Inheritance (Topic 2): Edexcel SNAB A Level Biology Exam Questions by Topic

20 questions · 44 marks · about 53 minutes. Answer in the spaces, then check the mark schemes at the end.

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10 Scientists have studied behavioural, anatomical and genetic variation in elephants.

The table shows some information about two populations of African elephants.

Population	Location	Feeding behaviour	Anatomical differences
Forest elephant	tropical forest of central and West Africa	feeds on leaves and fruits of high-growing plants such as shrubs and trees	• lower jaw longer and narrower • tusks straighter and downward facing • overall a much smaller size
Savannah elephant	African savannah	feeds on grass and leaves of low-growing shrubs	• lower jaw shorter and wider • tusks more curved and upward facing • overall a larger size

The photographs show elephants from the two populations.



Forest elephant



Savannah elephant

DNA samples were collected from these two populations of elephants.

(a) One of the genes showing variation was the GBA gene. The table shows the frequency of the alleles of the GBA gene in the two populations.

GBA allele	Frequency of allele in the elephant population	
	Savannah elephant	Forest elephant
J	0.05	0.43
K	0.00	0.57
L	0.95	0.00

(i) State what is meant by the term **allele**.

(1)

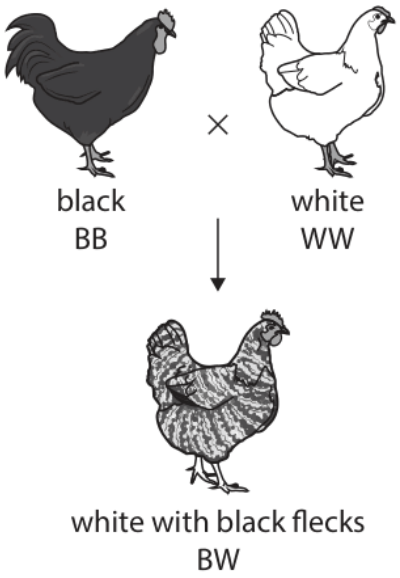
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3 The phenotype of an organism is affected by its genotype.

Chickens have different patterns and colours in their feathers as a result of their genotypes.

The image shows the genotypes and phenotypes of two chickens used in a breeding programme and one of their offspring.

A gene has the alleles B and W.



(a) (i) State what is meant by the following terms.

(2)

Genotype

.....

.....

Phenotype

.....

.....

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Question 3 · A level Paper 1 · June 2019 · Q11(a) · 2 marks

11 Batten disease is a rare, inherited disorder of the nervous system. It usually begins in childhood. It is a recessive disorder.

(a) Explain what is meant by an inherited recessive disorder.

(2)

Question 4 · AS Paper 1 · June 2018 · Q4(b)(i) · 1 mark

(b) Achondroplasia is a genetic condition that causes dwarfism in humans.

Genetic screening can be used to identify achondroplasia in embryos.

Individuals that are heterozygous for achondroplasia have shortened limbs.

Individuals homozygous for achondroplasia will not usually survive for more than one year.

(i) Deduce if achondroplasia is caused by a dominant or recessive allele.

(1)

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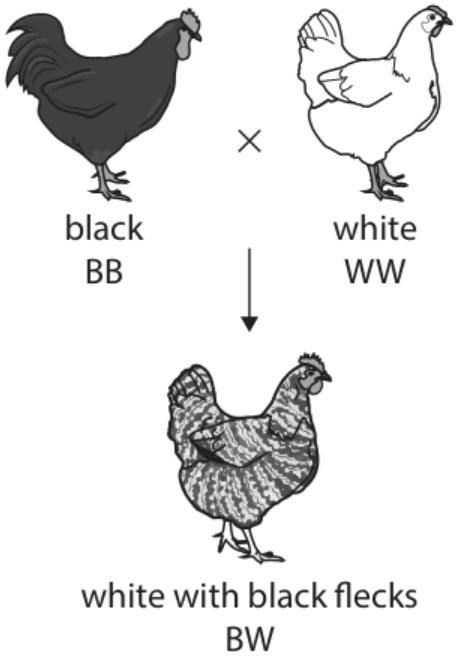
Question 5 · information from earlier in the question

3 The phenotype of an organism is affected by its genotype.

Chickens have different patterns and colours in their feathers as a result of their genotypes.

