Whitley Academy

Biology Paper 2 (F) Knowledge Recall Booklet

Paper Biology 2F 8464/B/2F

For this paper, the following list shows the major focus of the content of the exam:

- 4.5.3 Hormonal control in humans
- 4.6.1 Reproduction
- 4.7.1 Adaptations, interdependence and competition
- 4.7.2 Organisation of an ecosystem

Required practical activity that **will be assessed**:

- Required practical activity 7: measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.

Your teacher will tell you specific topic areas to focus on …

Topic	RAG			Revision technique					Date completed	Teacher Signed
	R	A	G	Flashcards	Mindmap	Notes	Video Watched (With notes)	Frog resource		

Required Practical – Measuring population size using sampling techniques

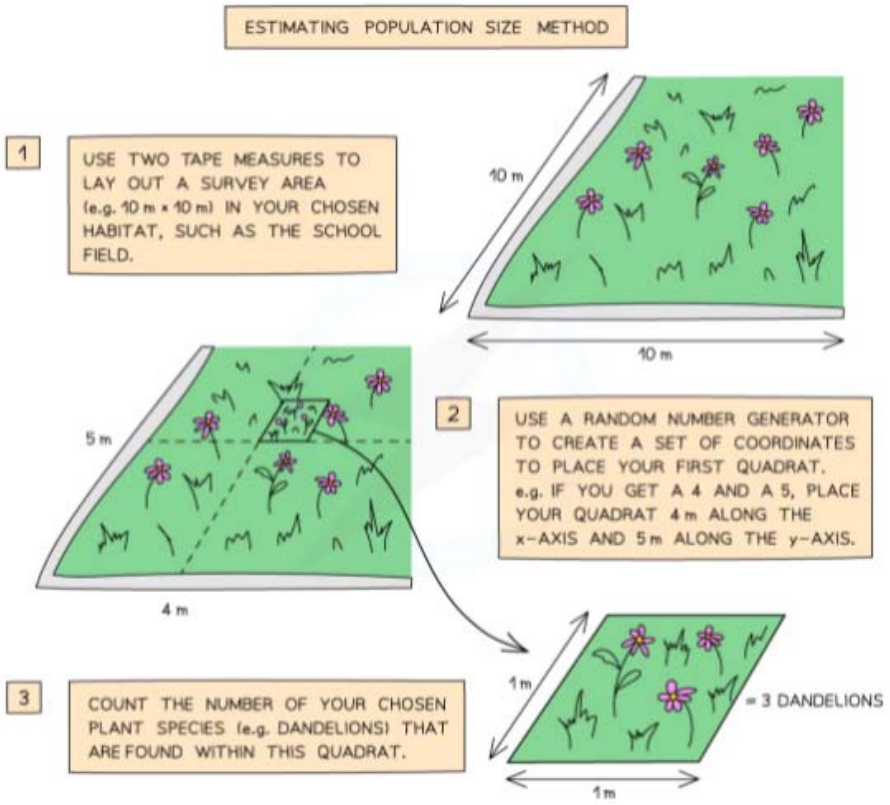
Recall it ...

Use the information in the following page(s) to answer these questions …

1. What is a quadrat?
2. How are quadrats placed?
3. What is counted within the quadrat?
4. How many times is the quadrat thrown?
5. How is the total number of species in the area estimated?

Required Practical – Measuring population size using sampling techniques

- Aim: To measure the population size of a common species in a habitat and use sampling techniques to investigate the effect of a factor on the distribution of this species
- You will:
  - Use a quadrat to estimate the population size of a plant species in a survey area
  - Use a transect line and a quadrat to investigate the effect of a factor on the number of plants in a survey area



Quadrat	Number of dandelions
1	3
2	4
3	2
4	1
5	0
6	0
7	2
8	5
9	3
10	1
Total	21

4 RECORD THIS NUMBER IN A RESULTS TABLE AND REPEAT STEPS 1–3 UNTIL YOU HAVE RECORDED THE NUMBER OF YOUR CHOSEN PLANT SPECIES IN 10 QUADRATS.

