show two types of structures found in plants.



A



B

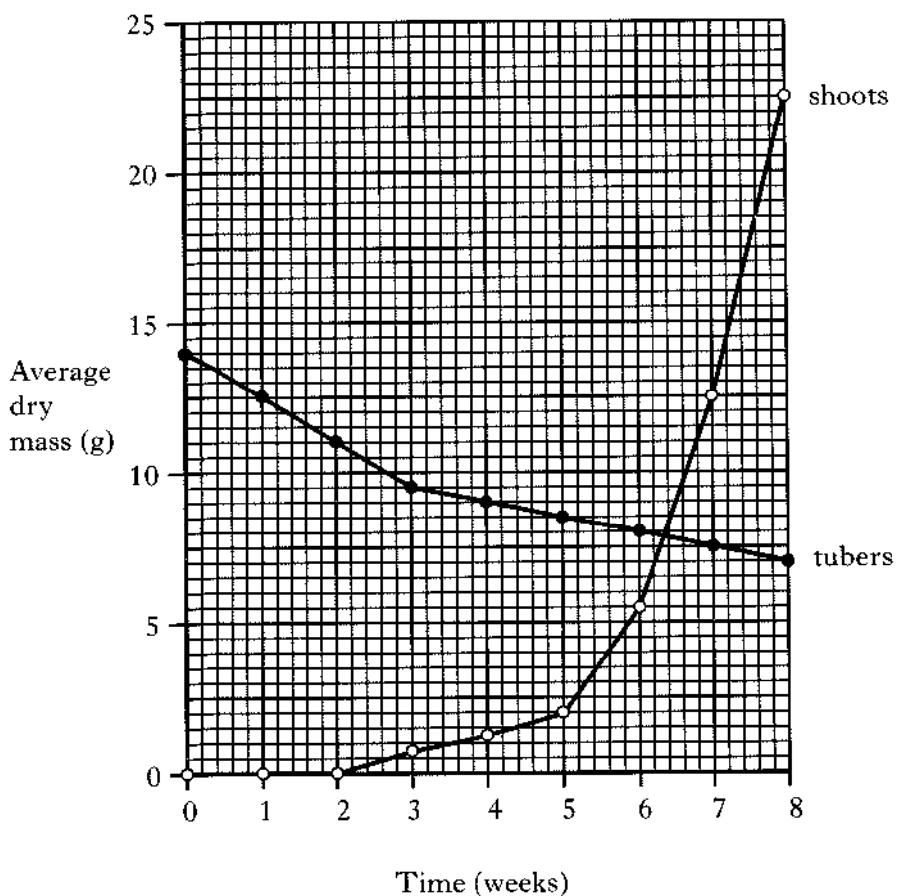
(i) Which structure would be found in the phloem?

1

(ii) Xylem helps to support a plant. State **one** other function of xylem.

1

3. The graph below shows the average dry mass of potato tubers and the shoots they produced over a period of eight weeks.



(a) The dry mass of the tubers decreased during the eight weeks.

Calculate the decrease as a percentage of their original dry mass.

Space for calculation

_____ %

1

(b) Why was the dry mass, rather than the fresh mass, of the tubers and shoots measured?

1

(c) Predict when the potato plants begin to photosynthesise and explain your answer.

Time from planting _____ weeks.

