

FOR OFFICIAL USE

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Total for
Sections B and C

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X007/201

NATIONAL
QUALIFICATIONS
2004

WEDNESDAY, 19 MAY
9.00 AM - 11.00 AM

BIOLOGY
INTERMEDIATE 2

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

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SECTION A (25 marks)

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

SECTIONS B AND C (75 marks)

- (a) All questions should be attempted.
(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.
- The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- Additional space for answers and rough work will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this book.
- The numbers of questions must be clearly inserted with any answers written in the additional space.
- Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.



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.

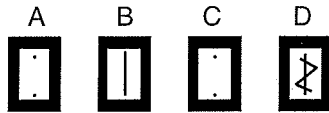
Sample Question

Which part of the brain is involved in the control of heart rate?

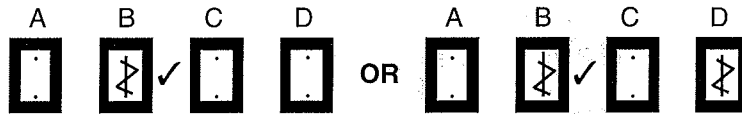
- A Cerebellum
- B Medulla
- C Hypothalamus
- D Cerebrum

The correct answer is B—Medulla. 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.

1. The energy values of different food materials are shown in the table.

Food	Energy value (kJ per gram)
Glucose	4
Protein	4
Fat	9

How much energy is contained in a food sample consisting of 3 grams of glucose and 2 grams of fat?

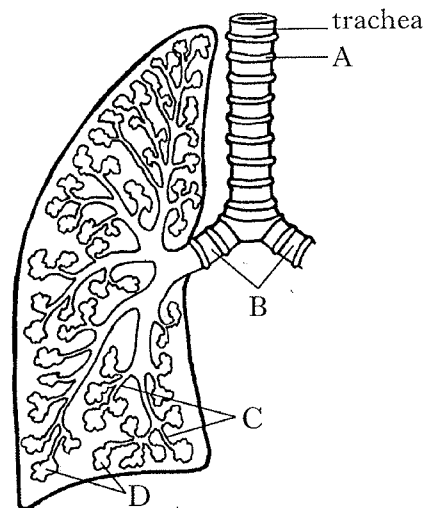
- A 17 kJ
 B 21 kJ
 C 30 kJ
 D 35 kJ
2. The function of the villi is to increase the surface area for
- A absorption
 B protection
 C acid production
 D peristalsis.
3. Bile is stored in the
- A liver
 B gall bladder
 C stomach
 D small intestine.
4. A piece of carrot weighs 20 g fresh and 2 g dry. What is the percentage water content of the carrot?
- A -2%
 B 10%
 C 72%
 D 90%

5. The table below shows the rate of blood flow to the body at rest and during strenuous exercise.

Which line in the table shows the greatest increase in blood flow during strenuous exercise?

	Region of body	Blood flow (cm ³ /minute)	
		at rest	strenuous exercise
A	brain	750	750
B	muscle	1200	22 000
C	heart	250	750
D	skin	500	600

Questions 6 and 7 refer to the diagram which shows the structure of the lungs.



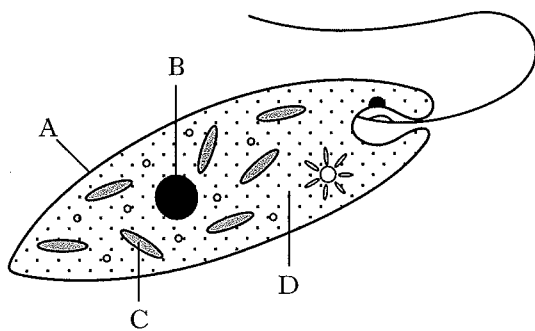
6. Which label identifies the bronchioles?
7. The function of part A is to
- A prevent the lungs from collapsing
 B keep the trachea open at all times
 C prevent food entering the windpipe
 D trap dirt and bacteria.

[Turn over

8. Which line in the table below identifies correctly how macrophages destroy bacteria?

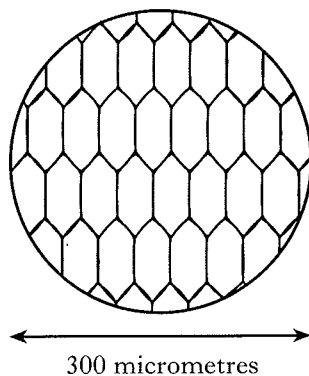
	<i>Phagocytosis</i>	<i>Antibody production</i>
A	yes	yes
B	yes	no
C	no	yes
D	no	no

9. The diagram below represents a unicellular organism.



Which part indicates this is a plant cell?

