Inheritance: AQA A Level Biology Exam Questions by Topic

18 questions · 40 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2025 · Q05.1 · 2 marks

0 5 . 1 Explain what is meant by the term **phenotype**.

[2 marks]

Question 2 · A level Paper 2 · June 2024 · Q04.1 · 2 marks

0 4 . 1 In fruit flies, a gene for body colour has a dominant allele for grey body, **G**, and a recessive allele for black body, **g**.

Explain how you would determine if the genotype of a grey fly is homozygous or heterozygous for body colour.

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

0 6 In humans, the ABO blood groups and Rhesus blood groups are under genetic control. The inheritance of the ABO blood groups is controlled by three alleles of a single gene, I^A, I^B and I^O. The alleles I^A and I^B are codominant, and the allele I^O is recessive to I^A and recessive to I^B.

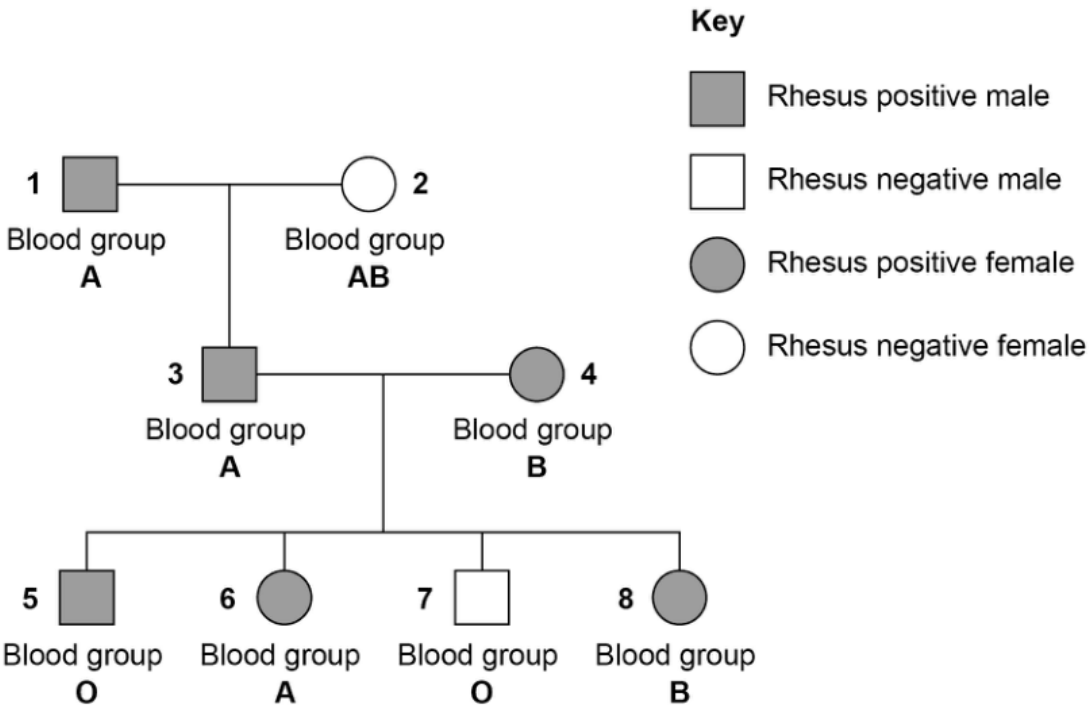
There are four ABO phenotypes, **A**, **B**, **AB** and **O**.

The gene for the Rhesus blood groups has two alleles. The allele for Rhesus positive, **R**, is dominant to the allele for Rhesus negative, **r**.

The genes for the ABO and Rhesus blood groups are **not** sex-linked and are **not** on the same chromosome.

Figure 3 shows the phenotypes in a family tree for the ABO and Rhesus blood groups.

Figure 3



0 6 . 1 Give the genotypes of the ABO blood groups for individuals **1** and **2**.

Do **not** include the genotypes for the Rhesus blood groups in your answer.

[1 mark]

1 _____

2 _____

Questions, mark schemes and examiners' report extracts © AQA.

