

FOR OFFICIAL USE

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X007/201

Total for
Sections B and C

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NATIONAL
QUALIFICATIONS
2003

MONDAY, 26 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.

SECTION A

All questions in this Section should be attempted.

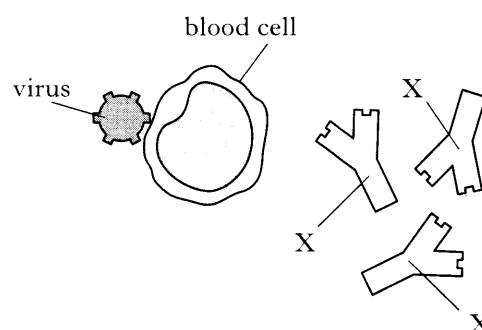
- Which carbohydrate is a component of cell walls?
 - Glycogen
 - Starch
 - Cellulose
 - Glucose
- Enzymes act as catalysts because they
 - are composed of protein
 - act on all substrates
 - raise energy input
 - lower energy input.
- The active site of an enzyme is complementary to
 - one type of substrate molecule
 - all types of substrate molecules
 - one type of product molecule
 - all types of product molecules.
- Four thin sections of onion tissue were immersed in 5% sugar solution. The sections were left for 15 minutes then viewed under the microscope. The table shows the percentage of cells plasmolysed in each section.

Section	Cells plasmolysed (%)
1	22
2	22
3	27
4	29

The average percentage of cells plasmolysed is

- 22
- 25
- 27
- 100.

- The breakdown of ATP in cells
 - releases energy and produces ADP only
 - releases energy and produces ADP + P_i
 - requires energy and produces ADP only
 - requires energy and produces ADP + P_i.
- How many more ATP molecules are produced per glucose molecule by aerobic respiration than by anaerobic respiration?
 - 2
 - 19
 - 36
 - 38
- Which of the following conditions in a greenhouse would produce earlier crops?
 - Glass shading
 - Cool air conditioners
 - Additional oxygen
 - Additional carbon dioxide
- The diagram below shows a virus attached to a blood cell. The blood cell has responded by producing specific protein molecules labelled X. (Diagram not drawn to scale.)



The molecules labelled X are

- antibodies
- antigens
- lymphocytes
- macrophages.

9. The table below refers to information about a breakfast cereal.

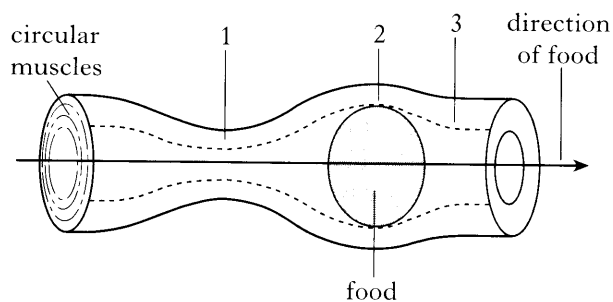
Ingredients	Mass per serving
Protein	6 g
Carbohydrate	62 g
Fat	4 g
Vitamins	1.4 mg
Iron	2.4 mg

One serving will provide 20% of a child's daily requirement for iron.

How many mg of iron are required daily by a child?

- A 0.12
- B 0.48
- C 12
- D 48

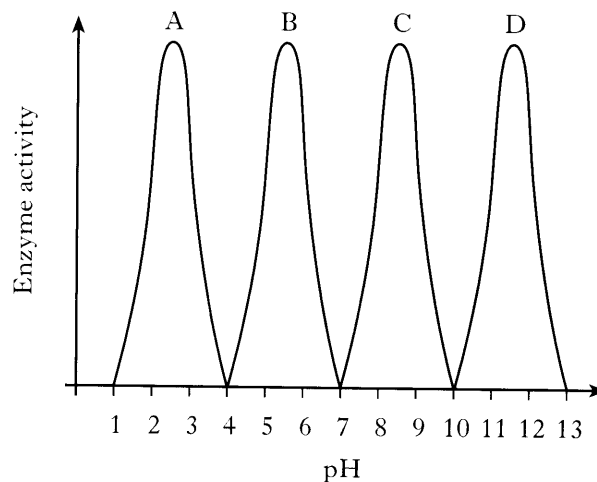
10. The diagram below shows the movement of food along the oesophagus.



Which line in the table below correctly describes the state of the circular muscles at points 1, 2 and 3 on the diagram?

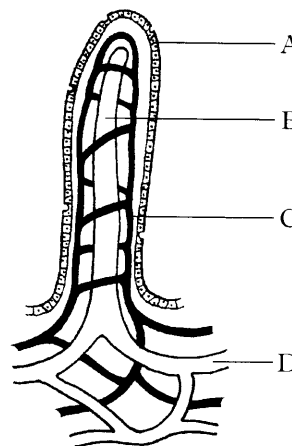
Circular muscles			
	Point 1	Point 2	Point 3
A	contracted	relaxed	contracted
B	relaxed	contracted	contracted
C	contracted	relaxed	relaxed
D	relaxed	contracted	relaxed

11. The following graph shows the results of an investigation into the effect of pH on the activity of four enzymes.



Which one of these enzymes could be pepsin in the stomach?

12. Which label correctly identifies the lacteal in the following diagram of a villus?



13. Which line in the table below correctly describes what happens to excess proteins in the diet?

	Site of deamination	Product
A	liver	urea
B	kidney	urea
C	liver	amino acids
D	kidney	amino acids

14. A food contains the elements carbon, hydrogen, oxygen and nitrogen. To which food group does it belong?

- A Carbohydrates
- B Proteins
- C Fats
- D Minerals

Questions 15 and 16 refer to the table below which shows the composition of the blood entering the kidney and the composition of the urine leaving the kidney.

