OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

BIOLOGY

F212

Molecules, Biodiversity, Food and Health

Candidates answer on the question paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Tuesday 18 January 2011
Afternoon

Duration: 1 hour 45 minutes

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Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **28** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 The condition known as AIDS is widespread in some parts of the world.

(a) (i) Identify the infective agent that causes AIDS.

..... **[1]**

(ii) The government has introduced needle exchange programmes for drug users.

Explain how this may help reduce the transmission of AIDS.

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..... **[2]**

(b) Fig. 1.1 shows a simplified diagram of the structure of the infective agent that causes the condition known as AIDS.

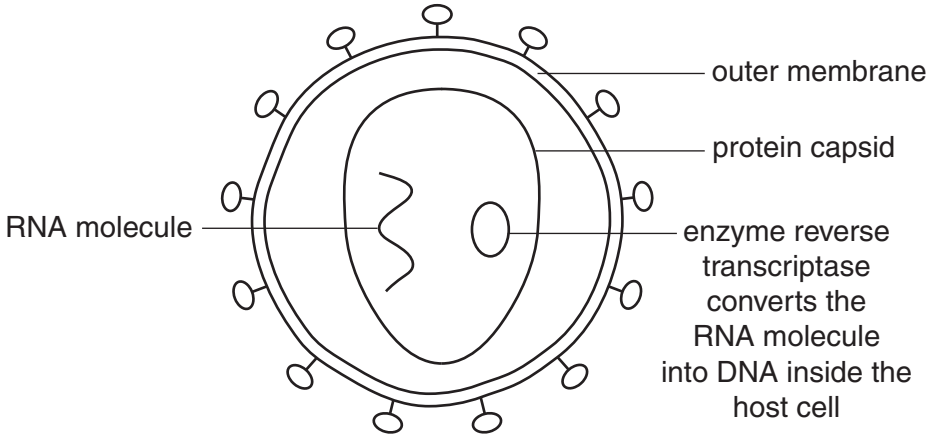


Fig. 1.1

(i) The proteins in the capsid and the RNA molecules are polymers. Polymers are made up of smaller monomer subunits.

Name the monomers that make up:

proteins .....

RNA ..... **[2]**

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(ii) The infective agent that causes AIDS takes control of the T lymphocytes of the host.

Using the information in Fig. 1.1, suggest why the infective agent is able to 'take control' once it has entered the T lymphocytes.

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..... **[2]**

(c) People with AIDS frequently become ill following infection with opportunistic diseases such as tuberculosis (TB).

(i) State **three** factors that increase the chance of infection with TB.

1 .....

2 .....

3 ..... **[3]**

(ii) When an infection occurs, some T lymphocytes produce cell signalling molecules called cytokines. These cytokines stimulate specific groups of B lymphocytes to divide.

Describe how cytokine molecules can stimulate specific groups of B lymphocytes to divide.

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..... **[3]**

[Total: 13]

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2 Fig. 2.1 shows part of an **amylose** molecule. This is an unbranched form of starch.

When iodine solution is added to starch, iodine fits into the helix of the amylose molecule, producing a colour change.

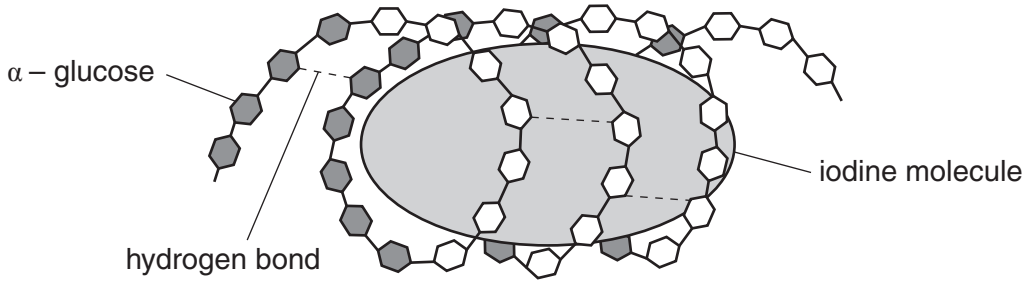


Fig. 2.1

(a) (i) State the colour of iodine solution in the presence of starch.