Question 4 · A level Paper 2 · June 2022 · Q06.2 · 2 marks

0 6 . 2 Explain **one** piece of evidence from **Figure 3** that the allele for Rhesus positive is dominant.

[2 marks]

Question 5 · information from earlier in the question

In a species of flowering plant, the **T** allele for tallness is dominant to the **t** allele for dwarfness. In the same species, two alleles $\mathbf{C^R}$ (red) and $\mathbf{C^W}$ (white) code for the colour of flowers. When homozygous red-flowered plants were crossed with homozygous white-flowered plants, all the offspring had pink flowers.

Question 5 · A level Paper 2 · November 2020 · Q06.3 · 3 marks

0 6 . 3 A dwarf, pink-flowered plant was crossed with a heterozygous tall, white-flowered plant.

Complete the genetic diagram to show all the possible genotypes and the ratio of phenotypes expected in the offspring of this cross.

[3 marks]

Phenotypes of parents: Dwarf, pink-flowered × Tall, white-flowered

Genotypes of parents: _____ _____

Genotypes of offspring: _____

Phenotypes of offspring: _____

_____

Ratio of phenotypes: _____

Questions, mark schemes and examiners' report extracts © AQA.

0 4 . 4 In fruit flies, a gene for wing shape has a dominant allele for curly wings, **R**, and a recessive allele for normal wings, **r**. The alleles for this gene are on a different pair of chromosomes from the gene for body colour.

Fruit flies that are homozygous dominant for curly wings do not survive beyond the embryo stage.

A curly-winged fly, homozygous for grey body colour was crossed with a curly-winged, black-bodied fly.

Complete the genetic diagram to show all the possible genotypes and the ratio of phenotypes expected to develop into adults from this cross.

[3 marks]

Phenotypes of parents Curly-winged, grey-bodied, × Curly-winged, black-bodied

Genotypes of parents _____ × _____

Genotypes of offspring _____

_____

Phenotypes of offspring _____

_____

Ratio of offspring _____

Questions, mark schemes and examiners' report extracts © AQA.

Question 7 · A level Paper 2 · November 2021 · Q04.1 · 2 marks

0 4 In fruit flies, males have the sex chromosomes XY and the females have XX.
In fruit flies, a gene for eye colour is carried on the X chromosome. The allele for red eyes, **R**, is dominant to the allele for white eyes, **r**.

0 4 . 1 Male fruit flies are more likely than female fruit flies to have white eyes.

Explain why.

[2 marks]

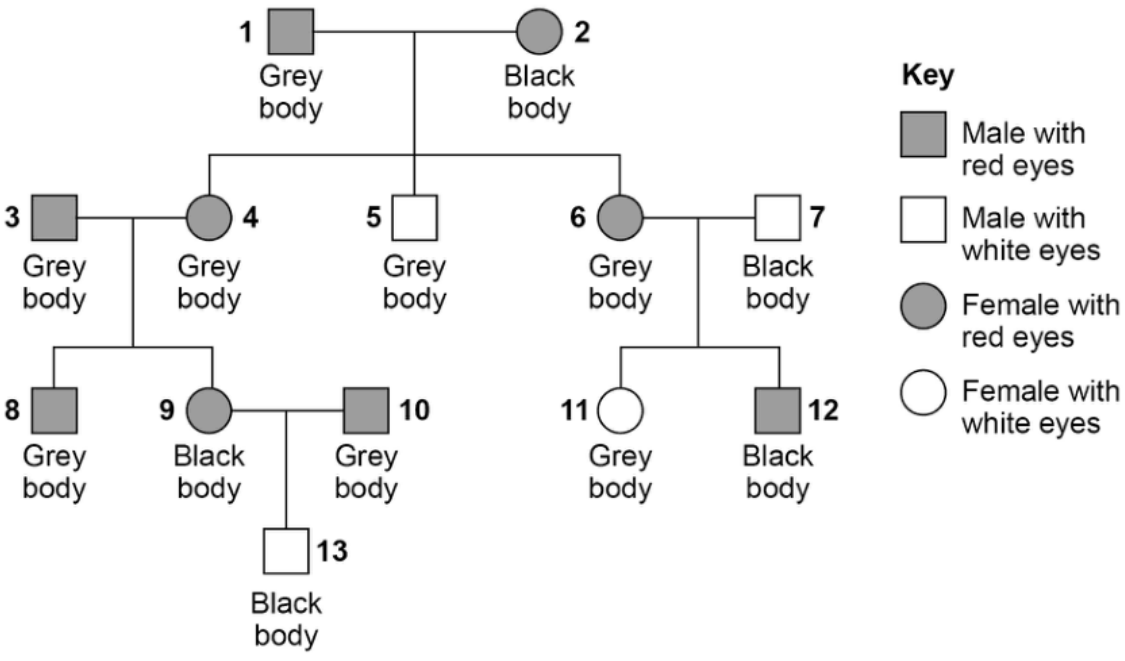
Question 8 · information from earlier in the question