Substances	Composition of blood entering the kidney (%)	Composition of urine leaving the kidney (%)
Water	92	95
Protein	7	0
Glucose	0.10	0
Salts	0.37	0.60
Urea	0.03	2.00

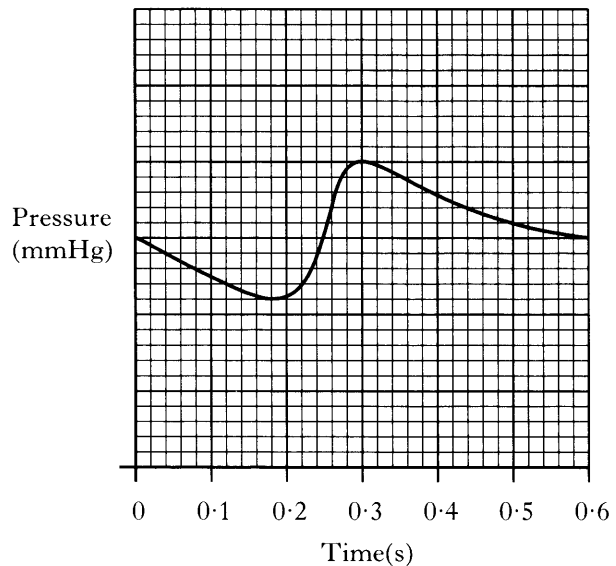
15. Which of the following substances are all excreted by the kidney?

- A Water, glucose and salts
- B Water, salts and urea
- C Salts, protein and urea
- D Salts, glucose and protein

16. How many times greater is the urea concentration in urine than in blood?

- A 0.015
- B 0.06
- C 1.97
- D 66.67

Questions 17 and 18 refer to the graph below which shows changes in blood pressure in the aorta during one heart beat cycle.



17. What is the heart rate in beats per minute?

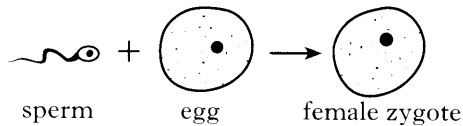
- A 30
- B 60
- C 100
- D 120

18. At what time do the ventricles start to contract?

- A 0.1s
- B 0.2s
- C 0.3s
- D 0.4s

[Turn over

19. The diagram below shows a human sperm, egg and female zygote.



Which line in the table correctly describes the sex chromosomes in each of these cells?

	<i>Sex chromosome(s) of sperm</i>	<i>Sex chromosome(s) of egg</i>	<i>Sex chromosome(s) of female zygote</i>
A	Y	X	XY
B	XY	XX	Y
C	XX	XY	X
D	X	X	XX

20. A species can be defined as a group of organisms which
- A contain identical genetic material
 - B have the same phenotypes
 - C contain the same number of chromosomes
 - D breed together to produce fertile offspring.

Questions 21 and 22 refer to the following statements about a woodland ecosystem.

- A All the oak trees
- B All the plants
- C All the plants and animals
- D All the oak trees and blackbirds

21. Which statement describes a population?

22. Which statement describes a community?

23. A sample of fresh soil from a woodland ecosystem was weighed, dried in an oven at 95 °C for one week and reweighed.

The results are shown below.

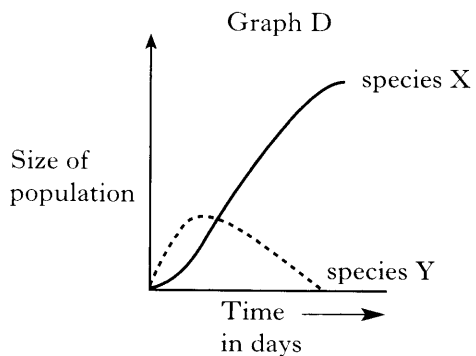
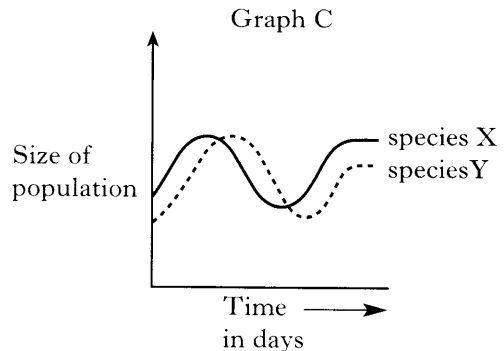
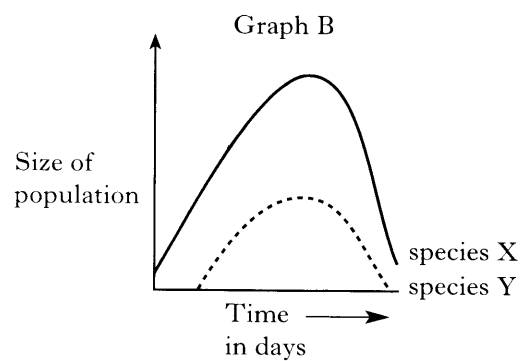
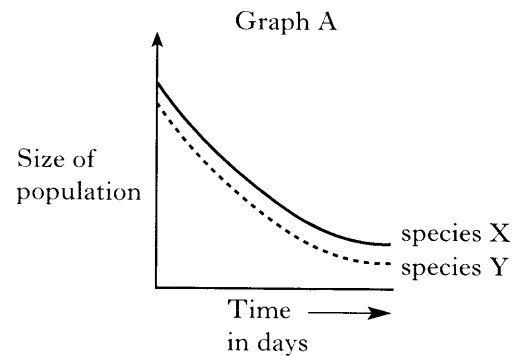
Mass of fresh soil = 50 g

Mass of dried soil = 32 g

What percentage of the soil sample was water?

- A 9
- B 18
- C 36
- D 64

24. Which one of the following graphs shows the effects of competition for the same food between a successful species and an unsuccessful species?



