OCR
Oxford Cambridge and RSA

H

Wednesday 15 June 2022 – Morning

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

J250/08 Paper 8 (Higher Tier)

Time allowed: 1 hour 10 minutes

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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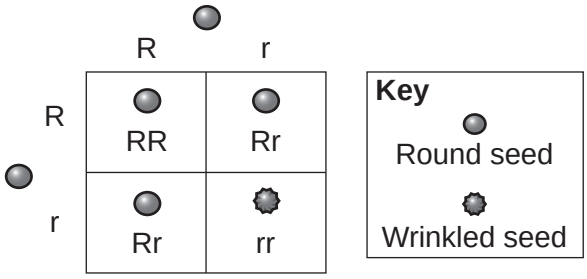
SECTION A

Answer **all** the questions.

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 seed shape in peas.



Which prediction about the offspring is **most** likely?

A All the offspring will be heterozygous for seed shape.

B All the offspring will be homozygous for seed shape.

C The ratio of heterozygous to homozygous offspring will be 1:1.

D The ratio of heterozygous to homozygous offspring will be 3:1.

Your answer ☐ **[1]**

2 The diameter of a human ovum is 100 000 nm. The diameter of the HIV pathogen is 100 nm.

How many orders of magnitude larger is the diameter of a human ovum compared to an HIV pathogen?

A 3

B 10

C 99

D 1000

Your answer ☐ **[1]**

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3 Which term describes **all** the different organisms living in an environment?

A Community

B Ecosystem

C Population

D Species

Your answer ☐ **[1]**

4 Which number per cell is halved during meiosis?

A Chromosome

B Gamete

C Haploid

D Nucleus

Your answer ☐ **[1]**

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5 HIV is spreading rapidly in many countries.

Which method is used to screen for the HIV virus in a person with **no** symptoms?

A Detection of the HIV antigen

B Detection of white blood cells

C DNA testing for tuberculosis

D Visual identification

Your answer ☐ **[1]**

6 Which substance in the blood plasma is changed by platelets during blood clotting?

A Fat

B Glucose

C Glycogen

D Protein

Your answer ☐ **[1]**

7 What medicine can be used to treat tuberculosis?

A Antibiotics

B Antiseptics

C Antitoxins

D Antivirals

Your answer ☐ **[1]**

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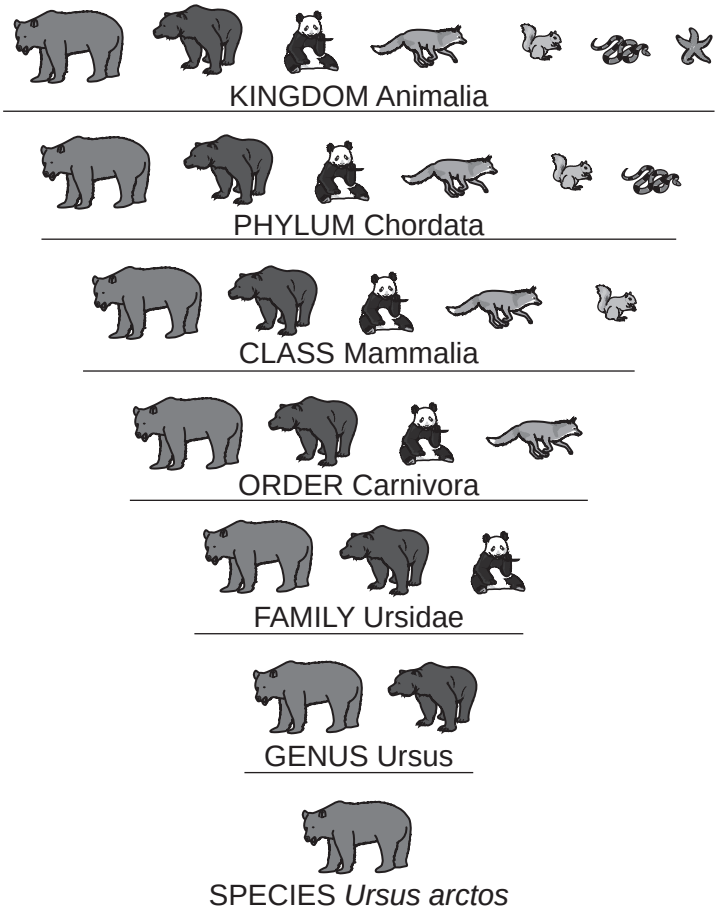
8 The diagram shows the classification of the brown bear and its relationship with other species.