The image shows the genotypes and phenotypes of two chickens used in a breeding programme and one of their offspring.

A gene has the alleles B and W.



Question 5 · AS Paper 1 · June 2025 · Q3(a)(ii) · 2 marks

(ii) Explain the type of inheritance shown in this example.

(2)

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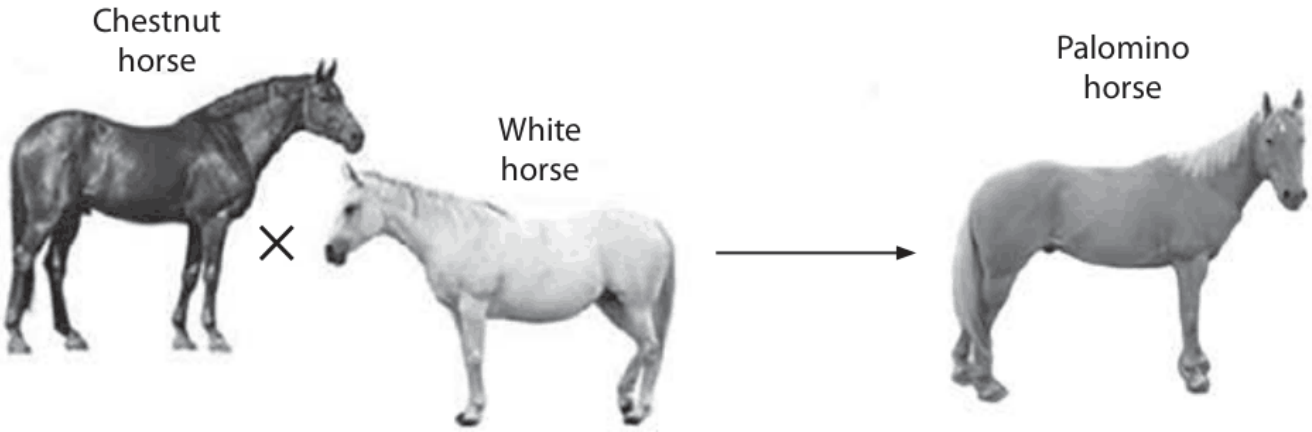
Question 6 · information from earlier in the question

4 The phenotype of organisms is affected by genotype.

(a) Chestnut horses are homozygous for the allele H^C. White horses are homozygous for the allele H^W.

If a chestnut horse is mated with a white horse, the offspring will be palomino.

Palomino horses have coats with a colour intermediate between chestnut and white.



Question 6 · AS Paper 1 · June 2018 · Q4(a)(ii) · 3 marks

(ii) Explain why the offspring have the palomino coat colour.

(3)

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Question 7 · AS Paper 1 · June 2024 · Q2(a) · 3 marks

2 The photograph shows red, white and pink snapdragon flowers.

Plants with genotype F^RF^R have flowers with red petals.

Plants with genotype F^WF^W have flowers with white petals.



(Source: © Irina Kryvasheina/Alamy Stock Photo)

(a) Deduce why heterozygous snapdragon plants produce flowers with pink petals.

(3)

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Question 8 · AS Paper 1 · June 2024 · Q2(b)(i) · 3 marks

(b) (i) Two snapdragon plants with genotype F^RF^W were crossed.

Determine the probability of each petal colour in the offspring of this cross, using a genetic diagram.