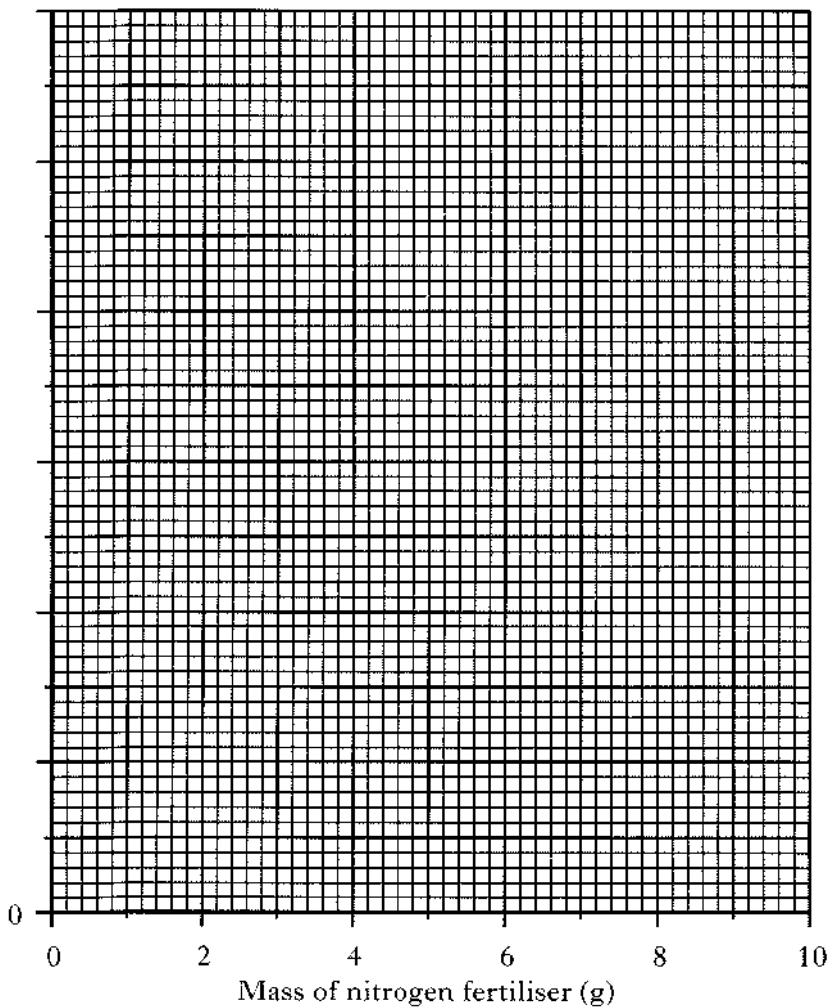
Explanation _____

1

4. Dwarf bean plants were grown in pots of sand containing different masses of nitrogen fertiliser. Five pots were set up for each mass of fertiliser. After 10 weeks, the plants were dug up and their root nodules were removed, washed and weighed. The results are shown in the table.

<i>Mass of nitrogen fertiliser (g)</i>	<i>Average mass of root nodules per plant (g)</i>
0	5.3
0.2	1.6
1.0	0.8
5.0	0.4
10.0	0.1

(a) (i) On the grid below, complete a **line graph** to show the effects of increasing the mass of nitrogen fertiliser on the mass of root nodules formed by the bean plants.
(An additional grid, if required, will be found on page 27.)



2

Marks	KU	PS
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4. (a) (continued)

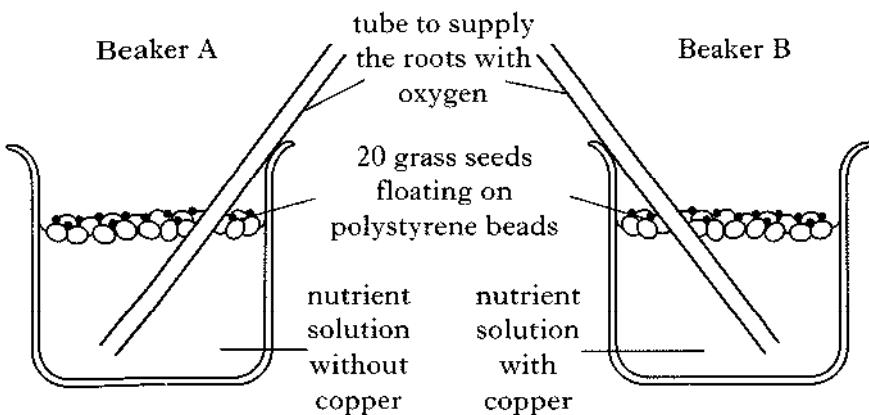
(ii) What effect does increasing the mass of nitrogen fertiliser have on the mass of root nodules formed per plant?

(b) Why was it good experimental technique to set up five pots for each mass of fertiliser?

(c) What type of bacteria is found in the root nodules of the dwarf bean plants?

[Turn over

5. (a) The experiment below was set up to investigate the effect of copper on the growth of one species of grass plant.



The length of the roots was measured every five days. The results are shown in the table.

Day	Average length of roots (mm)	
	Beaker A	Beaker B
0	0	0
5	13	9
10	15	13
15	19	13
20	22	14
25	30	18

(i) Calculate the average increase in root length per day, during the 25 days, for the grass plants in Beaker A.

Space for calculation

Average increase in root length _____ mm per day. 1

(ii) Calculate the simplest whole number ratio of average length on day 25 for the roots of the plants in Beaker A to those in Beaker B.

Space for calculation

_____ : _____
Beaker A Beaker B 1

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5. (a) (continued)

(iii) Describe the difference which copper makes to the growth of the grass plants.

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(iv) Beaker A is a control. What is the purpose of the control in this experiment?

Page 10 of 10

(b) A similar experiment was carried out to investigate the effect of copper on the growth of a different species of grass plant.

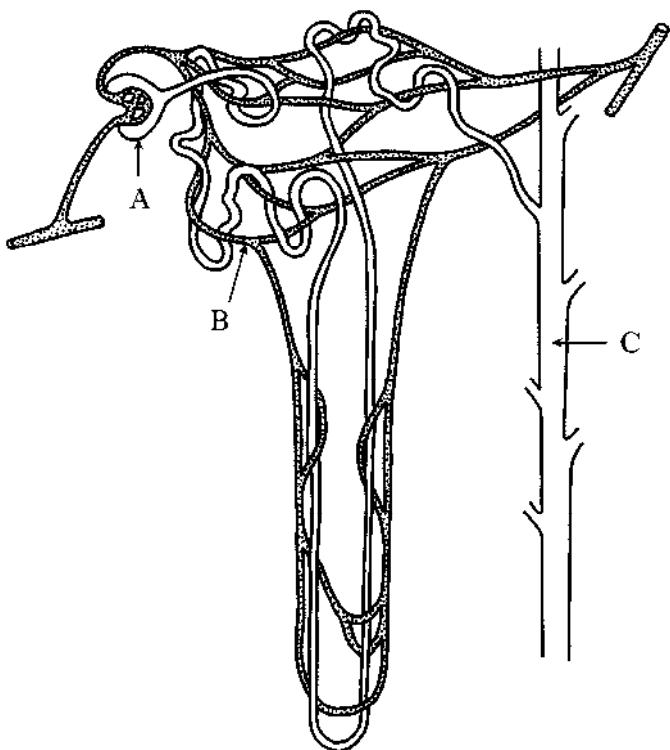
State **two** precautions that would have to be taken to ensure that a valid comparison could be made between the two experiments.

