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OCR
Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/08 Summer 2023 series

Version 1

ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 8 series overview

J250/08 is the second of two higher tier papers that determine the Biology content of the GCSE (9-1) Gateway Combined Science A course. It assesses content from specification topics B4-B6 and CS7. This paper is synoptic and so does contain material covered by topics B1-3. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

The majority of candidates seemed to have been able to access the paper, with very few leaving questions with no responses. The majority of candidates were able to demonstrate reasonable scientific knowledge and understanding. The main area of concern seems to be the ability of candidates to describe experimental methods and identify variables.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• completed genetic diagrams to predict probability using the correct notations Question 11(b) • were able to explain concepts and apply knowledge and understanding in Question 13 • were able to analyse information and suggest ideas to develop and improve experimental procedure in Questions 14(b)(ii) and 16(c) • completed calculations without error in Questions 11(c)(i) and 12(d).	• attempted to analyse data in Question 16(a)(iv) • recalled some basic concepts of Biology in Questions 12(a), 12(c)(i) and 15(b) but were unable to apply their knowledge • demonstrated a lack of understanding of how to calculate percentages in Questions 11(c)(i) and 12(d).

Section A overview

Section A consisted of multiple-choice questions. It was encouraging to see that most candidates attempted all these questions. Of these questions, candidates tended to do better on Questions 2, 3, 7 and 8 and less well on Questions 1, 5, and 6. Where candidates decide to change their answer, they should be encouraged to cross out their original answer. They then should write the correct answer next to the box rather than try and write one letter on top of another.

Question 1

1 Which is a **true** statement about artificial classification?

A It is based on the observation of only one or a few characteristics.

B It involves the use of DNA sequencing.

C It relies on the use of phylogenetics.

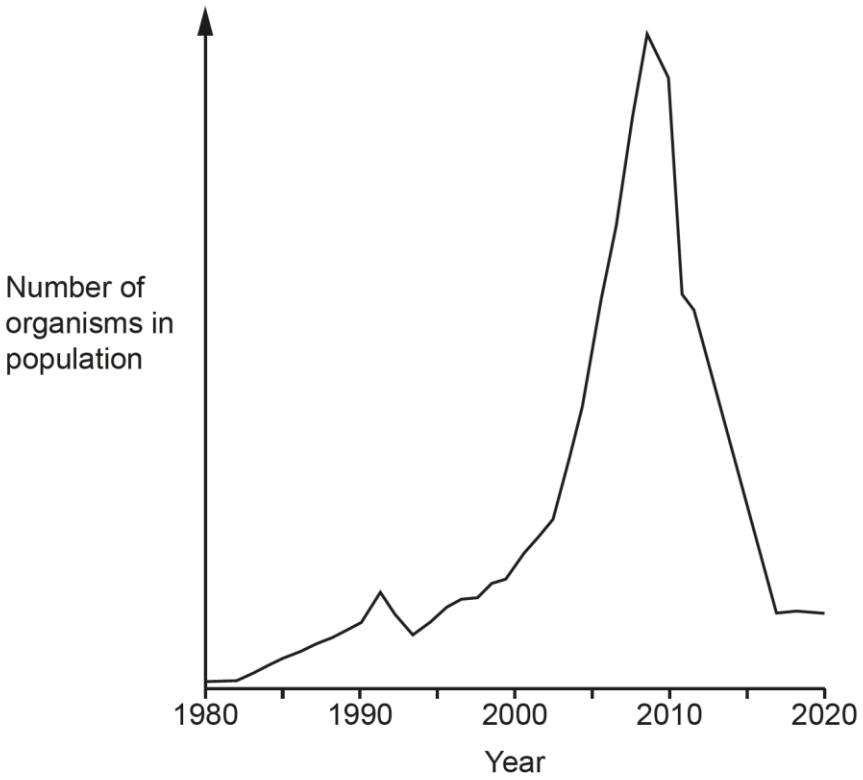
D It uses the fossil record to link common ancestors.

Your answer ☐ **[1]**

Few candidates successfully identified A as the correct response. Option B seemed to be a common response, showing a misunderstanding of the term artificial.

Question 2

2 The graph shows the changing population of one species in a habitat.



Predict the years when this species had the **highest** availability of their food source.

A Between 1980 and 1990

B Between 1990 and 2000

C Between 2000 and 2010

D Between 2010 and 2020

Your answer ☐ **[1]**

The majority of candidates recognised that populations increase when food becomes more available. The correct response of B was usually seen.

Question 3

3 Which process in the water cycle returns water to the land from the atmosphere?

A Condensation

B Evaporation

C Precipitation

D Transpiration

Your answer ☐ **[1]**

Most candidates correctly identified C as the correct response. There was no clear pattern to the incorrect choices.

Question 4

4 Which would help to maintain biodiversity in the rainforest?

A Building large hotels for ecotourism in the rainforest

B International agreements to reduce climate change

C Making it legal to remove large areas of forest for wood

D Using large areas of forest to grow crops

Your answer ☐ **[1]**

The majority of candidates understood that maintaining biodiversity requires international agreements.

Question 5

5 Which sub-cellular structure from a prokaryotic cell is used in genetic engineering?

A Mitochondrion

B Nucleus

C Plasmid

D Ribosome

Your answer ☐ **[1]**

Most candidates successfully recalled that plasmids are used in genetic engineering.

Question 6

6 Which row correctly describes human stem cells?

	They are only found in human embryos	One risk of their use as a treatment is rejection	They can divide by mitosis	They differentiate to form cancer cells
A	✓		✓	
B		✓		✓
C	✓			✓
D		✓	✓	

Your answer ☐ **[1]**

The more successful candidates identified D as the correct description of human stem cells. The majority of candidates got this question incorrect, identifying A or C, indicating that stem cells are only found in human embryos.

