

- 4 (a) Lactose is a sugar found in milk. It is digested by an enzyme called lactase. Some people cannot make lactase. The condition they have is called lactose intolerance.

The condition is caused by a recessive allele. This means that only people with the homozygous recessive genotype can be lactose intolerant.

- (i) What is meant by the term **homozygous**?

(1)

- (ii) State the two possible genotypes of an individual who is **not** lactose intolerant.

Use the symbols **D** for the dominant allele and **d** for the recessive allele.

(2)

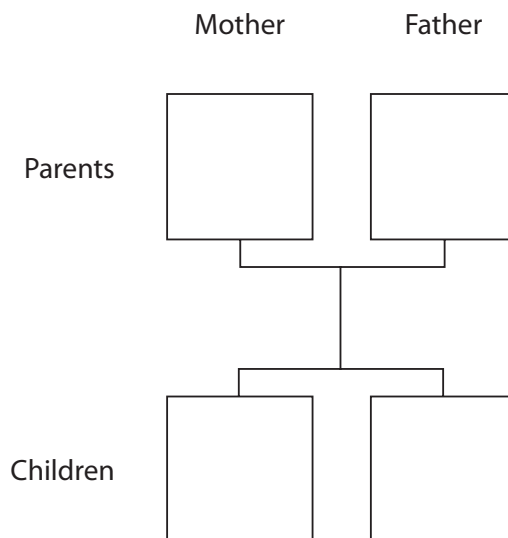
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- (b) (i) A homozygous dominant mother and a homozygous recessive father have two children.

In the boxes below give the genotypes of the parents and their children.

(2)



- (ii) What is the probability that the children are lactose intolerant?

(1)

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- (c) People from different countries were tested to find out if they were lactose intolerant. The table shows the number of people who were tested in each country and the percentage who were lactose intolerant.

Country	Number of people tested	Percentage who were lactose intolerant
A	160	4
B	315	12
C	134	18
D	20	75
E	59	89
F	71	93
G	134	98
H	24	100

- (i) The population size of country B is 190 million.

Calculate the number of people in this country likely to be lactose intolerant.

Show your working.

(2)

Answer

- (ii) Suggest a reason why the value of 100% for country H may not be correct.

(1)

(Total for Question = 9 marks)

- 5 Human blood group is an example of a phenotype determined by alleles that show codominance.

The table shows the different blood groups and their genotypes.

Blood group	Genotypes
A	$I^A I^A$ or $I^A I^O$
B	$I^B I^B$ or $I^B I^O$
AB	$I^A I^B$
O	$I^O I^O$

(a) Explain what is meant by the term **codominance**.

(1)

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- (b) A man with blood group A married a woman with blood group B. They had four children, each with a different blood group.

Use a genetic diagram to show this cross.

(3)

Genotypes of the parents

Gametes

Genotypes of the offspring

(Total for Question = 4 marks)

- 1 Mendel crossed together pure breeding pea plants with purple flowers and pure breeding pea plants with white flowers. The offspring plants all had purple flowers.

(a) Explain which phenotype is dominant.

(2)

- (b) In a second cross, the purple offspring plants were self-pollinated (pollen from a flower put on the stigma of the same flower).

Suggest how Mendel made sure that all the purple offspring plants were self-pollinated.

(2)

- (c) (i) Use a genetic diagram to show the ratio of plants expected by crossing the purple offspring plants in part (b).

Show the parental genotypes and gametes, and the offspring genotypes and phenotypes. Use **F** and **f** to represent the alleles.

(4)

Parent genotypes

Gametes

Offspring genotypes

Offspring phenotypes

- (ii) The plants actually produced in this cross were 36 purple and 8 white flowered plants.

Calculate the ratio of purple to white flowered plants.

(1)

Answer

- (iii) Suggest why the actual ratio of phenotypes differs from the one predicted by your genetic diagram.

(2)

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(d) A student suggested that purple flowers are more likely to be visited by bees than white flowers.

Use your knowledge of natural selection to suggest how this might affect the number of purple and white flowers in the wild.

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(Total for Question = 16 marks)