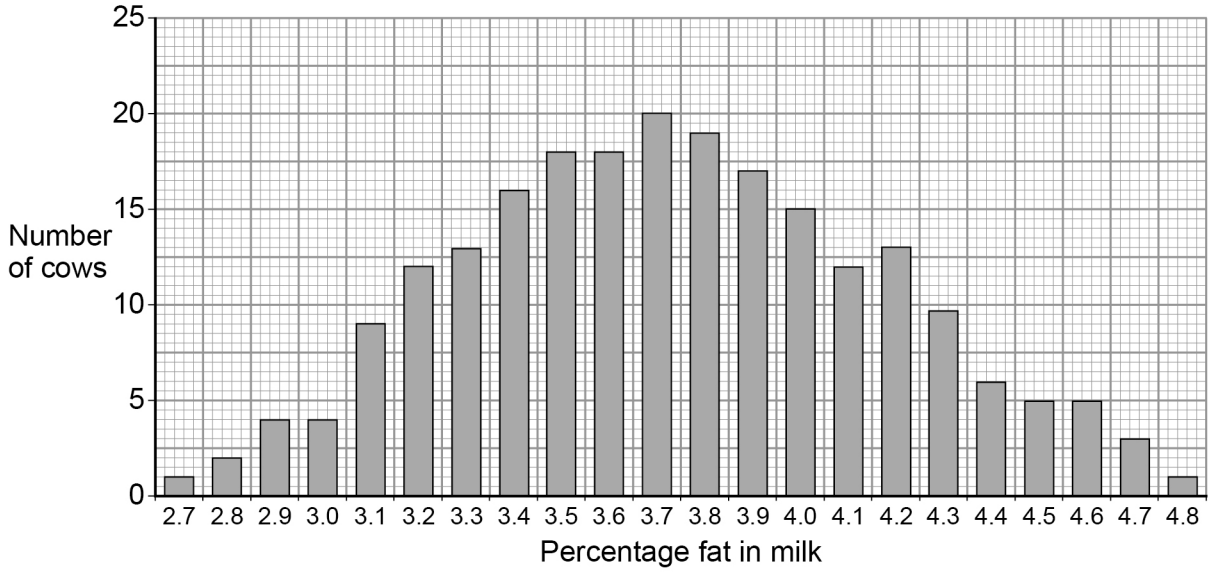
0 8 Scientists want to breed cows that produce milk with a low concentration of fat.

Figure 10 shows information about the milk in one group of cows.

The cows were all the same type.

Figure 10



0 8 . 1 In **Figure 10** the mean percentage of fat in the milk is equal to the modal value.

Give the mean percentage of fat in the milk of these cows.

[1 mark]

Mean percentage = _____

0 8 . 2 A student suggested:

'The percentage of fat in milk is controlled by one dominant allele and one recessive allele.'

How many different phenotypes would this produce?

[1 mark]

Tick **one** box.

2		3		22		46	

Do not write outside the box

0 8 . 3 Give the evidence from **Figure 10** which shows the percentage of fat in the milk is controlled by several genes.

[1 mark]

0 8 . 4 One of the genes codes for an enzyme used in fat metabolism.

A mutation in this gene causes a reduction in milk fat.

The mutation changes one amino acid in the enzyme molecule.

Explain how a change in one amino acid in an enzyme molecule could stop the enzyme working.

[3 marks]

Question 8 continues on the next page

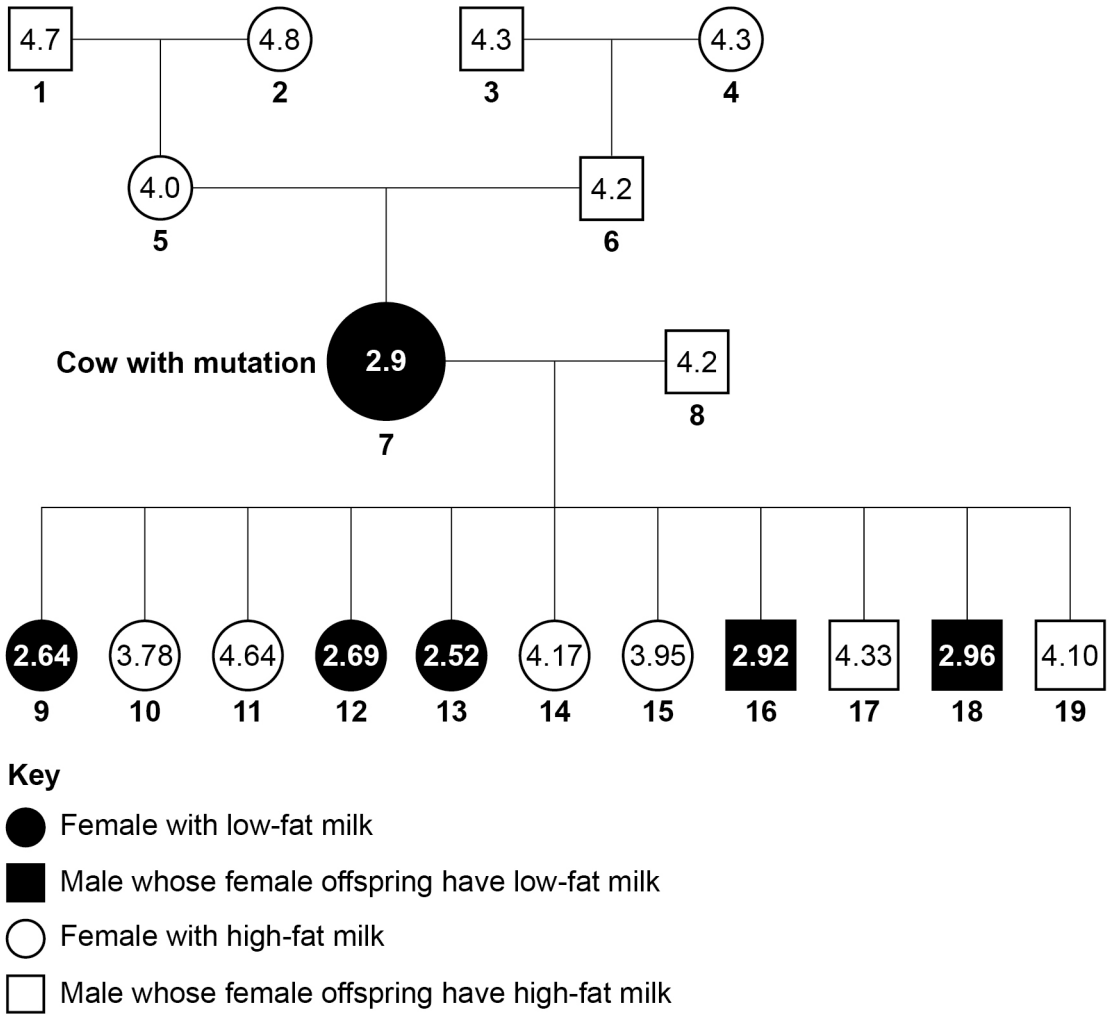
The scientists found one cow with a mutation.