1

2 _____

[Turn over

(a) The diagram below represents a kidney nephron.



Complete the table by adding the correct letters, name and function.

Letter	Name	Function
	Collecting duct	Collects urine
A		Filters the blood
	Blood capillary	

Marks	KU	PS
2	██████████	
1		██████████
1		██████████
In over		

6. (continued)

(b) Dialysis is a process by which waste products are removed from the blood. The following information refers to artificial dialysis used as treatment for kidney failure.

Haemodialysis. Blood is removed from a vein in the forearm and passed into a "kidney machine". A synthetic membrane separates the blood from dialysis fluid into which impurities from the blood diffuse. This treatment lasts for five hours and is required three times per week.

Peritoneal Dialysis. The natural membrane (called the peritoneum) lining the abdomen is used to filter waste from the blood vessels that surround the peritoneum. Three times each day, fluid is run through a plastic tube into the abdomen and left for four hours. The fluid is then drained out and fresh fluid is run in to continue the process.

(i) Complete the table to summarise this information.

<i>Name of treatment</i>	<i>Type of membrane (natural or synthetic)</i>	<i>How often the treatment is required</i>

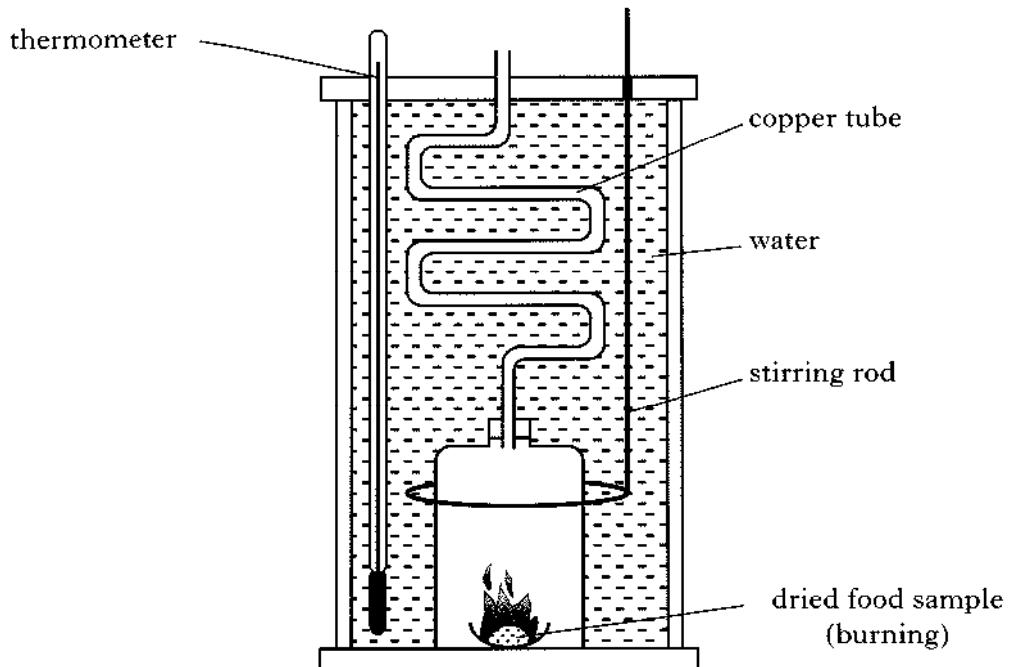
(ii) One of the impurities removed from the blood is urea. From which food component is urea produced?

From which food component is urea produced?

People with kidney failure can be given a kidney transplant. Give **one** benefit to the patient of having a kidney transplant compared to dialysis.

[Turn over

7. The diagram shows apparatus used to compare the energy content of dried food samples. A sample is weighed and then burned. The energy in the food is converted to heat and this is measured from the rise in temperature of the water.



(a) (i) Why is it necessary to weigh the food samples before burning?

1

(ii) Explain the need for the following features of the apparatus.

1 A rod to stir the water _____

1

2 The copper tube is thin-walled and coiled _____

1

MARKS				
Marks	KU	PS		
7. (a) (continued)				
(iii) The following table shows results obtained using this apparatus.				
Each food sample had a dry weight of 5 g.				
Food type	Initial temperature (°C)	Final temperature (°C)	Rise in temperature (°C)	Energy value (Joules/g)
olive oil	23	45	22	35
potato	23	32	9	14
lean meat	25			14

Complete the table by inserting the final temperature and the rise in temperature for the sample of lean meat.

Space for calculation

1

(iv) This apparatus always gives an underestimate of the energy content of the foods tested.

Suggest a possible source of this error.

1

(b) Which of the main types of food components, carbohydrates, fats or proteins, contains the most chemical energy per gram?