..... **[1]**

(ii) Hydrogen bonds hold the amylose molecule in its helical shape.

Describe how a hydrogen bond is formed.

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..... **[2]**

(iii) Using the information in Fig. 2.1, suggest what would happen to the iodine-amylose complex if the solution was heated to 60 °C.

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..... **[2]**

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(b) **Amylase** is an enzyme that hydrolyses amylose to maltose. Maltose, like glucose, is a reducing sugar.

A student investigated the action of amylase on amylose. She mixed amylase with amylose and placed the mixture in a water bath.

Describe how she could measure the change in concentration of maltose (reducing sugar) as the reaction proceeds.



In your answer, you should ensure that the steps in the procedure are sequenced correctly.

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..... **[7]**

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(c) Fig. 2.2 shows the results that the student obtained from a practical procedure in which the rate of formation of maltose was measured in the presence and absence of chloride ions.

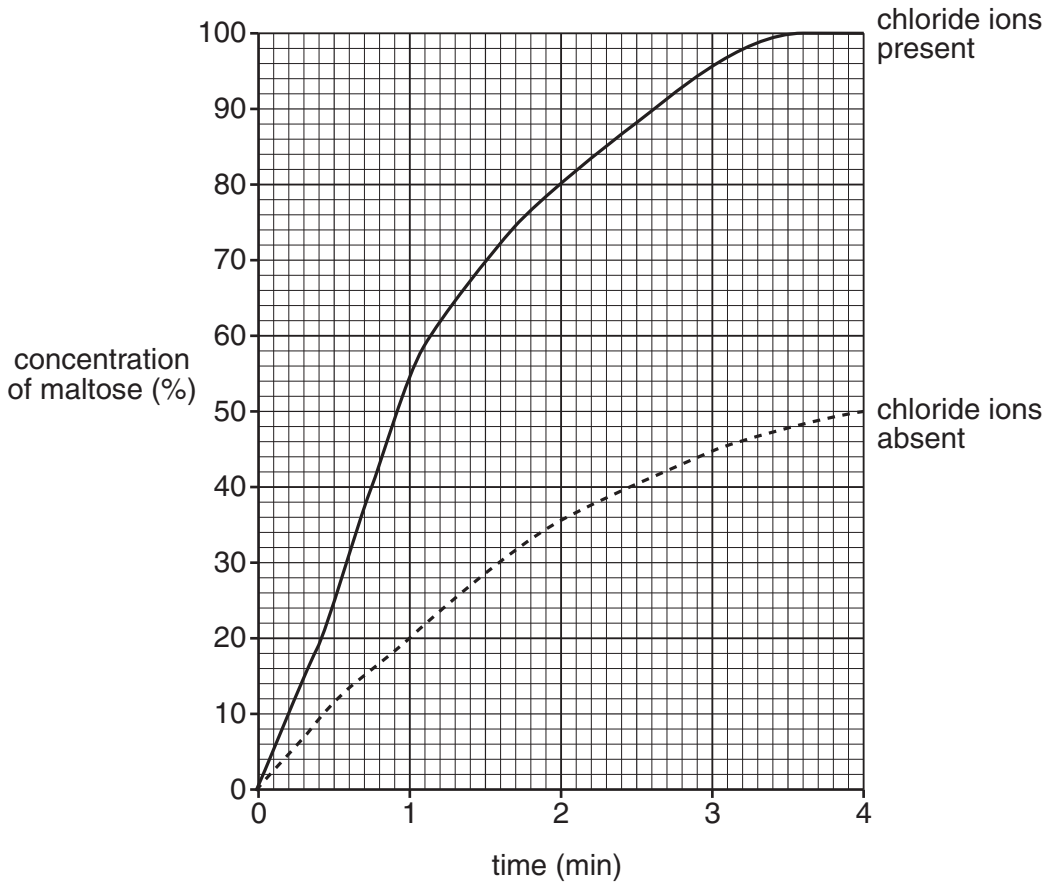


Fig. 2.2

(i) Describe the effect of chloride ions on the rate of reaction.

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..... **[2]**

(ii) Suggest how chloride ions have this effect on the rate of reaction.