5 ESTIMATE THE POPULATION OF DANDELIONS IN YOUR SURVEY AREA USING THE EQUATION:

$$\text{ESTIMATED POPULATION SIZE} = \frac{\text{TOTAL AREA}}{\text{AREA SAMPLED}} \times \text{TOTAL NUMBER OF DANDELIONS COUNTED}$$

TOTAL SURVEY AREA WAS 10 m × 10 m

$$= \frac{100}{10} \times 21$$

$$= 210$$

EACH QUADRAT IS 1 m × 1m AND 10 QUADRATS WERE PLACED

Required Practical – Investigating the effect of factor on the distribution of species

Recall it ...

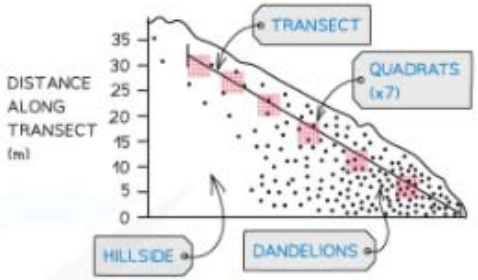
Use the information in the following page(s) to answer these questions …

1. What is a transect?
2. What is placed at intervals along the transect?
3. What is counted within the quadrat, and at intervals along the transect line?
4. How is the relationship determined?

Required Practical – Investigating the effect of factor on the distribution of species

INVESTIGATING THE EFFECT OF A FACTOR ON THE DISTRIBUTION OF A SPECIES METHOD

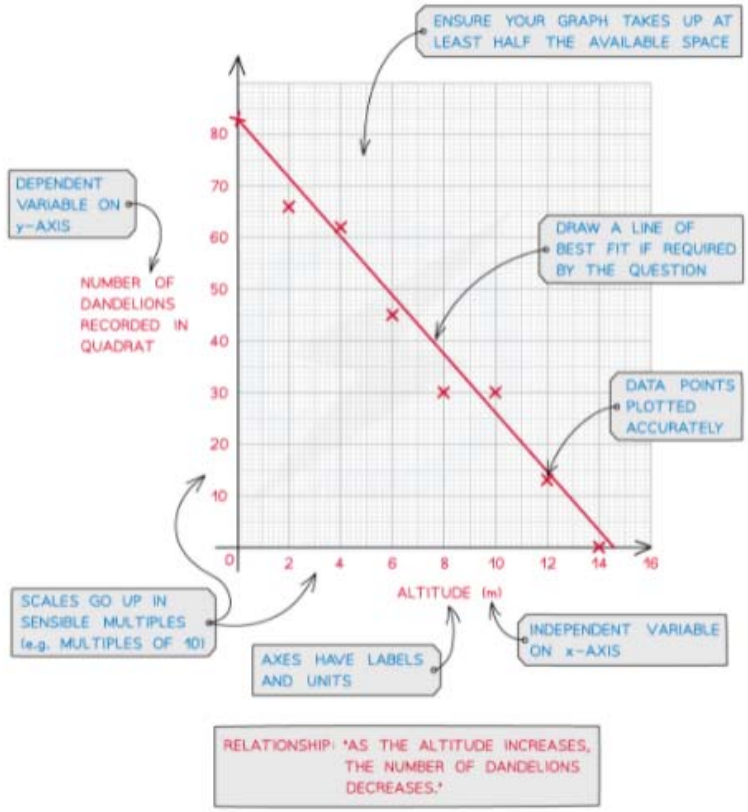
1 SET YOUR TRANSECT UP THROUGH THE AREA YOU ARE INVESTIGATING. IN THIS CASE, A 30 m TAPE MEASURE IS PLACED UP A HILLSIDE. PLACE A QUADRAT AT EQUAL INTERVALS (e.g. EVERY 5 m) ALONG THE TRANSECT.



