

APOLLO

Inheritance

HL

Biology

First assessment 2025

10 questions | questions

- 31.** A *Mirabilis jalapa* plant with red flowers was crossed with one with white flowers. All plants in the F1 generation had pink flowers. What phenotype ratio would be expected in the F2 generation?
- A. 100 % pink
 - B. 50 % red and 50 % white
 - C. 25 % white, 50 % pink and 25 % red
 - D. 75 % red and 25 % white

- 31.** Pink flowers arise from the incomplete dominance between red and white flowers in the four o'clock flower (*Mirabilis jalapa*). A pink-flowering variety is crossed with a white-flowering variety.



What could be the possible phenotypes of the offspring?

- A. White flowers only
- B. Pink and white flowers
- C. Red and white flowers
- D. Pink flowers only

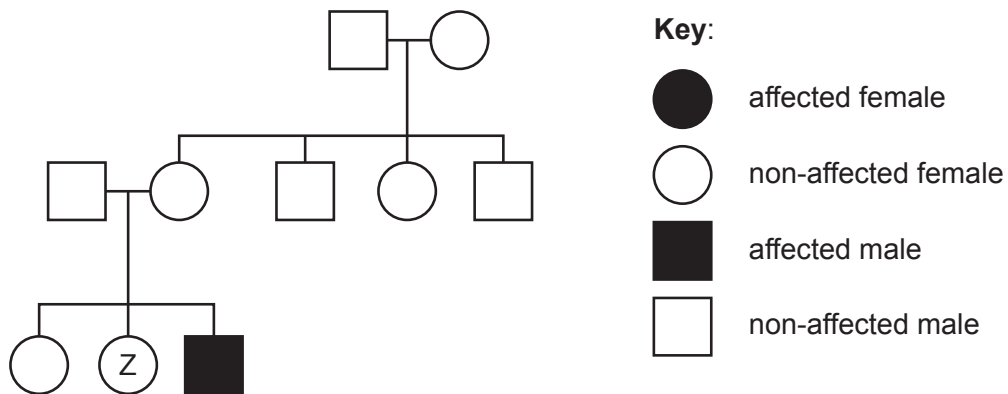
32. Phenylketonuria is caused by a mutation to a gene. Which genotype would result in the condition and what is the consequence?

	Genotype	Consequence
A.	AA only	Tyrosine is converted to phenylalanine
B.	aa only	Tyrosine is not converted to phenylalanine
C.	AA and Aa	Phenylalanine is converted to tyrosine
D.	aa only	Phenylalanine is not converted to tyrosine

31. When white flowers of the species *Mirabilis jalapa* are fertilized by pollen from red flowers, the resulting plants produce pink flowers. What is the pattern of inheritance and the reason for this?

	Inheritance	Reason
A.	incomplete dominance	offspring show both parental phenotypes
B.	codominance	offspring show both parental phenotypes
C.	incomplete dominance	offspring show a blended phenotype of the parents'
D.	codominance	offspring show a blended phenotype of the parents'

30. The pedigree chart shows the incidence of colour blindness in three generations of a family. Colour blindness is caused by a sex-linked recessive allele.



What could the genotype of individual Z be?

- A. $X^B X^B$ only
- B. $X^B X^b$ only
- C. $X^B X^B$ or $X^B X^b$
- D. $X^b X^b$ or $X^B X^b$

31. A heterozygous fruit fly (*Drosophila melanogaster*) with straight wings and red eyes was crossed with a curly-winged, sepia-eyed homozygous fruit fly. The offspring produced are shown in the table.

Phenotype	Number of offspring
straight wings, red eyes	25
straight wings, sepia eyes	24
curly wings, red eyes	26
curly wings, sepia eyes	25

What conclusions can be drawn from this experiment?

- A. The wing shape and eye colour genes are on the same chromosome.
- B. The alleles of both genes are codominant.
- C. Individuals with straight wings and sepia eyes must be the result of crossing over.
- D. The genes for wing shape and eye colour are not linked.

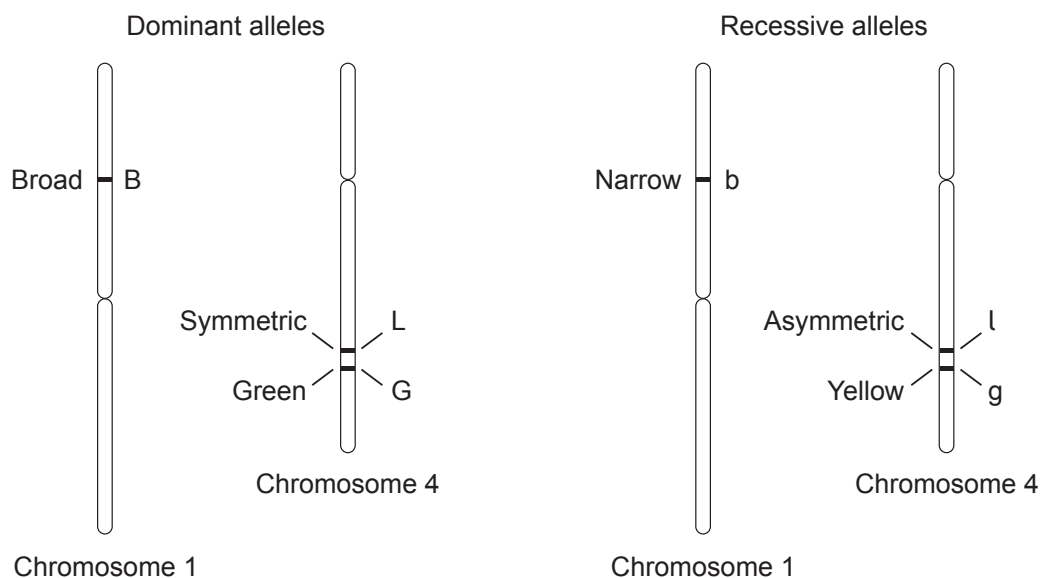
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Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

6. Scientists determined the loci of three genes on chromosomes 1 and 4 of the thale cress plant (*Arabidopsis thaliana*). All three genes are involved in influencing the characteristics (width, symmetry and colour) of the plant's leaves.