25. A river was sampled at six points along its length. The numbers of different animals, the oxygen concentration and the pH were recorded for each sampling point.

The results are shown in the table below.

	<i>Sampling points</i>					
	1	2	3	4	5	6
Mayfly nymphs	0	0	0	5	6	132
Dragonfly nymphs	1	1	0	0	1	1
Chironomid fly larvae	0	1	1	2	231	36
Molluscs	0	0	0	0	46	73
Oxygen concentration (%)	88	80	75	71	30	63
pH	5.6	6.0	6.5	7.3	7.5	8.0

Using these results identify which of the following conclusions is **correct**.

- A Chironomid fly larvae do not survive in water of a low oxygen concentration.
- B Molluscs survive better in water of a lower pH.
- C The distribution of Dragonfly nymphs is not affected by changes in the pH and oxygen concentration of the water.
- D The distribution of Mayfly nymphs is not affected by the oxygen concentration of the water.

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

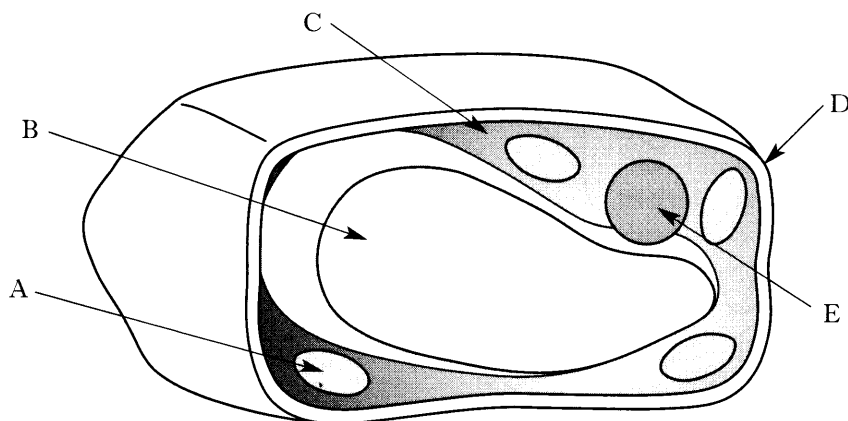
[Turn over for Section B on *Page nine*

SECTION B

All questions in this section should be attempted.

Marks

1. The diagram below shows a section through a plant cell.



(a) (i) Which **two** letters identify structures found in both plant and animal cells?

1

(ii) Name the enzyme-controlled process associated with structure A.

1

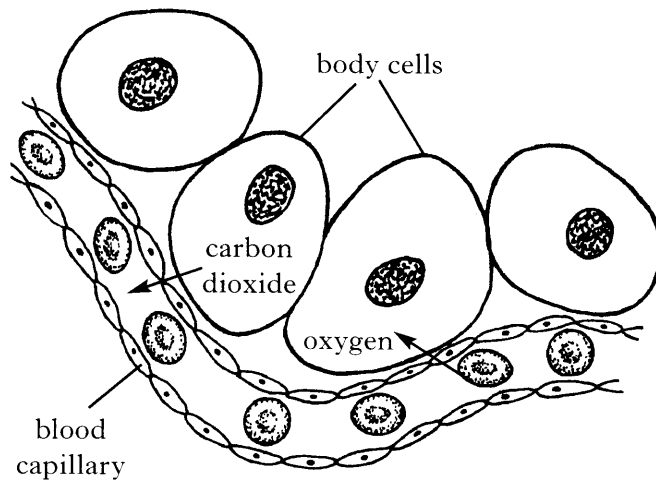
(b) Name a molecule found in structure E which is composed of a sequence of bases.

1

[Turn over

Marks

2. The diagram below represents a section of human tissue showing an exchange of materials between the body cells and blood.



- (a) Name and describe the process by which carbon dioxide moves out of the body cells into the blood.

Name of process _____

1

Description of process _____

1

- (b) Why is it important that carbon dioxide is removed from the body cells?

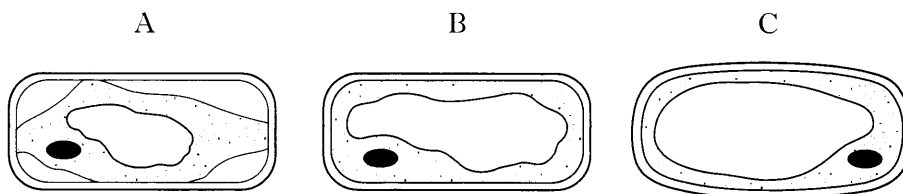
1

- (c) Name the cell process which uses oxygen as a raw material.

1

Marks

3. Three discs were cut from the same potato and were placed in three salt solutions of different concentrations. After 30 minutes the discs were removed from the solutions and the cells examined under a light microscope. A cell from each disc is shown below.



- (a) (i) Identify the cell which was placed in
 a hypertonic solution _____
 an isotonic solution _____
- (ii) Name the process which causes the difference in appearance of the cells.

- (iii) What name is used to describe the condition of cell C?

- (b) Name the cell structure which prevents plant cells from bursting.

- (c) Describe the appearance of red blood cells when placed in a hypertonic solution.

- (d) Name the enzyme which catalyses the synthesis of starch in potato cells.

1

1

1

1

1

1

[Turn over

Marks

4. (a) The corncrake is a bird once found throughout the UK, but now mostly found in the north and west of Scotland.



