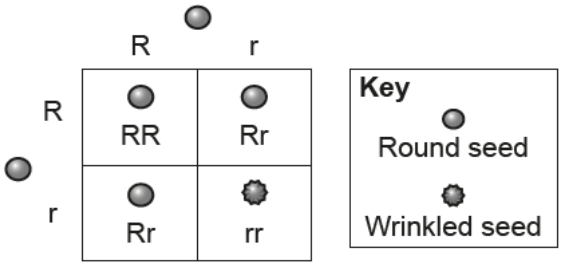
Genes, inheritance and selection – 2022 GCSE Gateway Biology Combined Science A

1. May/2022/Paper_J250/08/No.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.

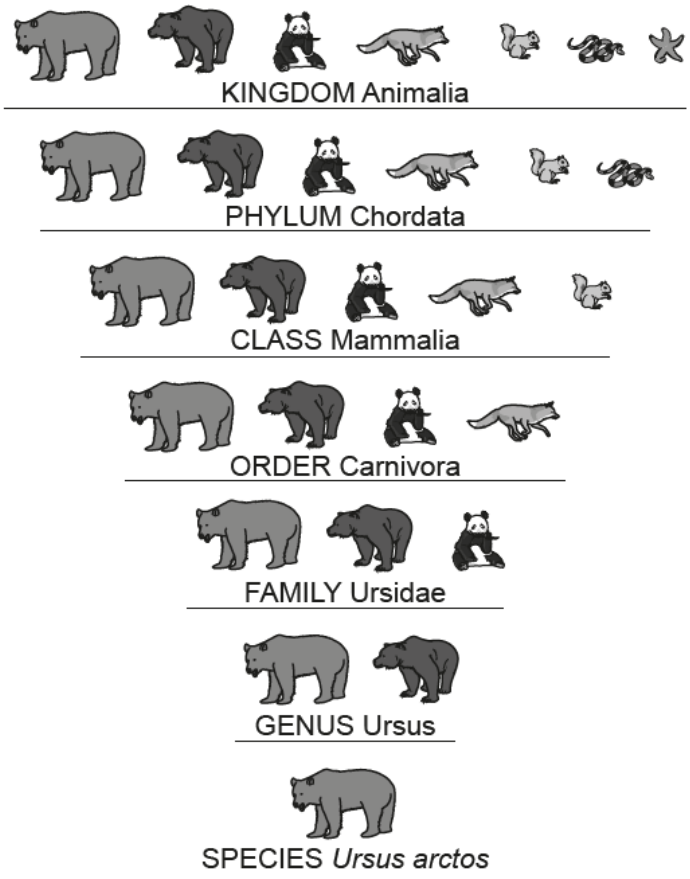
C The ratio of heterozygous to homozygous offspring will be 1:1.

