

(Inherited disorders (cystic fibrosis, polydactyly))

Q1.(2021)

Sickle cell anaemia is an inherited condition that affects red blood cells.

Sickle cell anaemia is caused by a mutation in the gene for haemoglobin.
Haemoglobin is the red pigment found in red blood cells.

A person who is homozygous for the normal haemoglobin allele (H^A) produces normal red blood cells.

A person who is homozygous for the mutated allele (H^S):

- produces red blood cells with abnormal haemoglobin
- has red blood cells that can form an altered shape
- has sickle cell anaemia and becomes ill.

A person who is heterozygous:

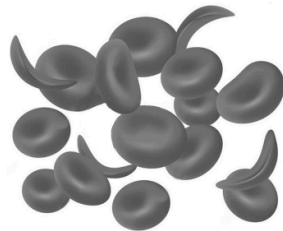
- has both normal and abnormal haemoglobin in the red blood cells
- has sickle cell trait
- is generally healthy but can become ill in certain circumstances.

Give the reason why a mutation in the gene coding for haemoglobin could be harmful.
[1 mark]

Q2.(2021)

Figure 13 shows some red blood cells from the blood of a person with sickle cell trait.

Figure 13

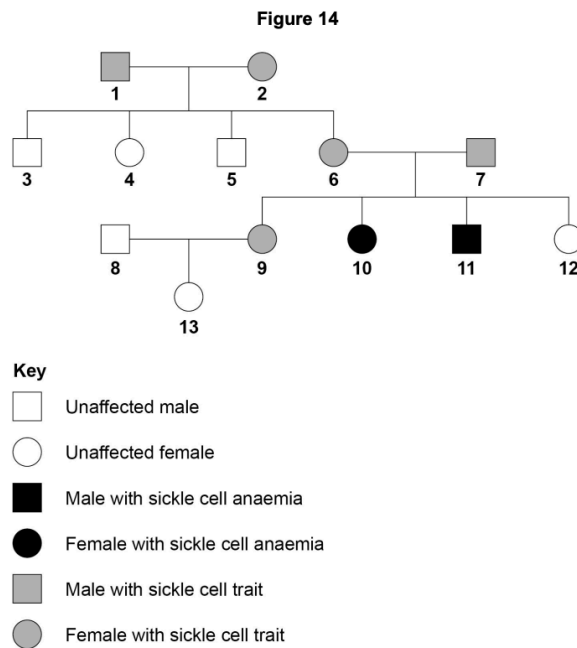


Calculate the proportion of cells in Figure 13 that have an altered shape.
[2 marks]

Proportion = _____

Q3.a)(2021)

Figure 14 shows the inheritance of sickle cell anaemia in one family.



Persons 8 and 9 in Figure 14 are expecting a second child.

Determine the probability that the child will be a girl with sickle cell trait.

You should:

- draw a Punnett square diagram
- identify the phenotype of each offspring genotype
- use the symbols:
 - H^A = normal haemoglobin allele
 - H^s = mutated haemoglobin allele.

[5 marks]

Q3.b)(2021)

Without medical treatment, people with sickle cell anaemia are frequently ill and have a reduced life expectancy.

The malarial parasite cannot live in the red blood cells of a person who has the H^S allele.

A scientist stated:

'It is an advantage for people to have the H^S allele in countries where malaria occurs.'

Evaluate the scientist's statement.

[3 marks]

Q4.(2024)

Some human disorders are inherited.

Polydactyly is an inherited disorder.

- A person with polydactyly has extra fingers or toes.
- Polydactyly is caused by a dominant allele.

What is a dominant allele?

[1 mark]