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..... **[2]**

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(iii) State **three** variables that need to be controlled in this practical procedure in order to produce valid results.

1 .....

2 .....

3 ..... **[3]**

[Total: 19]

QUESTION 3 STARTS ON PAGE 8

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3 Part of the Cairngorms National Park in the Scottish Highlands is at an altitude of approximately 1000 metres. It presently supports a range of plants and animals including some that are normally found in sub-arctic conditions.

Table 3.1 shows the breeding success of a number of bird species between 1970 and 2000. Specialist sub-arctic species are marked with an asterisk *.

Table 3.1

species	number of young raised per year			
	1970	1980	1990	2000
snow bunting *	78	69	36	2
Lapland bunting *	7	3	0	0
ptarmigan *	1280	1134	960	876
red grouse	890	920	933	962
wheatear	209	240	190	231
meadow pipit	23	45	48	82
ring ouzel	23	21	29	26
dotterel *	45	43	39	35

* = specialist sub-arctic species

(a) (i) Using the data in Table 3.1, compare the breeding success of the sub-arctic species and the non sub-arctic species between 1970 and 2000.

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..... **[3]**

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(ii) Suggest **two** reasons for the trends described.

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..... **[2]**

(b) A study of insects was carried out in the same area of the Cairngorms National Park to determine species richness.

(i) What is meant by species richness?

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..... **[1]**

(ii) The insects were sampled using a sweep net method. Fig. 3.1 shows a sweep net being used. With this method, a net is swept through the vegetation. Insects are removed, identified and counted.

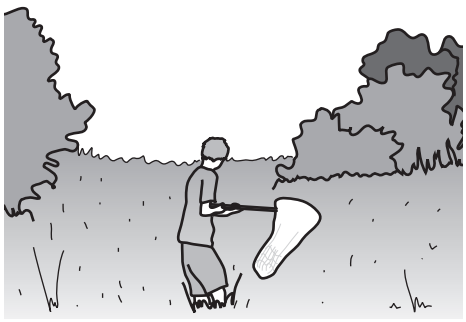


Fig. 3.1

Describe **three** ways in which the sampling procedure could be designed to try to make sure that a representative sample was obtained.

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..... **[3]**

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(iii) Species evenness also contributes to the measurement of biodiversity.

Explain the importance of species evenness in determining the biodiversity in a habitat.

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..... **[3]**

[Total: 12]

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QUESTION 4 STARTS ON PAGE 12

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4 **(a)** The World Health Organisation has promoted the concept of health.

What is meant by the term *health*?

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..... **[2]**

(b) The body has adaptations that provide it with a primary defence against the entry of pathogens and parasites.

State **two** features of the body that form part of the primary defence.

For each feature, explain how it **helps to prevent the entry** of pathogens and parasites into the body.

feature 1 .....

explanation .....

.....

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feature 2 .....

explanation .....

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..... **[4]**

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(c) Fig. 4.1 shows the life cycle of the threadworm. This is a common parasite in young children.

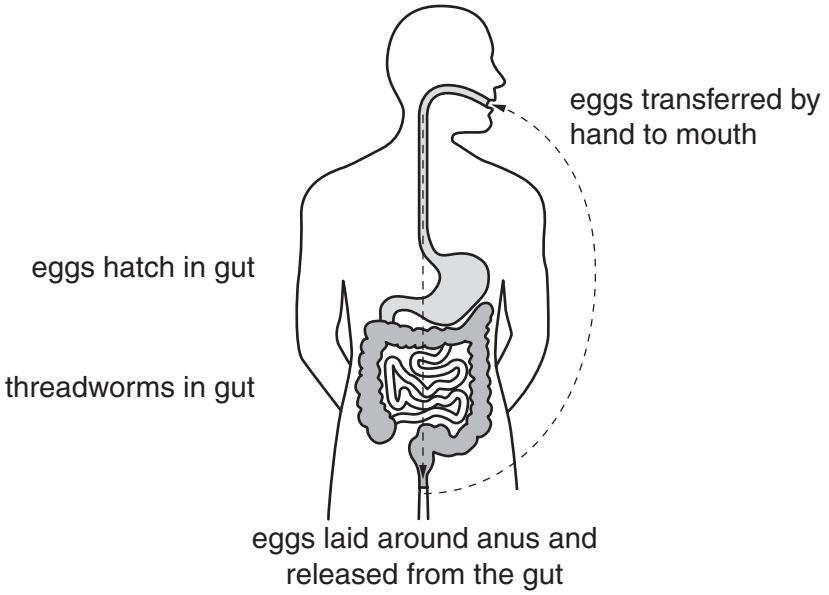


Fig. 4.1

(i) Define the term *parasite* **and** suggest how the threadworm benefits from this relationship.