0 6 In fruit flies, a gene for body colour has a dominant allele for grey body, **G**, and a recessive allele for black body, **g**.

A gene for eye colour has a dominant allele for red eyes, **R**, and a recessive allele for white eyes, **r**, and is located on the **X chromosome**.

Figure 4 shows the phenotypes of fruit flies over four generations.

Figure 4



Questions, mark schemes and examiners' report extracts © AQA.

Question 8 · A level Paper 2 · June 2019 · Q06.3 · 2 marks

0 6 . 3 Explain one piece of evidence from **Figure 4** to show that the gene for body colour is **not** on the **X chromosome**.

[2 marks]

Question 9 · A level Paper 2 · June 2019 · Q06.4 · 3 marks

0 6 . 4 A heterozygous grey-bodied, white-eyed female fly was crossed with a black-bodied, red-eyed male fly.

Complete the genetic diagram below to show all the possible genotypes and the ratio of phenotypes expected in the offspring from this cross.

[3 marks]

Phenotypes of parents: Grey-bodied, white-eyed female × Black-bodied, red-eyed male

Genotypes of parents: _____ × _____

Genotypes of offspring _____

Phenotypes of offspring _____

Ratio of phenotypes _____

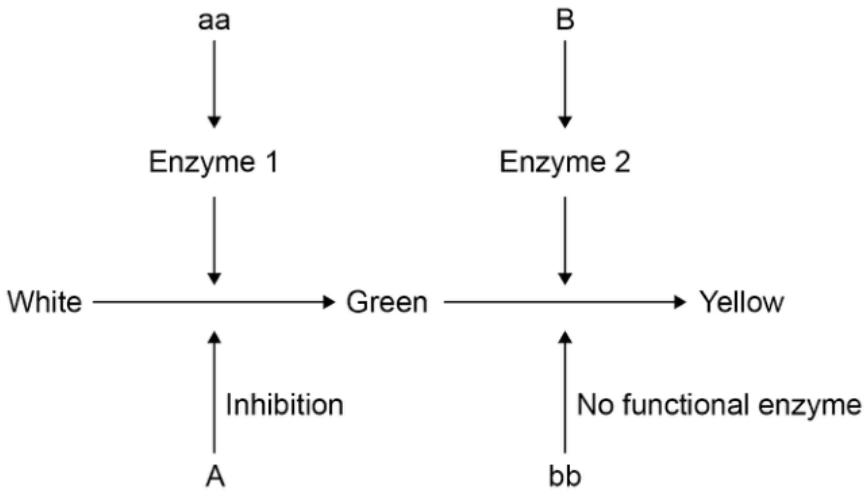
Questions, mark schemes and examiners' report extracts © AQA.

Question 10 · A level Paper 2 · June 2017 · Q07.2 · 1 mark

0 7 . 2 The inheritance of fruit colour in summer squash plants is controlled by two genes, **A** and **B**. Each gene has two alleles.

Figure 7 shows the interaction of these two genes in controlling fruit colour in summer squash plants.

Figure 7



Name the type of gene interaction shown in **Figure 7**.

[1 mark]

Question 11 · A level Paper 2 · June 2017 · Q07.4 · 3 marks

0 7 . 4 Genes **A** and **B** are **not** linked.

Complete the genetic diagram to show all the possible genotypes and the ratio of phenotypes expected in the offspring of this cross.