Which classification group would show the **most** similarities in DNA sequencing?

A Class

B Family

C Genus

D Order

Your answer ☐ **[1]**

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9 Scientists that genetically engineer bacteria need to identify those bacteria that have taken up the modified plasmid.

What is used to identify bacteria that have taken up the modified plasmid?

A Antibiotic resistant genes

B Ligases

C Restriction enzymes

D Vectors

Your answer ☐ **[1]**

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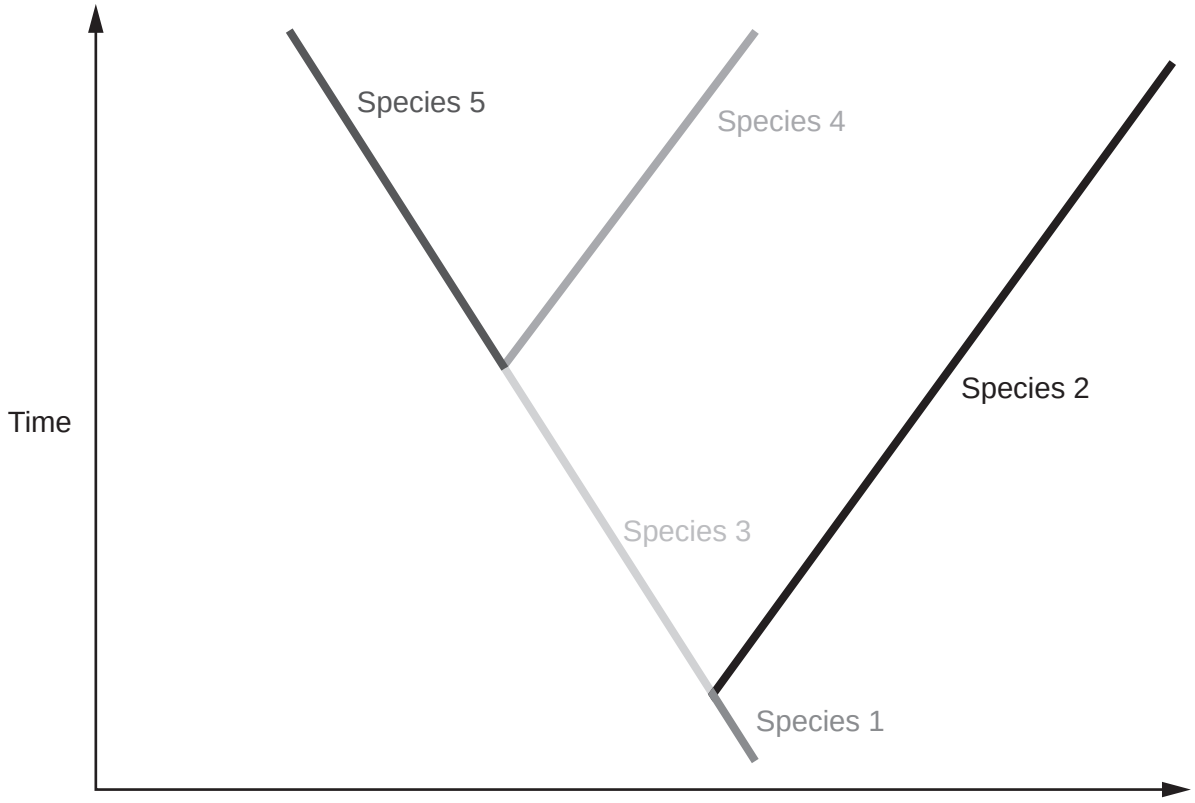
10 When one species splits to become two new separate species it is called a **speciation event**. Phylogenetic trees represent speciation events from the past.

The diagram shows a phylogenetic tree.



How many speciation events are in this phylogenetic tree?

