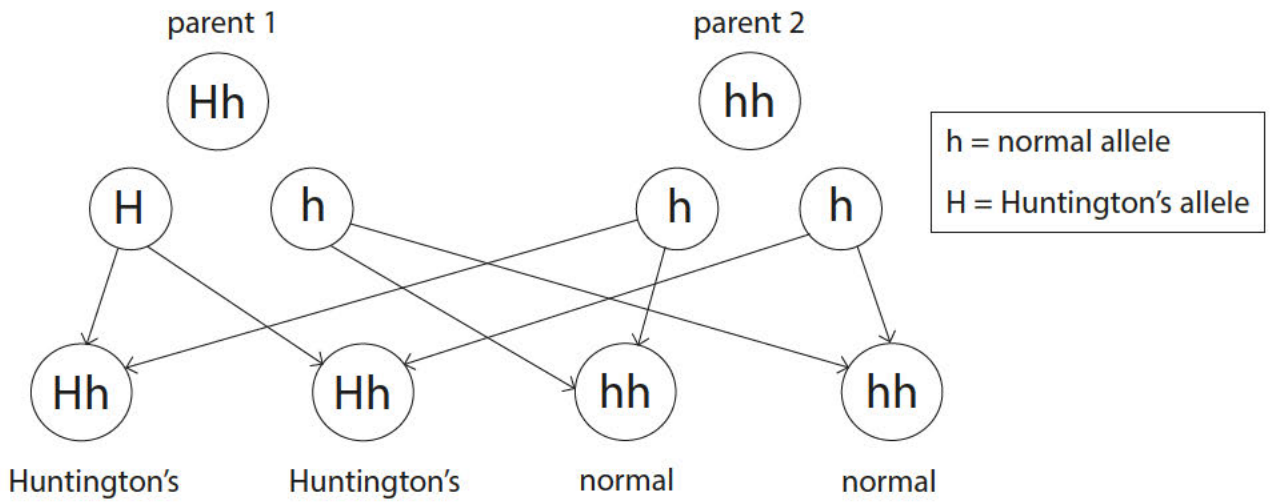
1 Huntington's disease is a genetic disorder.

The genetic diagram shows the inheritance of this disorder.



(a) (i) Use words or letters from the box to complete the following sentences.

(2)

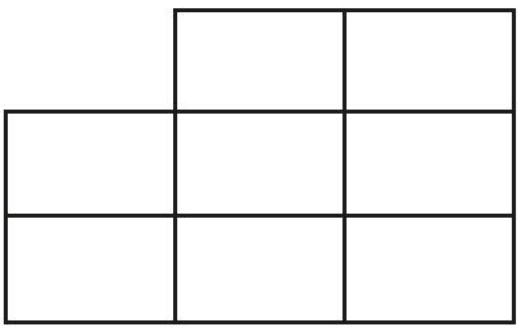
dominant	recessive	phenotype
h	HH	hh

Huntington's disease is caused by a ..... allele.

People with Huntington's disease can have the genotype Hh or ..... .

(ii) Complete the Punnett square to show the potential offspring of two parents heterozygous for Huntington's disease.

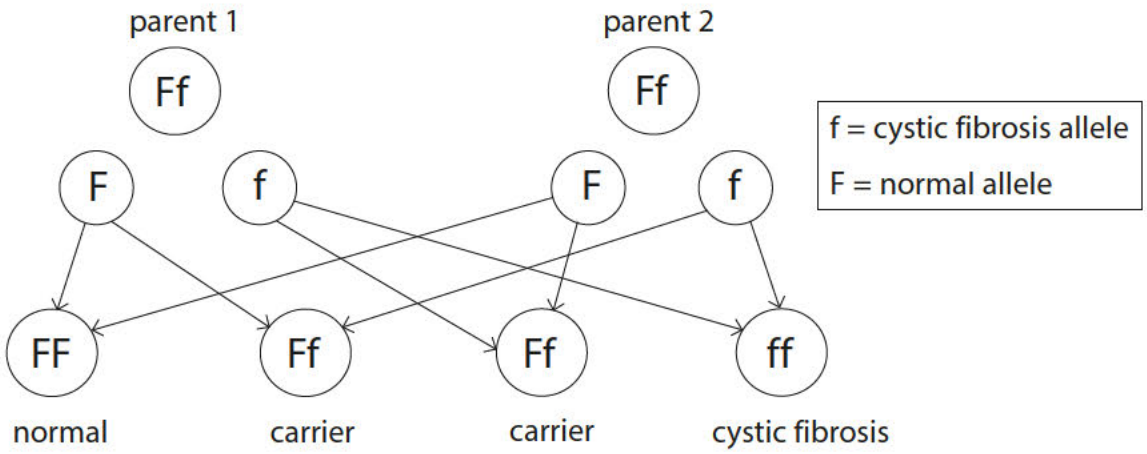
(2)