Question 7

7 Lions hunt and eat antelopes.

Which row correctly describes lions in this relationship?

	Type of factor	Type of relationship
A	abiotic	predator
B	abiotic	prey
C	biotic	predator
D	biotic	prey

Your answer ☐ **[1]**

The majority of responses correctly identified C. A few candidates knew that lions were predators, however they confused the terms abiotic and biotic, selecting A as their response.

Question 8

8 There are practical and ethical issues when using gene therapy to treat people.

Which statement is **only** a practical consideration with **no** ethical issues?

A Choosing which person should benefit from the treatment.

B How to insert the modified allele into a target cell.

C Religious beliefs of the patient.

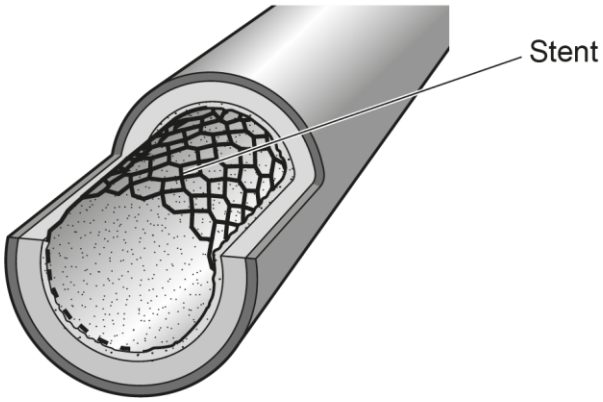
D Who should pay for the treatment.

Your answer ☐ **[1]**

The majority of candidates correctly identified B as the only practical consideration.

Question 9

9 A stent is a small wire structure. It is placed inside the artery that supplies the heart muscle with oxygen.



Why would someone need a stent fitting?

A A high-fat diet has resulted in fatty deposits inside their arteries.

B Drinking too much alcohol has caused cirrhosis.

C Lack of exercise has reduced the strength of their heart muscles.

D Smoking has damaged the blood vessels in their lungs.

Your answer ☐ **[1]**

Most candidates understood that a stent is fitted as a result of fatty deposits blocking arteries. A common misconception seemed to be that it would be fitted to work in the blood vessels of the lungs. The possible explanation for this is the mention of oxygen in the stem. Candidates often find the function of the coronary artery to be a difficult concept.

Question 10

10 What is the function of restriction enzymes in genetic engineering?

A To act as a vector and carry the DNA into the host.

B To cut the required gene from the DNA.

C To identify which cells have taken up the gene.

D To stick the gene into the DNA of the host.

Your answer ☐ **[1]**

The majority of responses recalled the function of restriction enzymes. There seemed to be no clear pattern in the incorrect responses.

Section B overview

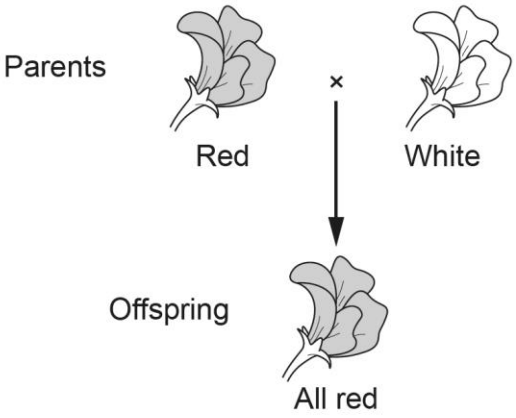
Section B consisted of structured questions ranging from 1 to 6 marks. There was clear evidence of knowledge and understanding (AO1). Candidates did not perform as well when required to apply their knowledge to answer questions (AO2) or analyse information and ideas (AO3). Candidates appeared to have had enough time to complete the paper, with the majority attempting all of the questions in Section B.

The additional pages at the back of the paper are available for those candidates who do need extra room to answer a question. Candidates should be encouraged to number any responses on the additional pages correctly. It was not always clear this series which question the response was for.

Question 11 (a) (i)

11 A gardener grows a species of plant that has either red or white flowers. The colour of the flowers is controlled by a single pair of alleles, R and r.

The gardener crosses a plant that is homozygous for red flowers with a plant that is homozygous for white flowers.
The diagram shows the results.



(a) (i) Explain why the offspring in the diagram are **all** red.

.....

.....

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

Most candidates successfully identified red as the dominant allele. However, only the more successful responses were able to explain that the offspring would all contain this dominant allele. Those candidates that included a genetics diagram to back up their explanation tended to be the most successful.

Question 11 (a) (ii)

(ii) The offspring are all heterozygous for flower colour.

What is meant by the term **heterozygous**?

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

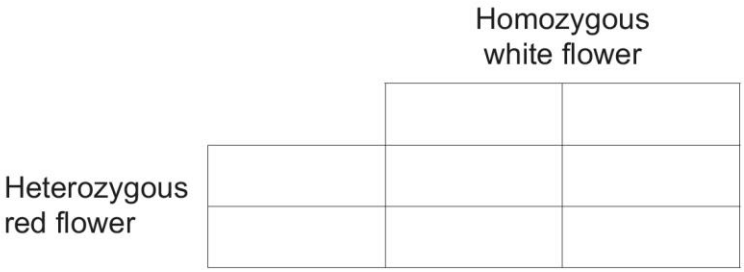
The majority of candidates understood that heterozygous individuals contain different alleles. One common error is the incorrect use of the word gene instead of allele.

Question 11 (b)

(b) The gardener crosses one of these offspring plants with a plant that is homozygous for white flowers.

Predict the probability that the next generation of plants will have white flowers.

Complete the genetic diagram to explain your answer.