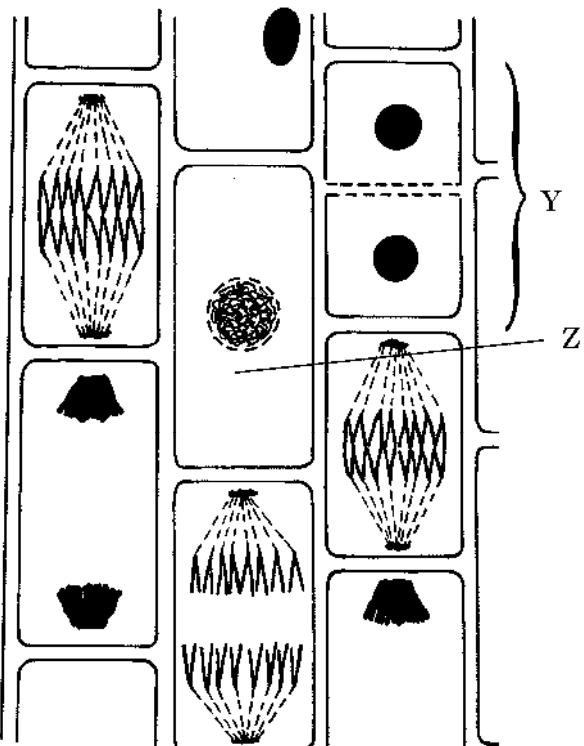
1

(c) Name the process by which the chemical energy of food is released in a cell.

1

[Turn over

8. The drawing represents part of a root tip as seen under high magnification.



(a) (i) What name is given to the type of cell division that can be seen in some of the cells?

1

(ii) Describe what is happening in cells Y and Z.

Cell Y _____

1

Cell Z _____

1

(iii) Daughter chromosomes produced by this type of cell division contain the same number of chromosomes as their parent cell. Explain the importance of this.

1

Marks	KU	PS
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8. (continued)

(b) (i) The process of cell division is controlled by many specific enzymes. Explain the term *specific* as used in this context.

110

1

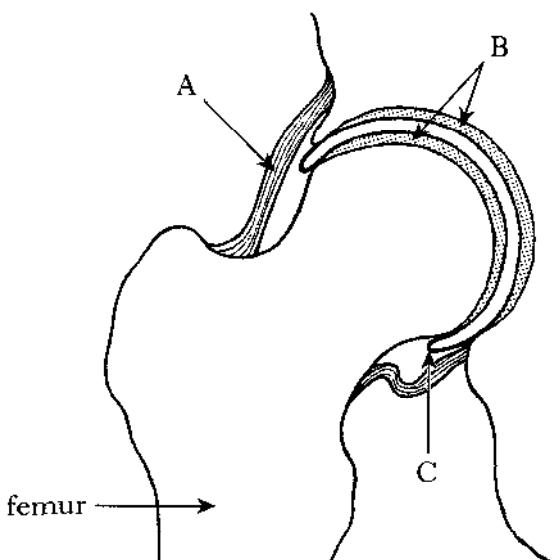
(ii) Enzymes have an optimum temperature and pH. Explain the meaning of the word *optimum*.

1

[Turn over

Marks	KU	PS
2		
3		

9. The diagram shows a human hip joint.



(a) Complete the table below by inserting the correct letters, name and functions.

Letter	Name	Function
B		cushions the bone
	synovial membrane	
	ligament	

(b) Decide if each of the following statements about the breathing system is **True** or **False** and tick (✓) the appropriate box.

If the statement is **False**, write the correct word in the **Correction** box to replace the word underlined.

Statement	True	False	Correction
The trachea is supported by rings of <u>lignin</u> .			
The air passages are lined by tiny hair-like <u>cilia</u> .			
Special cells produce sticky <u>plasma</u> which prevents dust entering the lungs.			

Marks	KU	PS
1		
2		

9. (continued)

(c) The following statements refer to gas exchange between the blood capillaries and the air sacs in the lungs.

- 1 Carbon dioxide diffuses in.
- 2 Carbon dioxide diffuses out.
- 3 Oxygen diffuses in.
- 4 Oxygen diffuses out.

Complete the tables by inserting the number of each statement in the correct box.

Air sacs	Blood capillaries

(d) The following grid contains terms which refer to parts of the nervous system.

A	B	C	D
spinal cord	touch receptor	relay nerve cell	medulla
E	F	G	H
cerebrum	cerebellum	motor nerve cell	sensory nerve cell

Use the letters from the grid to identify the following.

- (i) Part of the brain concerned with balance _____
- (ii) Structure which carries information from the sense organs _____
- (iii) Structure which carries information across the spinal cord during a reflex action _____
- (iv) Part of the brain which controls breathing and heart rates _____

[Turn over

Marks	KU	PS
1		
1		
1		

10. Read the following passage and answer the questions which follow it.

All The Better To See You With, adapted from J. Marsden, *Biological Sciences Review*, Vol 8, 1995

Aqueous humour is a clear fluid that fills the front of the eye. Light passes through it before reaching the lens. It is constantly being made and drained away and supplies the metabolic needs of the lens and the cornea which have no blood supply. Aqueous humour contains glucose, amino acids and dissolved gases. Its pressure supports the eyeball and helps the eyeball to keep its shape.

Glaucoma occurs when the pressure inside the eye rises above normal. If not controlled, the pressure can squeeze the blood vessels in the eye. The increased pressure is usually due to problems with the drainage of the aqueous humour rather than too much being made. The effect is that the optic nerve is damaged due to decreased blood flow and poor oxygen supply resulting in loss of vision.