(3)

Petal colour	Probability
Pink	
Red	
White	

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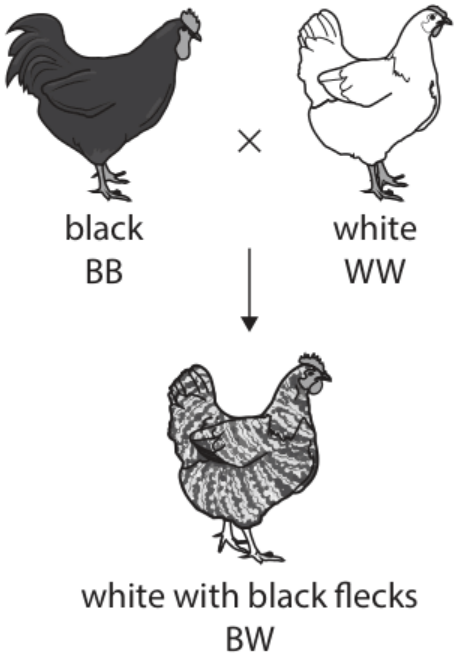
Question 9 · information from earlier in the question

3 The phenotype of an organism is affected by its genotype.

Chickens have different patterns and colours in their feathers as a result of their genotypes.

The image shows the genotypes and phenotypes of two chickens used in a breeding programme and one of their offspring.

A gene has the alleles B and W.



Question 9 · AS Paper 1 · June 2025 · Q3(b)(i) · 3 marks

(b) Two chickens, both white with black flecks, were used in a further breeding programme.

(i) Draw a genetic diagram to find the expected ratio of the phenotypes of the offspring.

(3)

Ratio of named phenotypes:

.....

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Question 10 · information from earlier in the question

(b) Achondroplasia is a genetic condition that causes dwarfism in humans.

Genetic screening can be used to identify achondroplasia in embryos.

Individuals that are heterozygous for achondroplasia have shortened limbs.

Individuals homozygous for achondroplasia will not usually survive for more than one year.

Question 10 · AS Paper 1 · June 2018 · Q4(b)(ii) · 3 marks

(ii) Use a genetic diagram to determine the probability that a child of parents with achondroplasia will be homozygous for this condition.

(3)

Answer .....

Question 11 · A level Paper 1 · November 2021 · Q6(c) · 2 marks

(c) Most cases of hereditary spherocytosis are caused by a dominant allele.

Use a genetic diagram to determine the probability of a child inheriting this condition if one parent is heterozygous and the other parent does not have the condition.

(2)

Answer .....

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Question 12 · A level Paper 2 · June 2022 · Q9(a)(i) · 2 marks

9 The inheritance of coat colour in mice has been investigated.

Some scientists crossed mice that had yellow coats. The offspring had either yellow coats or non-yellow coats.

(a) (i) Explain how the scientists knew which allele for coat colour was recessive.

(2)

Question 13 · A level Paper 2 · June 2022 · Q9(a)(ii) · 2 marks

(ii) The crosses led to a total of 1599 offspring being produced.

Predict the number of yellow and non-yellow offspring produced.

(2)

Offspring with a yellow coat	Offspring with a non-yellow coat

Question 14 · information from earlier in the question

(b) Some people can have a recessive genetic condition of the eye due to a non-functional gene.

Genetically modified viruses can be used to treat these people by introducing a functional version of the gene into the cells of the eye.

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Question 14 · A level Paper 2 · June 2023 · Q7(b)(iii) · 3 marks

