

Name: .....

Date: .....

Class: .....

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# IGCSE BIOLOGY EDEXCEL 9-1

## CHAPTER WORKBOOK

# GENES AND INHERITANCE

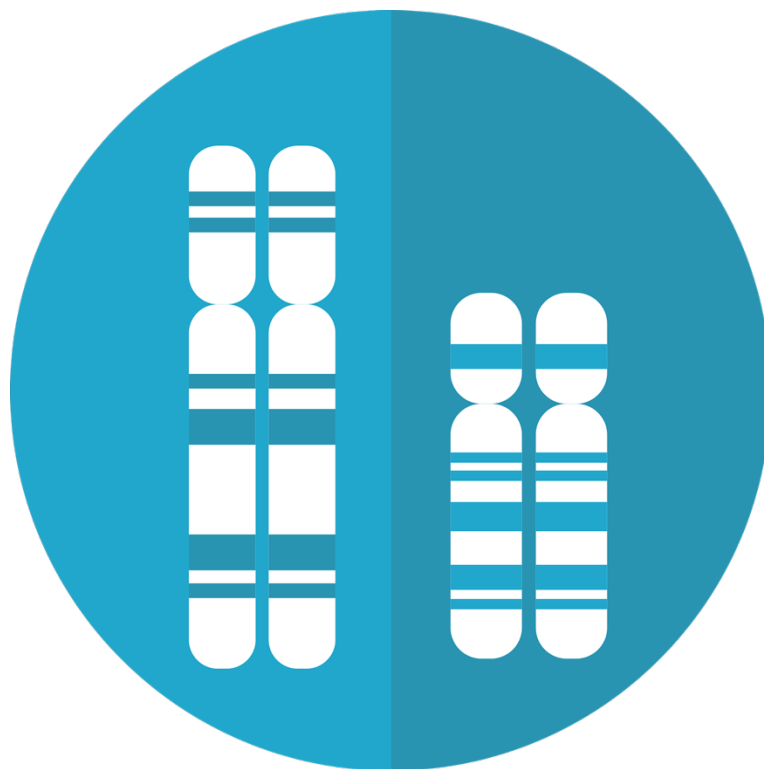


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## Essential Vocabulary

1. Define the following keywords:

Keyword	Definition
Gene	..... .....
Allele	..... .....
Dominant	..... .....
Recessive	..... .....
Homozygous	..... .....
Heterozygous	..... .....
Genotype	..... .....
Phenotype	..... .....



## Inheritance

Question 1, 2 and 3 below relate to a specific species of plant that has a single gene which determines whether it is tall or short. The alleles are represented with the letters "T" and "t". Upper case "T" represents the allele for the tall trait and lower case "t" represents the allele for the short trait. The tall allele is dominant to the short allele. This information is summarized below:

Trait	Symbol	Dominant or Recessive
Tall	T	Dominant
Short	t	Recessive

1. Two parent plants, one tall (Tt) and one short (tt), were crossed and produced 100 seeds. These seeds were grown and about 50 of them were tall with genotype Tt, and about 50 of them were short with genotype tt.

State:

a) The offspring genotypes:

.....

b) The Phenotypic ratio:

.....



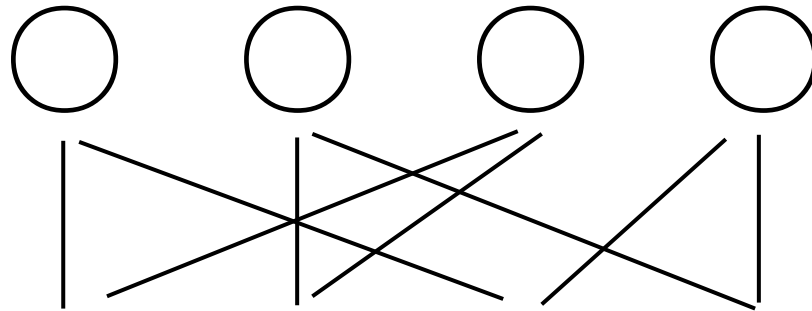
2. Complete the genetic diagram to determine the offspring genotypes and phenotypic ratio of the following cross:

Parent  
Genotypes:

TT

tt

Gametes:



F<sub>1</sub>

genotypes: .....

Phenotypic

ratio: .....



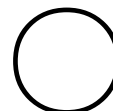
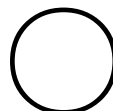
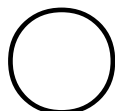
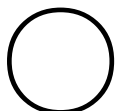
3. Complete the genetic diagram to determine the offspring genotypes and phenotypic ratio of the following cross:

Parent  
Genotypes:

$Tt$

$Tt$

Gametes:



$F_1$

genotypes:

.....

