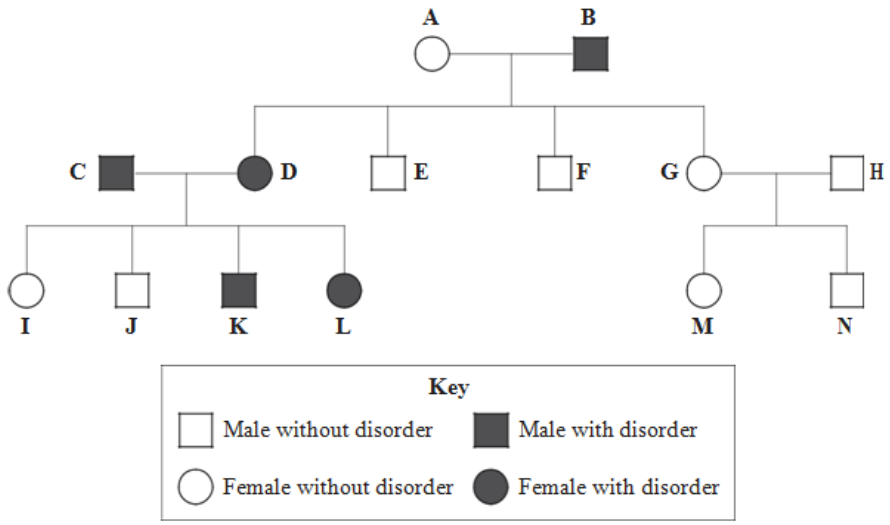
Inherited Disorders

Q:1 The diagram shows a family tree in which some individuals have an inherited disorder, which may cause serious long-term health problems.



(a) What proportion of the children of A and B have the disorder?

_____

(1 mark)

(b) Explain the evidence from the diagram which shows that the allele for the disorder is dominant.

Use the appropriate letters to identify individuals in your answer.

You may use genetic diagrams in your explanation. There is space for you to draw a genetic diagram at the top of the facing page.

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(3 marks)

(c)(i) What is meant by 'embryo screening'?

(1 mark)

(c)(ii) A doctor suggests that couple C and D should have their embryos screened but that couple G and H do not need this procedure.

Explain the reasons for the doctor's suggestions.

(3 marks)

Q:2 (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families. Neither of them has cystic fibrosis.

Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol A for the dominant allele and the symbol a for the recessive allele.

(3 marks)

(b) Mr and Mrs Smith decided to visit a genetic counsellor who discusses embryo screening. Read the information which they received from the counsellor.

Under an anaesthetic five eggs will be removed from Mrs Smith's ovary.

The eggs will be fertilised in a dish using Mr Smith's sperm cells.

The embryos will be grown in the dish until each embryo has about thirty cells.

One cell will be removed from each embryo and tested for cystic fibrosis.

A suitable embryo will be placed into Mrs. Smith's uterus and she may become pregnant.

Any unsuitable embryos will be killed.

(b)(i) Suggest why it is helpful to take five eggs from the ovary, rather than just one.

(1 mark)

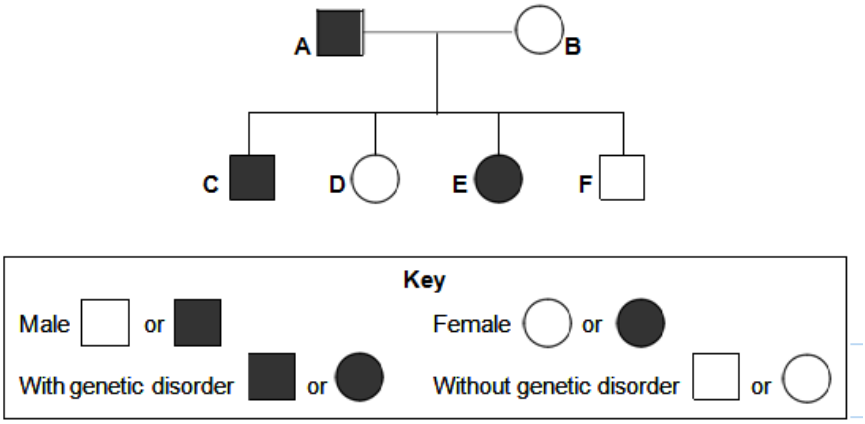
(b)(ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion as part of your evaluation.