10. The diagram below shows onion cells as observed under a microscope at a magnification of 100 X.



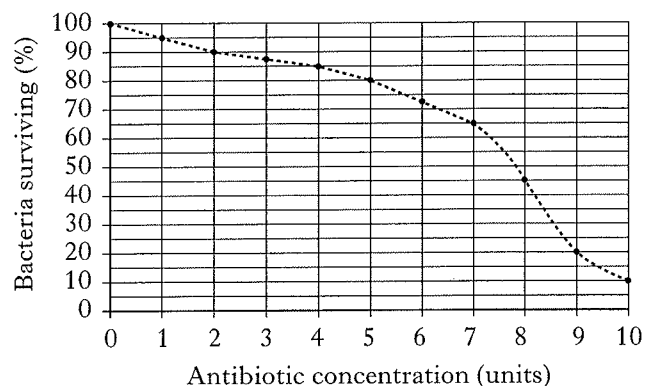
The diameter of the field of view is 300 micrometres. The average width of each cell in micrometres is

- A 0.38
- B 0.75
- C 37.5
- D 75.0

11. Which line in the table below correctly matches the organism, product and the commercial use of the product?

	<i>Organism</i>	<i>Product</i>	<i>Commercial use of product</i>
A	yeast	methane	biogas
B	bacteria	alcohol	biogas
C	yeast	alcohol	gasohol
D	bacteria	methane	gasohol

12. The graph below shows the effect of increasing antibiotic concentrations on the percentage of bacteria surviving within a population. None of the bacteria had resistance to the antibiotic.

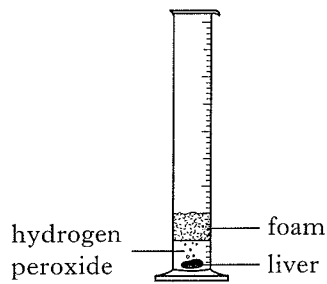


Another experiment was carried out with different bacteria, some of which had resistance to the antibiotic.

Which of the following **best** describes the effect on the bacteria surviving in this second experiment?

- A The percentage of bacteria surviving would increase.
- B The percentage of bacteria surviving would decrease.
- C There would be no change in the percentage of bacteria surviving.
- D All of the bacteria would survive.

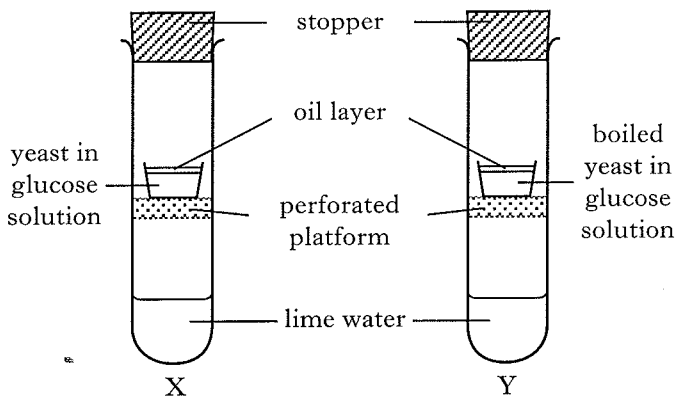
13. Two grams of fresh liver was added to hydrogen peroxide.



The time taken to collect 10 cm^3 of oxygen foam was 2 minutes.

The rate of oxygen production was

- A $2.5\text{ cm}^3/\text{g}/\text{min}$
 B $5.0\text{ cm}^3/\text{g}/\text{min}$
 C $10.0\text{ cm}^3/\text{g}/\text{min}$
 D $20.0\text{ cm}^3/\text{g}/\text{min}$
14. The diagram below illustrates an investigation of respiration in yeast.



Lime water is an indicator which changes from clear to cloudy in the presence of carbon dioxide.

The investigation was allowed to run for 24 hours.

Which line in the table below identifies correctly the appearance of the lime water in tubes X and Y after 24 hours?

	X	Y
A	clear	clear
B	cloudy	cloudy
C	clear	cloudy
D	cloudy	clear

15. Which of the following are **all** limiting factors in photosynthesis?
- A Carbon dioxide concentration, temperature and light intensity
 B Carbon dioxide concentration, oxygen concentration and light intensity
 C Oxygen concentration, temperature and light intensity
 D Oxygen concentration, carbon dioxide concentration and temperature
16. Which line in the table below identifies the **best** conditions for the production of early crops?

	Added factor	Light intensity
A	oxygen	high
B	oxygen	medium
C	carbon dioxide	medium
D	carbon dioxide	high

17. The following stages occur during photosynthesis.

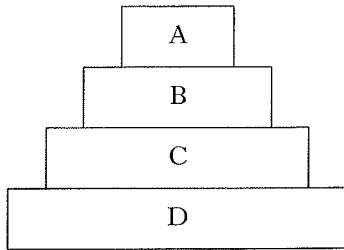
- W glucose is formed
 X water is broken down to produce hydrogen
 Y glucose is converted to starch
 Z hydrogen is combined with carbon dioxide

The correct order for these stages is

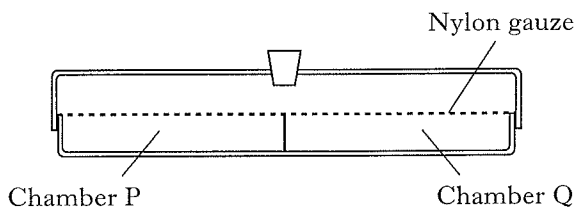
- A W Z X Y
 B Z Y X W
 C X Z W Y
 D Y X Z W
18. Which of the following is a correct description of a decomposer?
- A A micro-organism which lives inside animals and causes disease.
 B An organism which releases chemicals from organic waste.
 C A fungus which grows on living tissue.
 D A green plant which roots in rotting vegetation.

