Oxford Cambridge and RSA

Monday 9 June 2025 – Morning

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 **24** pages.

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

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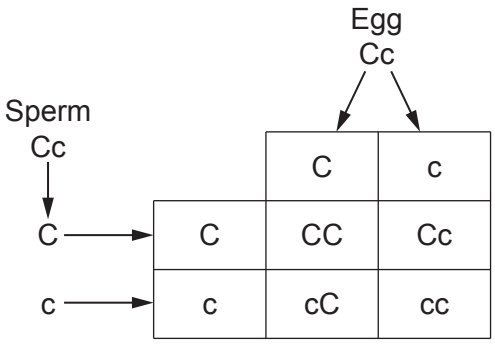
Section A

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

Write your answer to each question in the box provided.

1 The diagram shows a genetic cross for inheriting cystic fibrosis.

Cystic fibrosis is a recessive inherited condition.



What percentage of the offspring will have cystic fibrosis?

A 0%

B 25%

C 75%

D 100%

Your answer ☐ **[1]**

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2 Which pathway shows how nitrates are used by plants to make proteins?

A Nitrates ⟶ amino acids ⟶ proteins

B Nitrates ⟶ carbohydrates ⟶ proteins

C Nitrates ⟶ DNA ⟶ proteins

D Nitrates ⟶ fatty acids ⟶ proteins

Your answer ☐ **[1]**

3 Which term describes the interaction between the biotic and abiotic factors in the environment?

A Community

B Ecosystem

C Habitat

D Species

Your answer ☐ **[1]**

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4 Water is recycled in the environment.

Which process **increases** the level of water in the atmosphere?

A Condensation

B Precipitation

C Translocation

D Transpiration

Your answer ☐ **[1]**

5 New drugs are tested in clinical trials.

A placebo looks like the drug being tested but has no medical effect.

Which row is the correct description for a **double-blind placebo trial**?

	All patients receive the drug	**Patient and doctors know who takes the drug**
A	no	yes
B	no	no
C	yes	yes
D	yes	no

Your answer ☐ **[1]**

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6 Cardiovascular disease can be treated in different ways.

The table shows some treatments for cardiovascular disease.

Treatment	Description
Heart bypass	A blood vessel is removed from another part of the body and used to replace the part of the coronary artery that is blocked.
Heart transplant	A new heart from a donor is inserted.
Statins	A pill is ingested which reduces cholesterol levels in the blood.
Stent	A small tube is inserted to open up a narrowed blood vessel.

Which treatment is most likely to prevent the coronary arteries from further narrowing?

A Heart bypass

B Heart transplant

C Statins

D Stent

Your answer ☐ **[1]**

7 Which statement about donor embryonic stem cells is **correct**?

A They are clones of the patient's own cells.

B They can divide without replication of DNA.

C They differentiate into only one cell type.

D They may be attacked by the patient's immune system.

Your answer ☐ **[1]**

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8 Which statement is **not** true about random sampling using a quadrat?

A A random-number generator can be used.

B Coordinates are used to select sample areas.

C It can be used to estimate how many of each species is present in a habitat.

D It can be used to study the distribution of organisms along a transect line.

Your answer ☐ **[1]**

9 The diameter of a bacterium is 0.540 μm. The diameter of a virus is 0.054 μm.

By how many orders of magnitude is the diameter of the bacterium larger compared to the virus?

A 0.486

B 1.00

C 4.86

D 10.0

Your answer ☐ **[1]**

10 Which statement describes a source of **systematic error** that could take place during an investigation?

A A person's reaction speed can affect timing measurements.

B Readings on a mass balance can vary with air currents.

C Room temperature varies throughout the investigation.

D Using a pH meter that is wrongly calibrated.