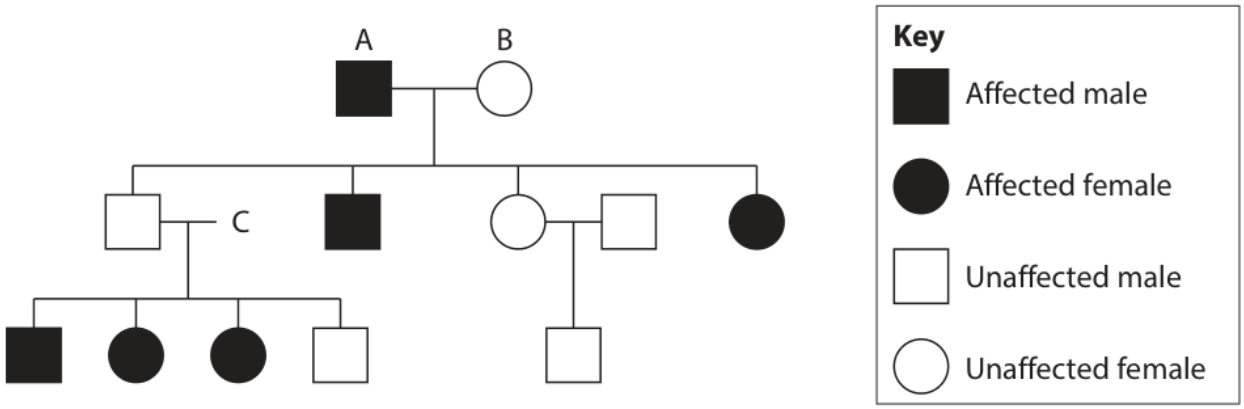
(iii) Explain why a person successfully treated using a genetically modified virus may still have a child with this recessive condition.

(3)

Question 15 · A level Paper 1 · June 2022 · Q5(b)(i) · 1 mark

(b) Porphyria is caused by a dominant allele and may not develop until later in life.

The pedigree diagram shows a family in which some individuals have porphyria.



(i) State the genotype and phenotype of person C.

(1)

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Question 16 · information from earlier in the question

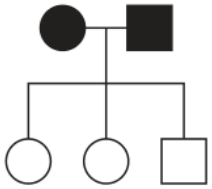
(b) One recessive genetic condition affecting the eye is fundus albipunctatus.

In this condition the speed of rhodopsin formation in rod cells is reduced after exposure to bright light.

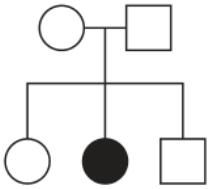
Question 16 · A level Paper 2 · June 2024 · Q7(b)(ii) · 2 marks

(ii) The diagram shows three family pedigrees. Each pedigree shows the inheritance of a different genetic condition. Only one of the pedigree diagrams definitely shows that fundus albipunctatus is inherited as a recessive condition.

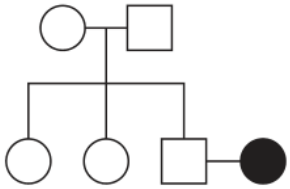
Pedigree 1



Pedigree 2



Pedigree 3



Key
a shaded shape shows the person has the condition

Explain which family pedigree shows the inheritance of fundus albipunctatus.

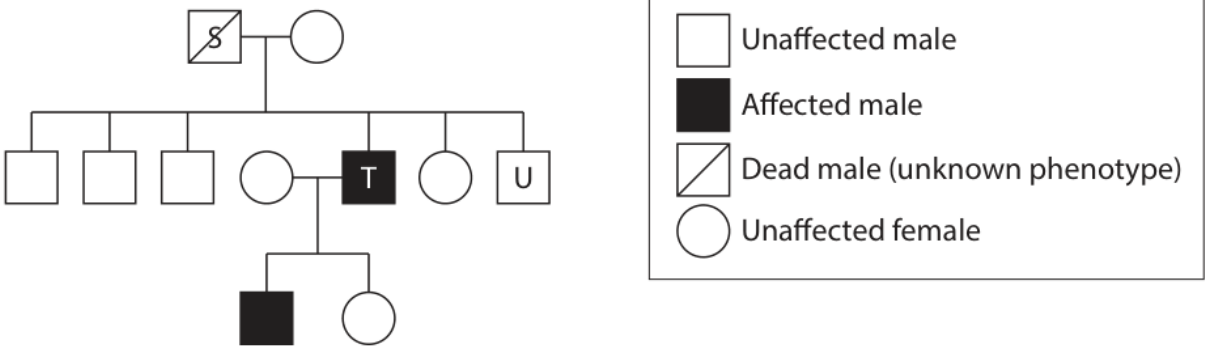
(2)

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(b) Some individuals have a clotting disorder caused by abnormal forms of fibrinogen.