Probability = ... **[3]**

There was clear evidence that candidates understood how to complete a single genetic cross. Many candidates however did not follow correct convention and use the letters provided in the question. Many used the letters W and R, which resulted in the marking of error carried forward being difficult when trying to determine if capital or lower case 'w' were used. To be given a mark for probability, the candidate's probability needed to match that for their cross.

Assessment for learning

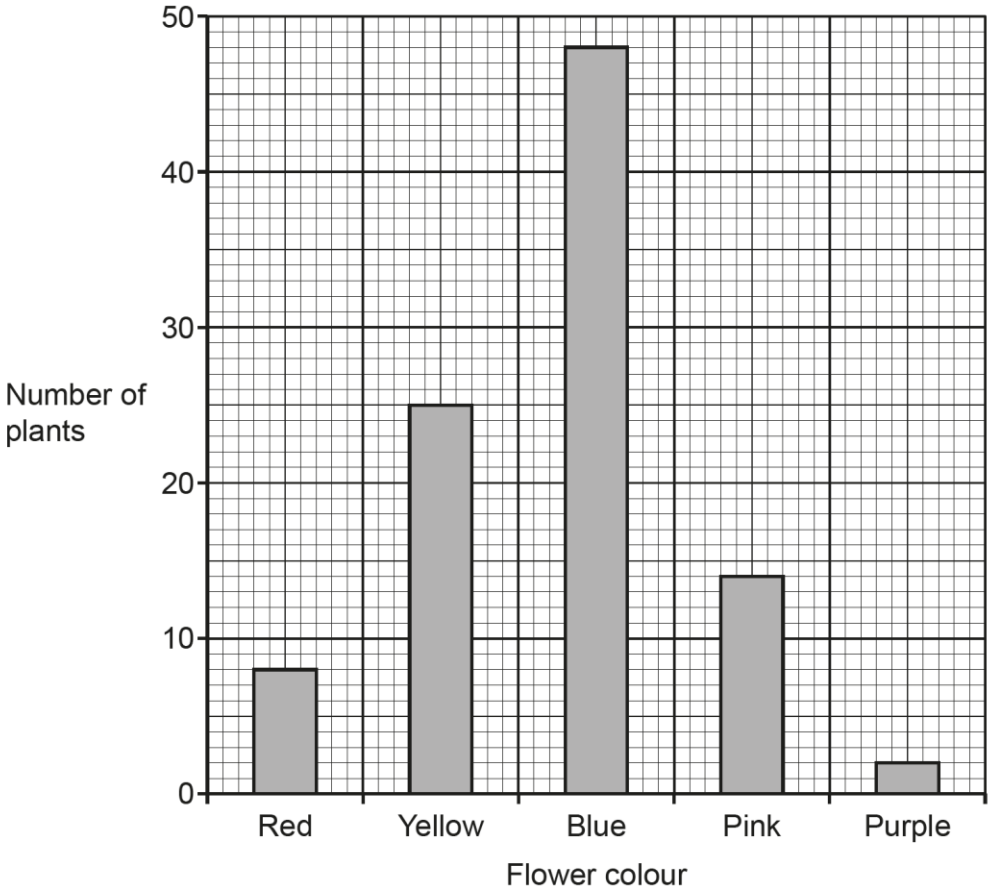
Centres are advised to encourage candidates to practice different examples of single genetic crosses using genetic diagrams as this is a common type of question. They should be encouraged to use letters provided in the questions to represent the different alleles. These letters should follow the usual convention of capital and lower case.

Question 11 (c) (i)

(c) The gardener grows another species of plant that can produce flowers of five different colours.

The gardener counts the number of plants for each flower colour.

The graph shows their results.



(i) The gardener counted 97 plants.

Calculate the percentage of these plants that have blue flowers.

Give your answer to the nearest whole number.

Percentage of plants with blue flowers = ... % **[3]**

Most of the responses were given at least 1 mark, usually for interpreting the graph to identify that there were 48 blue flowers. Some candidates then struggled to calculate the percentage. Other candidates calculated the percentage correctly; however, they then rounded up rather than down.

OCR support

The Mathematical Skills Handbook and accompanying check in worksheet would be useful to share with candidates or incorporate into lessons to practice using standard form and rearranging equations, among other mathematical skills.

Question 11 (c) (ii)

(ii) What evidence is there in the graph that flower colour is an example of discontinuous variation in this species?

.....

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

Candidates struggled with the concept of discontinuous variation. Many candidates assumed the graph showed discontinuous variation because most of the flowers were blue. Only the more successful candidates were able to explain in terms of distinct groups or limited number of colours.

Question 11 (d)

(d) The male gametes of a plant are called pollen.

The sentences in the text box are about pollen.
There are two words in the sentences that are **not** correct.

Put (rings) around the **two** words that are **not** correct.

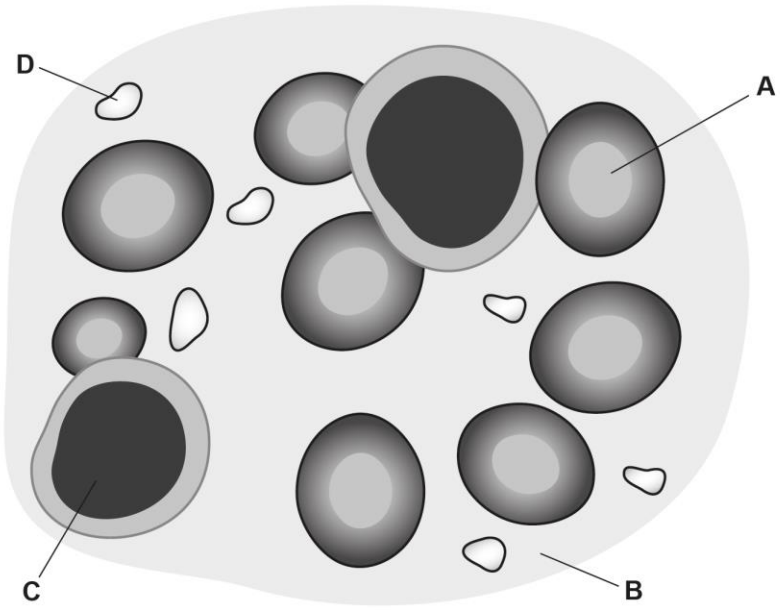
> Pollen cells are haploid. This means that the pollen cells of a plant have twice the number of chromosomes as the leaf cells of the plant.
>
> Pollen cells are formed by a type of cell division called mitosis.