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..... **[4]**

(ii) Using the information in Fig. 4.1, suggest **two** ways in which the cycle of infection could be broken.

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..... **[2]**

[Total: 12]

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5 DNA and RNA are nucleic acids.

(a) The table below contains a number of statements relating to nucleic acids.

Complete the table, using a letter **D**, **R** or **B**, to show whether each statement applies to:

- DNA only (**D**)
- RNA only (**R**)
- both DNA and RNA (**B**).

The first one has been done for you.

statement	DNA only (**D**) or RNA only (**R**) or both DNA and RNA (**B**)
contains thymine	D
contains ribose	
consists of two chains connected to each other with hydrogen bonds	
has a sugar-phosphate backbone	
has four different nitrogenous bases	
contains a pentose sugar	
is found in the nucleus and cytoplasm	

[6]

(b) It has been found that 98.4% of chimpanzee DNA is identical to that of a human.

(i) Suggest how the information obtained by DNA analysis can be useful to taxonomists.

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..... **[2]**

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(ii) State **two** types of evidence, other than biochemical evidence, that are used by taxonomists when classifying organisms.

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..... **[2]**

(c) Cytochrome C is a protein found in living organisms. The structure of cytochrome C varies between different organisms. However, closely related organisms have similar cytochrome C.

Fig. 5.1 shows a possible evolutionary tree for vertebrates.
Common ancestors are indicated by the number 1 and various letters.