Distance along transect (m)	Number of dandelions	Attitude (m)
0	84	2
5	66	4
10	62	6
15	45	8
20	30	10
25	30	12
30	13	14

2 RECORD THE NUMBER OF YOUR CHOSEN PLANT SPECIES INSIDE EACH QUADRAT. RECORD YOUR ABIOTIC FACTOR (e.g. ALTITUDE) AT EACH QUADRAT. RECORD YOUR RESULTS IN A TABLE.

3 PLOT YOUR DATA IN A GRAPH AND DESCRIBE ANY RELATIONSHIP THAT CAN BE OBSERVED.



RELATIONSHIP: "AS THE ALTITUDE INCREASES, THE NUMBER OF DANDELIONS DECREASES."

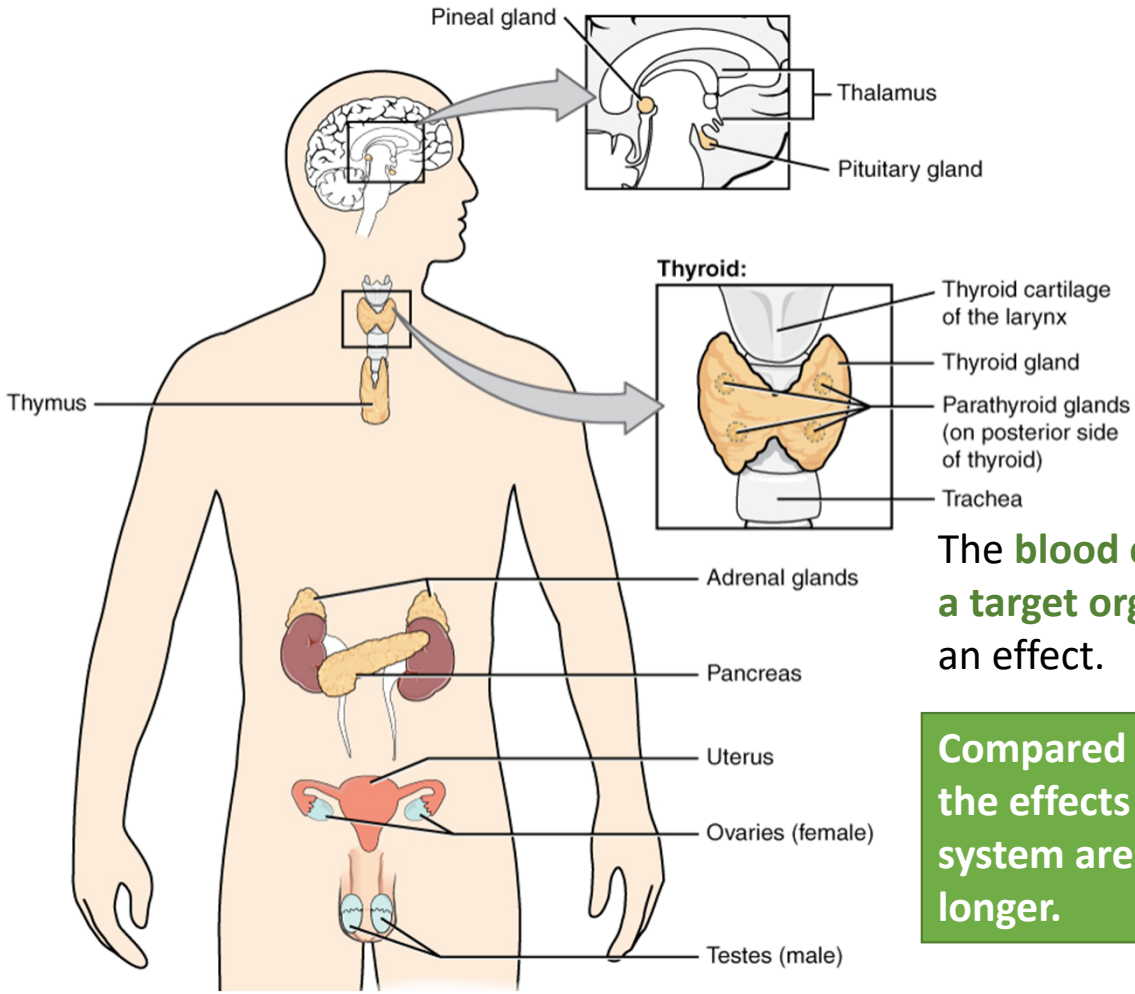
Recall it ...