Your answer ☐ **[1]**

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Section B

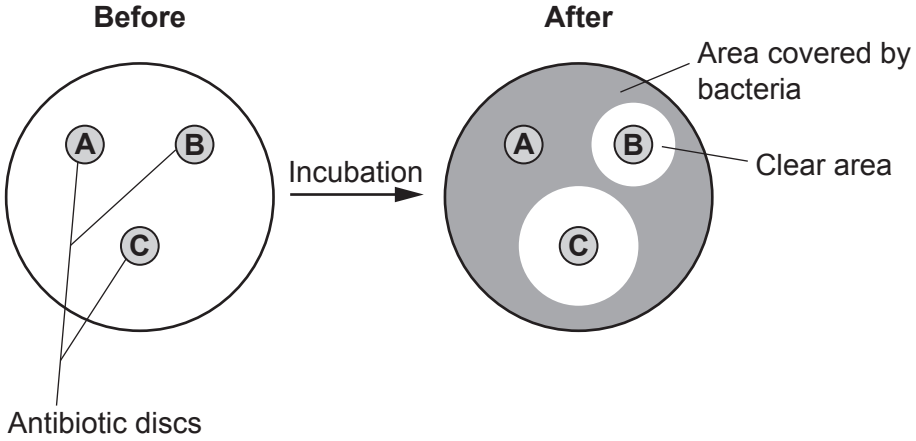
11

(a) A student wants to find how effective three antibiotics are for treating a range of bacterial infections.

This is their method:

- Spread bacteria across an agar plate.
- Soak discs with different antibiotics (**A**, **B** and **C**) and place them on the surface of the agar plate.
- Leave the plate to incubate for 5 days.

The student's results are shown in the diagram.



(i) Which antibiotics are the most and least effective at inhibiting bacteria growth?

Put a (ring) around the correct answers.

Most effective antibiotic	**A**	**B**	**C**
Least effective antibiotic	**A**	**B**	**C**

Explain your answers. Use the diagram.

.....

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

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(ii) Suggest **two** improvements to the method to increase **validity** of the investigation.

1 .....

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2 .....

.....
[2]

(b) Bacteria are one cause of communicable disease.

Outline the role of the immune system of the human body in defence against disease.

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

(c) Tuberculosis (TB) is caused by bacteria. The bacteria usually attack the lungs.

It is estimated that 8.7 million people develop TB worldwide each year.

1.1 million of these people are estimated to have HIV.

(i) Calculate the percentage of people who develop TB worldwide each year who are estimated to have HIV.

Percentage ..... % **[2]**

(ii) Infection with HIV makes you more likely to develop TB.

State **one** reason why having HIV makes you more likely to develop TB.

.....

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

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(d) Antibiotics are developed to kill bacteria.

Bacteria have appeared that antibiotics can not kill.

Explain how bacteria could have evolved to become antibiotic resistant.

Use ideas about **natural selection**.

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

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12 Many characteristics of organisms show variation.

(a) Variation in a characteristic can be:

- caused by genes **only**, the environment **only** or both
- classified as continuous or discontinuous variation.

Draw three lines to connect each **characteristic** with its type of **influence** and then to how it is **classified**.

Characteristic	**Influence**	**Classified**
weight	genetic	continuous
eye colour	environment	discontinuous
language spoken	both genetic and environment	

[2]

(b) **Fig. 12.1** shows a photograph of all the chromosomes in one human cell.

This is called a karyotype.

Fig. 12.1

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(i) Complete the sentences about human genetics.

Use words from the list.

alleles	**amino acids**	**gametes**	**genome**
mutations	**nucleus**	**proteins**	**recessive**

The entire genetic material of an organism is called the ..... .

Different versions of a gene are called ..... .

All variants arise from ..... in DNA.

[2]

(ii) Genetics determine a person's sex.

Determine the sex of the person whose chromosomes are shown in **Fig. 12.1**.

Give a reason for your answer.

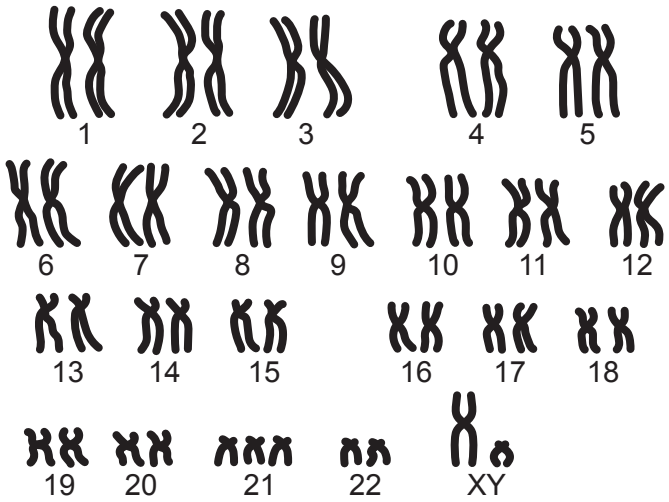
Sex of the person .....