A 1

B 2

C 3

D 4

Your answer ☐ **[1]**

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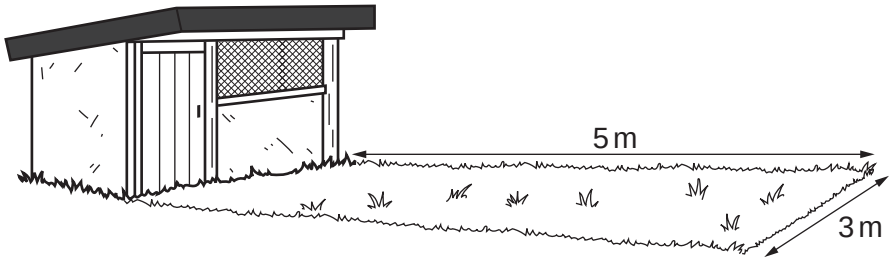
SECTION B

Answer **all** the questions.

11 Two students investigate the population of daisies in a lawn. The diagram shows the lawn in front of a shed.



(a) **(i)** Complete these sentences about the method the students use to find the population of daisies.

Use the words in the list.

pooter	**quadrat**	**random**	**square**

The lawn is sampled using a square frame called a ..... .

Drop the square frame over one shoulder to provide a ..... sample.

Count and record the number of daisy plants present in the square grid.

Repeat this process in 10 different areas of the lawn.

[2]

(ii) **Table 11.1** shows their results.

Table 11.1

Square frame	1	2	3	4	5	6	7	8	9	10	**Total**
Number of daisies counted	14	3	8	10	16	15	11	10	11	12	110

Estimate the population of daisies in the lawn.

- The students used a 0.5 m × 0.5 m frame to sample the lawn.
- The lawn size is 5 m × 3 m.

Estimate of population of daisies in the lawn = ... **[3]**

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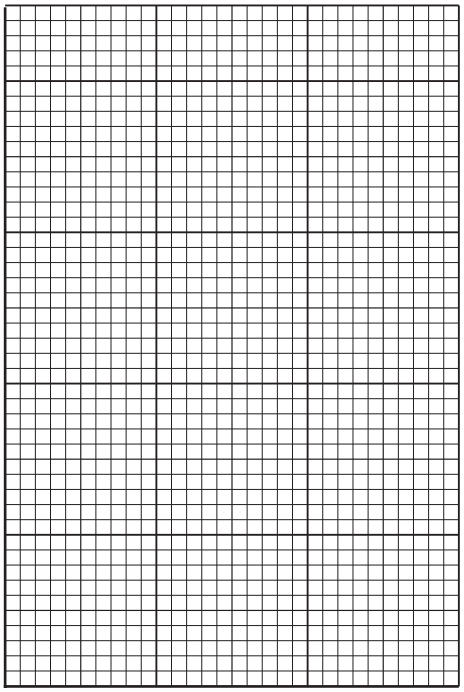
(b) The students develop their investigation to show how the shed affects where daisies grow in the lawn.

Table 11.2 shows the results.

Table 11.2

Distance from shed (m)	Number of daisies
1.0	0
1.5	2
2.0	4
2.5	6
3.0	8
3.5	10
4.0	12
4.5	14
5.0	16

(i) Plot a line graph of the results from **Table 11.2**. Draw a straight line of best fit.



[4]

(ii) Use the graph to determine the slope of the line.

Slope = ... **[1]**

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(iii) Daisy plants require lots of light.

Explain the effect of the shed on the growth of daisies in the lawn.

.....

.....

.....

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

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12 **(a)** Complete these sentences about different factors that affect the ecosystem.

Use the words or phrases in the list.

abiotic	**biotic**	**carbon dioxide**	**food**	**oxygen**
pH in soil	**predators**	**temperature**		

Living organisms affecting the ecosystem are known as ..... factors.

Physical factors that affect living organisms are described as ..... factors.

Physical factors that can directly affect the rate of photosynthesis include

..... and ..... concentration.

[3]

(b) A student investigates the relationship between bean plants and the bacteria that live in the roots of the bean.

They think the bacteria live inside root nodules.