This condition is called dysfibrinogenemia.

The family tree shows the inheritance of dysfibrinogenemia in one family.



In this family, the mutation responsible for dysfibrinogenemia is in the fibrinogen gene located on chromosome 4.

(i) Individual T was heterozygous for this mutation.

State whether this mutation is dominant or recessive.

(1)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 18 · A level Paper 3 · June 2025 · Q3(b)(ii) · 2 marks

(ii) Scientists suggested this was a new mutation in this family originating in the genome of individual T.

Explain why the scientists suggested this.

(2)

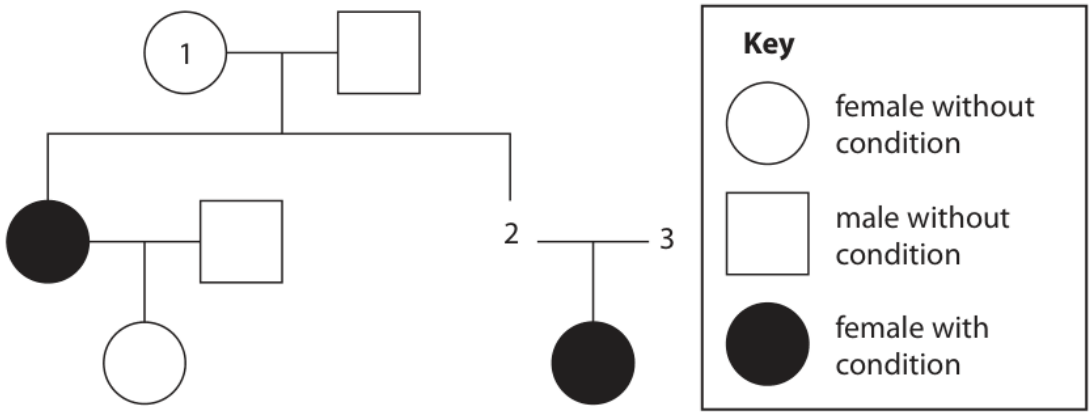
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Question 19 · A level Paper 2 · November 2021 · Q3(c) · 4 marks

(c) Mucopolysaccharidosis type 1 (MPS 1) is a recessive genetic condition.

People with MPS 1 cannot break down mucopolysaccharides.

The pedigree diagram shows the inheritance of MPS 1 in a family.



Determine the probability that person 2 has the same sex and MPS 1 phenotype as person 1.

(4)

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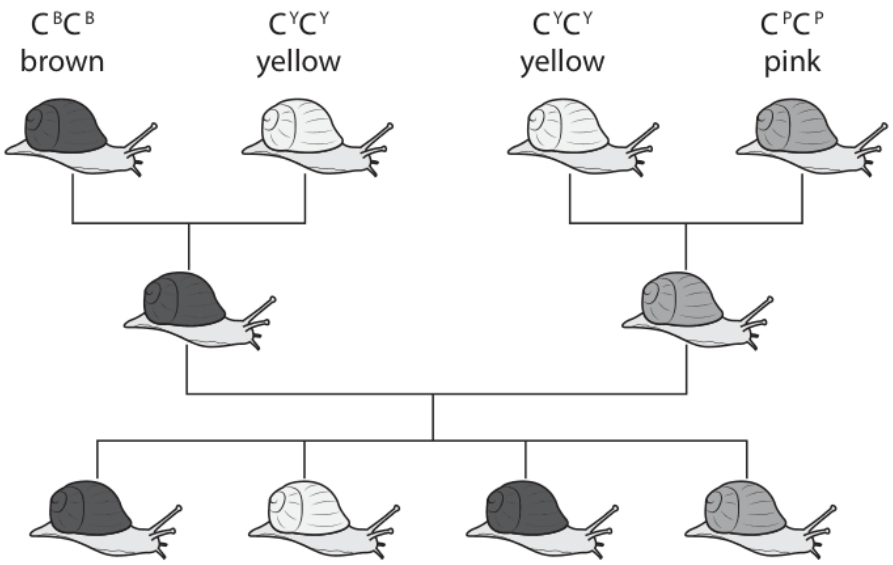
Question 20 · A level Paper 3 · October 2020 · Q2(b) · 2 marks

(b) The shell colour of the banded snail can be yellow, pink or brown.