(iii) State the probability that a child of two parents, heterozygous for Huntington's disease, will have the disease.

(1)

(b) The genetic diagram shows the inheritance of cystic fibrosis.



(i) Explain why, if both sets of parents are heterozygous, the chance of inheriting Huntington's disease is greater than the chance of inheriting cystic fibrosis.

(2)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A symptom of cystic fibrosis is the overproduction of

(1)

- ☐ **A** mucus
- ☐ **B** red blood cells
- ☐ **C** stomach acid
- ☐ **D** white blood cells

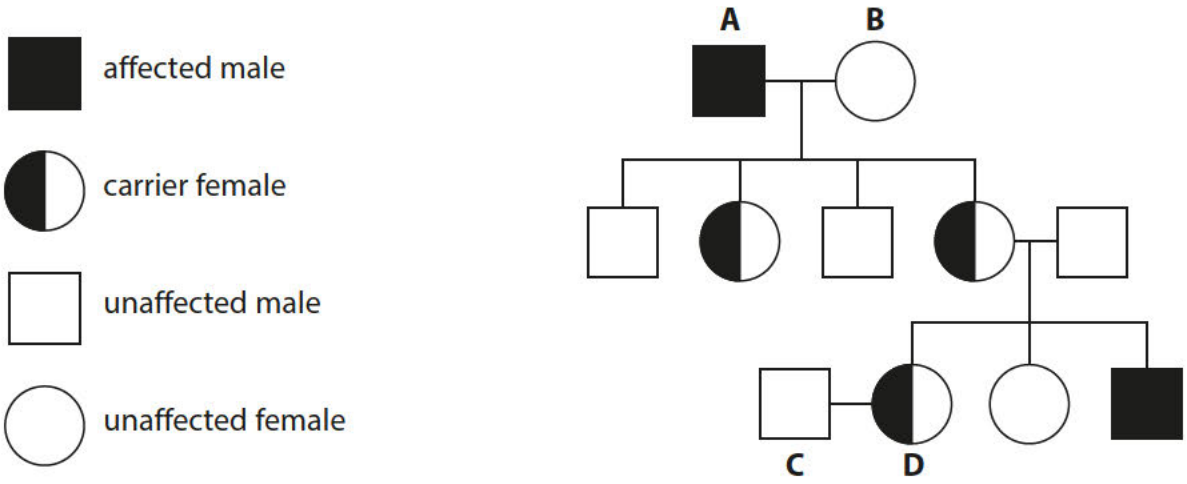
(iii) Explain why a man with cystic fibrosis may be infertile.

(2)

(Total for Question 1 = 10 marks)

2 Haemophilia is a recessive sex-linked disorder.

This family pedigree shows the inheritance of haemophilia.



(a) (i) State the sex chromosomes of person **B**.

(1)

.....

(ii) Explain why the male offspring from **A** and **B** do not have haemophilia.

(2)

.....

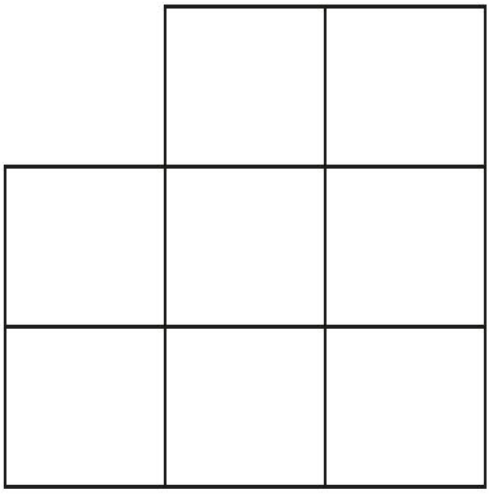
.....