The diagrams show the names and symbols of the alleles of these genes.



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(Question 6 continued)

- (a) The expected ratio of phenotypes in the offspring of a cross between a plant with narrow, yellow leaves and a plant heterozygous for the genes for leaf width and colour is 1:1:1:1.

Justify this expected ratio using a Punnett grid or other diagram.

[3]

- (b) Explain whether a ratio of 1:1:1:1 would be expected in the offspring of a cross between a plant with asymmetric, yellow leaves and a plant heterozygous for the genes for leaf symmetry and colour.

[2]

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- 31.** Female grasshoppers have XX sex chromosomes and males have XO, signifying a single X chromosome. An X chromosome will be present in only half of the male gametes. A recessive mutation is induced by radiation in the X chromosome of a male. In which generation will the effect of this radiation appear?
- A. F1 females
 - B. F1 males
 - C. F2 females
 - D. F2 males

Turn over

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

6. In humans, sex is determined genetically and human populations have approximately equal numbers of males and females in each generation.

(a) Outline how sex is determined in humans. [2]

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(b) Down syndrome is a genetic condition in which the cells of an individual contain three copies of chromosome 21. Explain how non-disjunction leads to trisomy 21. [3]

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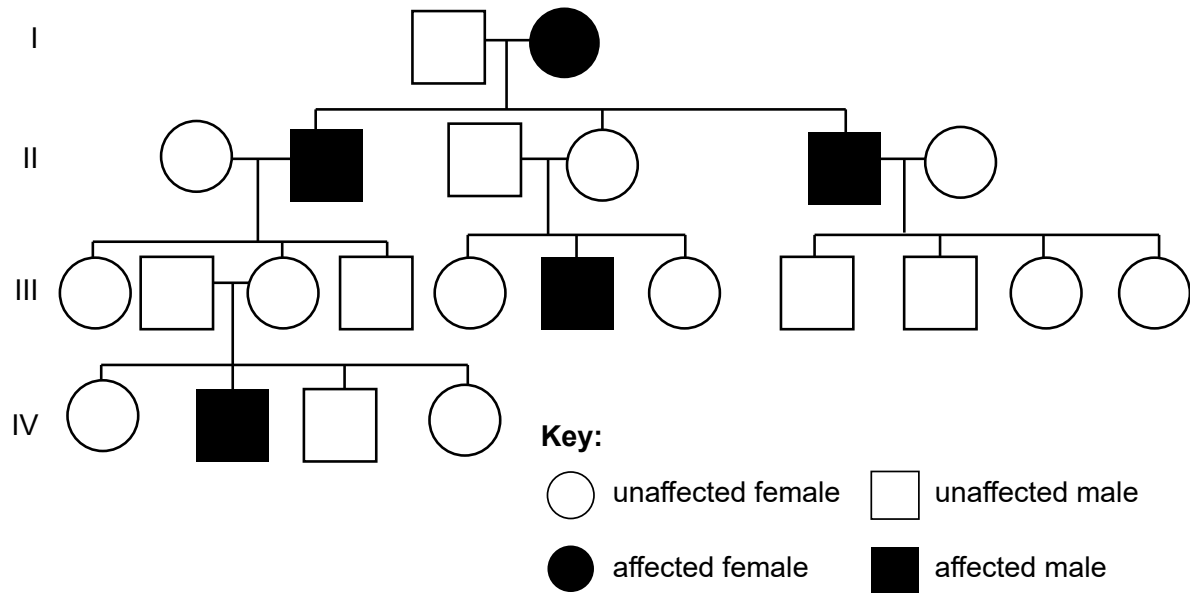
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(Question 6 continued)

- (c) The pedigree chart shows the inheritance of hemophilia in a human family over four generations. Symbols represent the phenotype of the individual.



Explain the evidence from this chart that the condition may be sex-linked.

[2]

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will not be marked.



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

7. Two alleles of a gene influence body colour in *Drosophila*. The dominant allele B results in a brown body colour while the recessive allele b codes for black body. In addition, two alleles of another gene determine wing shape; normal wings (V) are dominant over vestigial wings (v).

In a dihybrid cross between a double heterozygote for body colour and wing shape (BbVv) and a homozygous recessive for both traits (bbvv), the following offspring were obtained:

- brown body, normal wings: 29
- brown body, vestigial wings: 8
- black body, normal wings: 10
- black body, vestigial wings: 33

- (a) Identify the recombinant phenotypes amongst the offspring. [1]

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- (b) Explain whether these results fit the predicted Mendelian ratios for this cross. [2]

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- (c) Outline the statistical test that could be used to provide more evidence of the type of inheritance. [2]

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