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

Your answer ☐ **[1]**

2. May/2022/Paper_J250/08/No.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]**

3. May/2022/Paper_J250/08/No.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

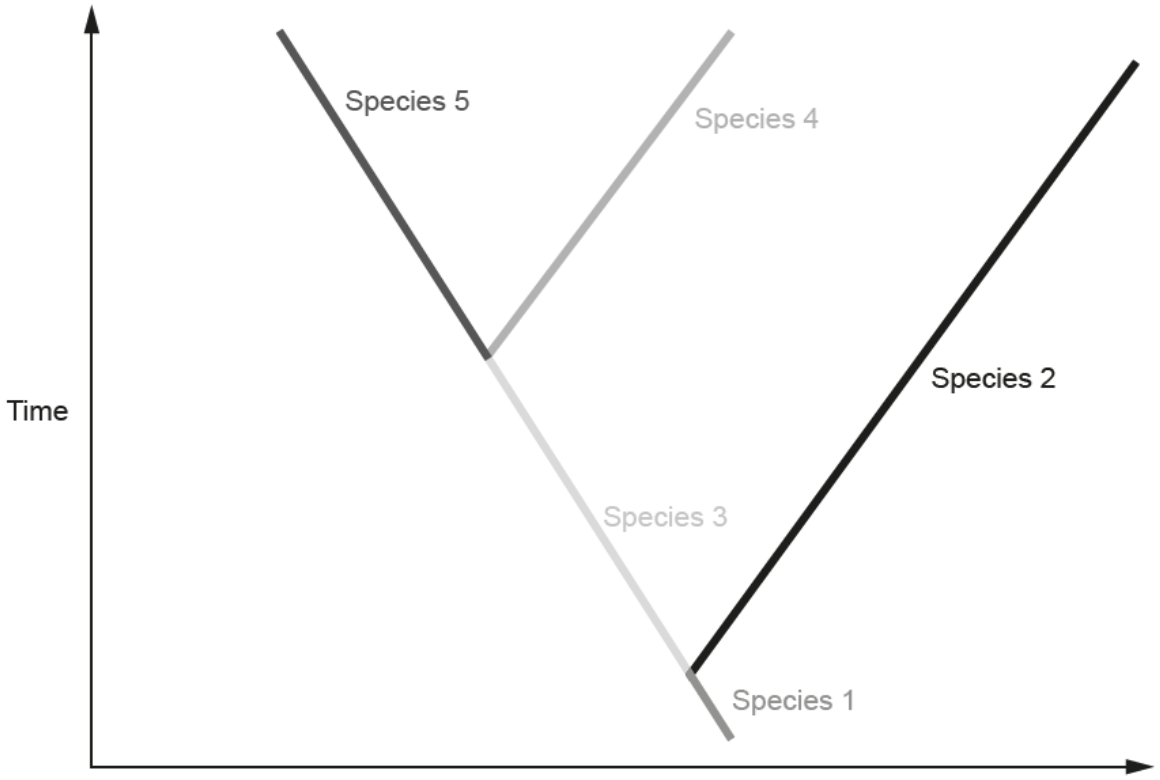
D Vectors

Your answer ☐ **[1]**

4. May/2022/Paper_J250/08/No.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]**

5. May/2022/Paper_J250/08/No.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.

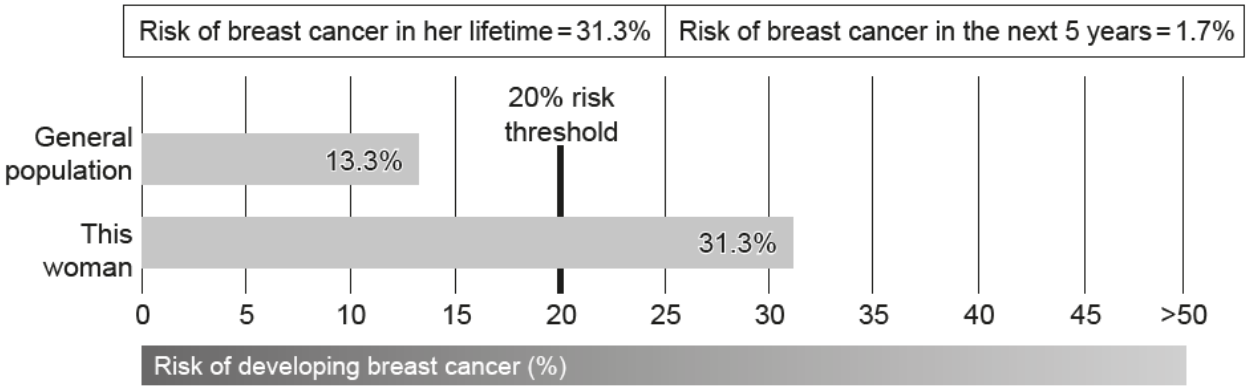
Use the letter **B** for the dominant BRCA allele.