.....

.....

(iii) Using the Punnett square, calculate the probability that individuals **C** and **D** could have a child with haemophilia.

(3)



(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

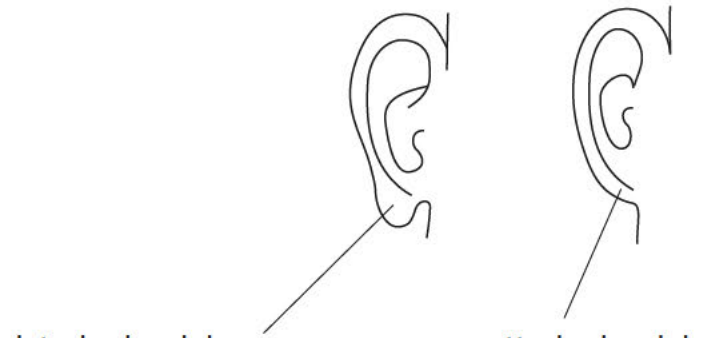
The conditions inside a fermenter have to be carefully controlled.

Explain why **one** named condition must be controlled in a fermenter.

(2)

(Total for Question 2 = 8 marks)

3 (a) The earlobes of an individual are detached or attached. This is determined by the alleles inherited from their parents.



An individual with attached earlobes must have inherited two recessive alleles from each of their parents and will have the genotype **ee**.

(i) State the genetic term used to describe an individual with the genotype **ee** for attached earlobes.

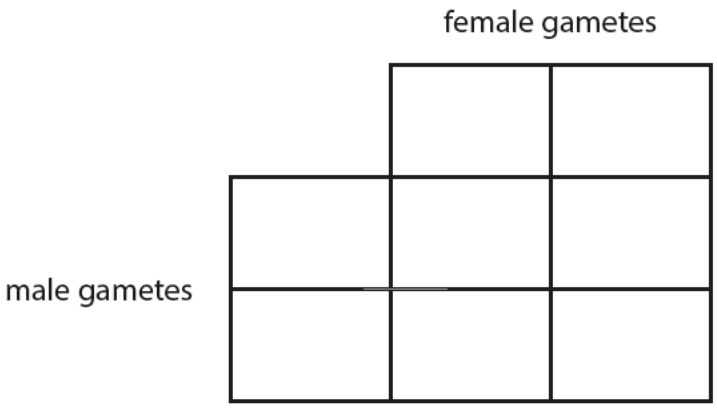
(1)

.....

(ii) A female with the genotype **ee** has attached earlobes and a male with the genotype **Ee** has detached earlobes.

Complete the Punnett square to show the gametes and genotypes of the offspring for this female and male.

(2)



(iii) State the probability of the offspring having detached earlobes.

(1)

.....

(iv) What is the percentage probability of a homozygous dominant mother and homozygous recessive father producing a child with attached earlobes?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0%

☒ **B** 25%

☒ **C** 75%

☒ **D** 100%

(b) Cystic fibrosis is a genetic disorder that is caused by the inheritance of two recessive alleles.

Describe the symptoms of cystic fibrosis.

(3)

.....

.....

.....