(4 marks)

Q:3 The diagram shows the family tree of a pair of pigs, A and B. Pigs A and B have four offspring, C, D, E and F.

Some of the pigs have a genetic disorder.



(a) Which pig, A, B, C, D, E or F, is:

(a) (i) a male pig with the genetic disorder

☐

(1 mark)

(a) (ii) a female pig without the genetic disorder?

☐

(1 mark)

(b) Draw a ring around the correct answer to complete the sentences.

Pig C has the genetic disorder.

(b) (i) Pig C inherited the genetic disorder from

pig A.
pig B.
pig E.

(1 mark)

(b) (ii) The gene for the genetic disorder was passed on in

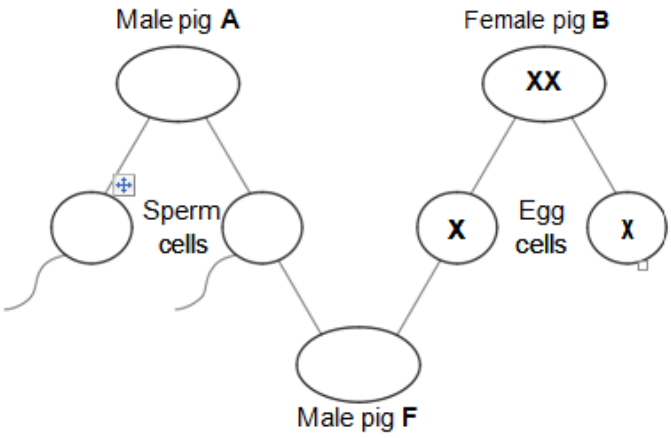
an embryo.
an enzyme.
a gamete.

(1 mark)

(c) Pig F is a male.

Complete the diagram to show how the sex of pig F depends on the inheritance of the sex chromosomes X and Y.

The sex chromosomes of pig B and the egg cells have been completed for you.



(3 marks)

Q:5 Cystic fibrosis and Huntington's disease are inherited disorders.

(a) Someone can be a carrier of cystic fibrosis.

Explain how.

You may include a genetic diagram in your answer.

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_____

_____

_____

(2 marks)

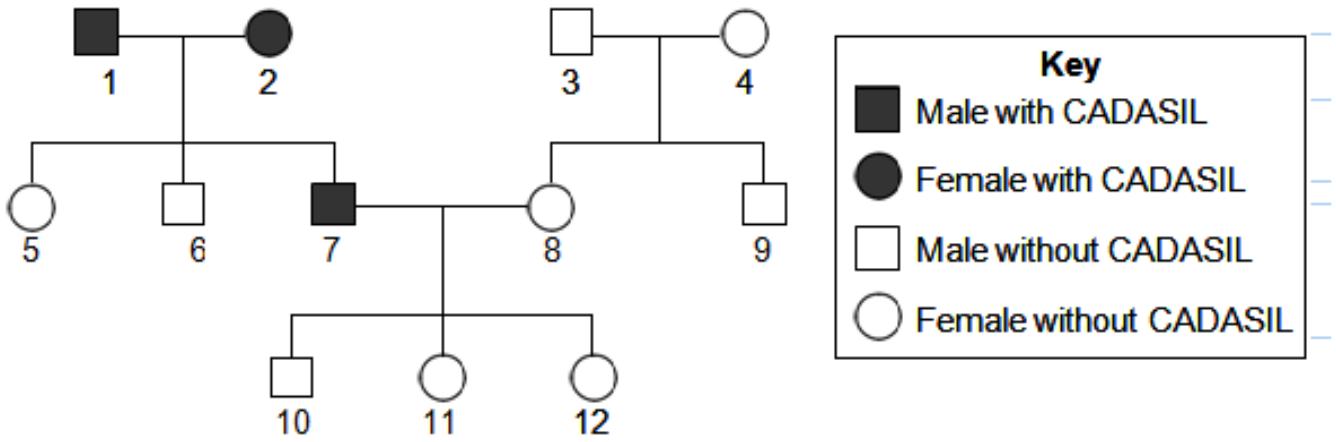
(b) Why does only one parent need to have the Huntington's disease allele for a child to inherit Huntington's disease?

