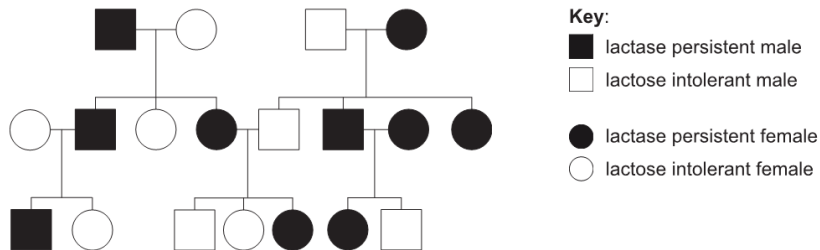


## Exercises 3.4. Inheritance [6 marks]

1. An allele for lactase persistence allows humans to digest milk as adults. People who lack this allele are lactose intolerant in adulthood. [1 mark]



What is the pattern of inheritance?

- A. Lactase persistence is sex-linked recessive.
- B. Lactase persistence is autosomal recessive.
- C. Lactase persistence is sex-linked dominant.
- D. Lactase persistence is autosomal dominant.

### Markscheme

D

2. A child has blood group A. The father of the child has blood group B. What are the possible genotypes of the mother? [1 mark]

I.  $I^A I^A$

II.  $I^A I^B$

III.  $I^A i$

A. I only

B. I and II only

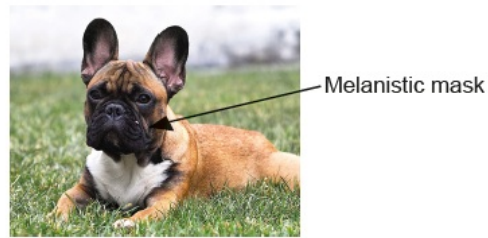
C. II and III only

D. I, II and III

### Markscheme

D

3. Some breeds of dogs are characterized by the presence of a melanistic mask, which is [1 mark]  
a darkening of the fur near the nose, as shown by the arrow in this photograph.



[Source: [https://commons.wikimedia.org/wiki/File:French\\_bulldog\\_on\\_the\\_grass.jpg](https://commons.wikimedia.org/wiki/File:French_bulldog_on_the_grass.jpg)]

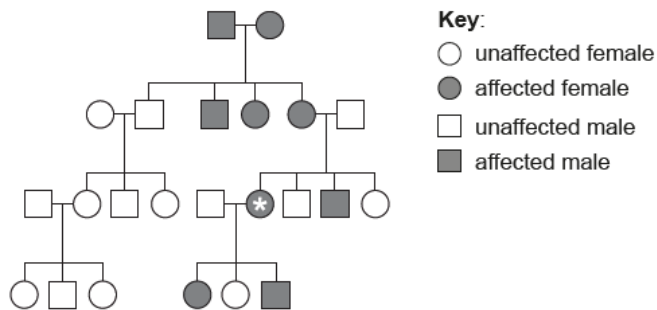
Which outcome is matched with a valid conclusion if dogs that were pure breeding for melanistic masks were crossed with dogs without melanistic masks?

- A. If 0 % of the puppies have a mask, the character is recessive.
- B. If 25 % of the puppies have a mask, the character is dominant.
- C. If 75 % of the puppies have a mask, the character is dominant.
- D. If 100 % of the puppies have a mask, the character is recessive.

## Markscheme

A

This is a pedigree chart of a family with hypophosphatemia, an X-linked condition, in which bone deformities occur because of poor absorption of phosphates into the blood.



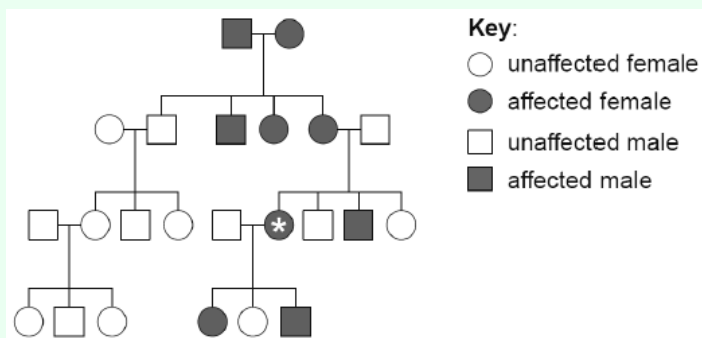
- 4a. Using the pedigree chart, deduce the type of allele that causes hypophosphatemia. [2 marks]

## Markscheme

a. dominant (allele)

*Reject dominant disease/homozygous dominant.*

b. all the offspring of the first generation would be affected if the allele was recessive (and one son is unaffected) / affected mothers could only have affected sons if the allele was recessive (and the pedigree shows that they can have both affected and unaffected sons) / affected mothers who have an unaffected son must be carriers of allele for being unaffected so the allele for being affected must be dominant / unaffected fathers could not have affected sons/daughters/children if the unaffected allele was dominant (and the pedigree shows that they can)



*There must be a coherent argument here and not just observations about individuals on the pedigree chart, but the argument can be expressed in various ways and can be shown using a Punnett square or other genetic cross diagram. Do not accept arguments that involve ratios between the phenotypes.*

- 4b. Identify the genotype of the individual marked with a star in the pedigree chart, using appropriate symbols for your answer. [1 mark]

## Markscheme

$X^H X^h$  «where H = hypophosphatemia and h = normal «absorption of phosphate»»

*For the mark, allow any upper and lower case versions of the same letter, as long as they are shown superscript to an X to indicate sex-linkage.*