Fig. 12.1 shows root nodules on a bean plant.

Fig. 12.1

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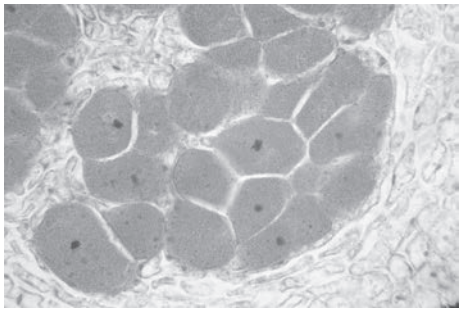
The student takes a thin section of the nodule and looks at it under a light microscope.

Fig. 12.2 shows bacteria inside the root nodule.

Fig. 12.2



(i) Describe how to take a **thin** section of the nodule **and** prepare it to view under a light microscope.

.....

.....

.....

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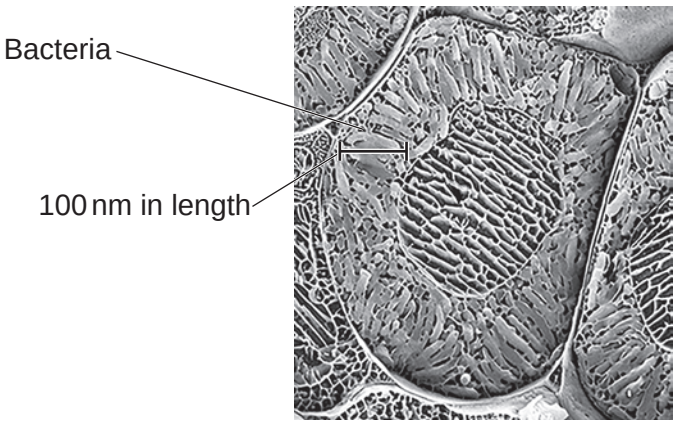
..... **[3]**

(ii) The bacteria were **not** visible clearly using a light microscope.

The student found an image taken using a different type of microscope.

Fig. 12.3 shows this image.

Fig. 12.3



The maximum resolution of a light microscope is 200 nm.

What type of microscope is used to take this image?

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

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(c) The bacteria live inside the bean plant cells in root nodules. The bacteria are able to take nitrogen gas from the air and turn it into nitrates. The plants use nitrates to make amino acids.

Explain the relationship between the bacteria and the bean plant.
Include ideas about photosynthesis in your answer.

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

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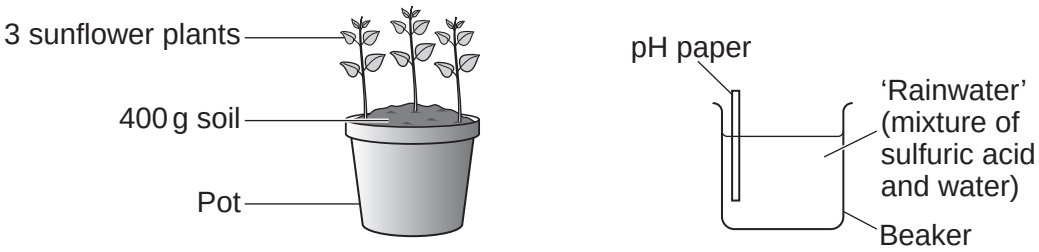
13 **(a)** A science club set up an experiment looking at the effect of acid rain on the growth of sunflower plants.

The diagram shows the apparatus they use.



This is the method they then used.

- Prepare 5 plant pots with 5 beakers of the 'rainwater' with varying pH values as shown in the table.

Pot with 3 sunflower plants	Beaker of 'rainwater'	pH Value
A	**A**	6.0
B	**B**	5.0
C	**C**	4.0
D	**D**	3.0
E	**E**	2.0

- Water each pot twice a day from its corresponding beaker with similar amounts of 'rainwater'.
- Leave the pots in the same place with the same growing conditions for 14 days.
- Measure the height of each sunflower every other day. Record the mean height of the 3 sunflowers in each pot.

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

Put a tick (✓) in the correct box.