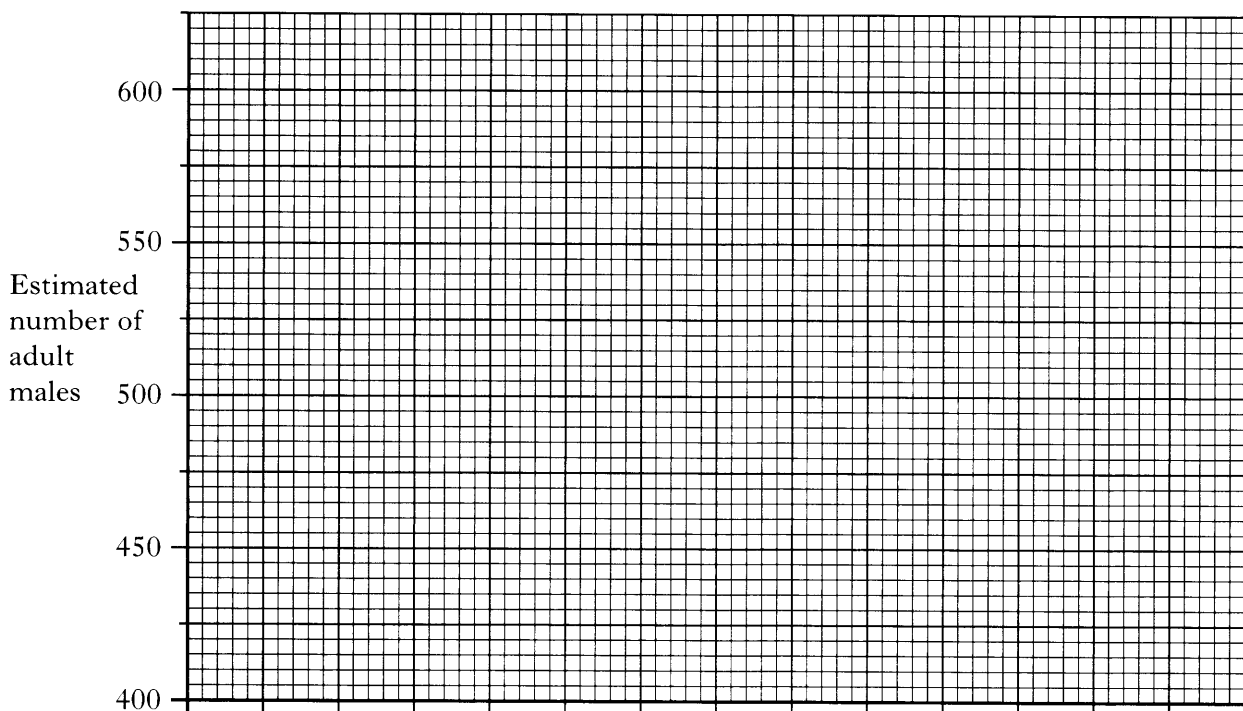
The decrease in corncrake numbers was caused by a change in hay cutting methods.

Different farming methods were introduced from 1992 to save the corncrake.

The following table shows the estimated numbers of adult corncrake males in Scotland from 1988 to 2001.

<i>Year</i>	<i>Estimated number of adult males</i>
1988	540
1990	485
1992	440
1994	470
1996	510
1999	590
2001	600

- (i) Present the results in an appropriate format on the grid below.
(Additional graph paper, if required, will be found on page 32.)



2

Marks

4. (a) (continued)

- (ii) Describe the effect of the introduction of different farming methods on the corncrake population.

1

- (b) The change in the corncrake population is the result of human activity. This affects biodiversity.

Give **one** other example of a human activity that affects biodiversity and describe the effect.

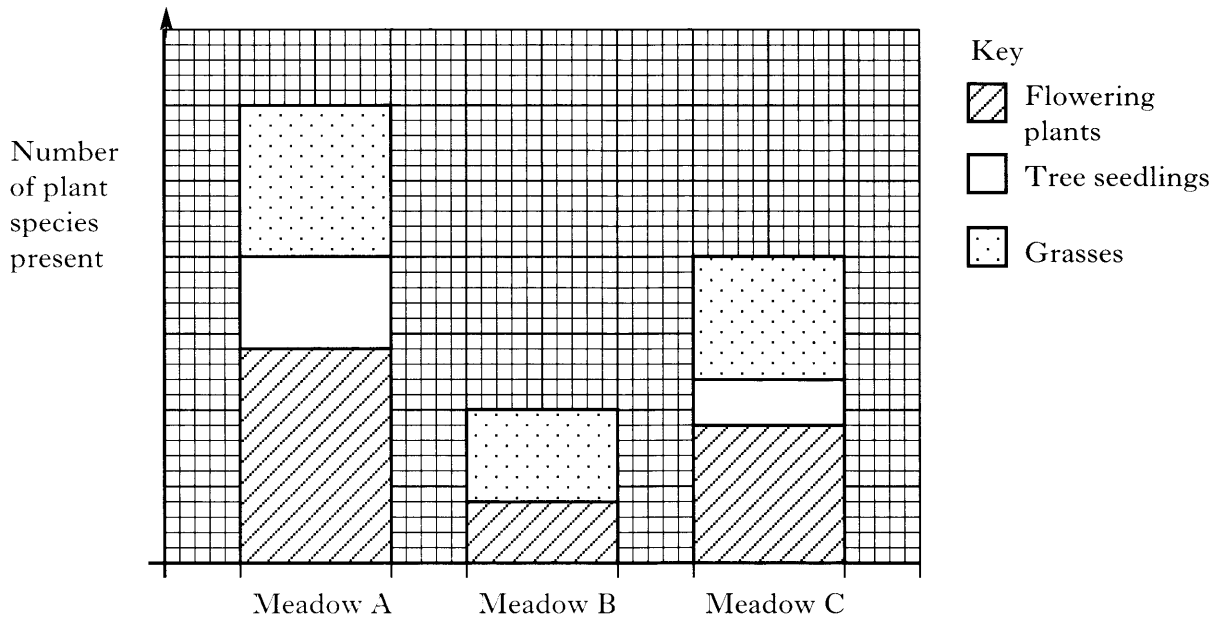
Human activity _____

1

Effect on biodiversity _____

1

- (c) The bar chart below illustrates biodiversity in three different meadows.