[2]

The majority of responses were given 1 mark, usually for mitosis. The most common incorrect word circled tended to be haploid. This may be because candidates were expecting the response to be scientific terms and not an incorrect description of a scientific term.

Question 12 (a)

12 (a) The diagram shows the four main components of the blood.



Draw lines to connect each **letter** to the **component** that they are labelling.
Then draw lines from each **component** to their correct **function**.

Two lines have been drawn for you.

Letter	Component	Function
A	plasma	clump together during blood clotting
B	platelet	defence against pathogens
C	red blood cell	transport dissolved nutrients
D	white blood cell	transport oxygen

[3]

The majority of candidates successfully identified the components of blood and their function. Most candidates were usually given at least 1 mark. However, they often confused the function of plasma and platelets.

Question 12 (b)

(b) White blood cells are adapted to their function.

Explain **two** adaptations of white blood cells.

1 .....

.....

2 .....

.....

[2]

Only the more successful candidates were given marks for their responses to this question. Some candidates stated that the cells produced antibodies; however they did not explain the adaptation in terms of function. Centres should encourage candidates to avoid descriptions of white blood cells fighting pathogens. Instead they should use terms such as binding to antigen or engulfing pathogens.

Misconception

There was evidence many candidates confused the adaptations of white blood cells with those of red blood cells. Many candidates referred to a large surface area for engulfing pathogens. A large surface area is an adaptation of red blood cells for the diffusion of oxygen. At this level of understanding it is the flexibility of the membrane that is more important for the white blood cell.

Question 12 (c) (i)

(c) Read the information in the text box.

Prevent the spread of HIV

- Use protection during sexual intercourse
- Don't share needles to inject drugs
- Avoid contact with blood from an infected person
- Get tested

Use your knowledge of HIV as a communicable disease to answer these questions.

(i) Why can HIV be spread by sharing needles?

.....

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

The majority of candidates showed an understanding of how HIV is transmitted by blood or bodily fluids.

Question 12 (c) (ii)

(ii) Suggest how testing will help prevent the spread of HIV.

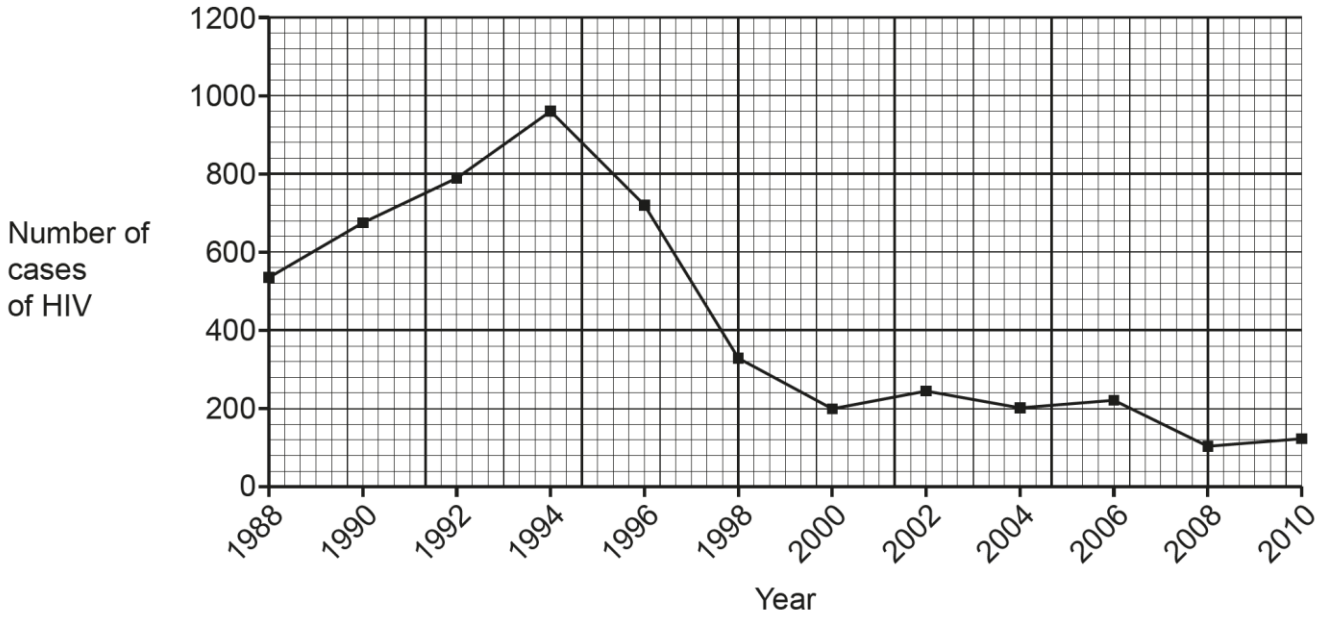
.....