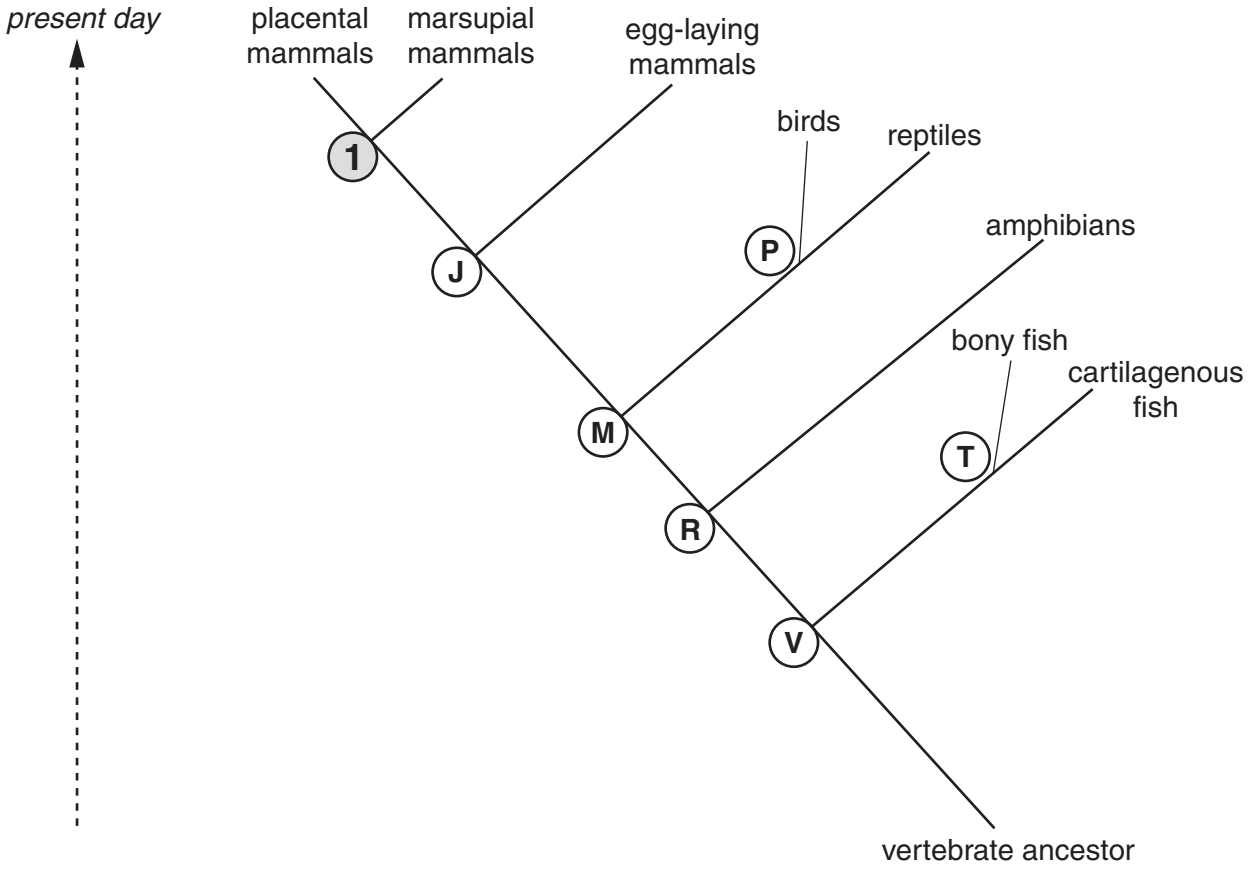


Fig. 5.1

State the **letter** of the common ancestor that has cytochrome C which will be:

most similar in structure to common ancestor **1** .....

least similar in structure to common ancestor **1** ..... **[2]**

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(d) The pine marten is a small mammal that is rare in the United Kingdom. Its numbers are particularly low in Wales and there have been few confirmed sightings of this animal in the past 50 years. There have been plans to introduce pine martens from other areas of the United Kingdom into Wales to increase the size of the population.

The DNA of museum specimens of Welsh pine martens in the National Museum of Wales was tested, the most recent specimens dating from 1948. The DNA analysis suggests that Welsh pine martens are genetically distinct from those found elsewhere in the United Kingdom.

(i) The relevance of this analysis has been questioned by some scientists.

Suggest why the findings from the museum specimens may not relate closely to the current pine marten population of the United Kingdom.

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..... **[1]**

(ii) Suggest why some people are concerned about the plan to introduce pine martens from other areas into Wales.

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..... **[1]**

[Total: 14]

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QUESTION 6 STARTS ON PAGE 18

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6 An important aspect of food production is maximising productivity. Maximum productivity can be achieved in a number of different ways.

(a) In selective breeding, humans look for variation between members of the same species and use this variation to improve productivity.

(i) State the **two** different causes of variation.

1 .....

2 ..... **[2]**

Fig. 6.1 is a scattergraph that shows the growth rate and egg productivity in a flock of chickens.