Which meadow has the lowest intensity of grazing?

1

- (d) Describe an adaptation of a desert plant and explain how this adaptation aids survival in desert conditions.

Adaptation _____

1

Explanation _____

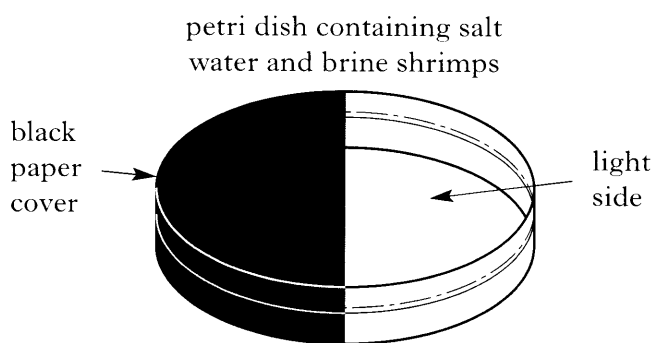
1

Marks

5. Brine shrimps are invertebrates that live in salt water. They feed on microscopic green plants filtered from the water.

An investigation into the effect of light on the behaviour of brine shrimps was carried out by five groups of students. The following description and diagram detail how this investigation was set up by each group.

1. A petri dish was half-filled with salt water and six brine shrimps were added.
2. The brine shrimps were allowed to swim around for two minutes.
3. Half of the petri dish was covered in black paper.
4. After a further two minutes the number of brine shrimps found in the light and dark sides was recorded.



- (a) State **one** variable that should be kept constant when setting up the investigation.

1

- (b) Why were the brine shrimps allowed to swim around for two minutes before the investigation was started?

1

Marks

5. (continued)

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

<i>Student Group</i>	<i>Number of brine shrimps after two minutes</i>	
	<i>Dark side</i>	<i>Light side</i>
A	4	2
B	1	5
C	3	3
D	2	4
E	1	5
Total	11	19

(i) From the results describe the response of brine shrimps to light.

1

(ii) Explain why this response helps the brine shrimp survive.

1

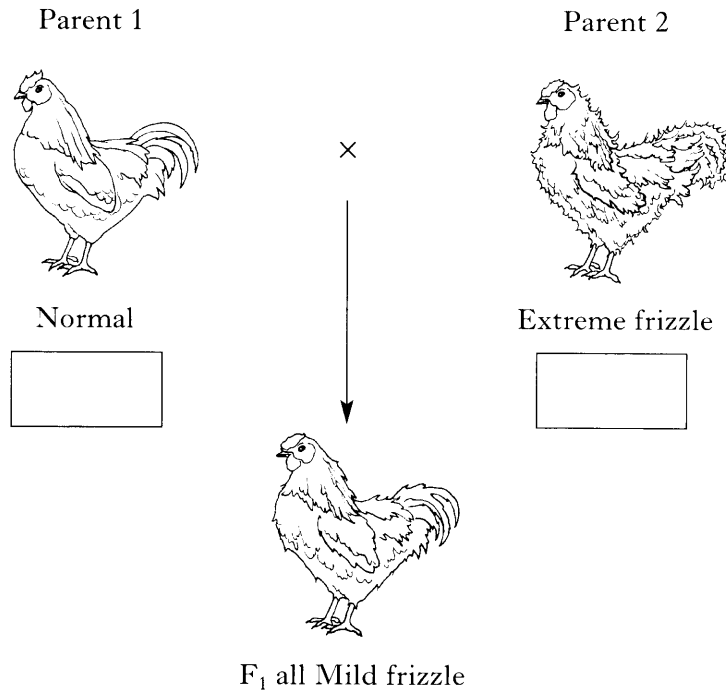
(d) Suggest **one** way in which the reliability of the results could be improved.

1

[Turn over

Marks

6. (a) In farmyard fowl, feather type is controlled by a single gene. The allele for normal feathers (N) is **co-dominant** with the allele for extreme frizzle feathers (F). The results of a cross between two homozygous fowl is shown below.



- (i) Complete the blank boxes in the diagram above to show the genotypes of the parents. 1

- (ii) Two mild frizzle fowl from the F₁ were crossed together.

Complete the punnet square below to show the genotype of the gametes from the F₁ male parent and the genotypes of the F₂ produced.

		genotype of gametes from F ₁ male parent	
genotype of gametes from F ₁ female parent	N		
	F		

2

- (iii) State the expected F₂ phenotype ratio.

Ratio ___ normal : ___ mild frizzle : ___ extreme frizzle

1

Marks

6. (continued)

- (b) Complete the table below by writing the correct word from the list to match the description.

List
interbreeding
recessive
heterozygous
homozygous
monohybrid

<i>Description</i>	<i>Word</i>
A genotype with different alleles of a particular gene.	
An allele which is always masked by a dominant allele.	
A type of cross between two true breeding parents that differ in one characteristic.	

3

- (c) Skin colour is an example of a human characteristic controlled by the alleles of more than one gene.