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

Most of the responses gave a sensible suggestion. Where responses were vague, they were not given the mark, such as protect others without saying how to protect them. Some responses did not apply knowledge of HIV and answered in general terms, such as isolate.

Question 12 (d)

(d) The graph shows the number of HIV cases for one country between 1988 and 2010.



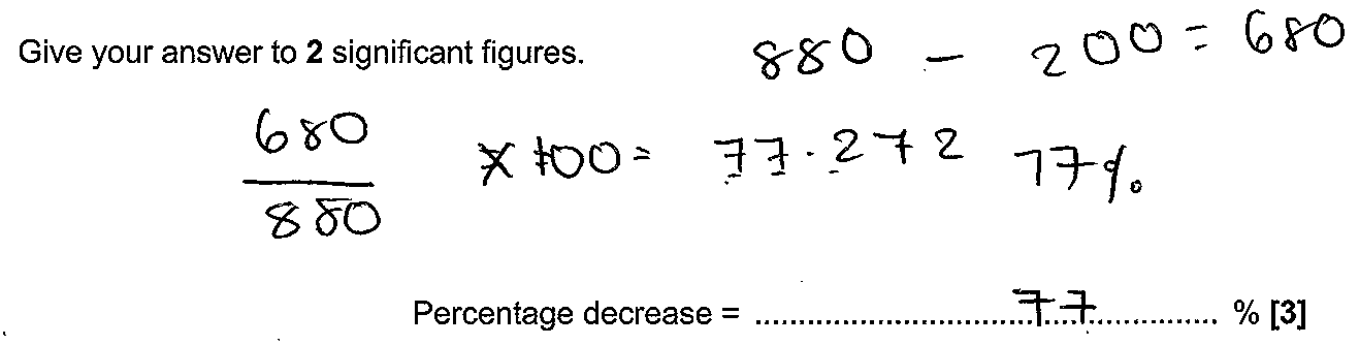
Calculate the percentage decrease in cases of HIV between **1995** and **2000**.

Give your answer to **2** significant figures.

Percentage decrease = ... % **[3]**

Many candidates found the scale of the graph challenging; they often misread the value for 1995. However, these candidates were still given credit for using their values in a correct calculation. A common error among less successful responses was to divide their value for 1995 by the value for 2000 rather than the other way round. Candidates should be encouraged to set out their calculation clearly as credit could have been given for answers of 2 significant figures if there was clear evidence for the examiner to follow. A few candidates were able to complete the calculation but not provide an answer to 2 significant figures: an answer to 2 decimal places being a common error.

Exemplar 1



The candidate in Exemplar 1 has started by subtracting the number of cases for 2000 from an incorrect value for 1995. They then set out the calculation so it is clear to the examiner how they obtained their final answer. The answer is correct using their values from the graph and there is evidence that they rounded correctly to 2 significant figures. They were given an ecf (error carried forward) and 2 marks. If this candidate had simply written 77 with no working out then the examiner would not be able to give any credit.

Question 13*

13* The pH of a soil will affect the crops that grow in the soil.
When the soil pH is suitable, more crops will grow. This results in a higher yield (mass of crops).

The table shows data about the yield of four different crops, **A**, **B**, **C** and **D**, when grown in soils of different pH.

pH range of soil	Yield as a percentage of the highest yield obtained (%)			
	crop A	crop B	crop C	crop D
4 – 4.9	25	3	14	65
5 – 5.9	74	8	34	75
6 – 6.9	100	98	100	100

A farmer measures the pH of the soil in their field. The soil is pH 4.5.

Which crop should the farmer grow in the field?

Explain your choice **and** give reasons why pH 4.5 prevents growth in some crops.
Include ideas about enzymes and their function in plants.

.....

.....

.....

.....

.....

..... **[6]**

The majority of candidates gave a Level 1 response for this question. They tended to identify crop D with evidence and make a simple statement about enzymes. This was usually the standard phrase that enzymes denature in acidic conditions. Only the more successful responses were able to apply synoptic knowledge from Topic B1 to explain the term denature and link enzymes to the growth of crops and metabolic process such as photosynthesis and respiration. A few responses included irrelevant information about the effect of temperature on enzymes in an attempt to show their knowledge of why enzymes denature.

Exemplar 2

The farmer should grow crop D in their field as D has the highest % yield obtained at pH 4-4.9 which includes 4.5 at 65%. This means that their crops will have a higher yield in pH 4.5 therefore more profitable for the farmer as higher yield means more for the farmer to sell. The reason pH 4.5 may prevent some crops growth / yield such as crop B which only has 3% yield at that pH is because the enzymes that control photosynthesis may be denatured. Every enzyme has an optimum pH ~~that~~ in which they work most effectively, too high or low results in denaturing where the active site changes shape so the substrate can't fit so the reaction can't take place. So with ineffective photosynthesis enzymes as it's an enzyme controlled reaction photosynthesis won't take place as much. Therefore less glucose-product of [6]

13) If photosynthesis (carbon dioxide + water → glucose + oxygen) will be produced - which ~~or~~ can be used up in respiration to release energy. Therefore less glucose means less energy for the plant (resulting in less growth and yield

Exemplar 2 shows a full mark Level 3 response. The candidate correctly interprets the data in the table. They set out a well-developed response that clearly shows their application of knowledge. The response includes a description of denaturing in enzymes and the consequences this has on the enzyme-controlled reaction. They then link enzymes photosynthesis and growth to show clear understanding.

Question 14 (a)

14 A student investigates the population of snails in a habitat.

This is the method they follow:

- Mark out a grid 2 m × 2 m: each square of the grid is 0.25 m^2.
- Write numbers 1 to 16 on pieces of paper and put them in a bag.
- Take one piece of paper out of the bag to select the square number.
- Record the number of snails in that square.
- Choose three more squares in the same way.