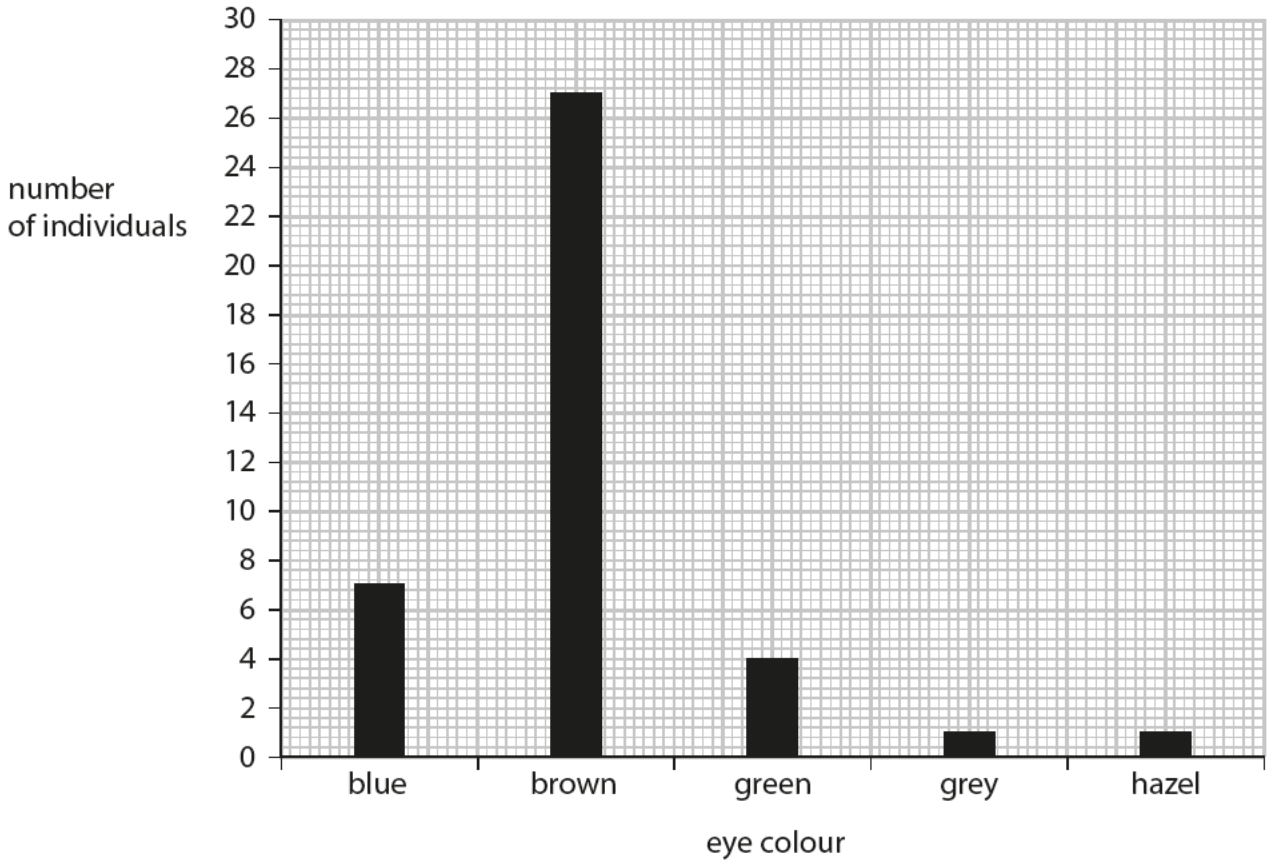
.....

.....

.....

(Total for Question 3 = 8 marks)

4 (a) The graph shows the variation in eye colour in a human population.



(i) How many individuals had their eye colour recorded in this human population?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 7

☒ **B** 27

☒ **C** 30

☒ **D** 40

(ii) Calculate the percentage of individuals with brown eyes in this human population.

(2)

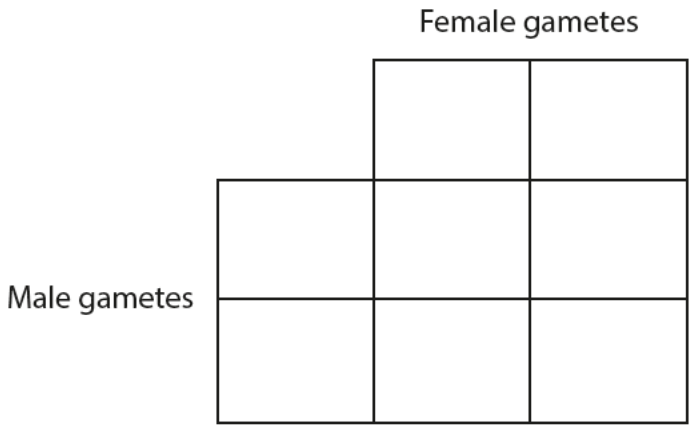
answer = ...%

(b) An individual's eye colour is determined by the alleles they inherit from their parents.