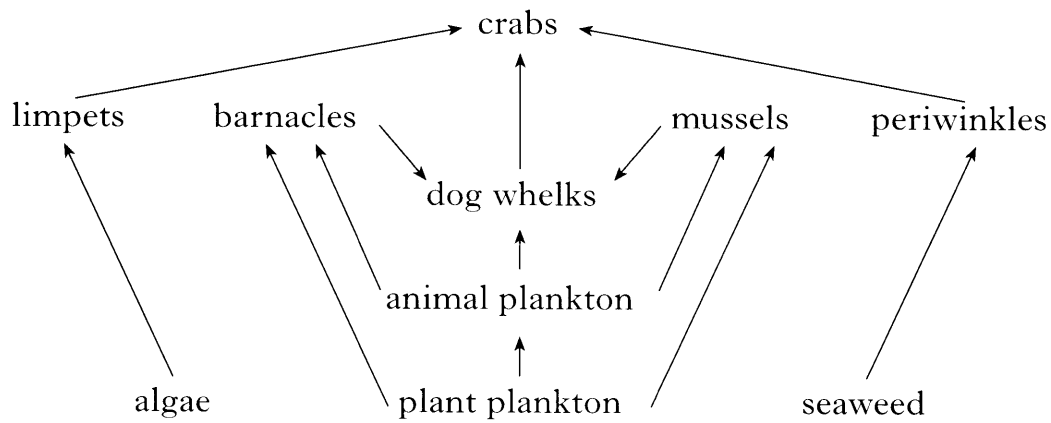
What name is given to this type of inheritance?

1

[Turn over

Marks

7. The diagram below shows part of a food web found on a rocky shore.



(a) Use the words “increases”, “decreases”, or “stays the same” to suggest what might happen to the populations of barnacles and periwinkles if all the mussels were removed. Give a reason for each answer.

1 Barnacle population _____

Reason _____

1

2 Periwinkle population _____

Reason _____

1

(b) Why is the biomass of algae greater than the biomass of limpets?

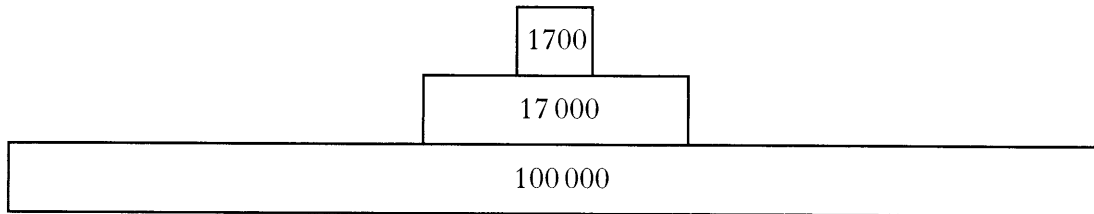
1

Marks

7. (continued)

(c) The following diagram shows a pyramid of energy for part of the rocky shore ecosystem.

The energy values are given in $\text{kJ/m}^2/\text{year}$.



(i) Why does the energy value decrease from one level to the next?

1

(ii) Use information from the food web and the pyramid of energy to complete the table below.

<i>Energy value</i> ($\text{kJ/m}^2/\text{year}$)	<i>Niche</i>	<i>Named organism</i>
100 000		
	primary consumer	animal plankton
		dog whelks

2

[Turn over

Marks

8. (a) The table below gives information about wheat produced by selective breeding over many generations.

<i>Generation number</i>	<i>Average height of stem (cm)</i>	<i>Grain yield (tonnes per hectare)</i>	<i>Average length of grain (mm)</i>
1	142	6.0	10
27	126	6.0	9
45	110	6.7	11
64	106	7.5	11
72	84	8.7	10

From the table, describe **one** improvement in the wheat and explain why it is a desirable characteristic.

Improvement _____

Explanation _____

_____ 2

- (b) Give **one** disadvantage of selective breeding.

_____ 1

- (c) Genetic engineering can be used to transfer human genes to bacteria.

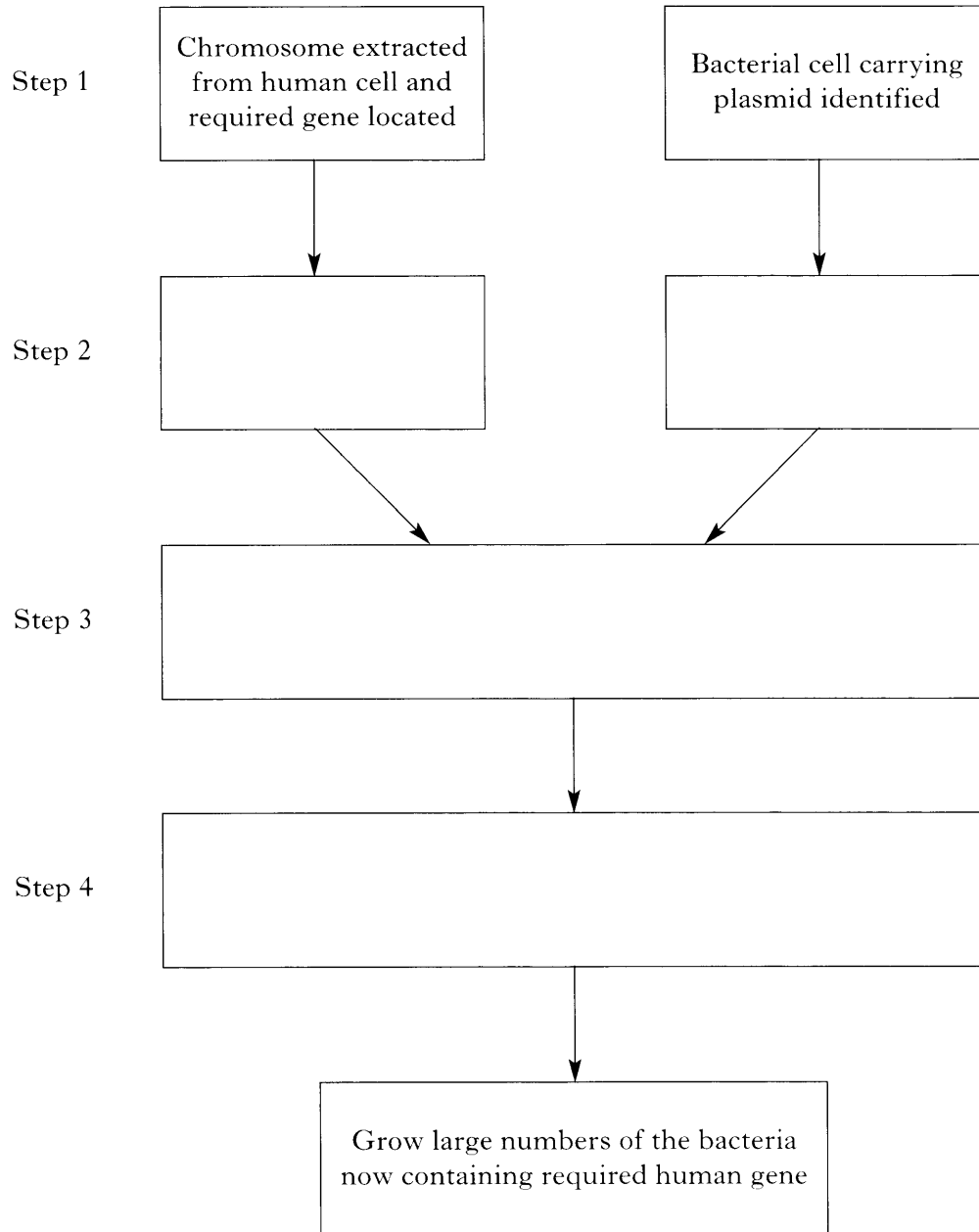
- (i) Name a human hormone which can be produced by genetically engineered bacteria.