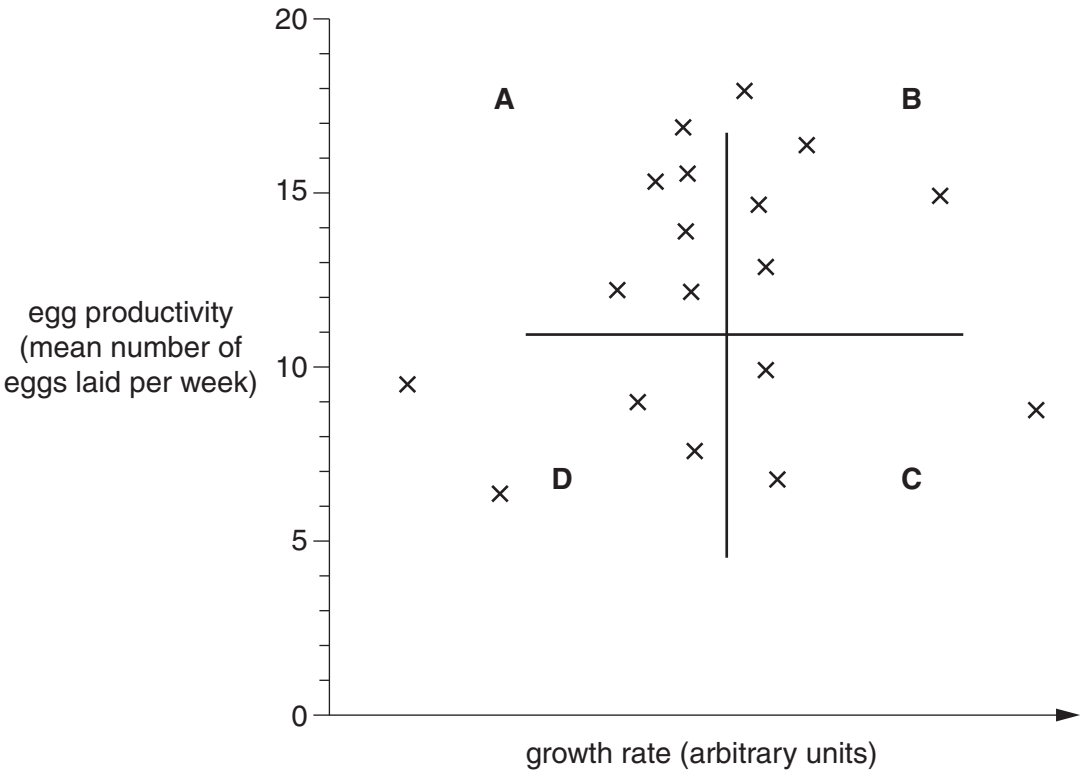


Fig. 6.1

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(ii) The growth rate of the chickens in Fig. 6.1 shows **continuous** variation.

Describe **three** characteristics of this type of variation.

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..... **[3]**

(iii) A chicken breeder divides the flock into four groups, **A**, **B**, **C** and **D**, as shown in Fig. 6.1.

State which group of chickens, **A**, **B**, **C** or **D**, he should use to breed from in order to improve the growth and productivity of the flock.

..... **[1]**

(iv) Suggest **two undesirable** consequences of selective breeding in chickens.

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..... **[2]**

(v) The wild ancestor of the domestic chicken is the red jungle fowl found in the rainforests of South East Asia.

Explain why it is important to preserve the population of the red jungle fowl.

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..... **[2]**

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(b) In the past, domestic chickens were given antibiotics as a growth promoter.

(i) When antibiotic growth promoters were used, it was claimed that the meat was of better quality, with less fat and increased protein content.

Suggest **two further** benefits of using antibiotics.

1 .....

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2 .....

..... **[2]**

(ii) The use of antibiotics as growth promoters in animal production was banned in the European Union in 2006.

Suggest a concern that led to this ban.

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..... **[1]**

[Total: 13]

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QUESTION 7 STARTS ON PAGE 22

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7 **(a)** Haemoglobin is a globular protein.

Describe the structure of a haemoglobin molecule.



In your answer, you should include details of the secondary, tertiary and quaternary structure of the molecule.

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..... **[7]**

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(b) Describe the ways in which the structure of collagen is **similar** to the structure of haemoglobin.

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..... **[4]**

[Total: 11]

QUESTION 8 STARTS ON PAGE 24

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8 Complete the following passage by selecting the most suitable term from the list below.

Each term may be used once, more than once or not at all.

antibiotics	**natural**
antibodies	**non-specific**
antibody	**specific**
antigen	**vaccination**
artificial	**vaccines**

The body can acquire immunity in a number of different ways.

In passive immunity, ... are introduced directly into the body. This may occur via breast milk or the placenta, in which case it is described as ..... immunity. This immunity provides the growing child with valuable protection until its immune system has developed fully. It is sometimes important to provide immediate protection, such as when a person has a wound that could be contaminated with tetanus bacteria. In this case, suitable blood serum from another individual is injected into the bloodstream to provide ..... immunity.

Edward Jenner pioneered the technique of stimulating the immune system into action so that the body develops immunity without developing the symptoms of the disease. Jenner's technique mimics the way in which the body would develop ..... immunity from direct contact with the pathogen and the stimulation of the primary response. Nowadays, a harmless form of the ..... is injected so that the body develops antibodies and memory cells for future defence. This technique is known as ..... . **[6]**

[Total: 6]

END OF QUESTION PAPER

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ADDITIONAL PAGE

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