The cow's milk contained only 2.9% fat.

Figure 11 shows the percentage of fat in the milk of cattle related to the cow with the mutation.

The values for male cattle are the mean values of their female offspring.

Figure 11



Do not write outside the box

0 8 . 5 Animal **8** is homozygous.

The mutation in animal **7** produced a dominant allele for making low-fat milk.

Give evidence from **Figure 11** that animal **7** is heterozygous.

[1 mark]

0 8 . 6 Animals **7** and **8** produced 11 offspring. These offspring were produced by in vitro fertilisation (IVF).

The embryos from IVF were transferred into 11 other cows.

Suggest why IVF and embryo transfer were used rather than allowing animals **7** and **8** to mate naturally.

[1 mark]

0 8 . 7 Draw a Punnett square diagram to show a cross between animals **7** and **8**.

Identify which offspring produce low-fat milk and which offspring produce high-fat milk.

[4 marks]

Use the following symbols:

D = dominant allele for making low-fat milk

d = recessive allele for making high-fat milk

Do not write outside the box

0 8 . 8 The scientists want to produce a type of cattle that makes large volumes of low-fat milk.

The scientists will selectively breed some of the animals shown in **Figure 11**.

Describe how the scientists would do this.

[4 marks]

16

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	3.7		1	AO2 4.7.2.1
08.2	2		1	AO1 4.6.1.6
08.3	(different combinations of alleles cause) many / 22 values **or** in-between values **or** large range of values **or** there are not only two values	allow continuous variation allow there are not only 3 values if 3 is given in question **08.2**	1	AO3 4.6.1.6 4.6.2.1
08.4	different protein made active site changed so substrate does not fit / bind	allow change in shape (of enzyme) or change in 3-D structure ignore denature allow description of substrate allow cannot form E-S complex ignore lock and key description	1 1 1	AO1 4.2.2.1 4.6.1.5
08.5	produces (some) offspring with high-fat milk **or** not all offspring have low-fat milk	ignore reference to alleles	1	AO3 4.6.1.6
08.6	takes less time (to obtain results) **or** more offspring at the same time	allow other sensible suggestion – eg allows screening **or** allow cow 7 to continue to produce eggs **or** avoid injury to cow 7 during mating or giving birth	1	AO3 4.5.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7		**max 3** marks if own symbols used with no key **max 3** marks if alternative diagram to Punnett square used		AO2 4.6.1.6
	male gametes correct: d (and d)		1	
	female gametes correct: D and d	allow **1** mark if gametes are correct but gender not identified	1	
	correct derivation of offspring genotypes from given gametes	allow 2 × 2 **or** 2 × 1 derivation	1	
	Dd identified as low-fat **and** dd identified as high-fat in offspring	if DD offspring are produced, must also identify as low-fat	1	
08.8	find female with low(est) fat in milk **and** high(est) milk yield	allow choose from 7, 9, 12, 13 which has the highest yield	1	AO3 4.6.2.3
	find male whose female offspring have high(est) milk yield **and** low(est) fat in milk **or**	allow choose from 16 or 18 whose female offspring has the highest yield	1	AO3 4.6.2.3
	find female with lowest fat in milk **or** cow 13 (1) **or** find male whose female offspring have high(est) milk yield (1)	allow female with high(est) milk yield allow male whose female offspring have lowest fat in milk / male 16		
	cross the best (for both features) female with the best male		1	AO2 4.6.2.3
	select best offspring (for both features) from each generation and repeat for several generations		1	AO2 4.6.2.3
Total			**16**	