[Turn over

19. The following diagram shows a pyramid of energy. Which level is the result of the energy from the sun being converted into chemical energy?



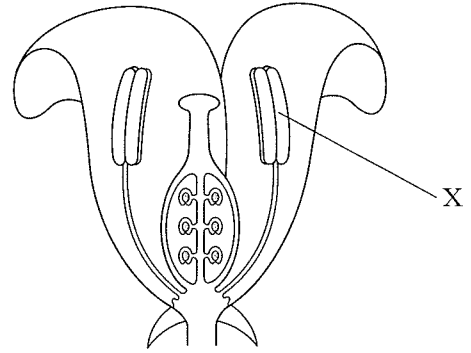
20. The following choice chamber was used to investigate the effect of humidity on the behaviour of woodlice.



Which line in the table below describes the **best** experimental set up?

	<i>Number of woodlice</i>	<i>Contents of chamber P</i>	<i>Contents of chamber Q</i>	<i>Modification to choice chamber</i>
A	10	Drying agent	Wet cotton wool	Half covered in black paper
B	10	Wet cotton wool	Drying agent	Totally covered in black paper
C	20	Drying agent	Wet cotton wool	Half covered in black paper
D	20	Wet cotton wool	Drying agent	Totally covered in black paper

21. The diagram below shows the main parts of a flower.



Which line in the table identifies X and the type of gamete it produces?

	<i>Name of X</i>	<i>Type of gamete produced</i>
A	ovary	male
B	ovary	female
C	anther	female
D	anther	male

22. The information below refers to some woodland birds.

<i>Bird species</i>	<i>Common food eaten</i>	<i>Nest location</i>
Lesser spotted woodpecker	insects	dead trees
Green woodpecker	ants, other insects	live trees
Greater spotted woodpecker	insects, nuts, seeds	live trees
Treecreeper	insects, spiders, seeds	dead trees

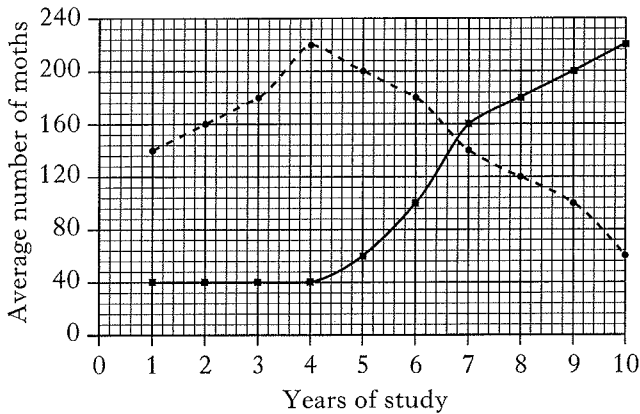
Between which two bird species will competition for food and nest location be greatest?

- A Lesser spotted woodpecker and treecreeper
 B Greater spotted woodpecker and lesser spotted woodpecker
 C Lesser spotted woodpecker and green woodpecker
 D Greater spotted woodpecker and treecreeper

23. In humans, all sperm contain
- A an X chromosome
 - B a Y chromosome
 - C an X and Y chromosome
 - D either an X or a Y chromosome.

24. The graph below shows the average number of peppered moths, in a woodland, in June of each year over a 10 year period.

Key - - - - light form
 - - - - dark form



Studies have shown that an increase in the number of dark moths is related to an increase in the level of pollution in the atmosphere.

Which of the following **best** describes what would happen to the number of moths if measures were introduced to reduce air pollution from year 7?

- A Increase in dark moths and decrease in light moths
- B Decrease in dark moths and increase in light moths
- C Increase in dark moths and increase in light moths
- D Decrease in dark moths and decrease in light moths

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

The following stages occur during genetic engineering.

- 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.

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

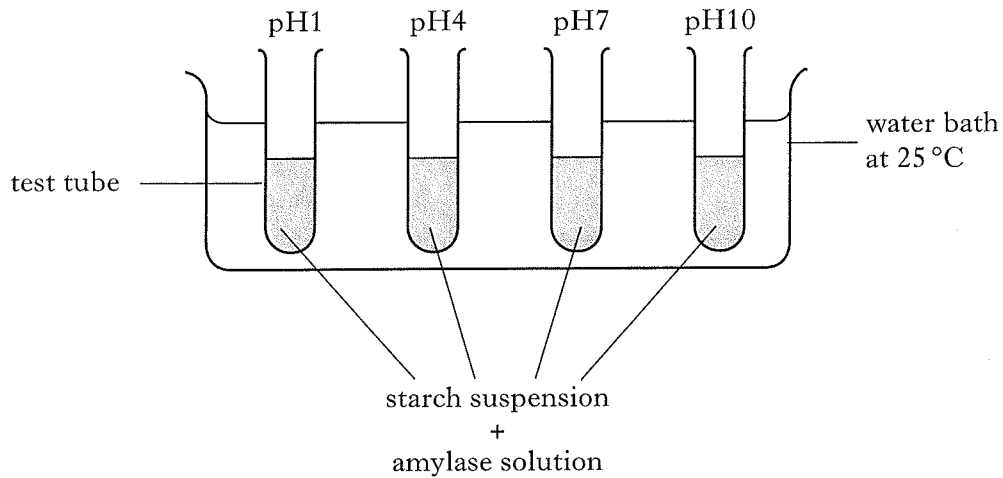
[Turn over for Section B on Page eight

SECTION B

Marks

All questions in this section should be attempted.