[3 marks]

Genotypes of parents **aabb** × **AaBb**

Genotypes of offspring _____

Phenotypes of offspring _____

Ratio of phenotypes _____

Questions, mark schemes and examiners' report extracts © AQA.

Question 12 · information from earlier in the question

0 4 In cats, males are XY and females are XX. A gene on the X chromosome controls fur colour in cats. The allele **G** codes for ginger fur and the allele **B** codes for black fur. These alleles are codominant. Heterozygous females have ginger and black patches of fur and their phenotype is described as tortoiseshell female.

The two alleles, **F** and **f** of a different gene, which is **not** sex-linked, interact with the gene controlling fur colour. The allele **F** is dominant and stops the formation of pigment in the fur, resulting in white fur. The allele **f** is recessive and has no effect on fur colour.

Question 12 · A level Paper 2 · June 2023 · Q04.3 · 3 marks

0 4 . 3 Complete the genetic diagram to show all the possible genotypes and the ratio of phenotypes expected in the offspring of this cross.

[3 marks]

Phenotypes of parents $\mathbf{X^GX^GFf}$ x $\mathbf{X^BYff}$

Genotypes of offspring _____

Phenotypes of offspring _____

Ratio of offspring phenotypes _____

Questions, mark schemes and examiners' report extracts © AQA.

In fruit flies, the genes for body colour and for wing development are **not** on the sex chromosomes. The allele for grey body colour, **G**, is dominant to the allele for black body colour, **g**. The allele for long wings, **L**, is dominant to the allele for short wings, **l**.

A geneticist carried out a cross between fruit flies with grey bodies and long wings (heterozygous for both genes) and fruit flies with black bodies and short wings.

Table 2 shows the results of this cross.

Table 2

Phenotype of offspring	Number of offspring
Grey body **and** long wings	223
Black body **and** short wings	218

0 4 . 3 Explain the results in **Table 2**.

[3 marks]

Questions, mark schemes and examiners' report extracts © AQA.

0 5 . 3 In sweet pea plants, the **F** allele for purple flowers is dominant to the **f** allele for red flowers. The **L** allele for long pollen is dominant to the **l** allele for round pollen.

A scientist carried out a genetic cross between a plant with purple flowers and long pollen (heterozygous for both genes) and a plant with red flowers and round pollen.

Table 2 shows the results of this cross.

Table 2

Phenotype of offspring	Percentage of total offspring
Purple flowers and long pollen	48.6
Red flowers and round pollen	47.5
Purple flowers and round pollen	2.1
Red flowers and long pollen	1.8

Use your knowledge of autosomal linkage to explain the results in **Table 2**.

Your answer should include:

- an explanation of what is meant by autosomal linkage
- a comment about the relative proportions of the different genotypes of gametes produced in this cross.

[3 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Question 15 · A level Paper 2 · June 2025 · Q04.3 · 1 mark

0 4 . 3 Haemophilia C is an **autosomal** recessive condition.

Two parents are both heterozygous for the haemophilia C allele.

Calculate the probability of these parents producing a son who has haemophilia C.

[1 mark]

Probability = _____

Question 16 · A level Paper 2 · June 2025 · Q05.2 · 2 marks

0 5 . 2 In genetic crosses, the observed phenotypic ratios obtained in the offspring are often **not** the same as the expected ratios.

Suggest **two** reasons why.

Do **not** refer to sex-linkage or autosomal linkage in your answer.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 17 · information from earlier in the question

Scientists determined the frequencies of the ABO alleles and ABO phenotypes in a large population. They then used a statistical test to determine if the frequencies of the four phenotypes differed significantly from the frequencies expected according to the Hardy–Weinberg equation.

Questions, mark schemes and examiners' report extracts © AQA.

Question 17 · A level Paper 2 · June 2022 · Q06.5 · 2 marks

0 6 . 5 Name the statistical test you should use to determine if the observed frequencies of the four phenotypes differed significantly from the frequencies expected according to the Hardy–Weinberg equation.

State how many degrees of freedom should apply.

[2 marks]

Statistical test _____

Number of degrees of freedom _____

Questions, mark schemes and examiners' report extracts © AQA.