Chronic glaucoma results from a small rise in pressure over a long period of time. Sufferers feel no pain but the optic nerve is slowly damaged and peripheral vision is gradually reduced. This type of glaucoma is often discovered during a routine eye test. Families of glaucoma sufferers are able to obtain free eye tests. Drugs, in the form of eye drops, are used to increase the drainage of aqueous humour.

Acute glaucoma is a massive and rapid increase in the internal pressure of the eyeball caused by the iris blocking the drainage mechanism of the aqueous humour. It causes severe pain and loss of vision. A laser beam is used to form a hole in the iris to make a new drainage channel. People tend to get one type of glaucoma or the other, but not both.

(a) Why must the fluid of the aqueous humour be clear?

1

(b) How will carbon dioxide, produced by the respiring tissue of the cornea, be removed from the cornea?

1

(c) What is the usual cause of increased pressure in the eyeball?

1

Marks	KU	PS
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1		

10. (continued)

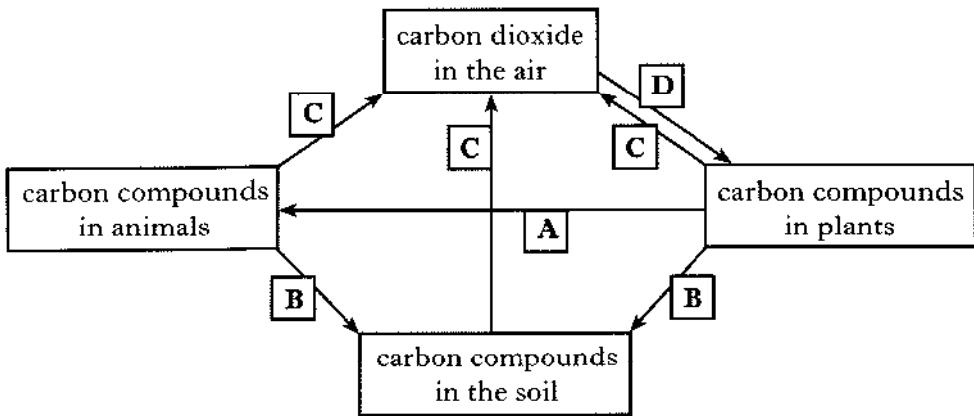
(d) Explain how an increase in pressure inside the eye can cause damage to the optic nerve.

(e) What information in the passage suggests that glaucoma has a genetic component?

(f) Describe **one** difference between chronic glaucoma and acute glaucoma.

[Turn over

11. The diagram below shows part of the carbon cycle.



(a) Use **one** letter from the diagram to identify each of the stages in the table below.

Stage	Letter
photosynthesis	
death and decay	
respiration	

2

(b) Name a type of organism responsible for process B.

1

(c) The following statements refer to the use of fossil fuels and nuclear fuels.

- 1 Contributes to acid rain.
- 2 Fuel supply likely to run out.
- 3 Waste material must be sealed in lead containers.
- 4 Releases carbon dioxide into the atmosphere.

Which statements refer to fossil fuels?

Tick the correct box.

1 and 2 only	<input type="checkbox"/>
2 and 3 only	<input type="checkbox"/>
1, 2 and 3	<input type="checkbox"/>
1, 2 and 4	<input type="checkbox"/>

1

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2		
1		

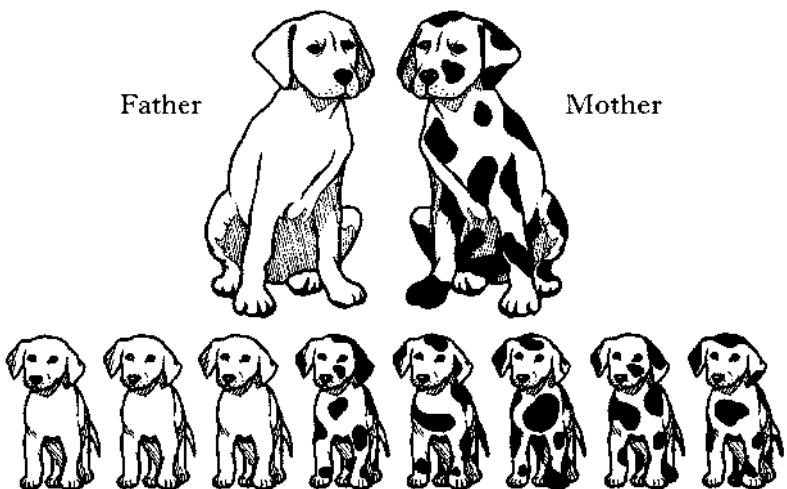
12. In dogs, the difference between a coat which is the same colour all over, and a coat which has blotches of colour, is controlled by different forms of the same gene.

B (dominant) causes a blotched coat pattern and **b** (recessive) causes the same colour all over.

(a) What name is given to the different forms of the same gene?

1

(b) A dog with the same coat colour all over mates with a blotched one. They have eight puppies, of which five have blotched coats and three are the same colour all over.



(i) What are the genotypes of the parent dogs?

Father _____ Mother _____

2

(ii) The predicted proportion of coat colours was equal numbers of each type. Explain why the actual numbers were different.

1

(c) Predict the genotypes and phenotypes of the puppies which would be produced if both parents had the same coat colour all over.

