6.1.6 Genetic inheritance

AQA GCSE Biology (Higher)
Question and answer notes

For more resources, visit www.mooramo.com

How to use these notes

These notes cover everything you need to know for this part of the specification. They have been written in question-answer format to make them easier for you to study from.

In order to study successfully, I recommend you do the following for each question and answer:

- Read it carefully and make sure you **understand** it.
- **Memorise** the answer.
- **Practice** applying your understanding to past exam questions.

A good way to memorise information is to use **retrieval practice**. This is when you practise retrieving information from your memory. You could do this by making a flashcard for each question with the question on one side and the answer on the other. Or you could use a flashcard app. Alternatively, use a sheet of paper to cover up the answer so you can only see the question. Try to answer the question and then check how you did.

You should practise retrieving each answer from your memory until you can do it perfectly. Even once you can retrieve the answer perfectly, your ability to retrieve it will probably fade as time passes without practising. Therefore you will need to keep going back to the questions that you have previously mastered and practising them again. However, each time you re-learn the answer, the memory will be stronger and will last longer than the time before.

What is a gamete?
A gamete is a sex cell. During fertilisation, a female gamete and a male gamete fuse to form a new individual. Each gamete has one set of chromosomes, so the new individual formed has two sets of chromosomes.

What is a chromosome? *[Note: this question has been covered in a previous section]*
A chromosome is a very large DNA molecule, usually containing hundreds or thousands of genes. Some chromosomes are circular, others are linear.

What is a gene? *[Note: this question has been covered in a previous section]*
A gene is a section of a DNA molecule that contains the instructions for making a particular protein.

What is an allele?
An allele is a particular version of a gene. For any given gene, there may be multiple different alleles present in the population, each coding for a different version of the protein.

How many copies of each gene does one human have?
Every human has two copies of each gene. These could be two copies of the same allele or they could be two different alleles.

What is an individual's genotype?
An individual's genotype is the combination of alleles that they have for a particular gene.

What is an individual's phenotype?
An individual's phenotype is the observable characteristics that they have. For example, if you were studying flower colour in a particular species of plant, one individual might have the phenotype 'yellow flowers'.

What is a dominant allele?
A dominant allele is an allele that is always expressed in the phenotype if it is present in the genotype - even if only one copy of it is present and regardless of what other alleles are present.

How are dominant alleles usually represented?
Dominant alleles are usually represented using upper case letters. For example, a dominant allele could be represented by the letter 'A'.

What is a recessive allele?
A recessive allele is an allele which is only expressed in the phenotype if two copies of it are present in the genotype. In other words, a recessive allele is only expressed if no dominant allele is present.

How are recessive alleles usually represented?
Recessive alleles are usually represented using lower case letters. For example, a recessive allele could be represented by the letter 'a'.

Define heterozygous.
An individual is described as being heterozygous for a particular gene if they have two different alleles of that gene. For example, an individual with the genotype Aa is heterozygous as they have one copy of a dominant allele and one copy of a recessive allele.

Define homozygous.
An individual is described as being homozygous for a particular gene if both of their copies of that gene are the same allele. If both copies are dominant (e.g. AA) then they are described as homozygous dominant. If both copies are recessive (e.g. aa) then they are described as homozygous recessive.

How do an individual's genes affect their phenotype?
The alleles that an individual has (in other words, their genotype) act at a molecular level to determine their characteristics (in other words, their phenotype).
For some characteristics, such as fur colour in mice and red-green colour blindness in humans, a single gene controls the phenotype.
However, for most characteristics the phenotype is the result of interactions between multiple genes.

For a characteristic controlled by a single gene, what phenotype would a heterozygous individual have?
For a characteristic controlled by a single gene, a heterozygous individual would have the phenotype associated with the dominant allele.

For a characteristic controlled by a single gene, what phenotype would a homozygous recessive individual have?
For a characteristic controlled by a single gene, a homozygous recessive individual would have the phenotype associated with the recessive allele.

For a characteristic controlled by a single gene, what phenotype would a homozygous dominant individual have?
For a characteristic controlled by a single gene, a homozygous dominant individual would have the phenotype associated with the dominant allele.

What is a genetic cross?
A genetic cross is when two individuals sexually reproduce and we study the way that alleles of a particular gene are inherited by the offspring.

How do we use a Punnett square to predict the results of a genetic cross with regards to one particular gene?
To predict the results of a genetic cross with regards to a particular gene, we do the following:

1. List the genotypes of the two parents for that particular gene.
2. List the alleles found in the parents' gametes for that particular gene.
3. Draw a Punnett square (a 2 x 2 grid of boxes). Write the gamete alleles of one parent along the top and write those of the other parent along the side.
4. Fill in the boxes, writing the genotype of the offspring formed from each possible combination of gametes.
5. List the offspring genotypes and state their ratio.
6. List the offspring phenotypes and state their ratio.

Example of a Punnett square for a cross between a homozygous dominant individual and a heterozygous individual.

Parent genotypes: AA; Aa

Parent gametes: A, A ; A, a

Punnett square:

	A	*A*
A	AA	AA
a	Aa	Aa

Offspring genotypes: AA, Aa in a 1 : 1 ratio.

Offspring phenotypes: 100% of the offspring have the dominant phenotype.

What is a family tree?

A family tree is a diagram showing how a group of individuals are related to each other. Each individual is usually represented by a circle or square. Often, squares are used for males and circles for females, however it is important to check the key as this may not always be the case. The colour or patterning of the circle or square is often used to indicate that individual's phenotype (this will be explained in the diagram's key). A horizontal line between two individuals shows that they have sexually reproduced, and the line coming down from this branches and connects to each of their offspring.