0 6 . 2 If two diploid (2n) gametes fuse at fertilisation, it can result in the growth of a tetraploid plant which has 4 copies of each chromosome.
Red clover is a plant grown to produce cattle feed. Tetraploid red clover plants produce a higher yield than diploid red clover plants.
Whether a red clover plant produces 2n gametes is genetically controlled.

Scientists investigated the possibility of breeding red clover plants that only produced 2n gametes.

- In breeding cycle 0, they grew red clover plants and identified plants that produced 2n gametes.
- In breeding cycle 1, they used the plants producing 2n gametes to produce offspring.
- In breeding cycles 2 and 3, they identified plants producing 2n gametes and used these to produce offspring.

Their results are shown in **Table 3**.

Table 3

	Observed		**Expected**	
Breeding cycle	Number of plants that **did not** produce 2n gametes	Number of plants that **did** produce 2n gametes	Number of plants that **did not** produce 2n gametes	Number of plants that **did** produce 2n gametes
0	50	4	50	4
1	14	42	……..	…….
2	2	44		
3	0	56		

The scientists used the following null hypothesis.

'The proportion of plants that produce 2n gametes will not change from one breeding cycle to the next.'

Complete **Table 3** to show the **expected number** of plants that **did not** produce 2n gametes and the expected number of plants that **did** produce 2n gametes after 1 cycle.
Give each answer to the nearest whole number.

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Mark schemes

Question 1 · A level Paper 2 · June 2025 · Q05.1 · 2 marks

05.1	1. Expression/appearance/characteristic/feature /trait due to genetic constitution / genotype /allele(s); 2. (And due to interaction with the) environment;	2 (2 x AO1)

1. Accept: named characteristic

1. Accept: homozygous/ heterozygous/genes /DNA for 'genotype'

1. Ignore: chromosomes

Questions, mark schemes and examiners' report extracts © AQA.

Question 2 · A level Paper 2 · June 2024 · Q04.1 · 2 marks

04.1	1. Cross with homozygous recessive (fly) **OR** Cross with a black (fly) **OR** Cross with gg (fly); 2. Black offspring/flies then is heterozygous/Gg **OR** Black and grey offspring/flies then is Heterozygous/Gg **OR** No black offspring/flies then is homozygous/GG **OR** All grey offspring/flies then is homozygous/GG;	2 (2 x AO2)

1. Accept cross with heterozygous (fly)

Alternative mark scheme, if cross not used.

Mark as pairs 3 with 4, and 5 with 6.

3. DNA base sequencing;

4. Compare base sequence with known alleles;

5. Separate alleles using electrophoresis;

6. Use gene/DNA probes to identify alleles

Questions, mark schemes and examiners' report extracts © AQA.

Question 3 · A level Paper 2 · June 2022 · Q06.1 · 1 mark

06.1	(1) I^AI^O **and** (2) I^AI^B;	1 (AO2)	Accept I^OI^A for (1) **and** I^BI^A for (2). Accept AO or OA for (1) **and** AB or BA for (2). Accept lower case for A, B and O.

Questions, mark schemes and examiners' report extracts © AQA.

Question 4 · A level Paper 2 · June 2022 · Q06.2 · 2 marks

06.2	1. Rhesus positive parents produce 7/Rhesus negative child **OR** 3 and 4 produce 7/Rhesus negative child **OR** Two Rhesus positive produce 7/Rhesus negative child; 2. Both Rhesus positive/3 and 4 have recessive allele **OR** Both Rhesus positive/3 and 4 are heterozygous/carriers **OR** If Rhesus positive was recessive, all children (of 3 and 4) would be Rhesus positive / have recessive (phenotype);	2 (2 x AO2)

1. Reject if incorrect evidence and correct evidence provided.

1.Accept Rhesus positive parents produce Rhesus positive and Rhesus negative child.

2. Reject if incorrect explanation and correct explanation provided.

1 and 2. Accept 'affected' for Rhesus positive and 'unaffected' for Rhesus negative.

Questions, mark schemes and examiners' report extracts © AQA.