Genotype(s) _____

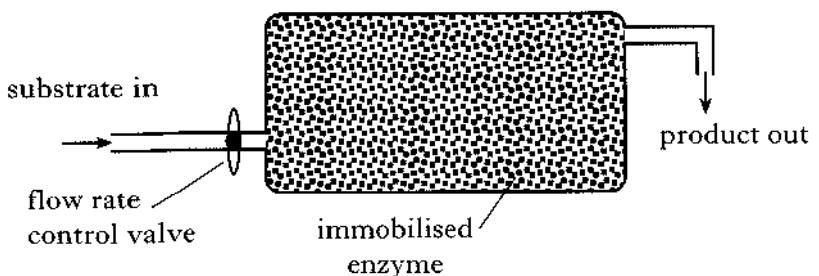
2

Phenotype(s) _____

(d) Is the variation in the dogs' coat pattern caused by the gene, continuous or discontinuous?

1

13. Sugar can be produced from starch using an immobilised enzyme in the apparatus shown in the diagram below.



(a) (i) What is meant by the word "immobilised" in connection with enzymes?

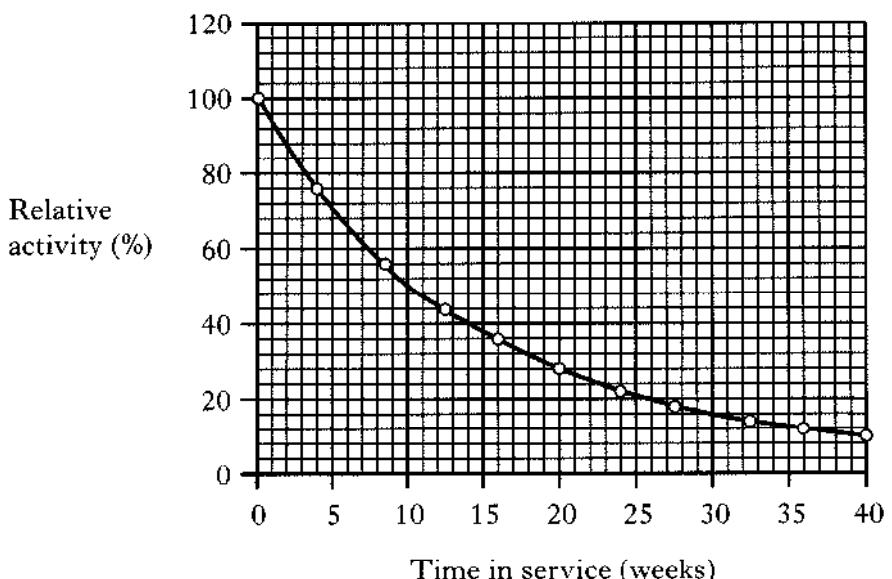
1

(ii) Describe **one** advantage of using immobilised enzymes.

1

(b) Immobilised enzymes lose some of their activity over time. The graph shows the results of tests on the effectiveness of one immobilised enzyme produced by a Scottish company.

The tests were carried out at a temperature of 40 °C.



Marks	KU	PS
1		
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1		
1		
1		
n over		

13. (b) (continued)

(i) What is the decrease in percentage relative activity of the enzyme after 26 weeks in service?

_____ %

1

(ii) When the enzyme is first used (time in service = 0 weeks), the substrate must remain in contact with it for six minutes to complete the reaction. How long would the enzyme require to be in contact with the substrate when the enzyme has been in use for ten weeks?

Space for calculation

_____ minutes

1

(iii) For the apparatus shown, how could the contact time between the enzyme and the substrate be increased?

1

(iv) What would happen to the required contact time if the temperature was changed to 20 °C?

1

(c) By using different enzymes in the same type of apparatus, it is possible to produce several synthetic antibiotics. Explain why a range of antibiotics is needed for the treatment of bacterial diseases.

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1

[Turn over

14. The table gives information about the composition of some fatty foods.

Food	Fat (g per 100g)	Cholesterol (mg per 100g)
Pork sausage	25	60
Cheddar cheese	36	80
Low fat spread	82	0
Butter	84	225
Milk	4	15
Egg	12	450

(a) Express as a simple whole number ratio the mass of fat for milk, cheddar cheese and butter.