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

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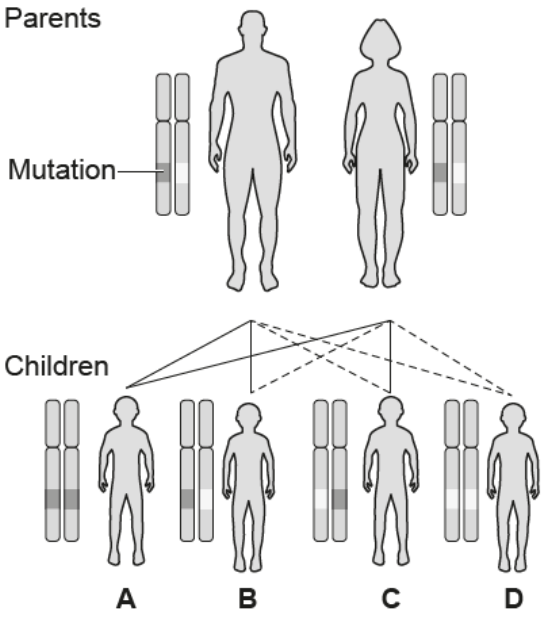
..... **[6]**

6. May/2022/Paper_J250/02/No.4

The diagram shows how a condition caused by a **recessive** gene mutation is inherited.

Which child, **A**, **B**, **C** or **D**, will inherit and develop the condition?



Your answer ☐ **[1]**

7. May/2022/Paper_J250/02/No.13

(a) A student models the inheritance of sex using two coins.

- The student puts a **red** sticker on **both** sides of one coin to represent a **female**.
- They then put a **red** sticker on one side and a **white** sticker on the other side of a second coin to represent a **male**.

Which of the two sex chromosomes is represented by each colour?

Red = ... chromosome

White = ... chromosome

[1]

(b) The student tosses the two coins 10 times and records the colour of the sticker showing on each coin.

The table shows their results.

Male coin	Female coin	Offspring Boy (B) or Girl (G)?
red	red	G
red	red	
white	red	
white	red	
white	red	
red	red	
white	red	
white	red	
red	red	
white	red	

The offspring is determined by the colour recorded for each coin.

(i) Complete the column for the offspring. One has been done for you. **[1]**

(ii) Calculate the ratio of boys to girls in the 10 offspring.

Ratio of boys : girls = ... **[1]**

(iii) The results do **not** match the expected ratio.

What is the expected ratio of offspring for boys : girls?

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

(c) Explain why the results do **not** match the expected ratio.
Suggest how the student could develop the experiment to get closer to the expected result.

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

8. May/2022/Paper_J250/02/No.15

(a) The diagram shows a killer whale and three species thought to be ancestors of the killer whale.

Killer whale

Species A

Species B

Species C

(i) Killer whales evolved from ancestors that walked on land and then went back into the sea.

Complete the table to show the time when each species **A**, **B** and **C** existed on this planet.

Species	Time the species existed on this planet
killer whale	present day
.....	41 million years ago
.....	43 million years ago
.....	48 million years ago

[2]

(ii) Species **A**, **B** and **C** have **not** existed on this planet for millions of years.

What have scientists used to provide evidence for the evolution of the killer whale?

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

*(b) Many tour companies offer whale watching sight-seeing trips when visiting Monterey in California. Read the article about whale watching trips.

> One of the best things to do in Monterey is to join one of the whale watching trips offered year-round in Monterey Bay.
>
> These trips allow the thousands of tourists that visit our area to see the spectacular diversity and large numbers of whales, dolphins and other wildlife.
>
> Marine biologist guides will accompany the trips. They provide information for the tourists and collect valuable data on the marine mammals that are sighted.
>
> The boats used are old whaling boats driven by diesel engines. Their original purpose was to hunt the whales for food but the hunting is now banned in Monterey Bay.

Explain how whale watching activities impact on biodiversity in Monterey Bay.

Your answer should include:

- benefits and challenges to maintaining biodiversity
- a judgement about the effect whale watching has on marine life.

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