_____

_____

(1 mark)

Q:6 CADASIL is an inherited disorder caused by a dominant allele. CADASIL leads to weakening of blood vessels in the brain. The diagram shows the inheritance of CADASIL in one family.



(a) CADASIL is caused by a dominant allele.

(a) (i) What is a dominant allele?

_____

_____

(1 mark)

(a) (ii) What is the evidence in the diagram that CADASIL is caused by a dominant allele?

_____

_____

(1 mark)

(a) (iii) Person 7 has CADASIL.

Is person 7 homozygous or heterozygous for the CADASIL allele?

Give evidence for your answer from the diagram.

_____

_____

(1 mark)

(b) Persons 7 and 8 are planning to have another baby.

Use a genetic diagram to find the probability that the new baby will develop into a person with CADASIL.

Use the following symbols to represent alleles.

D = allele for CADASIL

d = allele for not having CADASIL

Probability = _____

(4 marks)

(c) Scientists are trying to develop a treatment for CADASIL using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain.

(c) (i) Why do the scientists use stem cells?

_____

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_____

_____

(2 marks)

(c) (ii) Embryonic stem cells can be obtained by removing a few cells from a human embryo. In 2006, scientists in Japan discovered how to change adult skin cells into stem cells.

Suggest one advantage of using stem cells from adult skin cells.

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_____

(1 mark)

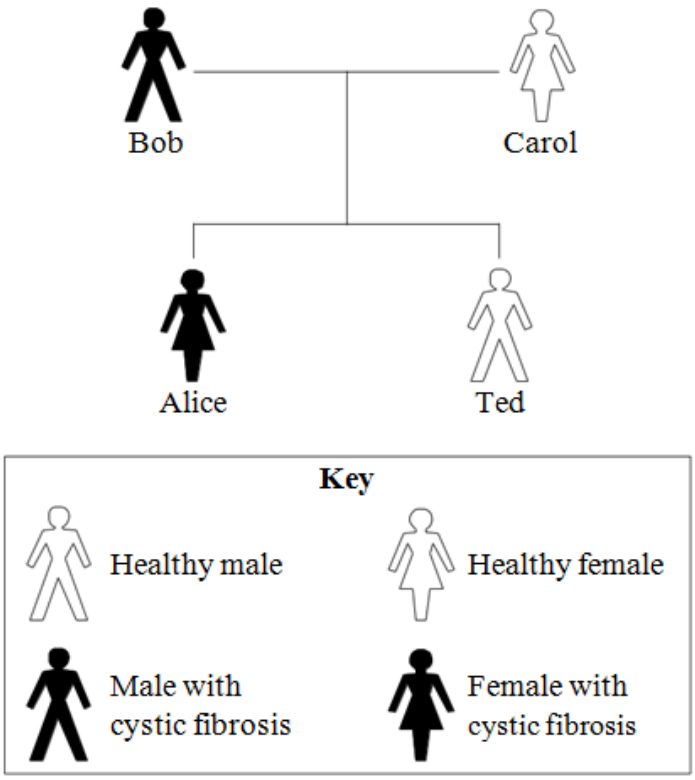
Q:7 Cystic fibrosis is an inherited disorder that can seriously affect health.

(a) Which one of these is affected by cystic fibrosis? Draw a ring around your answer.

blood cell membranes kidneys nervous system

(1 mark)

(b) The diagram shows the inheritance of cystic fibrosis in a family. The allele that produces cystic fibrosis is recessive.



(b)(i) Explain why Alice inherited cystic fibrosis.

_____

_____

_____

_____

(2 marks)

(b)(ii) Explain why Ted did not inherit cystic fibrosis.

_____

_____

_____

(2 marks)

(c) Bob and Carol know that there is a risk that their next baby will have cystic fibrosis. Embryos can be screened for the allele that produces cystic fibrosis.

Many people support the screening of embryos, but others do not.

(c)(i) Suggest one reason why many people support the screening of embryos for the cystic fibrosis allele.

_____

_____

_____

(1 mark)

(c)(ii) Suggest one reason why many people are against the screening of embryos for the cystic fibrosis allele.

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(1 mark)

TOTAL MARKS=43