OCR
Oxford Cambridge and RSA

Friday 7 June 2024 – Afternoon

GCSE (9–1) Combined Science A (Gateway Science)

J250/08 Biology (Higher Tier)

Time allowed: 1 hour 10 minutes

H

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 Gardeners are changing the way they care for their garden.

Which change would **increase** biodiversity?

A Adding chemical fertilisers to a grass lawn

B Cutting a grass lawn more often than usual

C Removing a grass lawn area and putting down paving stones

D Replacing a grass lawn area with a wild flower meadow

Your answer ☐ **[1]**

2 Which row is a correct comparison of meiosis and mitosis?

	Involves cell division	**Halves the number of chromosomes**	**Requires DNA replication**
A	both	meiosis only	both
B	both	both	both
C	meiosis only	both	mitosis only
D	mitosis only	meiosis only	mitosis only

Your answer ☐ **[1]**

3 Which statement describes a **difference** between red blood cells and white blood cells?

A Red blood cells contain enzymes.

B Red blood cells make antibodies.

C White blood cells contain proteins.

D White blood cells respond to antigens.

Your answer ☐ **[1]**

4 Which disease may develop due to an interaction with HPV?

A AIDS

B Cervical cancer

C Tuberculosis

D Type 2 diabetes

Your answer ☐ **[1]**

5 Why does a plant scientist use antibodies specific to a type of antigen?

A To develop new plants using selective breeding

B To find new species of plants growing around the world

C To identify communicable diseases in plants

D To study the evolution of plants

Your answer ☐ **[1]**

6 Which row shows the correct order of some processes in the water cycle?

A Condensation → evaporation → precipitation → condensation

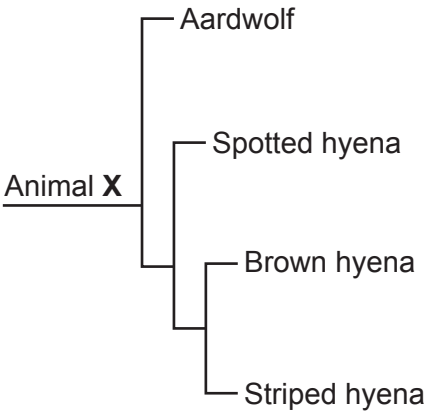
B Condensation → precipitation → evaporation → condensation

C Precipitation → condensation → evaporation → precipitation

D Precipitation → evaporation → condensation → evaporation

Your answer ☐ **[1]**

7 The diagram shows a phylogenetic tree for a group of related animals.



Which statement is correct?

A Aardwolf is not related to the striped hyena.

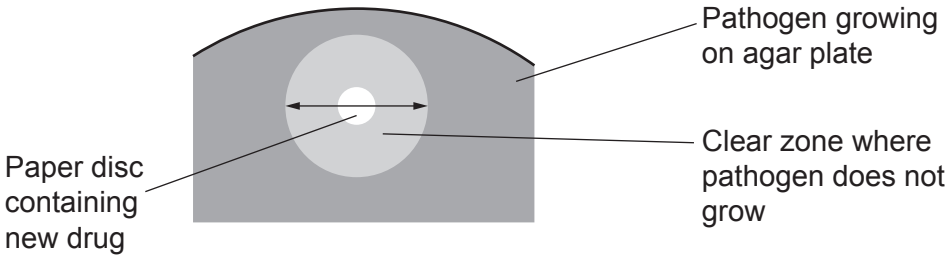
B Animal **X** is a common ancestor to all the hyenas.

C Brown hyena and striped hyena are the same species.

D The closest relation to the striped hyena is the spotted hyena.

Your answer ☐ **[1]**

8 Scientists test the effect of new drugs on the growth of a pathogen.



The area of the clear zone is used to indicate the effectiveness of the drug.

The diameter is 2.4 **cm**.

What is the area of the clear zone (including the area of the paper disc)?

Use the formula $A = \pi r^2$
$\pi = 3.14$

A 37.68 mm^2

B 75.36 mm^2

C 452.16 mm^2

D 1808.64 mm^2

Your answer ☐ **[1]**

9 Which row shows how a high cholesterol diet is linked to cardiovascular disease?

	Coronary vessel blocked by cholesterol	**Gas unable to be transported to cardiac muscle, damaging the heart**
A	artery	carbon dioxide
B	artery	oxygen
C	vein	carbon dioxide
D	vein	oxygen

Your answer ☐ **[1]**

10 To function correctly, the brain needs to make a chemical called dopamine.
Parkinson's disease is where the brain does not make enough dopamine.
Embryonic stem cells might be used to treat Parkinson's disease.