The Endocrine system

Use the information in the following page(s) to answer these questions …

1. What is the endocrine system? Describe how hormones are carried? Name 7 glands in the body? Describe what they adrenal and thyroid glands do?
2. Why is the pituitary gland called the master gland?
3. Name 6 hormones released by the pituitary gland, their target organ, and what they do?
4. What hormones are released from the pancreas? What do they do?
5. Describe what they pancreas and liver do if your blood glucose levels are too high?
6. What is diabetes? Describe the causes and treatment of type 1 and type 2 diabetes?

Hormonal coordination in humans Part 1 - Human endocrine system

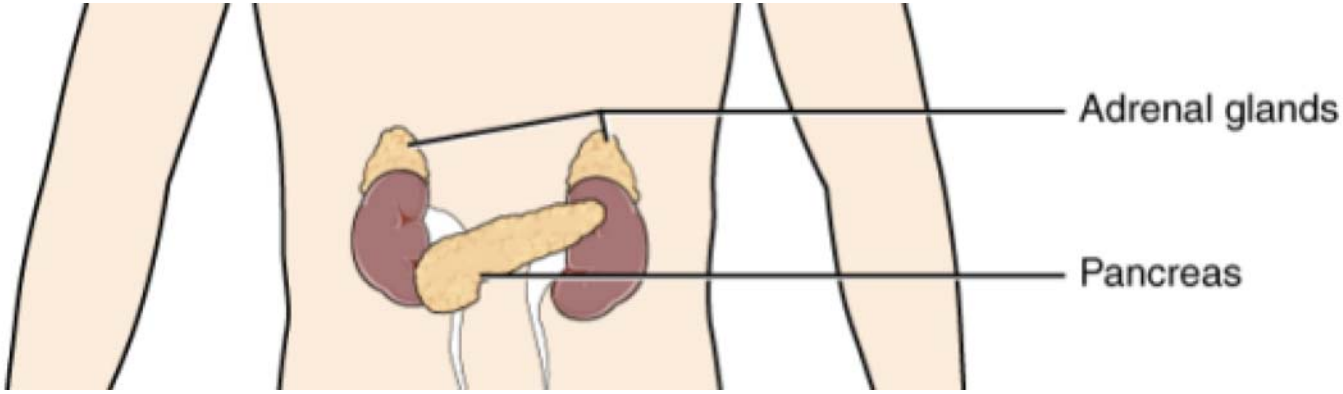


The **endocrine system** is composed of **glands** which **secrete chemicals** called **hormones** directly into the bloodstream.

The **blood carries** the **hormone** to **a target organ** where it produces an effect.