_____ 1

Marks

8. (c) (continued)

(ii) In the boxes below, describe each of the steps carried out to transfer successfully a human gene to a bacterial cell.

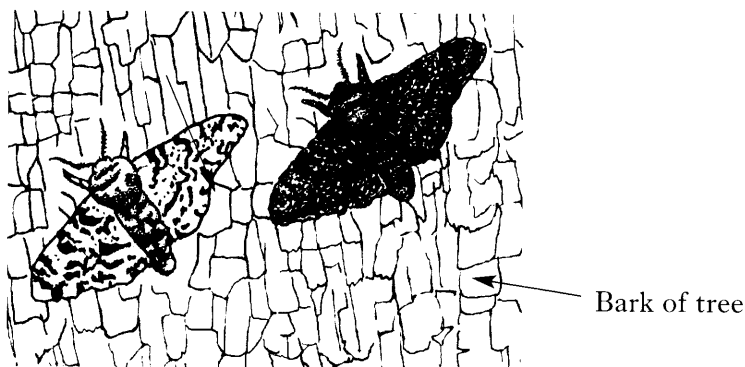


3

[Turn over

Marks

9. The diagram below shows the light and dark varieties of the peppered moth, *Biston betularia*.



In an investigation moths were captured in a woodland area, marked and released. Twenty four hours later moths were recaptured and the results are shown in the table below.

Variety	Number of moths marked and released	Number of marked moths recaptured	Percentage recaptured
Light	320	192	60
Dark	280	112	40

- (a) (i) Explain why it was necessary to calculate the **percentage** of moths recaptured.

1

- (ii) The results indicate that the investigation was carried out in a non-industrial area.

Explain why the percentage of light coloured moths recaptured is high.

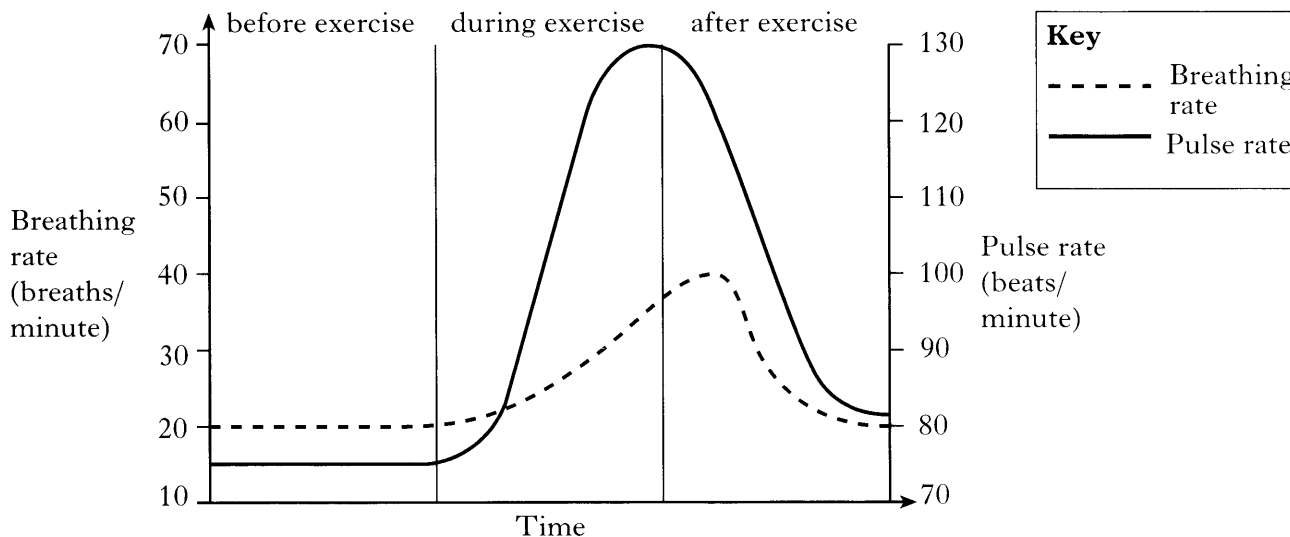
1

- (b) What name is given to the process which results in the difference in numbers of these two varieties in this area?