Explanation

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

(iii) **Fig. 12.2** shows the karyotype of a human who has a genetic condition called Down's Syndrome.

Fig. 12.2



Identify what causes Down's Syndrome.

Use **Fig. 12.2** in your answer.

.....

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

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13 Anastrozole is a drug that has been used in the treatment of breast cancer for many years.

It is now approved for use in healthy people to try and prevent breast cancer developing.

(a) The female hormone oestrogen stimulates the growth of breast tissue.

Anastrozole reduces levels of the hormone oestrogen.

Explain why anastrozole prevents breast cancer developing.

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

(b) The BRCA1 gene and the BRCA2 gene are associated with an increased risk of developing breast cancer.

Scientists discovered the link between these genes and disease in the 1990s.

Suggest **one** reason why scientists were unable to link genes with diseases before this time period.

.....

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

(c) Cancer, cardiovascular disease and type 2 diabetes are all diseases.

What group of diseases do they belong to?

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

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14 Dogs have been bred by humans for thousands of years. Humans breed the dogs to be pets and to help in the workplace.

One way this is done is by selective breeding.

- The American hairless terrier has no hair and a friendly nature.
- German shepherd dogs have thick fur, are intelligent, powerful and have a strong sense of smell.

American hairless terrier

German shepherd dog

(a)* Discuss the selective breeding of these two types of dogs.

Include in your answer:

- how selective breeding is done
- the benefits to humans of producing these two types of dogs.

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

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(b) The mass of German shepherd dogs has been increased over time by selective breeding.

The table shows the mean mass of male German shepherd dogs in 1915 and 2024.

Year	Mean mass of male German shepherd dog (kg)
1915	24.95
2024	35.83

Calculate the percentage increase in mean mass of the male German shepherd from 1915 to 2024.

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

Percentage increase ..... % **[3]**

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15 Sourdough bread is made using a culture that contains yeast and bacteria.

- The yeast uses glucose supplied by the bacteria to carry out fermentation and make ethanol and carbon dioxide.
- The carbon dioxide bubbles make the dough rise.
- The bacteria depend on the yeast for amino acids.

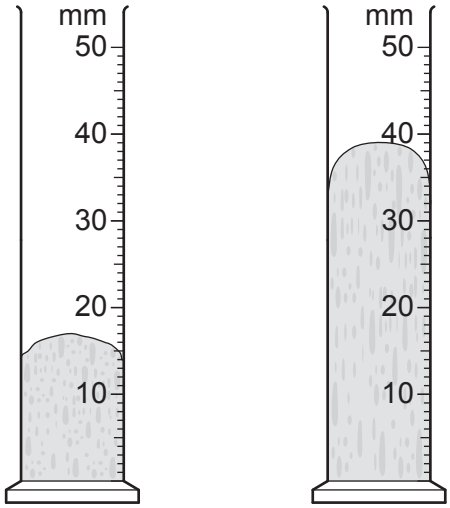
(a) Bacteria and yeast are in an interdependent relationship.

What is the name of this type of relationship?

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

(b) Some students investigate the effect of temperature on the rate of fermentation of dough.

They measure the increase in height of the dough after **1** hour.



Before **After**

(i) State the independent variable, dependent variable and a control variable in this investigation.

Type of variable	Correct variable
Independent	.....
Dependent	.....
Control	.....

[2]

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The table shows the students' results.