Phenotypic

ratio

.....



4. Determine the **offspring genotypes and phenotypic ratios** for the following crosses. Use a Punnett square for each one.

a) Species A is an animal similar to a rabbit. Parents with genotypes LL and ll are crossed. L is allele for long ears, which is dominant to the allele for short ears (l).

	<b>L</b>	<b>L</b>
<b>l</b>		
<b>l</b>		

Offspring Genotypes: .....

Phenotypic ratio: .....

b) Species B is a plant. Parents with genotypes Pp and Pp are crossed. P is allele for purple petals, which is dominant to the allele for white petals (p).


Offspring Genotypes: .....

Phenotypic ratio: .....



d) Species C is a plant. The first parent is heterozygous for the seed colour gene and has green seeds. The second parent is homozygous for the seed colour trait and has yellow seeds. The allele for green seeds (G) is dominant to the allele for yellow seeds (g)


Offspring Genotypes: .....

Phenotypic ratio:.....

e) Species D is a plant. Both parents are homozygous for the gene for seed texture, which can be smooth or wrinkled. Both parents came from seeds of different textures. The allele for smooth has the symbol (S), and smooth is dominant to wrinkled.


Offspring Genotypes: .....

Phenotypic ratio:.....



## Test Crosses

As stated in an example seen previously in this workbook, a certain species of plant has a gene for height, with alleles "T" and "t", where "T" represents the dominant allele for the tall trait, while "t" represents the recessive allele for the short trait. The following questions relate to this species.

1. A scientist has a tall plant and wants to know what its genotype is.

a) State the possible genotypes for the plant.

b) The scientist decides to do a **test cross** to find the genotype of the tall plant. He crosses the tall plant with a short plant. Explain why the scientist must use a short plant.

c) Using Punnett squares show the possible phenotypic ratios of offspring.

**First possibility:**

**Second possibility:**

Phenotypic ratio:

Phenotypic ratio:





d) The scientist carried out the test cross and collected 100 seeds produced in the cross. He grew all of the seeds and 47 of the plants were tall, and 53 were short. State and explain what the genotype of the tall parent is.

Genotype: .....

Explanation:

.....

.....

.....

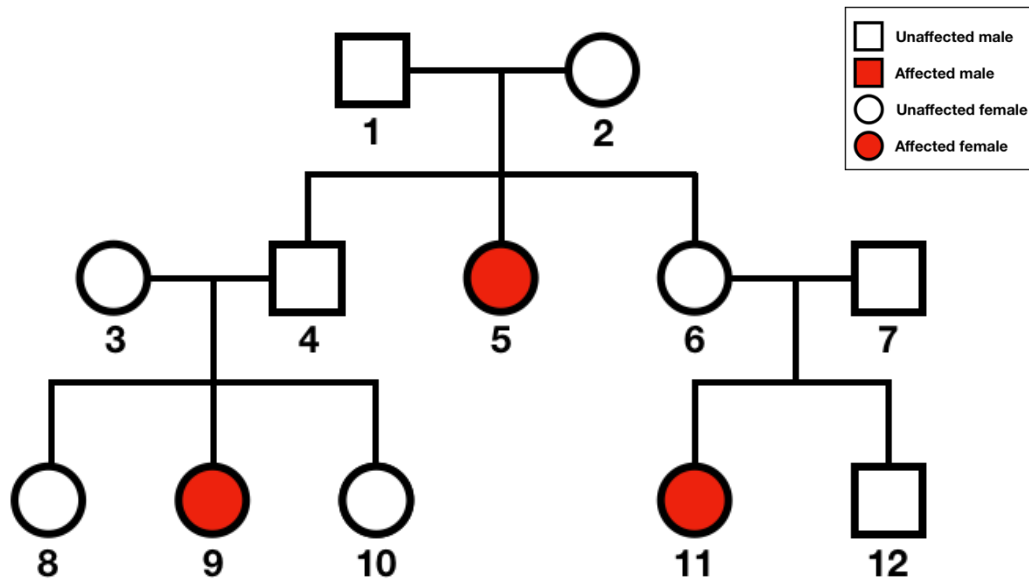
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## Pedigree Diagrams