Question 5 · A level Paper 2 · November 2020 · Q06.3 · 3 marks

06.3	1. ttC^RC^W **and** TtC^WC^W; 2. TtC^RC^W, TtC^WC^W, ttC^RC^W **and** ttC^WC^W; 3. Tall pink, tall white, dwarf pink, dwarf white, **and** ratio 1 : 1 : 1 : 1;	3	2 and 3. Accept: any order of genotypes and phenotypes and ignore if on incorrect answer lines. 3. Accept: sequence of phenotypes does not need to mirror genotypes but must be correct. 3. Accept equivalent ratios e.g. 4:4:4:4. Allow equivalent of mark points 2 and 3 for cross using homozygous tall parent i.e. TTC^WC^W. Allow **one mark** for correct dihybrid genotypes of offspring from incorrect parental genotypes.

Questions, mark schemes and examiners' report extracts © AQA.

04.4	1. RrGG and Rrgg; 2. RrGg, (x2), rrGg, (and RRGg); 3. Curly(-winged), grey(-bodied) and Normal(-winged), grey(-bodied) **and** ratio 2 : 1;	3 (3 x AO2)

1 and 2. Accept the alleles in any order e.g. RGrG and accept if not shown on answer lines.

Accept if different letters than shown are used for the alleles.

3. Accept ratios equivalent to 2 : 1.

Note: If no mark awarded allow **one** (principle) **mark** when parental genotypes are incorrect but correct dihybrid genotypes shown for offspring from this cross.

Questions, mark schemes and examiners' report extracts © AQA.

Question 7 · A level Paper 2 · November 2021 · Q04.1 · 2 marks

04.1	1. Males have one allele; 2. Females need two recessive alleles **OR** Females must be homozygous recessive **OR** Females could have dominant and recessive alleles **OR** Females could be heterozygous/carriers;	2	1 Accept males only need one allele. 1 and 2. Ignore references to X and Y chromosomes. 1 and 2. Accept r as recessive allele and R as dominant allele. If no reference to allele, accept for **one mark** male needs one recessive gene whereas females need two recessive genes.

Questions, mark schemes and examiners' report extracts © AQA.

06.3	1. (Fly) 3 (and 4) produce 9/black (fly) **OR** (Fly) 9 would not be black **OR** (Fly) 9 would be grey **OR** Grey parents/male produce black **female** (fly); 2. (Fly) 3 would pass dominant <u>allele</u> to 9; 3. (Fly) 2 (and 1) produce 5/grey (fly) **OR** Black **female** produces grey **male** **OR** (Fly) 5 could not be grey **OR** (Fly) 5 would be black; 4. (Fly) 5 would receive recessive <u>allele</u> from 2;	2 max

Mark in pairs 1 and 2 or 3 and 4.

2. Accept <u>allele</u> for grey colour would be passed on by 3.

4. Accept <u>allele</u> for black colour would be passed on by 2.

Questions, mark schemes and examiners' report extracts © AQA.

06.4	1. GgX^rX^r **and** ggX^RY; 2. GgX^RX^r, ggX^RX^r, GgX^rY **and** ggX^rY; 3. Grey-bodied red-eyed female, black-bodied red-eyed female, grey-bodied white-eyed male, black-bodied white-eyed male **and** ratio 1 : 1 : 1 : 1;
	If 1, 2 and 3 incorrect **allow one mark** for correct gametes from incorrect dihybrid parental genotypes.

3	1 and 2. Accept the following alternative notations for sex-linked crosses e.g. for mp 1 Ggrr and ggRY or Ggrr and gg R- or Ggrr and ggR i.e. space for Y
	chromosome. 2 and 3. Accept any order of genotypes and phenotypes. 3. Accept sequence of phenotypes does not need to mirror genotypes but must be correct. 3. Accept alternative ratios in correct

Questions, mark schemes and examiners' report extracts © AQA.

Question 10 · A level Paper 2 · June 2017 · Q07.2 · 1 mark

07.2	Epistasis OR Epistatic (interaction/control);	1	Accept: phonetic spellings. Ignore: preceding word e.g.(recessive/dominant) epistasis.