Amount of light sunflowers receive	
Height of sunflowers	
Number of sunflowers	
pH of acid rainwater	
Volume of rainwater added to sunflowers	

[1]

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(ii) Write down **two** changes that would improve the **accuracy** of these acid rainwater measurements.

1 .....

.....

2 .....

.....
[2]

(iii) Acid rain forms due to the emission of sulfur dioxide and nitrogen oxides when fossil fuels are burnt. These gases react with water, oxygen and other chemicals in the atmosphere.

The science club used sulfuric acid to represent acid rain.

Suggest why this is **not** a true representation of acid rain.

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

(iv) Suggest how the investigation could be developed to better represent acid rain.

.....

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

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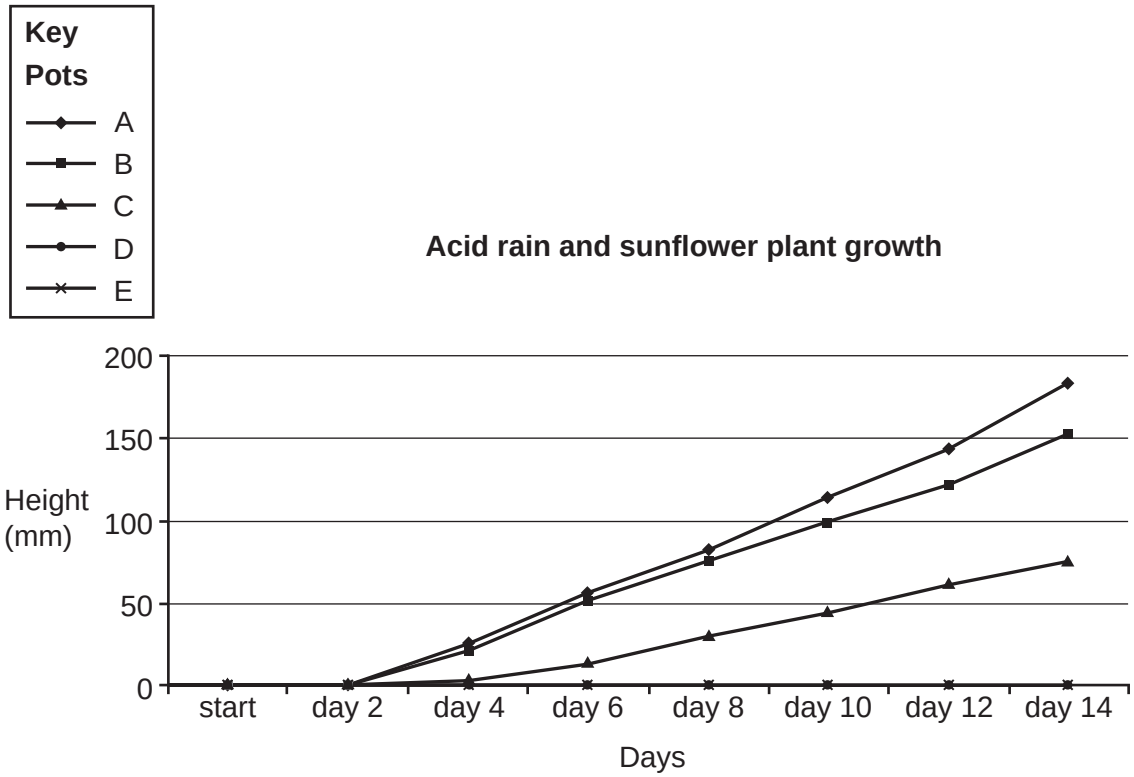
(b) This is a graph of the results, produced using computer software.



(i) Estimate the range of acidity that by day 14 causes the sunflower plants to be reduced in height by about 50% compared to the sunflower plants in pot **A**.

Put a tick (✓) in the correct box.

pH 2.0–3.6 ☐

pH 3.0–3.6 ☐

pH 4.0–4.6 ☐

pH 5.0–5.6 ☐

[1]

(ii) Describe the impact of acid rain on biomass production.

.....

.....