A single gene controls shell colour in the banded snail.

There are three alleles for this gene, C^Y, C^P, and C^B.

The effects of these alleles on shell colour is shown in the genetic pedigree diagram.



Deduce the dominance of the alleles for shell colour.

(2)

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Mark schemes

Question 1 · A level Paper 1 · June 2017 · Q10(a)(i) · 1 mark

Question Number	Answer
10(a)(i)	A answer that makes reference to the following: • {alternative form / different form / version / variation} of a gene (1)

Additional Guidance	Mark
IGNORE type of gene	1

Question 2 · AS Paper 1 · June 2025 · Q3(a)(i) · 2 marks

Question Number	Answer
3(a)(i)	An answer that makes reference to the following: • (genotype is) the {genetic makeup / combination of alleles} (of the organism) (1) • (phenotype is) the {observable / physical} characteristics resulting from the expression of {genes / alleles} (1)

Additional Guidance	Mark
ALLOW the alleles of {an organism / a gene} ALLOW (phenotype) results from the expression of {genes / genotype} interacting with the environment	(2)

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Question 3 · A level Paper 1 · June 2019 · Q11(a) · 2 marks

Question Number	Answer
11(a)	An explanation that makes reference to the following: • (a recessive disorder is one) caused by a faulty allele (1) • that is only expressed in the { homozygous condition / absence of a normal allele } (1)

Additional guidance	Mark
ALLOW faulty gene ALLOW only expressed if genotype is { homozygous recessive / bb } or if two recessive alleles are inherited	**(2)**

Question 4 · AS Paper 1 · June 2018 · Q4(b)(i) · 1 mark

Question Number	Answer Additional Guidance	Mark
4(b)(i)	• dominant (allele)	**(1)**

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Question 5 · AS Paper 1 · June 2025 · Q3(a)(ii) · 2 marks

Question Number	Answer
3(a)(ii)	An explanation that makes reference to the following: • incomplete dominance / co-dominance (1) • (because) both the **allele** for black feathers and the **allele** for white feathers are expressed (in the phenotype) (1)

Additional Guidance	Mark
ALLOW both **alleles** are expressed DO NOT ALLOW genes for alleles	**(2)**

Question 6 · AS Paper 1 · June 2018 · Q4(a)(ii) · 3 marks

Question Number	Answer
4(a)(ii)	An explanation which makes reference to the following: • (palomino / offspring) is heterozygous (1) • therefore { incomplete dominance / co-dominance } occurs (1) • because both alleles are expressed (1)

Additional Guidance	Mark
ALLOW palomino horses have the genotype $H^C H^W$ or correct genetic diagram to show this ALLOW alleles are co-dominant	**(3)**

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Question 7 · AS Paper 1 · June 2024 · Q2(a) · 3 marks

