

GCSE Biology B (Twenty First Century Science)
J257/02 Depth in Biology (Foundation)

Question Set 10

1 Cystic fibrosis is a disease caused by a person's DNA.

(a) Describe the structure of DNA.

[4]

DNA strands run antiparallel to each other.
made of two strands, joined together to form a double helix. The strands are made of nucleotides, each of which is made of 1 phosphate group, 1 pentose sugar, and 1 base. Each base is part of a complementary pair, and there are 4 bases.

$A \leftrightarrow T$ $C \leftrightarrow G$.

Complementary base pairs are joined by hydrogen bonds, which is how the 2 strands are kept together.

phosphate group and pentose sugar form sugar-phosphate backbone which is held together by phosphodiester bonds.

Cystic fibrosis is caused by a single gene.

There are two alleles of the gene:

- the dominant allele, **F**, does not cause cystic fibrosis
- the recessive allele, **f**, causes cystic fibrosis.

- (b) (i) What is the phenotype of a person who has the alleles **FF**? no cystic fibrosis. [1]
(ii) What is the phenotype of a person who has the alleles **Ff**? no cystic fibrosis, but is a carrier. [1]
(iii) What is the genotype of a person who has cystic fibrosis? **ff** [1]

(c) A couple is thinking about having a baby.
The woman and the man both have the alleles **Ff**.

The Punnett square shows the possible combinations of alleles in their offspring.

	F	f
F	FF	Ff
f	Ff	ff

Use the Punnett square to help you answer the questions.

(i) What proportion of their offspring is likely to have the allele combination **FF**?

..... 1 in every 4

[1]

(ii) What percentage of their offspring is likely to have the allele combination **Ff**?

Percentage = 50 % [2]

(iii) What is the probability that any one of their offspring will have cystic fibrosis

Probability = 25% or 1/4 [2]

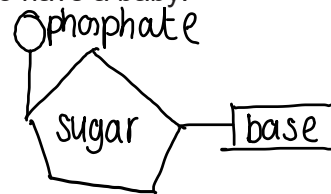
(d) A different couple is also thinking about having a baby.

- The woman has had a genetic test. It showed that she has the **f** allele.
- She does **not** have cystic fibrosis.
- The man does not know what alleles he has.
- He does **not** have cystic fibrosis.

Explain the possible genotypes and phenotypes of their baby **and** explain what things the couple should consider before deciding to have a baby. [6]

Q)a)cont]

a nucleotide :



the mother : → has f allele → does not have Cf

* therefore genotype must be ff.

the father : → does not have Cf

* therefore genotype could be ff or Ff.

	mother	
	F	f
father	F	Ff
	f	Ff

no chance of Cf

	mother	
	F	f
father	f	Ff
	f	Ff

1/4 chance of Cf

before having a baby, the couple have to consider the genotype of the man, and find this by doing a genetic test. If the man does

have a f allele, the chance of the baby having Cf rises from 0% to 25%, which is a significant change.

Total Marks for Question Set 10: 18

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