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

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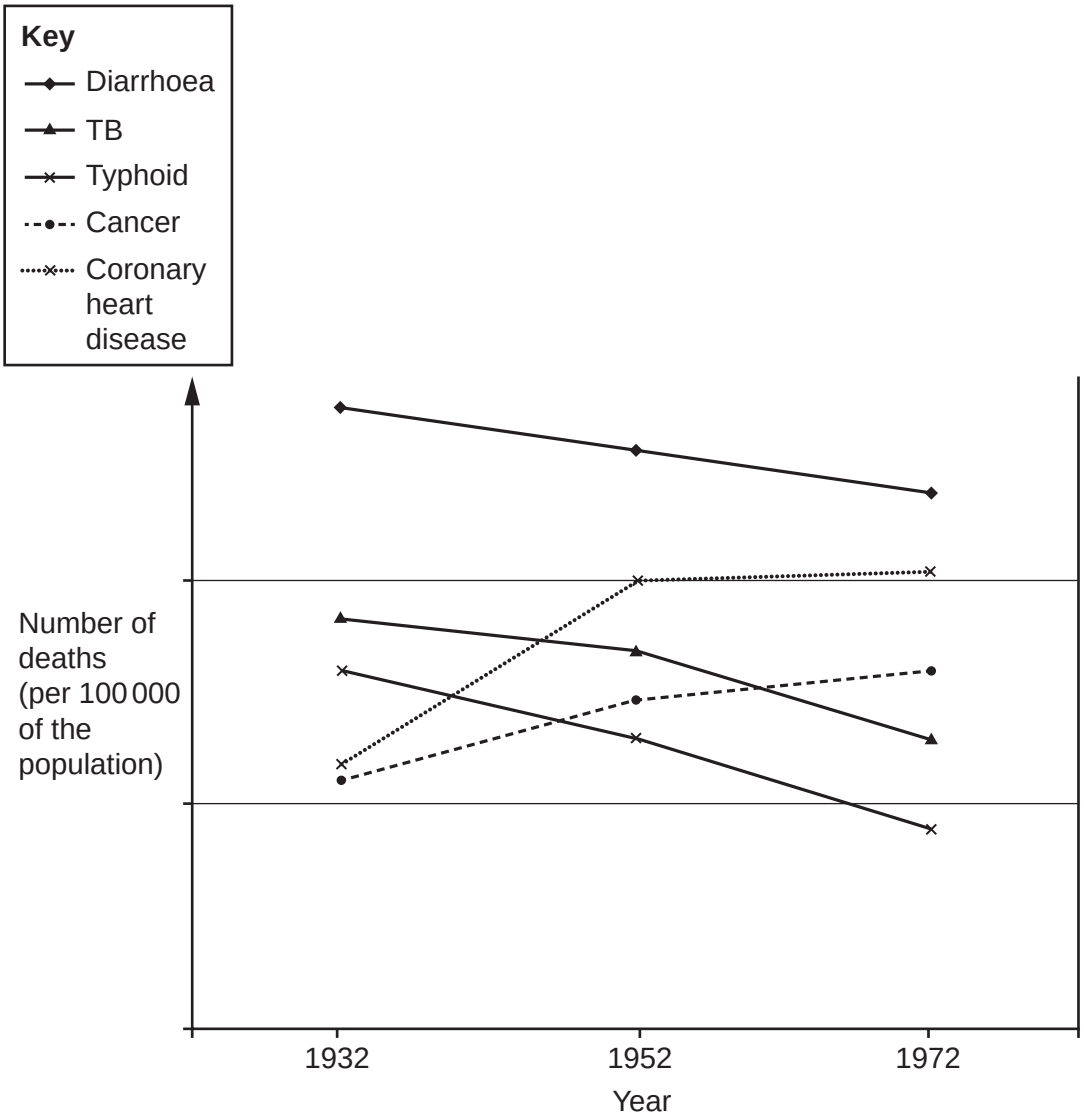
14 **(a)** The deaths in one country from different diseases were measured over a 40-year period.

Lifestyle and living conditions in this country changed during the 40 years of the study.

The graph shows the number of deaths per 100 000 of the population for each disease.



(i) The diseases can be grouped into communicable and non-communicable diseases. The graph shows the trends of these two different types of disease over the 40-year period.