1. An experiment was set up to investigate the effect of pH on the action of the enzyme salivary amylase.



After 30 minutes a sample from each test tube was tested for the presence of simple sugars.

- (a) (i) Other than temperature, state **two** variables that must be kept constant in the experiment.

1 _____

2 _____

2

- (ii) Name the reagent used to test for simple sugars.

1

- (b) The results obtained are shown in the table below.

<i>pH</i>	<i>Simple sugars test</i>
1	negative
4	negative
7	positive
10	negative

Marks

1. (b) (continued)

(i) What conclusion can be drawn from these results?

1

(ii) Predict the results if the enzyme had been boiled before use. Give an explanation for your answer.

Prediction _____

Explanation _____

2

(c) Explain why food containing starch must be digested before it can be used in the human body.

2

[Turn over

Marks

2. (a) Complete the following sentences by underlining one option in each pair of brackets to describe correctly the body's response to exposure to **low** temperature.

The temperature change is detected by receptors in the skin which send nerve impulses to the { hypothalamus / pituitary }. Nerve impulses are then sent to arterioles in the skin causing them to { constrict / dilate }. Sweat production { decreases / increases } to help return the body temperature to normal.

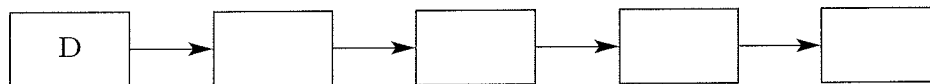
2

- (b) The table below lists the stages in a reflex arc. Each stage is represented by a letter.

Stage	Letter
An impulse passes through a motor neurone	A
An impulse passes through a sensory neurone	B
The effector brings about a response	C
A receptor detects a stimulus	D
An impulse passes through a relay neurone	E

- (i) Complete the following flow chart to show the correct order of these stages.

The first stage has been given.



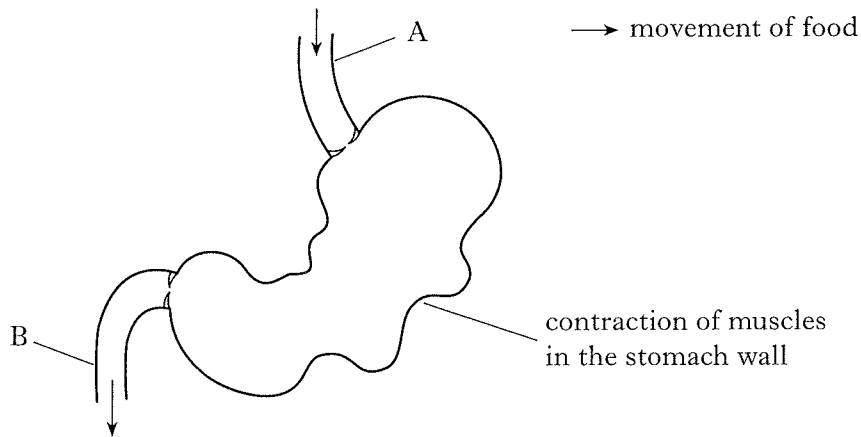
1

- (ii) What is the function of reflex actions?

1

Marks

3. The diagram shows part of the digestive system.



(a) Name structures A and B.

A _____

B _____

2

(b) Name **one** type of muscle found in the stomach wall.

1

(c) How do the contractions of the muscles in the stomach wall help the digestion of food?

