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GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250
For first teaching in 2016

J250/02 Summer 2019 series

Version 1

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. 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 can be downloaded from OCR.

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Paper 2 series overview

This is the second year that the current Gateway GCSE Combined Science suite has been available. J250/02 is the second Biology foundation tier paper in this suite and it assesses content from specification topics B4-B6 and CS7. To perform well on this paper, candidates need to have a sound knowledge of the theory covered in topics B4-B7 and be able to apply this to novel situations. They also need to apply the skills and understanding that they have developed in the practical activities covered in topic CS7. In addition, this paper also contains questions that have elements of synopticity, drawing on material covered by topics B1-3. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

Candidates who did well on this paper generally were able to do the following:

- Appreciate some of the principles of experimental design, including the idea of independent variables and control variables: Q11(a)(i) and (a)(ii)

- Draw conclusions from their calculations: Q11(c)

- Interpret graphical data: Q15(c)(i)

- Show a good understanding of the mode of transmission of HIV: Q12(d)

- Differentiate between type 1 and type 2 diabetes: Q14(a)

Candidates who did less well on this paper generally did the following:

- Found it difficult to recall factual detail such as the definition of genomes and the role of white blood cells: Q12(c)(i) and Q12(e)

- Confused environmental or abiotic factors with biotic factors: Q11(e)(i) and Q15(a)

- Made errors in calculating the mean: Q11(b)(i)

- Found it difficult to interpret the information provided in the carbon cycle: Q15(b)(i) and (b)(ii)

Section A overview

Many candidates scored quite highly on this section, Questions 3, 4 and 10 being the most accessible questions. If candidates make a mistake, then they should be encouraged to cross through the incorrect letter and write the new letter. All too often credit could not be given due to 'hybrid' letters that were hard to distinguish.

Question 1

1   Which cell is adapted to defend the body from infection?

    A   **B**   **C**   **D**
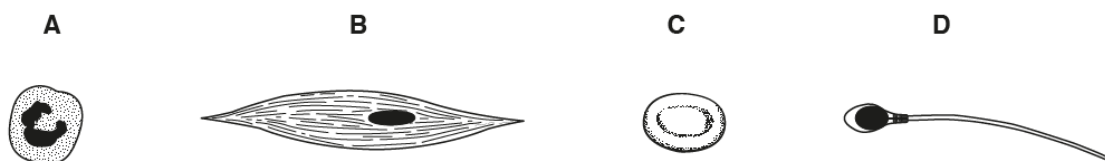
Your answer [ ]   [1]

The incorrect option C was chosen as often as the correct answer A, indicating significant confusion between white and red blood cells. As a result, the majority of candidates did not score for this question.

Question 2

2   What do antibodies bind to when they defend the body?

    A   Antigens

    B   Platelets

    C   Red blood cells

    D   White blood cells

Your answer [ ]   [1]

Again, this question was quite challenging, with option D the most common incorrect answer.

Question 3

3   A surface graze on the skin might get infected.

Which of these is usually used to prevent infection of grazed skin?

A   Antibiotic

B   Antiseptic

C   Antiviral

D   Vaccination

Your answer ☐   **[1]**

Most candidates correctly identified B as the correct answer.

Question 8

8   Which word describes the number of chromosomes in a human sperm cell?

A   Diploid

B   Dominant

C   Haploid

D   Recessive

Your answer ☐   **[1]**

This was another challenging question with incorrect answers scattered around the three distractors.

Question 9

9   In 2008 there were 16 600 people with liver disease. Of these, 600 survived liver disease due to a liver transplant.

Calculate the percentage of people with liver disease who survived because of a liver transplant in 2008.

A   3.6%

B   3.7%

C   26.7%

D   27.7%

Your answer ☐   **[1]**

Option D was the most common incorrect answer, presumably chosen by candidates who divided 16 600 by 600 and then did not multiply by 100.

Section B overview

The higher ability candidates answered well on the questions concerning experimental design and could draw conclusions from their calculations or from data provided in graphical form. Question 12 based on HIV proved to be challenging to many candidates, either due to lack of recall or due to not using information that was provided in the question. Many candidates also found Q13(b) and Q15(d) very challenging and were unable to apply any knowledge of natural selection or selective breeding to the contexts in the questions.