Space for calculation

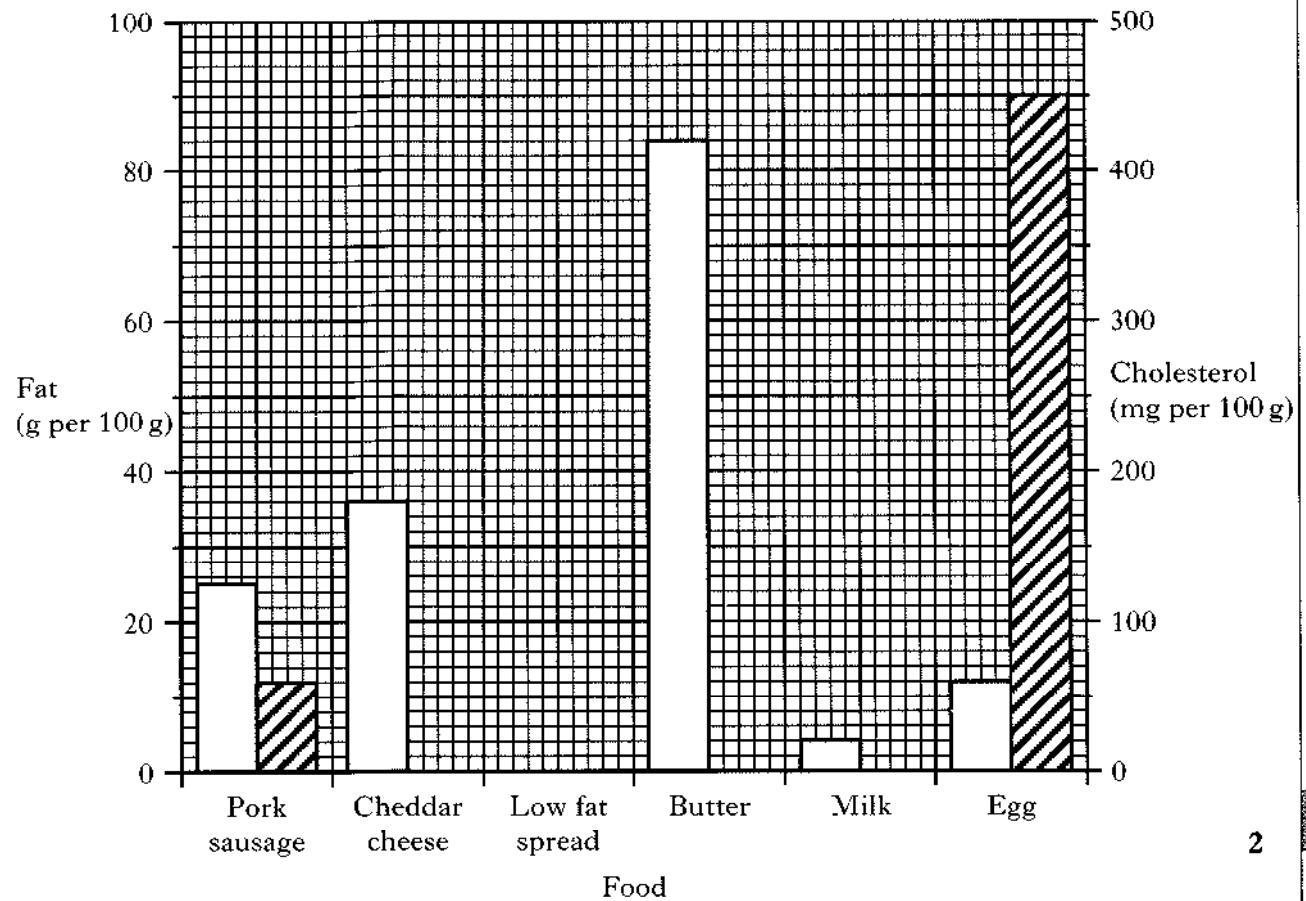
_____ : _____ : _____
milk cheddar butter
cheese

1

14. (continued)

(b) Complete the bar chart using information from the table.
(An additional grid, if needed, will be found on page 28.)

Fat (g per 100 g)
 Cholesterol (mg per 100 g)



(c) What is the main difference in composition between low fat spread and butter?

1

[Turn over]

15. The table below contains information about some species of fish.

Species	Size of scales	Number of dorsal fins	Barbels
Burbot	small	two	present
Pike	large	one	absent
Eel	small	one	absent
Grayling	large	two	absent
Miller's thumb	small	two	absent

Use the information from the table to complete the boxes of the paired statement key below.

1 Large scales go to 2

Small scales go to 3

2 One dorsal fin.....

1

Two dorsal fins.....

3 Barbels present

1

4 Eel

..... go to 4

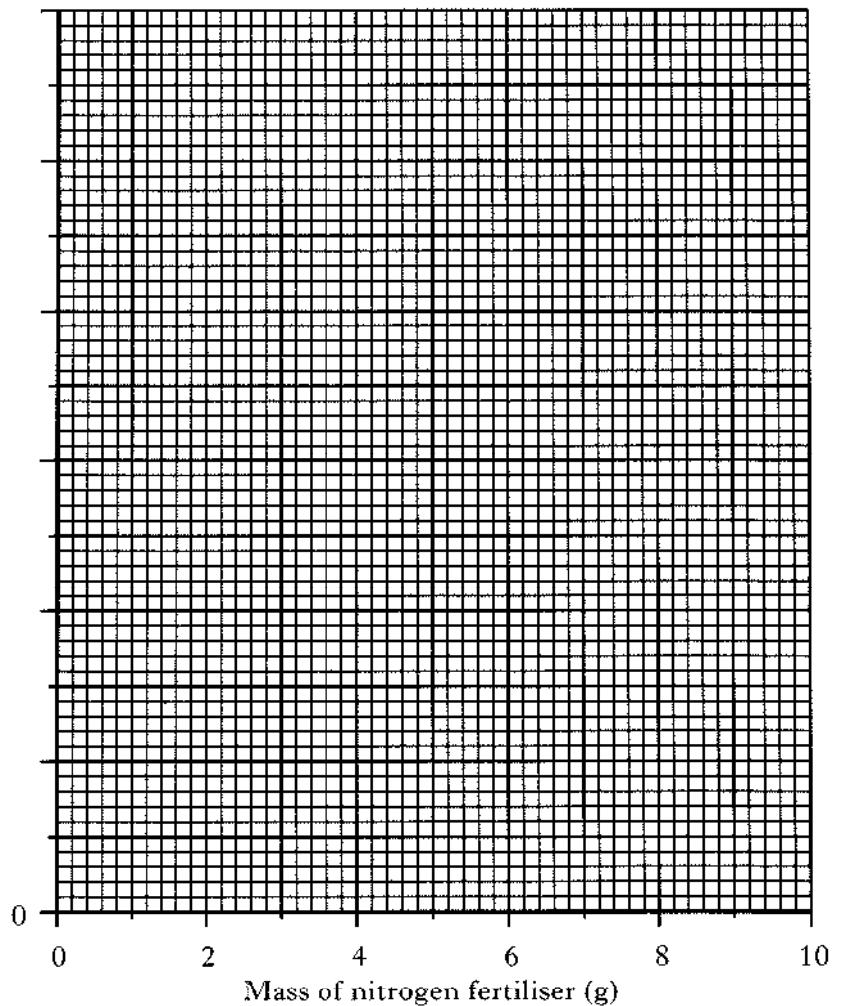
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..... Miller's thumb