What is an ethical consideration in this kind of treatment?

A The embryonic stem cells are obtained from a human fetus.

B The embryonic stem cells may not produce the correct type of dopamine.

C The embryonic stem cells may be rejected by the patient's immune system.

D The embryonic stem cells will not have the same genome as the patient.

Your answer ☐ **[1]**

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Section B

11 Scientists are concerned that increased pollution in a forest is affecting the population of insects living in the forest.

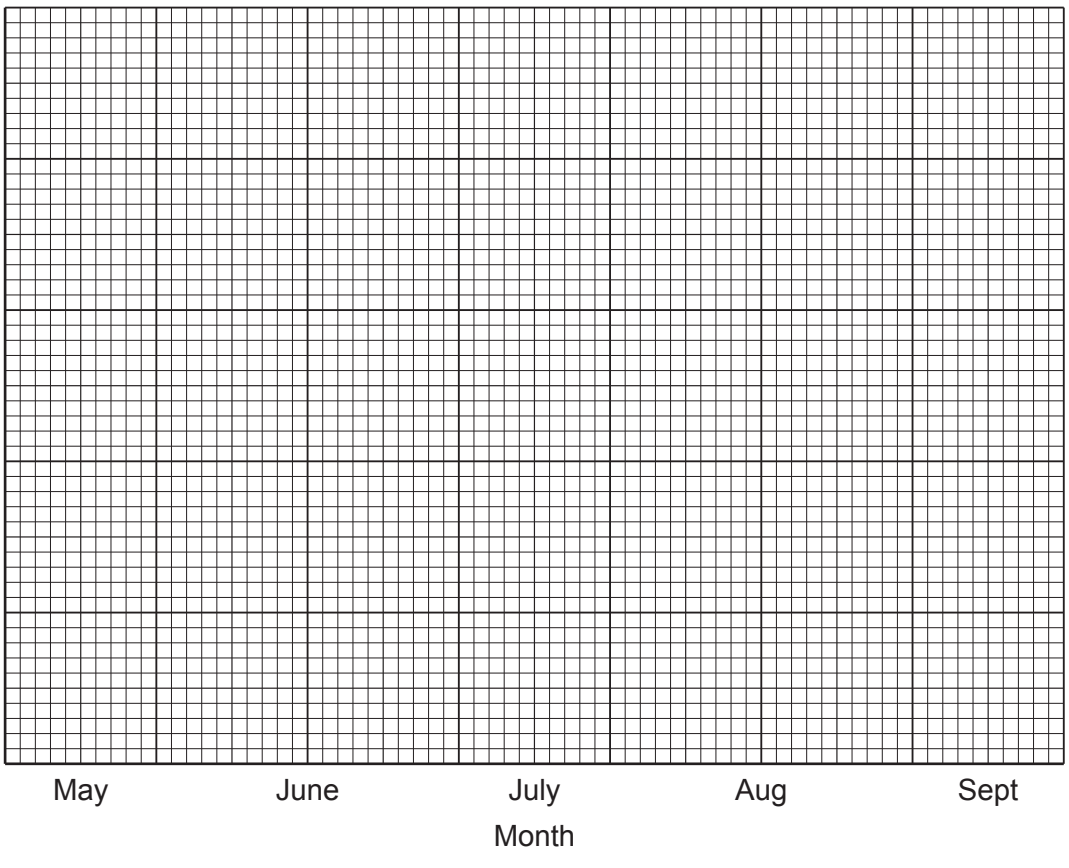
(a) In an investigation, scientists estimated the population of **flying** insects in a forest.

- They trap the insects using nets.
- The mass of insects collected each month is then recorded. The data is collected in two different years, 1995 and 2015.

The table shows their results.

Month	Mass of insects trapped (g)	
	1995	**2015**
May	450	50
June	520	120
July	920	160
August	420	110
September	100	20

(i) Complete the bar chart to show the mass of insects collected each year.
Both years should be included on the same grid.
Include a Key to identify which year the bars represent.



[4]

(ii) What **two** conclusions can be made about the mass of flying insects in 1995 compared to 2015?

1 .....

.....

2 .....

.....

[2]

(iii) How can the scientists' method be developed to investigate biodiversity in the forest?

Tick (✓) **one** box.

Place traps in different parts of the forest.	
Record the number of different species found in the nets.	
Repeat their method again in 2025 to see if mass changes.	
Use their data to calculate mean mass for each year.	

[1]

(b) In a separate investigation, scientists estimated the population of insects that live on the forest **ground**.