Question 11 (a) (i)

11 Two students want to see if the length of a pea pod affects the number of pea seeds inside the pod.

Pod   Pea seed
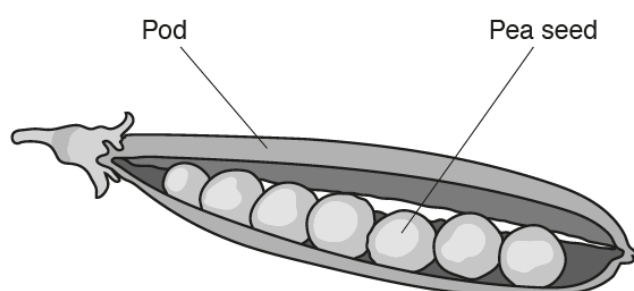
They measure the length of pea pods in millimetres using a ruler. They open the pods and count the pea seeds inside.

(a) (i)   What is the **independent** variable in their investigation?

Tick (✓) **one** box.

Age of pea pod.   ☐

Length of pea pod.   ☐

Number of seeds.   ☐

Size of seeds.   ☐

[1]

Many of the candidates found identifying the independent variable challenging, with incorrect answers spread among the distractors.

Question 11 (a) (ii)

> **(ii)** Write down **two** variables they need to **control** to make the data valid.
>
> **1** ....
>
> **2** ....
>
> [2]

There were many correct answers here referring to the age of the seeds or the conditions that the peas were grown in. However, there were also a significant number that simply stated the variables that were being measured, i.e. length of pod and number of seeds.

Question 11 (b) (i)

> **(b)** The students choose five pea pods with a length of between 45 – 55 mm and count the number of seeds inside each pod.
>
> Look at their results.

	Pod 1	Pod 2	Pod 3	Pod 4	Pod 5	Mean
Length of pod (mm)	52	51	48	52	47	50
Number of seeds	5	6	6	4	4	....

> **(i)** Calculate the mean number of seeds.
>
> Write your answer in the table.
>
> [1]

Most candidates could correctly calculate the mean.

Question 11 (b) (ii)

> **(ii)** Use your answer to part **(b)(i)** to calculate the length of pod per seed.
>
> Length of pod per seed = ... mm [2]

Again, most candidates could divide the length of pod by their mean for the number of seeds to obtain the correct answer. In a few cases, candidates had made an error in calculating the mean but if they followed the correct method using their mean they were given credit. An example of this is seen in Exemplar 1.

Exemplar 1

$$\frac{50}{25} =$$

Length of pod per seed = ... 2 .... mm [2]

Question 11 (c)

(c) The students repeat the experiment for pea pods between 65 – 75 mm.

The mean number of seeds was 6.7 and length of pod per seed was 11.2 mm.

Write down **two** conclusions from this experiment.

1 ....

....

2 ....

....

[2]

This was quite a good discriminator with many candidates correctly referring to the relationship between the number of seeds and the length of pod. Only the higher ability candidates also commented on the spacing of the seed. Other candidates gave conclusions involving variables that were not mentioned, such as the size of the seeds. An example of this is seen in Exemplar 2 which scores the first marking point only.

Exemplar 2

1 Bigger the pod in Length the more seeds you get.
2 The seeds get bigger the bigger the pod.

[2]

Question 11 (d)

(d) How could the students make sure the samples they collect are representative?

....

.... [1]

Very few candidates seemed to understand the significance of the term representative and so a mark was rarely scored on this question.

Question 11 (e) (i)

(e) The phenotype of peas is controlled by many factors.

(i) Write down **two** environmental factors that could affect pea pod length.

1 ....

2 ....

[2]

Some candidates gave answers that involved biotic factors rather than environmental, and other answers were deemed too vague, such as the weather or the sun.

Question 11 (e) (ii)

(ii) Early genetic studies identified the colour of pea pods as green or yellow.
Results suggested that the colour is an example of single gene inheritance.

Why is it **not** easy to work out the genotype of skin colour in humans?

....

.... [1]

Very few candidates stated that skin colour was controlled by multiple genes rather than one gene. There were a small number of candidates who gained credit for referring to the effect of sunlight on skin colour.

Question 12 (b) (i)

(b) In the laboratory, scientists have used gene technology to completely remove HIV genes from infected cells.

(i) Explain how removing HIV genes could affect the spread of HIV.

....

.... [1]

The stem of the question stated that HIV inserts genes into human cells and the cells then copy the HIV genes. However, very few candidates used this information to point out that removing the gene would prevent the gene being copied. Many answers simply reworded the question and so did not score.

Question 12 (b) (ii)

(ii) Suggest why some people are concerned about the use of gene technology in HIV treatment.

....

....

.... **[2]**

There were correct references to ethical objections and concerns about gene damage or mutations. However, many answers were too vague to score, such as that seen in Exemplar 3.

Exemplar 3

May not Work or may damage Something else in the body. **[2]**

Question 12 (c) (i)

(c) The Human Genome Project mapped the human **genome**.

(i) Write down what is meant by the term genome.

.... **[1]**

There were very few correct definitions of the term genome for this question.