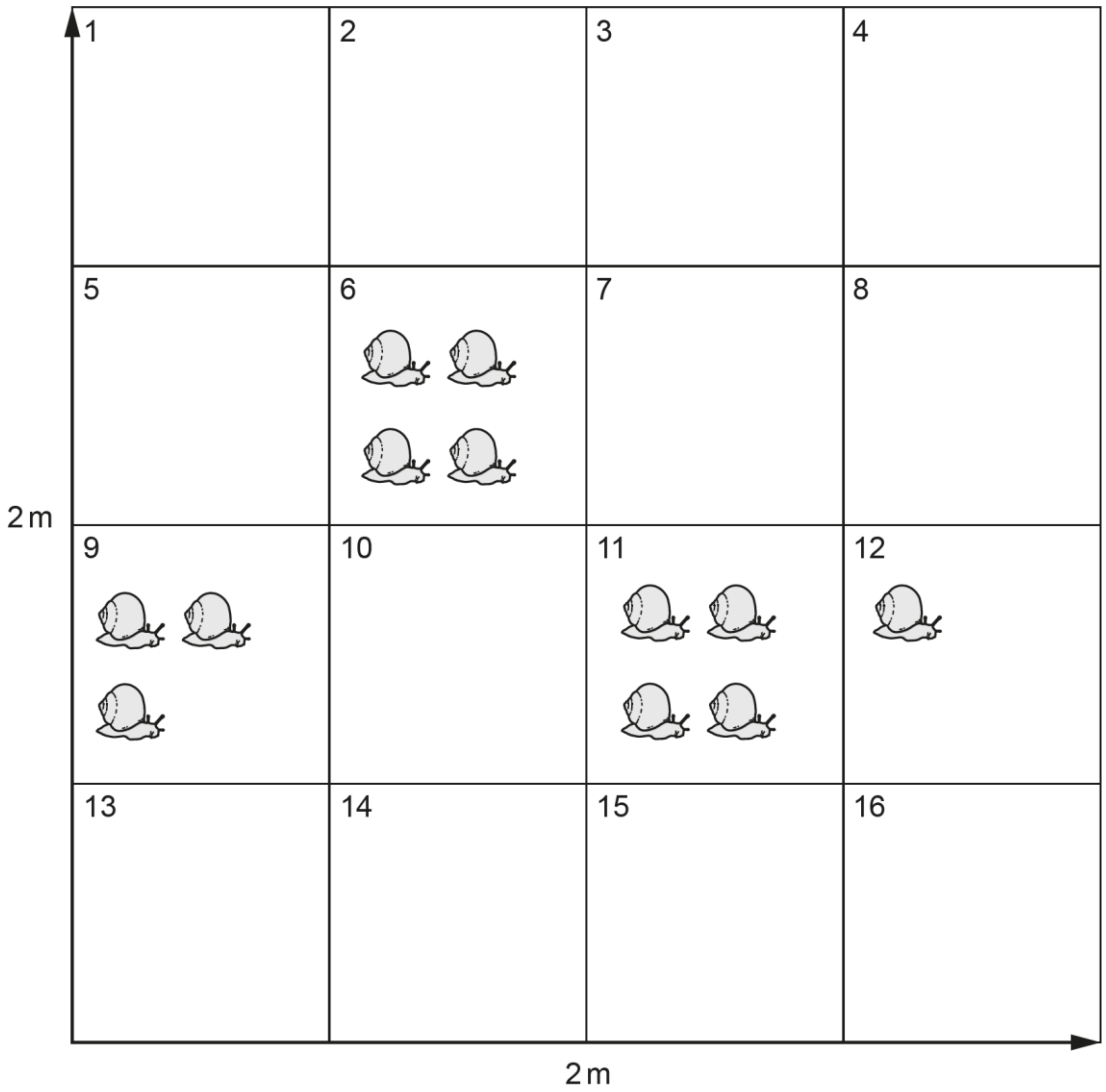
(a) Why does the student use the pieces of paper to choose the squares in the grid?

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

Most candidates understood that the method would result in random sampling.

Question 14 (b) (i)

(b) The diagram shows the grid they use and the number of snails in the **four** squares they count.



(i) Each square has an area of 0.25 m^2. The total area of the habitat is 900 m^2.

Estimate the population of snails in the habitat.

Estimated population = ... snails **[2]**

Only the more successful candidates calculated an estimate of the population. Many candidates assumed each square of the grid was 1m^2, leading to them incorrectly assuming there 12 snails in 4m^2 rather than 12 snails in 1m^2.

Question 14 (b) (ii)

(ii) The student thinks the estimate is much larger than they would expect.

Suggest **two** ways the student could improve their investigation to get a more accurate estimate.

1 .....

.....

2 .....

.....

[2]

The majority of responses were given at least 1 mark, usually for stating the student should count more squares. Some candidates suggested the student should simply repeat the investigation; this response was seen as too vague and not given credit. Candidates who suggested increasing square or grid size again were not given credit due to uncertainty in the exact meaning of their response. A larger gird would make no difference if only 4 squares were again counted. Candidates should be encouraged to be more precise in their responses and apply the response to the situation in the question rather than make general comment such as 'repeat it'.

Question 14 (c)

(c) The student uses a transect to investigate the plants in the habitat.

Explain how to use a transect to investigate the distribution of different plant species in a habitat.

.....

.....

.....

.....

.....