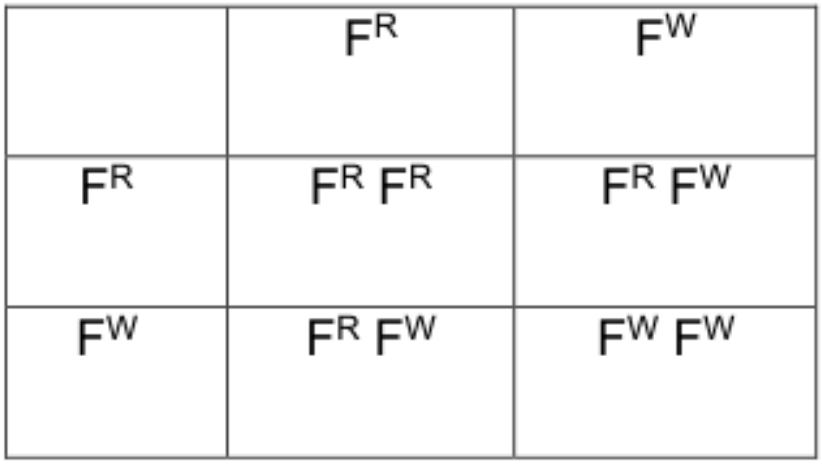
Question Number	Answer
2(a)	An answer that makes reference to three of the following: • incomplete dominance (1) • (the plants with pink petals have genotype) F^RF^W (1) • both the allele for red colour petals and the allele for white colour petals are expressed in the phenotype (1) • (therefore) the flower {has a colour that is intermediate between red and white / has an intermediate phenotype} (1)

Additional Guidance	Mark
ALLOW codominance ALLOW both F^R and F^W are dominant alleles ignore they are dominant alleles unqualified ALLOW both alleles shown in phenotype ALLOW both alleles are expressed ignore genes ALLOW overlap of colours producing pink flowers	**(3)**

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 8 · AS Paper 1 · June 2024 · Q2(b)(i) · 3 marks

Question Number	Answer
2(b)(i)	• correct gametes in Punnett square (1) • correct offspring genotypes (1) • correct probabilities (1)

Additional Guidance	Mark
	(3)

	F^R	F^W
F^R	$F^R F^R$	$F^R F^W$
F^W	$F^R F^W$	$F^W F^W$

Petal colour	Probability
Pink	{0.5 / 50% / ½}
Red	{0.25 / 25% / ¼}
White	{0.25 / 25% / ¼}

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Question 9 · AS Paper 1 · June 2025 · Q3(b)(i) · 3 marks

Question Number	Answer
3(b)(i)	• correct gametes in genetic diagram (1) • correct offspring genotypes (1) • correct ratio for named phenotypes (1)

Additional Guidance	Mark
E.g. <table><tr><td></td><td>B</td><td>W</td></tr><tr><td>B</td><td>BB</td><td>BW</td></tr><tr><td>W</td><td>BW</td><td>WW</td></tr></table> allow WB 1 black : 2 white with black flecks : 1 white ALLOW 1:2:1 without qualification DO NOT ALLOW a different ratio order without named phenotype no ECF	**(3)**

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Question 10 · AS Paper 1 · June 2018 · Q4(b)(ii) · 3 marks

Question Number	Answer
4(b)(ii)	• both parents heterozygous (1) • correct offspring genotypes (from genetic diagram) (1) • correct probability (1) •

Additional Guidance	Mark
ALLOW from gametes in diagram ALLOW ECF 0.25/ 25% / $\frac{1}{4}$ ALLOW ECF	(3)

Question 11 · A level Paper 1 · November 2021 · Q6(c) · 2 marks

Question Number	Answer
6(c)	An answer that makes reference to the following • correct genetic diagram used to determine genotypes of offspring (1) • correct probability 0.5 linked to correct genotypes of offspring (1)

Additional guidance	Mark
e.g. Ss and ss ALLOW 50% / ½ / 1 in 2	(2)

	S	s
s	Ss	ss
s	Ss	ss

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Question 12 · A level Paper 2 · June 2022 · Q9(a)(i) · 2 marks

Question Number	Answer
9(a)(i)	An explanation that makes reference to the following: • the parents were {heterozygous / had a dominant and a recessive allele} as the offspring had both yellow and non-yellow coats (1) • (because the parents had yellow coats) the recessive allele was for non-yellow coat (1)

Additional Guidance	Mark
ALLOW parents were carriers	(2)