1

Marks

10. The pulse rate and breathing rate of a student were taken before, during and after a period of exercise. The graph below shows the results obtained.



- (a) (i) Complete the table to show the changes in pulse rate.

	<i>Before exercise</i>	<i>During exercise</i>	<i>After exercise</i>
<i>Breathing rate</i> (breaths/min)	20	from 20 to 35	from 35 to 40 to 20
<i>Pulse rate</i> (beats/min)			

1

- (ii) Explain why breathing rate increases during the exercise.

2

- (b) Muscle fatigue may occur during exercise. Name the chemical that results in muscle fatigue.

1

- (c) (i) Name the structures in the lungs where gas exchange takes place.

1

[Turn over

Marks

10. (c) (continued)

(ii) State **two** ways by which blood carries carbon dioxide around the body.

1 _____

2 _____

2

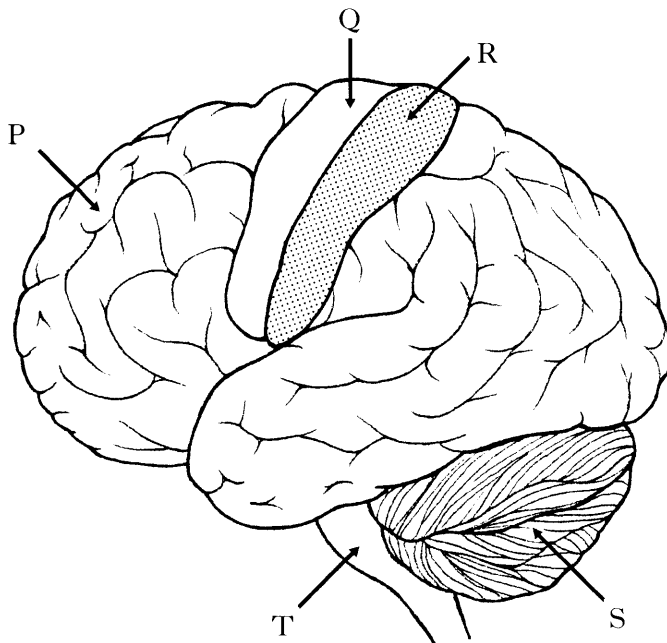
(d) Underline one option in each set of brackets to make the following sentence correct.

In the lungs haemoglobin { combines with / releases } oxygen at { high / low } oxygen levels.

1

Marks

11. The following diagram shows the human brain.



(a) Complete the table to identify areas of the brain and their functions.

<i>Name of area</i>	<i>Letter</i>	<i>Function</i>
Sensory strip		Receives nerve impulses from the sense organs
Cerebellum		
	T	

2

(b) The brain forms one part of the Central Nervous System (CNS).

Name the other part.

1

(c) Name the type of neurone which links the receptors in the sense organs to the CNS.

1

[Turn over

Marks

11. (continued)

(d) Decide if each of the following statements about temperature regulation in the body 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>
External temperature is detected by receptors in the <u>skin</u> .			
The area of the brain which regulates body temperature is the <u>medulla</u> .			
Blood vessels in the skin <u>constrict</u> in response to an increase in external temperature.			

3

SECTION C

Both questions in this section should be attempted.

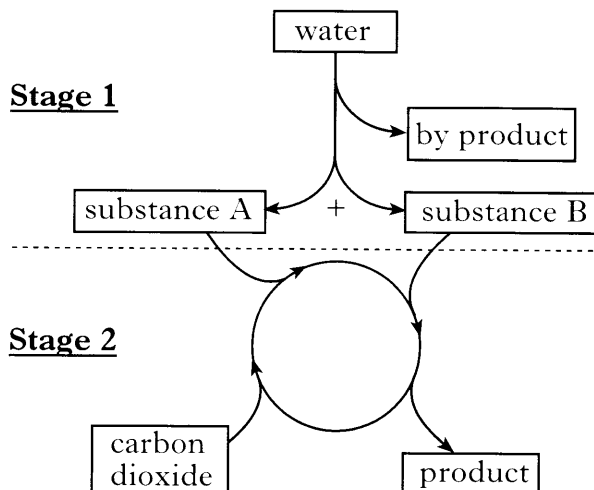
Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.
Supplementary sheets, if required, may be obtained from the invigilator.

Marks

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

A. The flow diagram below shows the two stages of photosynthesis.

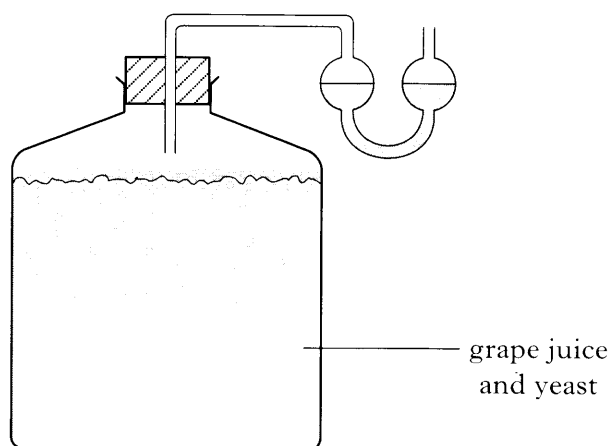


Name and describe **Stage 1** and **Stage 2**.

5

OR

B. The diagram below shows a container used for home wine production.



Describe the anaerobic pathway of respiration which results in wine production in this container.

5

Question 2 is on Page thirty.

Marks

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

Labelled diagrams may be included where appropriate.

A. Describe the structures of arteries, veins and capillaries. Give the function of each of these types of blood vessel.

5

OR

B. Freshwater bony fish have a water balance problem. State the water balance problem and describe how these fish overcome the problem.

5

[END OF QUESTION PAPER]