1

[Turn over

Marks

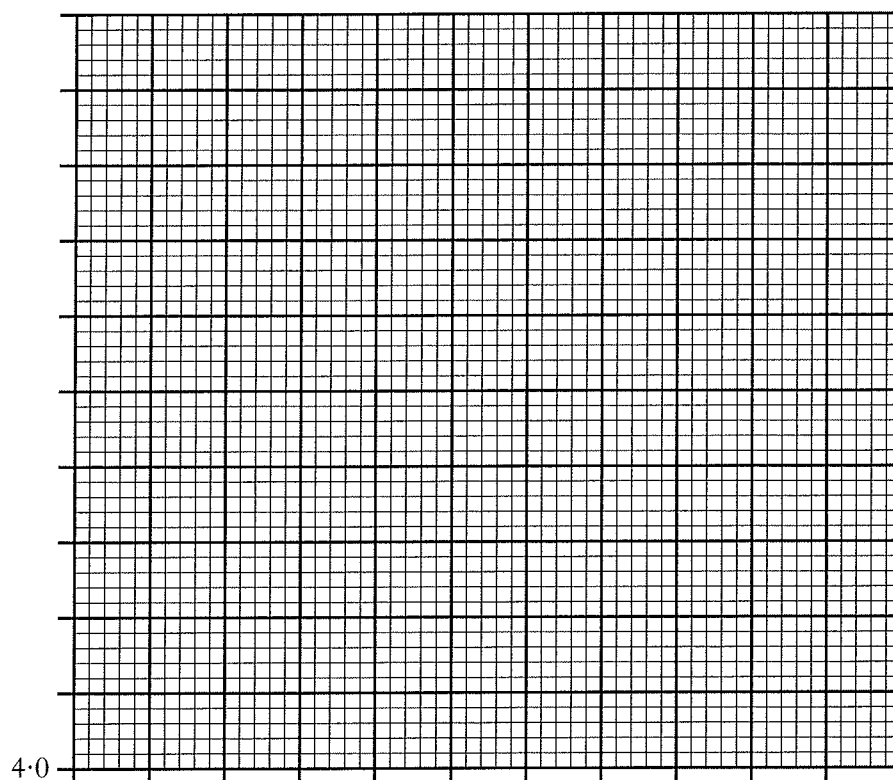
4. The oxygen concentration of the air decreases as the height above sea level increases.

The table below shows the red blood cell count of a mountaineer taken at different heights above sea level.

<i>Height above sea level</i> (metres)	<i>Red blood cell count</i> (millions/mm ³ of blood)
200	5.0
1000	5.6
2200	6.5
3600	7.6
4800	8.5

- (a) On the grid, plot a line graph to show red blood cell count against height above sea level.

(Additional graph paper, if required, will be found on page 30.)



3

Marks

4. (continued)

- (b) (i) From the table, describe the relationship between the height above sea level and the red blood cell count.

1

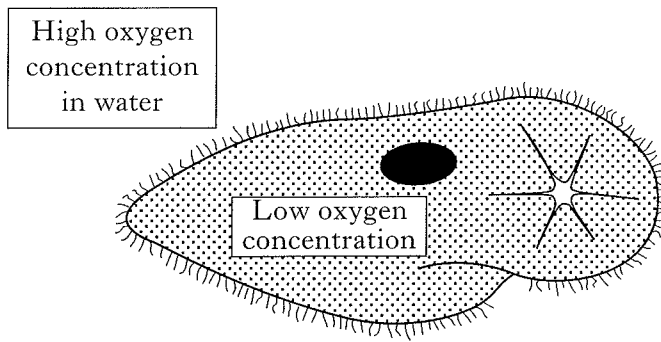
- (ii) Explain the importance of this change in the red blood cell count.

1

[Turn over

Marks

5. (a) The diagram below shows the unicellular organism *Paramecium* which lives in freshwater.



- (i) Name the process by which oxygen moves from the water into the organism.

1

- (ii) Name a substance that moves from the organism into the water.

1

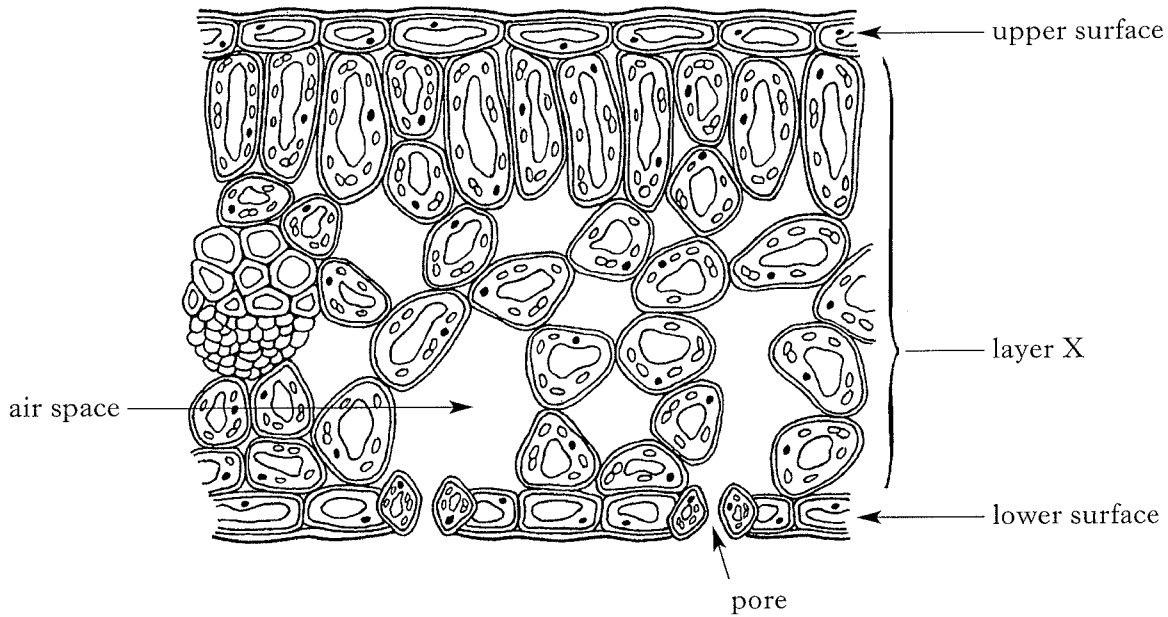
- (iii) Name the cell structure which controls the entry and exit of materials.