Complete the sentences explaining these trends shown in the graph.

Communicable diseases have .....

.....

Non-communicable diseases have .....

.....

[2]

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(ii) Suggest how lifestyle and living conditions in this country might have changed to cause the trends shown in the graph.

.....

.....

.....

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

(b) To calculate the death rate in a given year, the following formula is used:

$$\text{death rate per } 100\,000 = \frac{\text{number of deaths} \times 10^5}{\text{population size}}$$

In 1972, the population was 55 million. The death rate from coronary heart disease was 28 deaths per 100 000 people.

Calculate the number of deaths from coronary heart disease in 1972.

Number of deaths = ... **[2]**

(c) The immune system provides a defence against bacterial diseases like TB (tuberculosis).

Part of this defence involves the production of antibodies.

Describe how antibodies help defend the body. Use ideas about antigens in your answer.

.....

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.....

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

(d) What does a vaccination contain **and** why does it protect the body from infection?

Vaccinations contain .....

.....

Vaccinations protect the body because .....

.....

[2]

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15 **(a)** Some forms of breast cancer are linked to specific mutated genes called BRCA.

BRCA is a dominant allele.

Inheriting the BRCA allele means in both males and females, the risk of developing breast cancer is affected. It does not mean a person has been diagnosed with cancer.

(i) A male who is heterozygous for BRCA has children with a female who is homozygous recessive.

How are they affected by the BRCA allele?

Put ticks (✓) in the correct boxes.

	Risk of Developing Breast Cancer	
	Increased risk	**Less risk**
Heterozygous male		
Homozygous recessive female		

[1]

(ii) What is the percentage probability of them having a child with an increased risk of developing breast cancer?

Use a labelled genetic diagram to explain your answer.

Use the letter **B** for the dominant BRCA allele.

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

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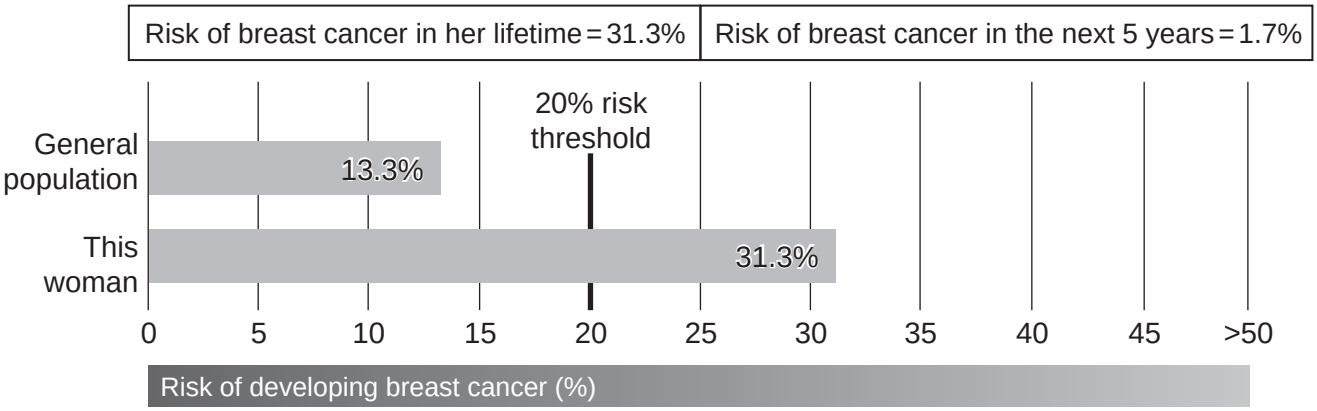
***(b)** Breast cancer has many genetic and clinical factors that affect its development.

A woman has her genome mapped because her mother had breast cancer. Medical risk factor tools are then used to predict her risk of developing breast cancer comparing it with the general population.

The diagram shows the results for this woman.



All women over the age of 50 have the opportunity to be screened for breast cancer every five years. Women at high risk of developing breast cancer are given the option of having their breasts removed and replaced with silicone implants.

Discuss how useful the results shown in the diagram are for this woman **and** suggest some of the ethical and practical issues involved in being made aware of the results.

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

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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