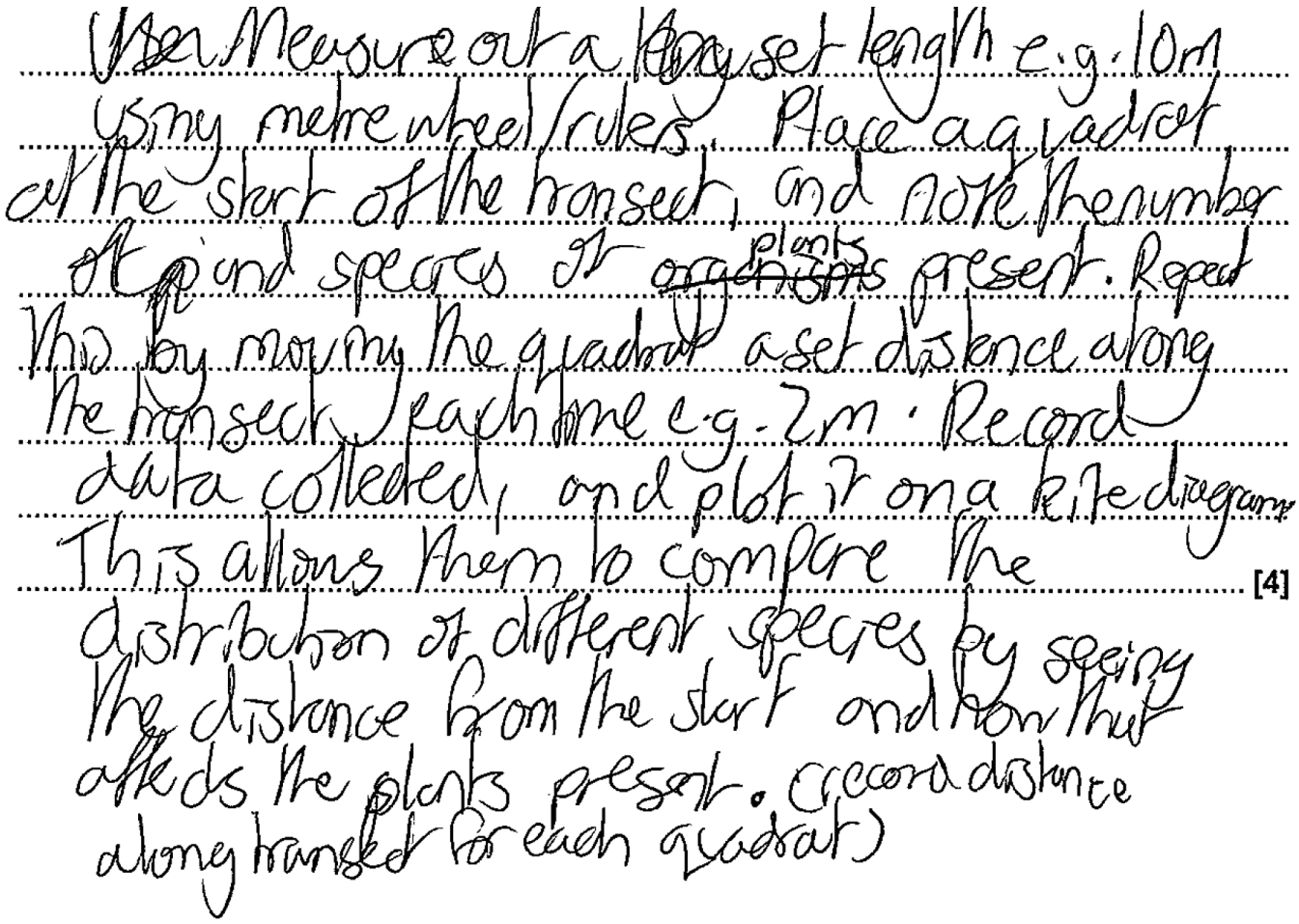
..... **[4]**

More successful responses were able to provide a clear explanation of how to complete a line transect across a habitat. However, there was evidence that many candidates struggled with the concept of a line transect. Many simply tried repeating the method from part (a); this method however would not show the distribution of plant species and therefore could not be given all 4 marks. Many candidates gained at least 1 mark, either for counting the number of plant species within a square or using the term quadrat.

OCR support

OCR provides Teacher and learner sheets for practical activities linked to sampling techniques and field investigations including how to complete a transect investigation.

Exemplar 3



[4]

The response in Exemplar 3 shows a clear understanding of how to complete a field investigation to find the distribution of different plant species in a habitat. The choice of a metre wheel/ruler to measure out the line transect is not the best choice. However, it does show an understanding of the need for some sort of distance being measured along a line. The candidate further demonstrated this by moving the quadrat set distances along the line transect. The use of a kite diagram to present the collected data would also be given credit. The candidate was awarded 4 marks.

Question 15 (a)

15 The picture is of a sword-billed hummingbird feeding on a flower.

- The hummingbird feeds on nectar from the flower.
- The flower benefits because the hummingbird transfers pollen from one flower to the next.
- This helps the flower to reproduce and develop seeds.

(a) What word describes the interdependence between the hummingbird and the flower?

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

The majority of candidates recalled the term mutualism.

Question 15 (b)

(b) The long beak of the sword-billed hummingbird is an adaptation that helps the bird to feed. The bird's ancestors had shorter beaks.

Explain how the sword-billed hummingbird may have evolved to have a long beak. Include ideas about natural selection.

.....

.....

.....

.....

.....

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

Candidates on the whole are successful at answering questions about natural selection. Many candidates gained at least 2 marks for ideas about survival of the fittest and the longer beak helping the hummingbird to gain more food. Only the higher performers gained full credit by referring to mutations or the passing on of alleles. Many candidates understood the characteristic would be passed onto the offspring but did not mention that this would be passed on in the alleles. Candidates should be encouraged to refer to many generations rather than over time as this is less vague.