Question 12 (c) (ii)

(ii) Knowledge of the human genome could identify the genes affected by HIV.

Write down **two** ways knowledge of the human genome could help with the treatment of HIV.

1 ....

....

2 ....

.... **[2]**

The idea of producing drugs targeted to specific genomes was only mentioned by the higher ability candidates. There were a small number of candidates who gained credit by referring to the possibility of identifying if a person had the gene.

Question 12 (d)

*(d) Some countries have set up centres where a person is counselled and tested for HIV.

The aim is to reduce new infections by 50%.

Describe how HIV is transmitted and how these centres can contribute to reducing the spread of HIV.

....

....

....

....

....

.... [6]

Most candidates gave answers that contained accurate details of how HIV is spread. The second part of the question which concentrated on the centres was less well answered. Candidates often focused on the treatment of the symptoms rather than the prevention of spread. Exemplar 4 shows a Level 1 answer where there is relevant comment about how HIV is spread but no reference to the roles of the centres.

Exemplar 4

Hiv or aids is spread by ɀ one humans Fluids entering a diffrents humans body this could be through kissing or having sex with a person.

to reduse the spread of HIV's could ɀ People should use protection when having sex with a person.

Question 12 (e)

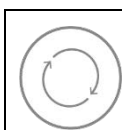**(e)** HIV invades white blood cells stopping them working.

Describe the role of white blood cells in the defence against disease.

....

....

.... **[2]**

Some of the candidates confused the role of white blood cells with other blood components. However, by far the most common error was the use of imprecise statements such as white blood cells act by 'fighting pathogens' or 'engulfing disease'.

	AfL	When describing phagocytosis, candidates should use the statement 'engulf and then digest bacteria/viruses/pathogens'. Disease is too vague, as are statements such as eat, fight, destroy etc.

Question 13 (a)

13 (a) The diagrams show two Blue Moon butterflies.

The two butterflies are the same species. However, there are differences between the colour and wing shape of the two butterflies.

What controls the colour and wing shape within the species?

....

.... **[1]**

There were many correct answers here referring to genes, DNA or chromosomes of the butterflies or their parents.

Question 13 (b)

(b) Evolution can take thousands of years, but occasionally change happens very quickly.

Read the information.

> Male embryos of the Blue Moon butterfly were attacked by a parasite.
>
> Only 1% of the male butterfly population survived.
>
> Within ten generations (1 year) males had returned to 40% of the butterfly population.
>
> The parasite had not disappeared.

Use ideas about natural selection to describe how the male Blue Moon butterfly population may have returned to 40% within a year.

....

....

....

....

....

....

.... **[4]**

> A number of candidates gained credit by stating that the 1% of the male butterflies survived and were able to breed. Unfortunately, very few candidates combined this with statements about these butterflies possessing genes that gave them resistance to the parasite.

Question 13 (c)

(c) Classification of living organisms has changed over time.

Describe how scientific methods and theories develop over time.

....

....

....

.... **[2]**

> The mark scheme required some reference to increased knowledge and improved technology or techniques. These could be specific examples or just generic statements. Many candidates scored one mark for this question.

Question 14 (a)

14 (a) The graph in **Fig. 14.1** shows the level of glucose and insulin from a person with **Type 2** diabetes over a four hour time period.

Item removed due to third party copyright restrictions

Fig. 14.1

Write down **two** ways the graph in **Fig. 14.1** shows that the person has Type 2 diabetes, not Type 1.

1 ....

....

2 ....

.... **[2]**

Some candidates confused type 1 diabetes with type 2. If candidates did score, they tended to realise that insulin levels were increasing in response to the glucose but did not state that glucose levels were not being controlled or falling slowly.

Question 14 (b) (i)

(b) The graph in **Fig. 14.2** shows the increase in Type 2 diabetes over a 10-year period.

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Fig. 14.2

(i) What factor does the graph in **Fig. 14.2** indicate is linked to an **increase** in Type 2 diabetes?

.... **[1]**

A significant number of candidates simply answered 'body weight' rather than an increase in body weight.

Question 14 (b) (ii)

(ii) Suggest **one** lifestyle change that could reduce this factor and avoid a person developing Type 2 diabetes.

.... **[1]**

This question was well answered with references to eating less fat/sugar, more exercise or dieting. Some answers were too vague to score marks, such as 'healthy eating'.