Question 11 · A level Paper 2 · June 2017 · Q07.4 · 3 marks

07.4	1. AaBb, Aabb, aaBb, aabb; 2. White, (white), yellow, green; 3. 2 : 1 : 1;	3	Note: If genotypes are incorrect = zero marks. 1. Accept: equivalent genotypes e.g. ABab for AaBb. Accept: sequence of phenotypes does not need to mirror genotypes but must be correct. 3. Accept: ratios of 2:1:1 or 1:2:1 or 1:1:2 even if sequence of phenotypes do not match if mark points 1 **and** 2 have been awarded. 3. Accept: alternative ratios in correct proportions e.g. 4:2:2 3. Ignore: percentages/fractions.

Questions, mark schemes and examiners' report extracts © AQA.

04.3	1. (Gametes) X^GF, X^Gf, X^Bf **and** Yf; 2. X^GX^BFf, X^GX^Bff, X^GYFf **and** X^GYff; 3. White female, Tortoiseshell female, White male, Ginger male, **and** ratio 1 : 1 : 1 : 1;	3 (3 x AO2)

Allow **one mark** for correct dihybrid genotypes of offspring from incorrect parental gametes.

1 and 2. Accept if g and b are used throughout for G and B.

2. Accept the alleles within a genotype in any order.

1 and 2. Accept in Punnet square.

2 and 3. Accept any order of genotypes and phenotypes and accept if on incorrect answer lines.

3. Accept sequence of phenotypes does not need to mirror genotypes but must be correct.

3. Accept equivalent ratios e.g. 4:4:4:4.

Questions, mark schemes and examiners' report extracts © AQA.

Question 13 · A level Paper 2 · November 2021 · Q04.3 · 3 marks

04.3	1. The (two) genes are linked **OR** Autosomal linkage;	3	1. Accept that the genes are on the same chromosome.
	2. No crossing over (occurs) **OR** (Linked) genes are close together; 3. No Gl and no gL (gametes produced) **OR** No Ggll and no ggLl (offspring produced) **OR** Only GL and gl (gametes produced);		1. Accept 'Alleles are linked' (accept symbols for alleles) but reject if context suggests alleles of the 'same gene'. 2. Accept crossing over less likely to occur. 1 2, and 3. Ignore reference to independent assortment.

Questions, mark schemes and examiners' report extracts © AQA.

Question 14 · A level Paper 2 · June 2025 · Q05.3 · 3 marks

05.3	1. Genes are on the same chromosome/autosome; 2. Crossing over **OR** Recombination; 3. Fewer F l and f L (gametes) **OR** More F L and f l (gametes);	3 (1 x AO1, 2 x AO2)

1. Accept chromatid for chromosome

1. Accept alleles of different genes but not alleles unqualified

1. Accept alleles at different loci on same chromosome

2. Accept chiasma(ta) for crossing over

3. Accept if different letters used e.g. P and p for F and f

Question 15 · A level Paper 2 · June 2025 · Q04.3 · 1 mark

04.3	0.125 / 12.5% / $^{1}/_{8}$;	1 (1 x AO2)	Reject 1 : 8 or 8 : 1 Accept 1 in 8 Reject 12.5 without %

Questions, mark schemes and examiners' report extracts © AQA.

Question 16 · A level Paper 2 · June 2025 · Q05.2 · 2 marks

05.2	1. Small sample size; 2. Crossing over; 3. Random fusion of gametes **OR** Random fertilisation; 4. Epistasis; 5. Lethal genotypes/alleles/genes; 6. Epigenetics;	2 max (2 x AO2)	Ignore mutation and independent segregation 3. Ignore random breeding/mating 5. Ignore lethal phenotypes

Question 17 · A level Paper 2 · June 2022 · Q06.5 · 2 marks

06.5	1. Chi-squared; 2. 3;	2 (2 x AO2)	1. Accept χ^2 or Chi^2

Questions, mark schemes and examiners' report extracts © AQA.

06.2

52	4

;;

Allow 1 mark for numbers totalling 56 except 14/42 - repetition of observed values.

If table is blank, award 1 mark for evidence of 56.

2	Both 52 and 4 required in table for two marks, do not credit 52 or 4 for one mark. Award 1 max for answers not given as whole numbers.

Questions, mark schemes and examiners' report extracts © AQA.