Misconception

Less successful candidates are more likely to think that populations choose to adapt to changes in the environment rather than adaptations occurring due to variation or random mutations. A few candidates confused natural selection with selective breeding.

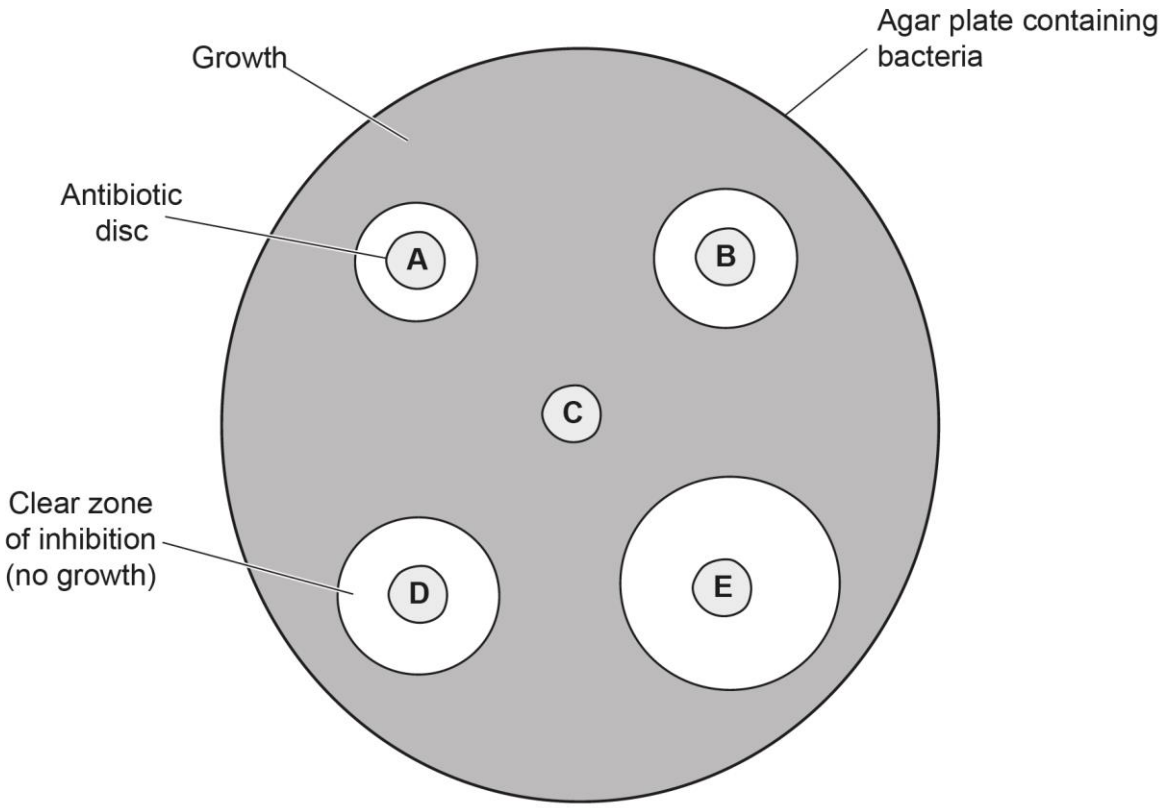
Question 16 (a) (i)

16 (a) A student investigates the effect of antibiotics on the growth of bacteria.

This is the method they follow:

- Place discs of paper containing different antibiotics on an agar plate containing bacteria.
- Leave the agar plate in a warm place.
- Observe the growth of the bacteria after three days.

The diagram shows their results. Clear zones around the antibiotic discs show where the bacteria growth is inhibited.



(i) What are the independent variable and the dependent variable for this investigation?

Independent variable .....

Dependent variable .....

[1]

Candidates seemed to struggle with the different types of variables in an investigation and many responses were not precise enough. A common response for dependent variable tended to be 'the growth of the bacteria'. However, in this case the dependent variable was quantitative and should have referred to the size of the clear zone.

OCR support

Our Language of Measurement in context resource can be used with candidates to help familiarise them with terms such as dependent and independent variable, and where to identify them in a practical.

Question 16 (a) (ii)

(ii) The student used a disc of paper with **no** antibiotics.

Which disc had **no** antibiotics on it?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐ **[1]**

The majority of candidates correctly chose C as their response.

Question 16 (a) (iii)

(iii) Explain why the student uses a disc with **no** antibiotics on it.

.....

.....

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

Most of the candidates understood that this disc was used as a control or comparison. However only the most successful responses went on to explain that it would show that the antibiotics and not the paper were affecting the bacteria.

Question 16 (a) (iv)

(iv) Which antibiotic, **A**–**E**, is the **most** effective?

Explain your answer.

Antibiotic .....

Reason .....

.....

[2]

The majority of candidates correctly identified E with the correct reason. Less successful responses tended to choose A, believing the smaller clear zone meant there was less growth.

Question 16 (b)

(b) After the student has recorded their results the agar plates are destroyed.

Why should agar plates containing bacteria be destroyed?

.....

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

Many candidates understood that this would stop the spread of the bacteria. However just stopping the spread is not enough to explain why the bacteria should be destroyed. Candidates should be encouraged to include ideas about bacteria being harmful or pathogens.

Question 16 (c)

(c) Suggest how the student could develop their investigation to show the effect of antibiotic **A** on the growth of different bacteria.

.....

.....

.....

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

The majority of candidates repeated the original investigation with different bacteria and compared the growth. Only the more successful responses provided a complete response that included using different agar plants containing bacteria and either measuring the clear zone or controlling a variable.

Misconception

? A few candidates completely missed the context of the question and suggested testing the antibiotics at different temperature or leaving more time for the bacteria to grow.

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ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

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