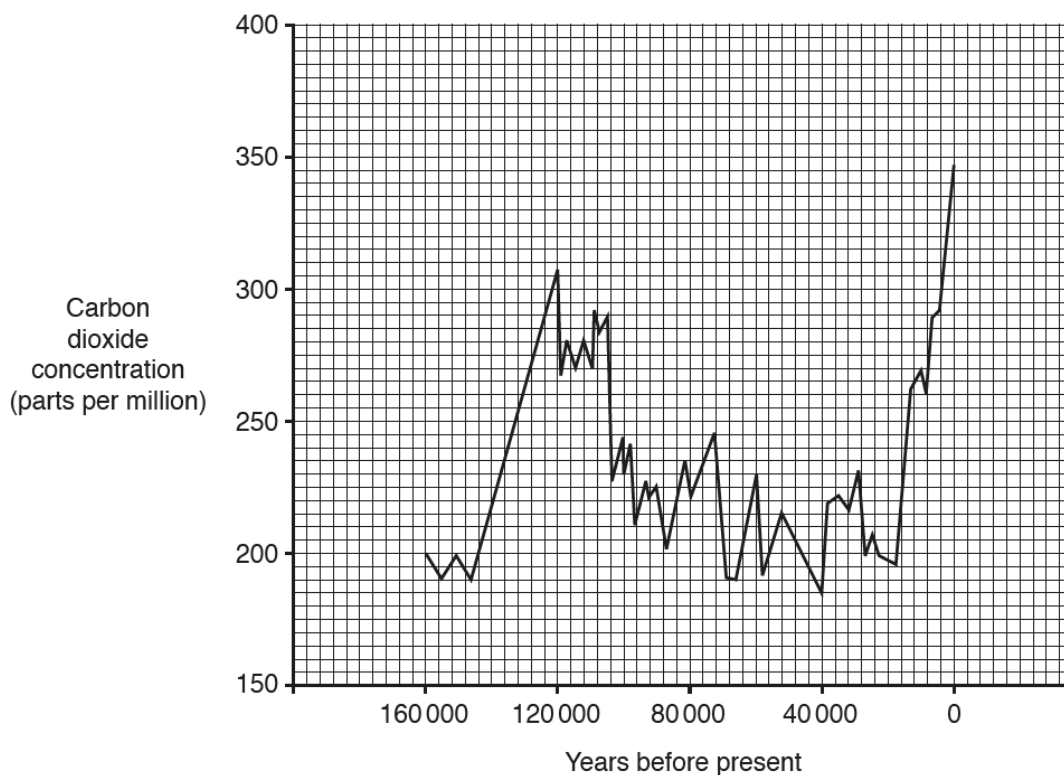## Question 15 (a)

15 **(a)** Water is cycled in nature.

Name **one** abiotic factor that affects water uptake by a plant.

.... [1]

Again, there was some confusion between biotic and abiotic factors in the answers seen here.

Question 15 (c) (i)

(c) The graph shows how carbon dioxide levels in the atmosphere have changed during the last 160 000 years.

(i) Read this statement:

Carbon dioxide levels in the atmosphere are rising out of control.

What evidence is there in the graph for and against this statement?

for ....

....

against ....

....
[2]

The lower ability candidates often simply stated a figure from the graph without referring to any trends or patterns. There were many good references to the levels being higher now than any other time and also that levels have fluctuated in the past.

Question 15 (c) (ii)

(ii) Look at the section of the graph for the last 20 000 years.

What conclusions can be made about the release of carbon dioxide into the atmosphere and also its removal from the atmosphere during the last 20 000 years?

....

....

....

.... **[2]**

Candidates often referred to the carbon dioxide levels going up or going down rather than discussing the removal or release of carbon dioxide. Sometimes the use of the word 'it' in the answer made it unclear what the answer was referring to. An example is shown in Exemplar 7.

Exemplar 5

There is a very large increase. This the highest its ever been in the end.

Question 15 (c) (iii)

(iii) Describe how human activity has contributed to the trends in the graph and suggest how this activity could affect biodiversity.

....

....

....

....

....

....

.... **[3]**

Many candidates were not credited marks here due to imprecise answers. They referred to cars being driven using fossil fuels but did not say that the use of fossil fuels was increasing. They also commented that biodiversity is affected without saying that it is decreasing. There were many correct comments about deforestation and habitat destruction.

Question 15 (d)

(d) The information in the box is part of a scientific journal report.

> **Growing crops with shiny leaves could cause an annual global cooling of over 0.1°C.**
>
> **This is almost 20% of the total global temperature increase since the Industrial Revolution.**

Most crop plants have non-shiny leaves.

A few varieties of crop plants do have shiny leaves but they do **not** all produce high yields.

Explain how scientists could use selective breeding to help reduce global temperatures.

....

....

....

....

.... **[2]**

There seemed to be a confusion between selective breeding and genetic engineering, with many answers saying that scientists transfer DNA between plants. Few candidates suggested breeding a shiny leaved plant with a high yielding plant.

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