1

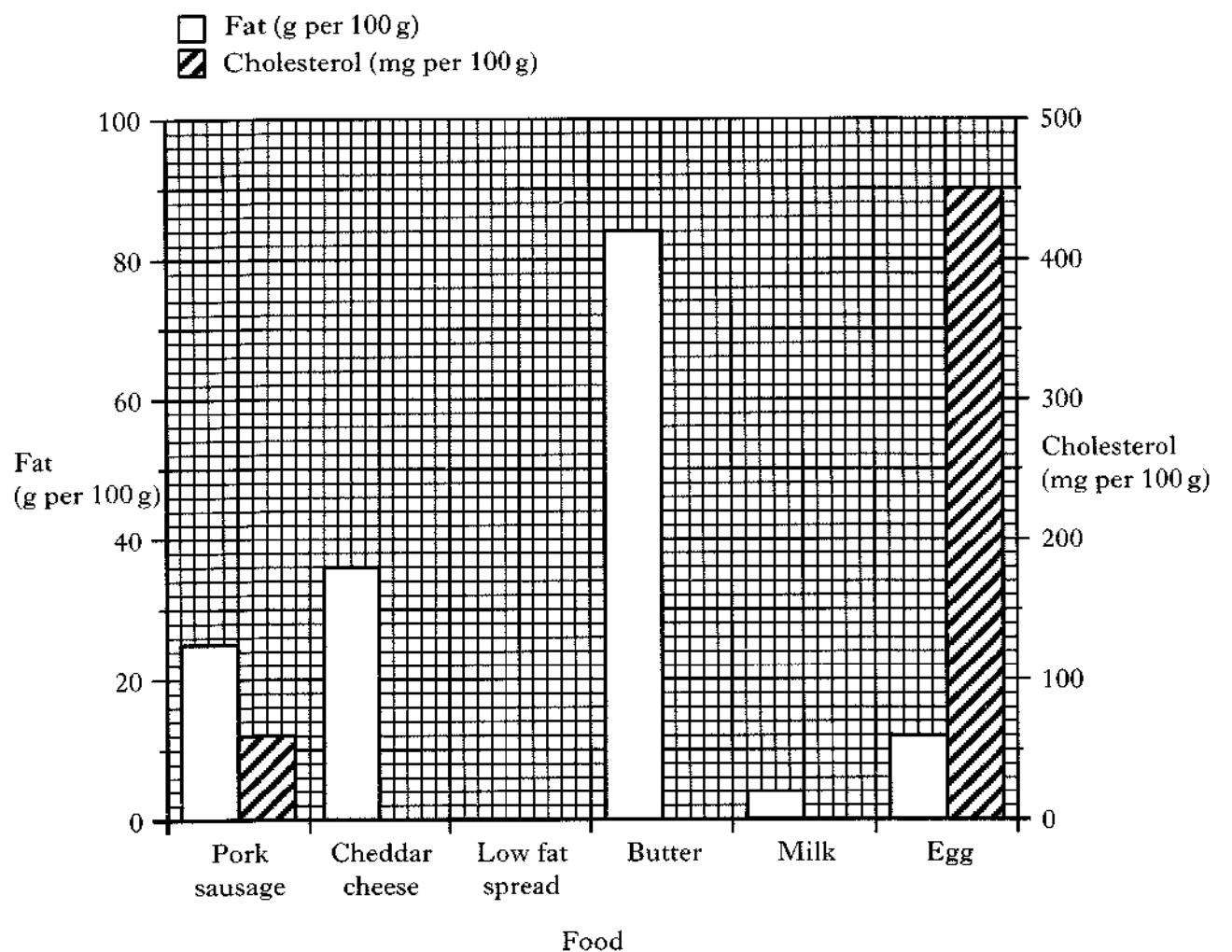
[END OF QUESTION PAPER]

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



[Turn over

ADDITIONAL GRID FOR QUESTION 14(b)



SPACE FOR ANSWERS
AND FOR ROUGH WORKING

SPACE FOR ANSWERS
AND FOR ROUGH WORKING

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