A female parent with the genotype **(bb)** had blue eyes and a male parent with the genotype **(Bb)** had brown eyes.

(i) Complete the Punnett square to show the gametes of the parents and the genotypes of the offspring.

(2)



(ii) If these two parents have one child, state the probability that this child would have blue eyes.

(1)

.....

(iii) Give the genetic term that describes the genotype **(bb)**.

(1)

.....

(c) Variation may arise due to the geographic isolation of a species.

Explain how geographic isolation of members of one species can lead to a new species evolving.

(3)

.....

.....

.....

.....

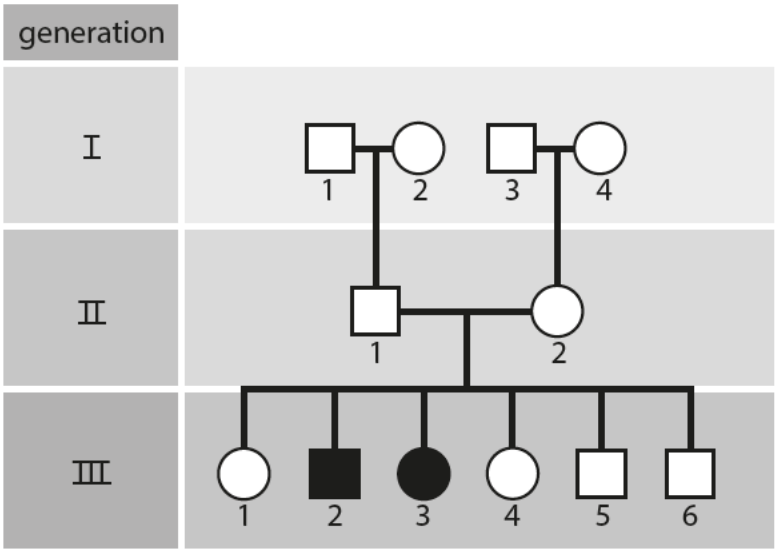
.....

.....

(Total for Question 4 = 10 marks)

5 Cystic fibrosis is a genetic disorder caused by recessive alleles.

The diagram shows the inheritance of cystic fibrosis in a family.



key		
female	male	
○	□	unaffected individual
●	■	affected individual

(a) (i) State the number of offspring in generation III who will have the disorder cystic fibrosis.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

In generation III, individual 3 is

(1)

☒ **A** a carrier of the cystic fibrosis allele

☒ **B** heterozygous for cystic fibrosis

☒ **C** homozygous dominant for cystic fibrosis

☒ **D** homozygous recessive for cystic fibrosis

(iii) Explain why both individuals in generation II must be heterozygous for cystic fibrosis.

(2)

.....

.....

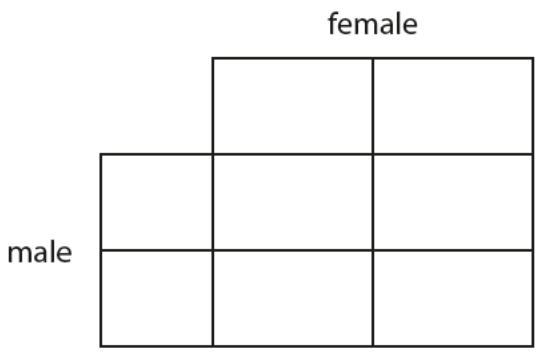
.....

.....

(b) Complete the Punnett square to illustrate the inheritance of cystic fibrosis from the two heterozygous parents in generation II.

Use B for the dominant allele and b for the recessive allele.

(2)



(c) Explain why pedigree analysis would be important to the unaffected individuals in generation III.

Use percentages or ratios to help illustrate this.

(2)

.....

.....

.....

.....

(Total for Question 5 = 8 marks)