1

Marks

5. (continued)

(b) The diagram below shows the internal structure of a leaf.



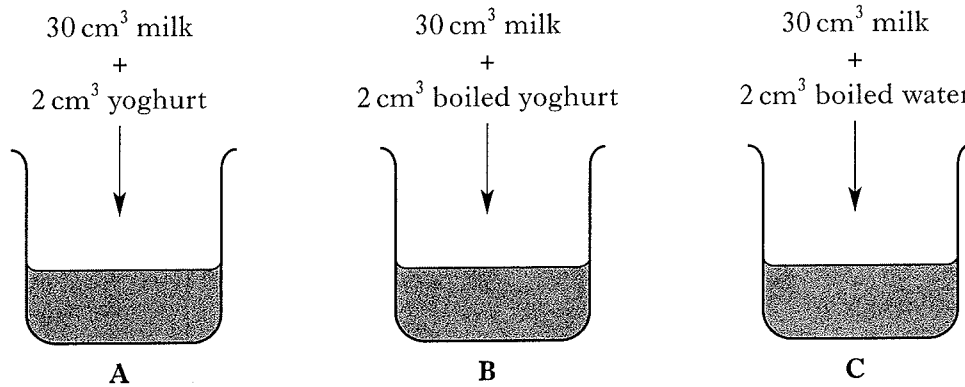
During the hours of daylight, the concentration of carbon dioxide in the air spaces is higher than in the cells of layer X.
Explain why this difference in concentration is important to the leaf cells.

2

[Turn over

Marks

6. Four groups of students carried out an investigation into the effect of the micro-organisms present in live yoghurt on milk. The milk was first sterilised to remove all micro-organisms present. Each group set up 3 beakers as shown below.



A lid was placed over each beaker. The beakers were placed in a water bath at 35°C . The pH of the contents of each beaker was measured at the start and 6 hours later.

- (a) (i) Name the type of micro-organism found in live yoghurt.

1

- (ii) Name the substance, produced by these micro-organisms, which causes a change in the pH of the milk.

1

- (iii) Suggest why the lid was placed over each beaker.

1

- (iv) Why was beaker C included as a control?

1

Marks

6. (continued)

(b) The results from the 4 groups are given in the table below.

Beaker	Change in pH				
	Group 1	Group 2	Group 3	Group 4	Average
A	-1.3	-1.8	-1.0	-1.5	
B	0.0	-1.2	0.0	0.0	-0.3
C	0.0	0.0	0.0	0.0	0.0

(i) Complete the table to show the average change in pH for beaker A.

Space for calculation

1

(ii) Why were the results from the 4 groups collected and an average calculated?

1

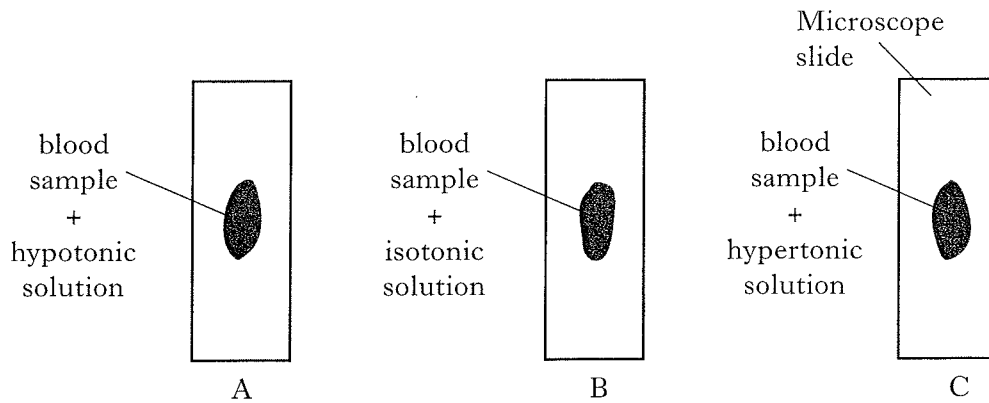
(iii) Account for the unexpected result in beaker B of group 2.

1

[Turn over

Marks

7. (a) An investigation into the effects of solutions of different salt concentrations on red blood cells was carried out. Three microscope slides were set up as shown below.



Each blood sample was observed under a microscope after 10 minutes.

- (i) Describe what would have happened to the red blood cells on slides A and C.

Slide A _____

Slide C _____

1

- (ii) Name the process responsible for these changes.

1

- (iii) What is meant by an **isotonic solution**?

1

- (b) (i) State **one** osmoregulatory problem experienced by marine bony fish.