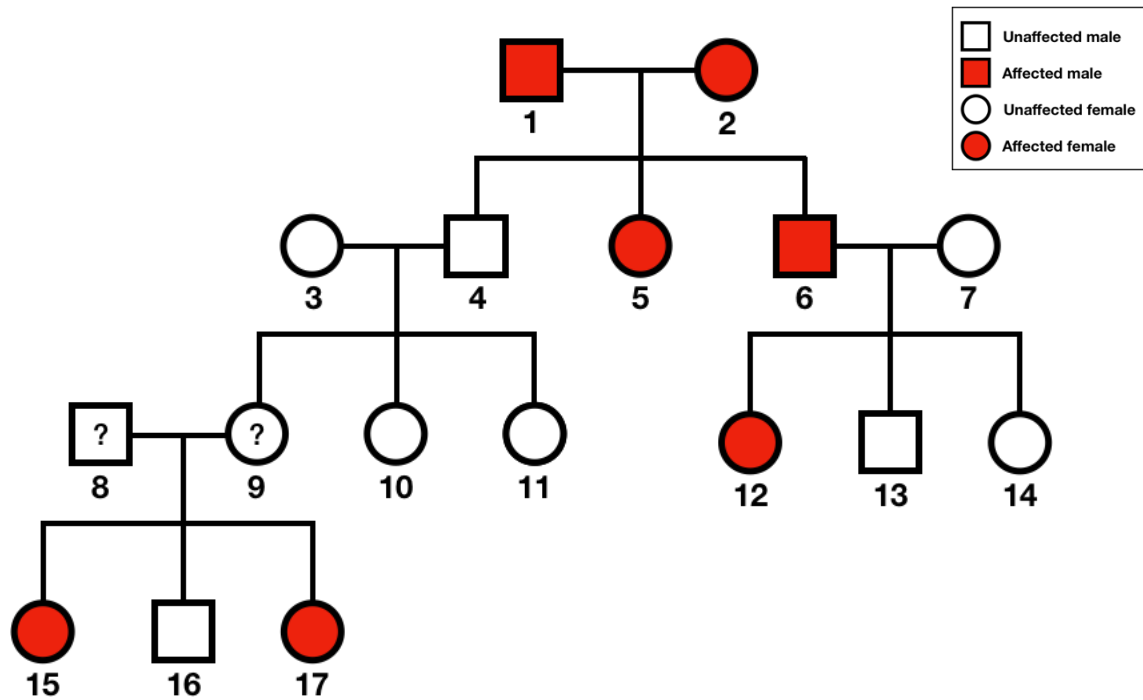
Cystic fibrosis is a genetic disease which mainly affects the lungs, but also other parts of the body. It is caused by a recessive allele. If a person's genotype is homozygous (ff) they will have cystic fibrosis. If they are heterozygous (Ff), they carry the allele but are not affected by cystic fibrosis, and if they are homozygous dominant (FF), they are neither affected, nor a carrier.

Below is a pedigree diagram representing a family within which there is a history of cystic fibrosis.



1. On the diagram above, next to each individual, label their genotype  
(Note, it is not possible to state a genotype for individuals 8, 10, and 12).

2. Below is a pedigree diagram showing members of a family that are affected and unaffected by a specific genetic condition (this is not cystic fibrosis, and not related to question 1).



a) i) Is this genetic condition caused by a dominant or recessive allele?

.....

ii) Explain your answer

.....  
 .....  
 .....  
 .....

b) i) State the phenotypes ("affected"/"unaffected") for persons 8 and 9.

Phenotype of person 8: .....

Phenotype of person 9: .....

ii) Explain your answer.

.....

.....

.....

.....



## Sex Determination

1. Complete the sentences relating to gender inheritance using the words/symbols below. Some can be used more than once.

X	male	gender	Y
22	sex	female	

Humans have 23 sets of chromosomes. .... of these are autosomal chromosomes, but 1 set are known as ..... chromosomes, and these determine a person's ..... . There are two types of sex chromosome, and these are given the symbols ..... and ..... . If an individual inherits two ..... chromosomes, the person will be ....., but if they inherit one ..... and one ..... Chromosome, they will be .....

2. Draw a genetic diagram to prove that the probability of a child being male or female is 50/50.



## Polygenic Inheritance

1. Complete the sentences below using the words in the box

Skin colour	polygenic	several
chromosome	gene	

Some characteristics are determined by only a single  
....., but others are determined by more than  
one gene. We say they are ..... . An example  
of this in humans is ..... . The skin tone of a  
person is determined by ..... different genes  
found at different places on a .....



## Co-Dominance

So far you have considered genes that have alleles which are either dominant or recessive. Some genes have alleles that are equally dominant. We call these alleles "co-dominant".

1. A species of flower has a gene which determines petal colour. Two alleles, R and W, code for petals coloured red or white respectively. These alleles are co-dominant.

a) List all possible genotypes for petal colour.

.....

b) List all possible phenotypes for petal colour.

.....

c) Use a Punnett square to show the results of a cross between two flowers, one with white petals and one with red petals.

Phenotypic ratio: .....

d) Use a Punnett square to show the results of a cross between two of the offspring of the above cross

Phenotypic ratio: .....