Question 13 · A level Paper 2 · June 2022 · Q9(a)(ii) · 2 marks

Question Number	Answer	Additional Guidance	Mark
9(a)(ii)	offspring with a yellow coat: 1199.25 offspring with a non-yellow coat: 399.75 1 mark for each predicted number	ALLOW 1199 for 1199.25 ALLOW 400 for 399.75	(2)

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Question 14 · A level Paper 2 · June 2023 · Q7(b)(iii) · 3 marks

Question Number	Answer
7(b)(iii)	An explanation that makes reference to three of the following: • genetic modification has {only occurred in cells of the eye / not occurred in gametes} (1) • (person treated) has gametes with the allele for the condition (1) • {partner / other gamete} also supplies a recessive allele (1) • mutation occurs in gene of offspring (1)

Additional Guidance	Mark
ALLOW gametes not changed / not infected by virus ALLOW only cells in the eye have the functional gene ALLOW other parent may be a carrier ALLOW non-functional gene on X chromosome / condition sex-linked	[3]

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Question 15 · A level Paper 1 · June 2022 · Q5(b)(i) · 1 mark

Question Number	Answer
5(b)(i)	• (the genotype is) heterozygous and (the phenotype is) affected with the disease (1)

Additional guidance	Mark
ALLOW any upper case and lower case letter to show heterozygous e.g. Pp IGNORE male/female	(1)

Question 16 · A level Paper 2 · June 2024 · Q7(b)(ii) · 2 marks

Question Number	Answer
7(b) (ii)	An explanation that makes reference to the following: • (pedigree) 2 (1) • (as only pedigree 2) shows parents { without the condition / heterozygous parents / carriers } having a child with the condition (1)

Additional Guidance	Mark
	2

Question 17 · A level Paper 3 · June 2025 · Q3(b)(i) · 1 mark

Question number	Answer	Additional guidance	Mark
3(b)(i)	An answer that makes reference to the following: • dominant		(1)

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Question 18 · A level Paper 3 · June 2025 · Q3(b)(ii) · 2 marks

Question number	Answer
3(b)(ii)	An explanation that makes reference to two of the following: • (T did not inherit mutation from mother) because the mother is homozygous recessive (1) • none of individual T's siblings are affected / only T out of the six offspring had the condition (1) • if mutation was present in individual S then more in T's generation {likely to be / would be} affected (1)

Additional guidance	Mark
(Assume that 'father', 'mother', 'siblings/offspring' are in relation to T) ALLOW mother does not have the {mutation / condition} /the mother is unaffected ALLOW only T is affected ALLOW more detailed descriptions e.g. if individual S was homozygous dominant would expect all of individual T's generation to be affected for both MP2 and 3	(2)

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Question 19 · A level Paper 2 · November 2021 · Q3(c) · 4 marks

Question Number	Answer
3(c)	An answer that makes reference to the following: • 0.5 probability for being { same sex / female} (1) • person 1 is heterozygous for MPS 1 (1) • (therefore) person 2 has a 0.75 probability of having same phenotype as person 1 for MPS 1 (1) • therefore probability of being female and not having MPS 1 will be 0.375 (1)

Additional guidance	Mark
ALLOW 50% for 0.5 ALLOW detail of proof of phenotype of person 1 e.g. does not show condition therefore has to have one dominant allele but (at least) one daughter has condition so received a recessive allele from person 1 ALLOW carrier for heterozygous ALLOW 75% for 0.75 ALLOW $^{3}/_{8}$ or 37.5% for 0.375	**(4)**

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Question 20 · A level Paper 3 · October 2020 · Q2(b) · 2 marks

Question number	Answer
2(b)	An answer that makes reference to the following: • $\{C^B / C^P\}$ is dominant and C^Y is recessive • the order of dominance is C^B over C^P over C^Y

Additional guidance	Mark
ALLOW C^B is dominant over C^P / C^P is dominant over C^Y / C^B is dominant over C^Y ALLOW brown is dominant to yellow and pink / pink is dominant to yellow ALLOW both marks if correct order of dominance stated	**(2)**

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