Science 1.9 AS 90948 Demonstrate understanding of biological ideas relating to genetic variation

Writing Excellence answers to **Test Cross** questions

Test Cross QUESTION	
Question: Discuss how a farmer could develop a group of sheep that are pure breeding for white wool. Use **R** to represent the dominant allele for common white wool, and **r** to represent the recessive allele for black wool. In your answer you should: • state the genotypes of the male and female sheep the farmer should use to breed from • explain how the animal breeder can determine the genotypes of the male and female to produce sheep that all have white wool. You should include at least two Punnett squares with your explanation • explain how the animal breeder could make sure that the offspring would always be pure breeding.	
ANSWER	
1. Explain the **genotype** of the parents needed to produce a pure breeding white group	To breed a group of white sheep, a breeder should use sheep that are both RR. Homozygous dominant
2. describe how a **test cross** could be used to find out a sheep genotype (RR or Rr) Draw **2 Punnett Squares**	The breeder can determine if a white sheep is RR by crossing a white sheep with a black sheep. The black sheep is homozygous recessive and will give 1 black allele (r) to each offspring) Possible outcomes gametes ♂ r r / ♀ R: R r, R r / ♀ R: R r, R r Punnett square 1 - If the phenotypes are all White wool then the unknown genotype is RR gametes ♂ r r / ♀ R: R r, R r / ♀ r: r r, r r Punnett square 2 - If any of the phenotypes appear as Black Wool then the unknown genotype is Rr
3. explain the results of the test cross if the sheep was **RR** (Homozygous dominant) or pure breeding – link to Punnett Square	If the white sheep is RR, none of the offspring will be black. As the sheep gave one R allele to each offspring and as this is dominant then the offspring will all be white – this can be seen in Punnett square 1
4. explain the results of the test cross if the sheep was **Rr** (Heterozygous)or not pure breeding – link to Punnett Square	If a black offspring is produced, the breeder can be certain the white parent was Rr. As black sheep are only produced when the offspring inherit a recessive (black) allele from each parent. – this can be seen in Punnett square 2
5. explain the need for **many crosses** and link to chance	The breeder would need to carry out many crosses to show that it was not just due to chance that a black sheep had not been produced, as Punnett squares are only predictions.
6. explain the **requirements** for a pure breeding white flock of sheep	The farmer should breed only with an RR male and white wool females, as this will ensure that all offspring are white.
7. discuss how a farmer could **continue to develop** a pure breeding white flock of sheep	if any black sheep appeared they should not be allowed to breed as this would remove the recessive allele from the group. Eventually the flock would become pure breeding with no r alleles present

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.