The scientists trap insects using a pitfall trap.
This is a hole in the ground that the insects fall into when they crawl along the ground.

For each estimate they use this method:

- Place pitfall traps in different areas of the forest.
- Count the total number of insects caught in the pitfall traps.
- Mark the insects.
- Release the insects where they are collected from.

A week later they trap a second sample of insects.

(i) The scientists used an ink that is not easily washed off to mark the insects for identification.

State **one** other precaution that they should take when deciding how to mark the insects.

.....

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

(ii) They complete their investigation during July 1995 and July 2015. This table shows the results of this investigation.

Year	Number of insects in first sample	Total number of insects in second sample	Number of marked insects in second sample
1995	114	60	8
2015	146	63	6

The scientists use this formula to estimate the population of insects living on the forest ground:

$$\text{Estimated population size} = \frac{\text{number in first sample} \times \text{total number in second sample}}{\text{number of marked insects in second sample}}$$

The population of insects in 1995 is estimated to be 855.

Use the formula to estimate the population size of insects in **2015**.
Give your answer to **3 significant figures**.

Estimated population of insects = ... **[2]**

(c) The aim of each investigation is to see if increased pollution has affected the insect population.

The population of insects living on the forest ground increased between 1995 and 2015.

Which statements about the two investigations are **true**, and which are **false**?

Tick (✓) **one** box in each row.

	True	False
Both investigations came to the same conclusion about changes in insect population.		
All insects living in the forest have been negatively affected by the increased pollution.		
Only one investigation shows how the insect population changes with each month.		
The two methods used to trap the insects will result in different types of insects being trapped.		

[2]

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12 Genetic material is required for inheritance in eukaryotic and prokaryotic cells.

(a) Compare the genetic material found in eukaryotic and prokaryotic cells.

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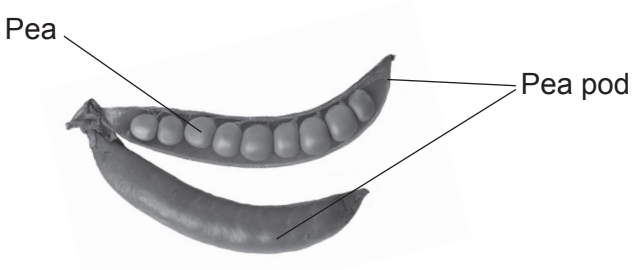
..... **[2]**

(b) Peas develop inside pods.



(i) Pea pods are either green or yellow. The allele for green is dominant over the allele for yellow.

The table shows some information about three different pea pods.

Complete the table.

Phenotype	Genotype	Description of genotype
yellow	gg	homozygous .....
green	GG	homozygous dominant
.....	Gg	.....

[2]

(ii) A gardener crosses a plant that has green pods with a plant that has yellow pods.
The gardener thinks both these plants have a homozygous genotype.

The result is 15 new plants with green pods and 3 plants with yellow pods.

Show that the gardener's green plant did **not** have a homozygous genotype by completing the two genetic diagrams.

Use letters G and g for the alleles.

If the green plant has a homozygous genotype:

		yellow pods	
green pods			

Offspring ratio .....

If the green plant does **not** have a homozygous genotype:

		yellow pods	
green pods			

Offspring ratio .....

[3]

(iii) The ratio the gardener achieved was 5 green to 1 yellow.

Suggest why this does **not** match either of the offspring ratios.

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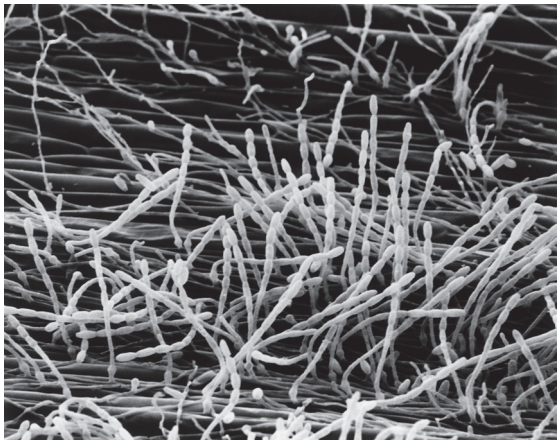
..... **[1]**

13 The picture shows the plant pathogen that causes powdery mildew.



(a) Describe how powdery mildew is spread from one plant to another.

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

(b) Powdery mildew reduces the efficiency of chloroplasts.

Explain how this might reduce the rate of respiration in a plant.

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

(c) Plants resistant to powdery mildew are developed by genetic engineering.

(i) Complete the sentences about genetic engineering.