	Increase in height of dough left for 1 hour (mm)			
Temperature (°C)	**Trial 1**	**Trial 2**	**Trial 3**	**Mean**
10	3	5	2	3
20	12	12	15	13
30	25	27	26	26
40	35	40	38	38
50	30	28	29	29

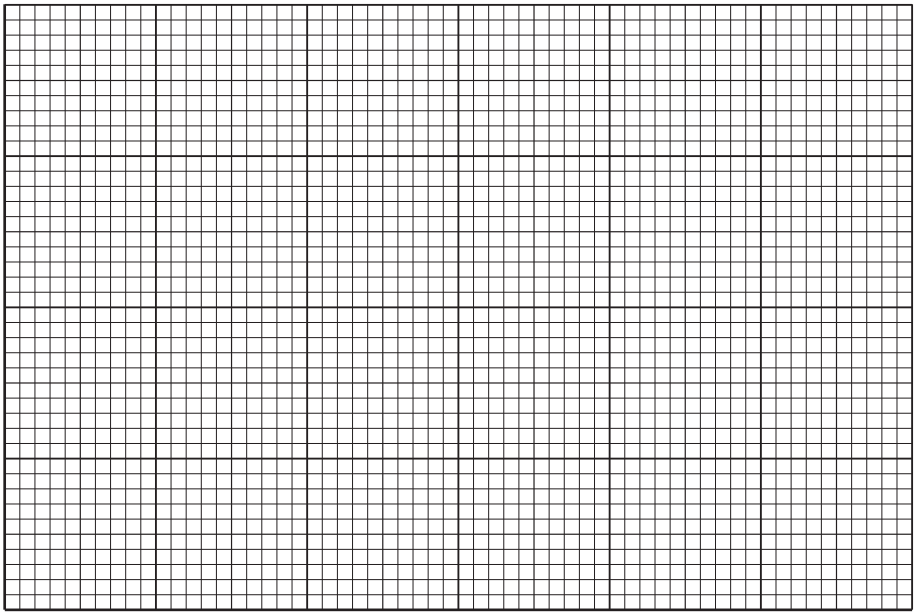
(ii) Plot the mean results from the table onto the grid.

Choose a suitable scale for both axes. **[3]**

(iii) Draw a curve of best fit through the points.

[1]

Mean increase in height (mm)



Temperature (°C)

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(c) A student looks at the table of results and concludes:

'The optimum temperature for all sourdough fermentation is 40 °C.'

(i) Explain how the results support this conclusion.

Include data.

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

(ii) Explain why the results **do not** support this conclusion.

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

(d) The bacteria in sourdough produces lactic acid which gives the dough its sour taste.

The production of this lactic acid slows down the growth of food-borne pathogens in the sourdough bread.

Explain why.

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

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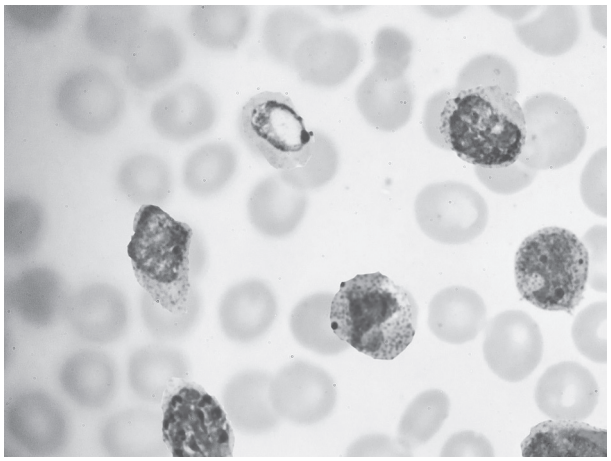
16 Malaria infections can be visually identified using a blood smear.

The image shows red blood cells infected by the malarial protist.



(a) Suggest **one other** way specific pathogens are identified.

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

(b) In humans, the malarial protist reproduces inside red blood cells. This causes the haemoglobin to be digested.

Explain why this will make an infected person feel unwell.

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

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(c) The malaria protist can reproduce asexually by mitosis.

At a different point in its lifecycle, the malaria protist reproduces sexually by meiosis.

State **three** differences between mitosis and meiosis.

	Mitosis	**Meiosis**
1	....	....
2	....	....
3	....	....

[3]

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

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

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