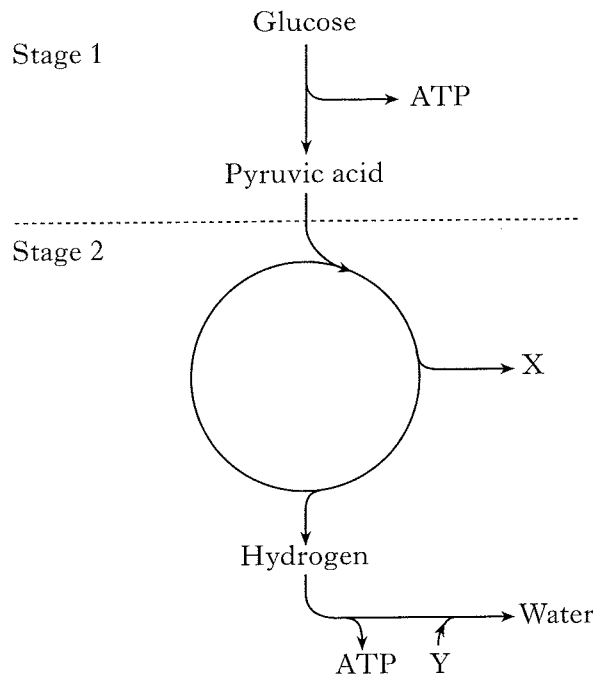
1

- (ii) Describe **one** method used by these fish to overcome the problem.

1

Marks

8. The diagram below shows the main stages of aerobic respiration.



(a) Name Stage 1.

1

(b) Name substances X and Y.

X _____

Y _____

1

(c) Which substance shown in the diagram is the **source** of the energy used to synthesise ATP?

1

(d) Complete the following word equation which represents the synthesis of ATP.

_____ + _____ + energy \longrightarrow ATP

1

(e) How many molecules of ATP are produced per glucose molecule during each of the following stages?

Stage 1 _____

Stage 2 _____

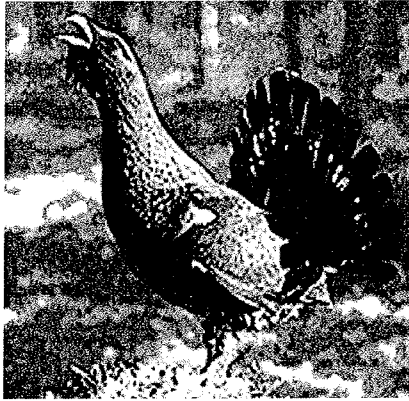
2

(f) During aerobic respiration some energy is lost from the cell. In what form is this energy?

1

Marks

9. (a) A natural pine forest provides excellent habitats for many different organisms.

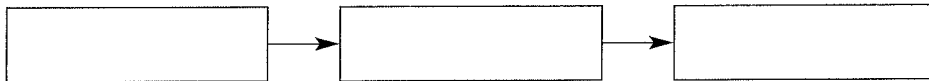


One of these organisms is a large bird called the capercaillie which nests in the deep vegetation on the forest floor. In summertime it eats berries, leaves and stems of the blaeberry and other forest plants. In winter it eats Scots pine needles and cones.

The capercaillie's natural predators are the fox and the wild cat. Crows eat their eggs.

Use information from the passage to answer the following questions.

- (i) Complete the boxes below to show a food chain.



1

- (ii) Complete the table of terms and named examples from the passage.

<i>Term</i>	<i>Named example</i>
ecosystem	
	all the crows
herbivore	

2

- (iii) Natural pine forests show high biodiversity. What is meant by the term biodiversity?

1

Marks

9. (continued)

- (b) The number of capercaillie in Scotland fell from 20 000 in 1970 to 3000 in 1991.

During the same period there was a large increase in the numbers of animals such as deer and sheep which graze on the forest floor.

Explain how this might have caused the decrease in the numbers of capercaillie.

1

- (c) Give **one** example of a human activity which could affect biodiversity.

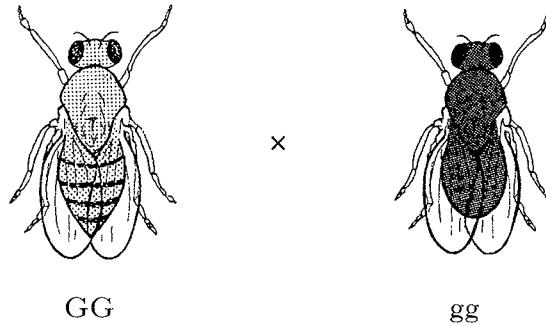
1

[Turn over

Marks

10. (a) In the fruitfly *Drosophila melanogaster*, the dominant form (G) of one gene determines grey body colour; black body colour results from the recessive form (g) of the gene.

The genotypes of the parent flies used in a cross are shown below.



- (i) State the genotype(s) of the F₁ offspring of this cross.

1

- (ii) Decide if each of the following statements about this cross 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 in the statement.

<i>Statement</i>	<i>True</i>	<i>False</i>	<i>Correction</i>
The different forms of the gene are <u>hybrids</u> .			
The <u>parents</u> in this cross are true breeding.			
The F ₁ flies are <u>homozygous</u> .			