The gene for resistance is cut out of DNA using a ..... enzyme.

The gene is then joined to bacterial DNA using a ..... enzyme.

To find out if the bacteria contain the gene, scientists use .....

.....

.....

[3]

(ii) Explain why the process of cutting the DNA is prevented by high temperatures.

Use your knowledge of enzymes.

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

(d) Powdery mildew can be controlled using chemicals.

Producing plants resistant to powdery mildew is better for biodiversity compared to using chemicals.

Suggest **two** reasons why.

1 .....

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2 .....

.....

[2]

14 The moisture content in soil affects the growth of plants.

(a) Two students investigate the moisture content of different soils.

This is the method used by student **X**:

- Measure the mass of each soil sample.
- Place the soil samples in a warm oven to dry for 4 hours.
- Measure the mass of each soil sample again.

The table shows their results.

Soil sample	Mass of soil sample at start (g)	Mass of soil sample after drying (g)	Percentage change in mass of soil sample (%)
A	120.1	97.3	19.0
B	154.2	125.5	18.6
C	126.3	121.3	.....

(i) Calculate the percentage change in mass of soil sample **C**.

Give your answer to **3** significant figures.
Write your answer in the table.

[3]

(ii) Soil sample **A** lost less mass than soil sample **B**.

Why is the percentage change in mass **greater** for soil sample **A**?

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

(iii) The two students compare their results.

- Student **Y** used a similar method but left the soil in the oven for a different length of time.
- Student **Y** found the moisture content of soil sample **C** to be much higher than student **X**.

Explain why student **Y** found the moisture content of soil sample **C** to be higher than student **X**.

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

(iv) What could both students do to check that the moisture content they measured is accurate?

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

(b) Moisture content is one factor that affects plants.

The amount of microorganisms in the soil can also affect plant growth.

Explain why soil microorganisms are important for plant growth.

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

(c) Why are microorganisms described as a biotic factor and soil moisture as an abiotic factor?

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

15

Dodo

The dodo lived in the forests on the island of Mauritius.

They evolved from a much smaller pigeon that flew to the island.

Pigeons escape predators by flying away; they nest in trees so predators find it harder to eat their eggs.

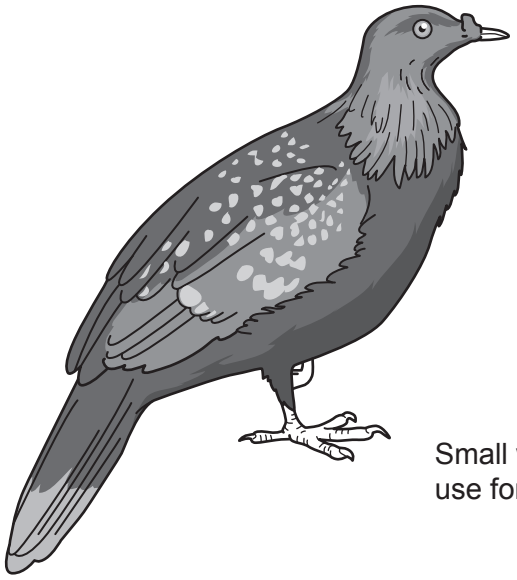
There were originally no predators or humans on Mauritius.

Dodos nested on the ground and did not fly.

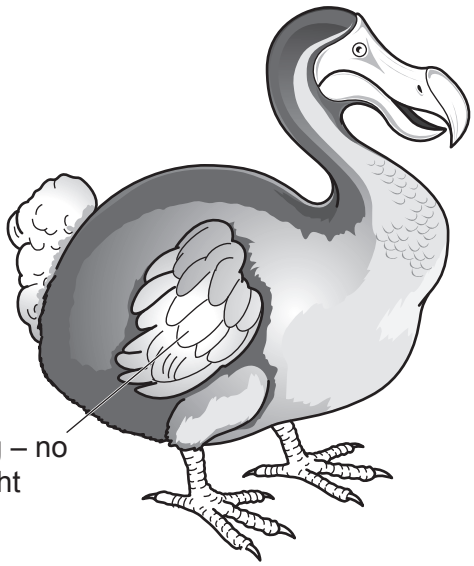
Humans arrived on the island in 1598. They brought with them animals that spread across the island destroying forests and eating eggs.

The dodo became extinct by 1700.

Pigeon similar to ancestor of dodo



Dodo



(a)* Explain how the dodo evolved to become a flightless bird **and** how the arrival of humans resulted in its extinction.

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

(b) Suggest **one** way scientists could find evidence that the pigeon and the dodo have a common ancestor.

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

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.