3

Marks

10. (a) (continued)

(iii) Two flies from the F_1 were allowed to breed together. This produced 56 grey flies and 14 black flies in the F_2 .

Express this result as a simple whole number ratio.

Space for calculation

_____ grey flies : _____ black flies

1

(iv) The expected ratio of grey flies to black flies in the F_2 is 3:1. Suggest why the observed ratio was different from the expected ratio.

1

(b) In a study of variation, a group of students collected information on the heights and blood groups of a class.

For each variation state whether it is continuous or discontinuous.

Height _____

Blood groups _____

1

(c) Polygenic inheritance occurs as a result of the interaction of several genes.

Give an example of polygenic inheritance in humans.

1

[Turn over

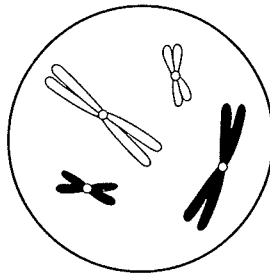
Marks

11. (a) Complete the table to give the site of production and number of chromosomes of each type of gamete.

<i>Human gamete</i>	<i>Site of production</i>	<i>Number of chromosomes</i>
egg		
sperm		

2

- (b) The diagram below shows the chromosome complement of a cell about to divide to form gametes.



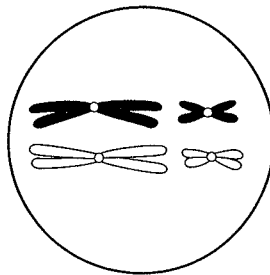
- (i) How many sets of chromosomes does this cell contain?

1

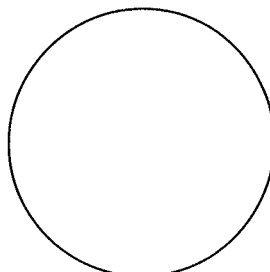
- (ii) Name the type of cell division which produces gametes.

1

- (iii) The following diagram shows one way in which these chromosomes may line up during cell division.



Complete the diagram below to show one other way in which the chromosomes may line up.



1

Marks

11. (continued)

- (c) Chromosome pairs line up in a variety of ways.
Explain why this random assortment is important.

1

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

SECTION C

Marks

Both questions in this section should be attempted.

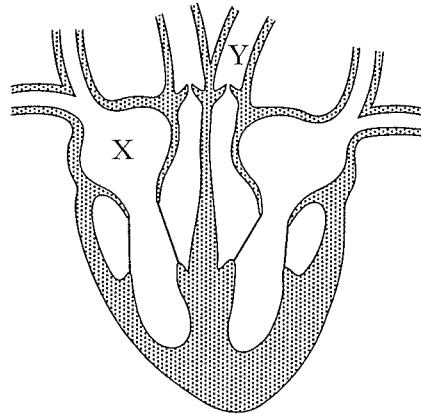
Note that each question contains a choice.

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

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

1. Answer either A or B.

A. The diagram below shows a section through the human heart.

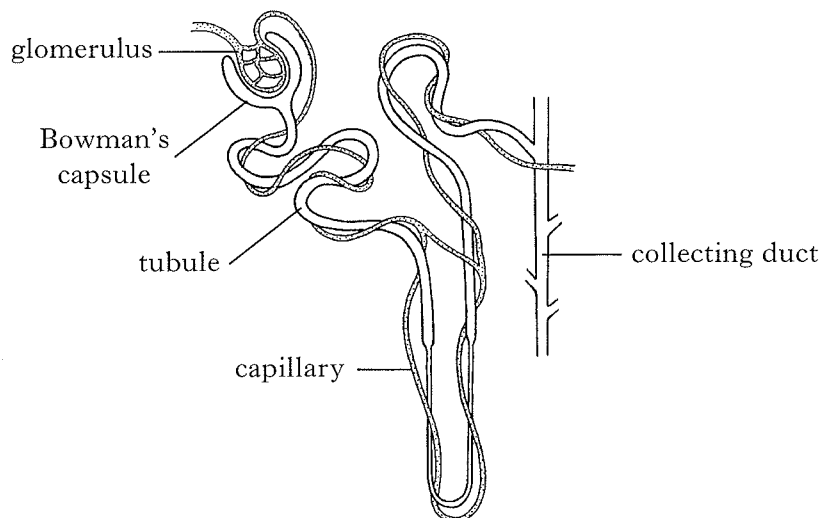


Describe the pathway of blood through the heart and associated structures starting at X and finishing at Y. There is no need to mention the valves.

5

OR

B. Urine production occurs in the kidney. The diagram below shows the structure of a nephron and its blood supply.



Describe how the nephron produces urine. There is no need to mention the role of ADH.

5

Question 2 is on Page twenty-eight.

Marks

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

Labelled diagrams may be included where appropriate.

A. Plants living in the desert are adapted for survival. Describe **three** adaptations and explain how each adaptation increases the chances of survival of the plant.

5

OR

B. Describe the structure of chromosomes. Explain how chromosomes determine the characteristics of an organism.

5

[END OF QUESTION PAPER]

SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 4(a)