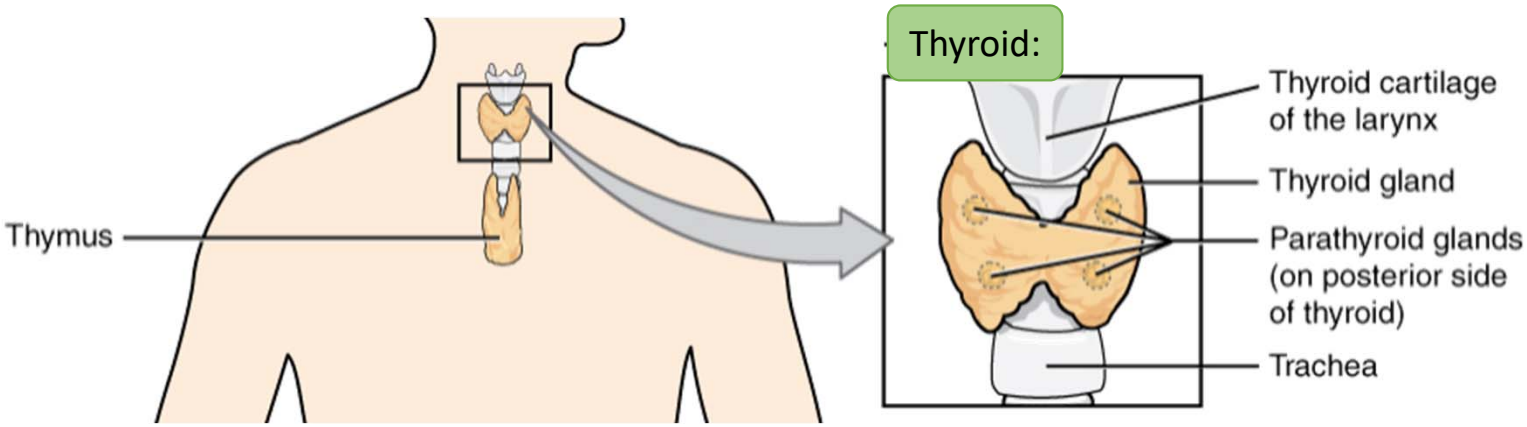
Compared to the nervous system the effects of the endocrine system are slower but act for longer.

Hormonal coordination in humans Part 1 - Human endocrine system



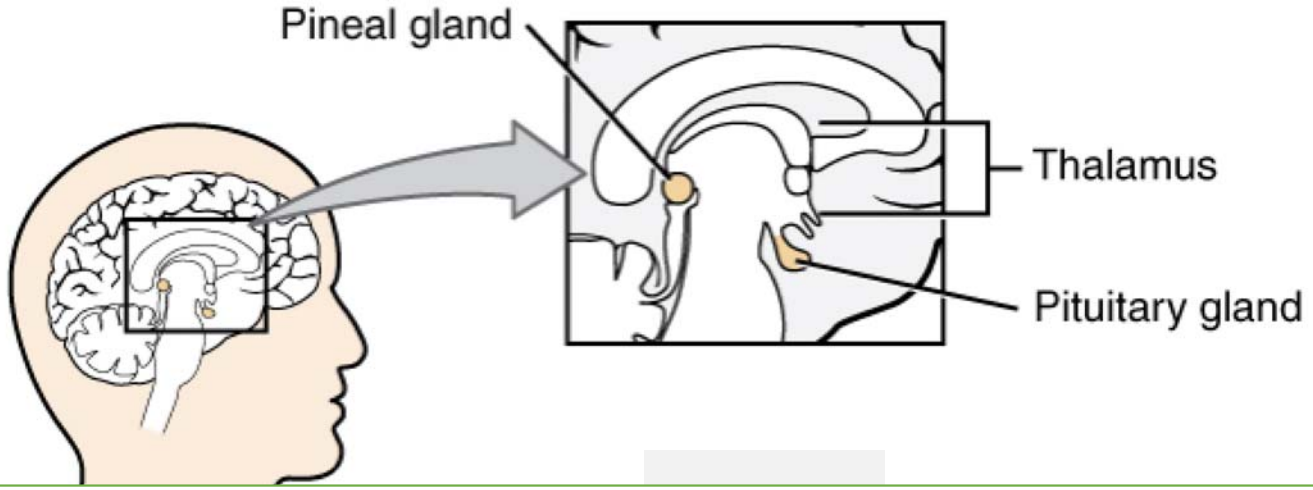
The **adrenal glands** produce and secrete the hormone **adrenalin. Adrenalin** prepares the body for **rapid activity** by increasing the **heart rate** and **blood glucose.** It diverts blood flow to the muscles and lungs. It is often called the **'fight or flight'** hormone.

Hormonal coordination in humans Part 1 - Human endocrine system



The **thyroid** produces and secretes the hormone **thyroxine. Thyroxine** regulates the **metabolic rate**, this is the rate at which **energy** is released in the body. Thyroxine **also** regulates **breathing**, **heart rate,** and **body temperature.**

Hormonal coordination in humans Part 1 - Human endocrine system

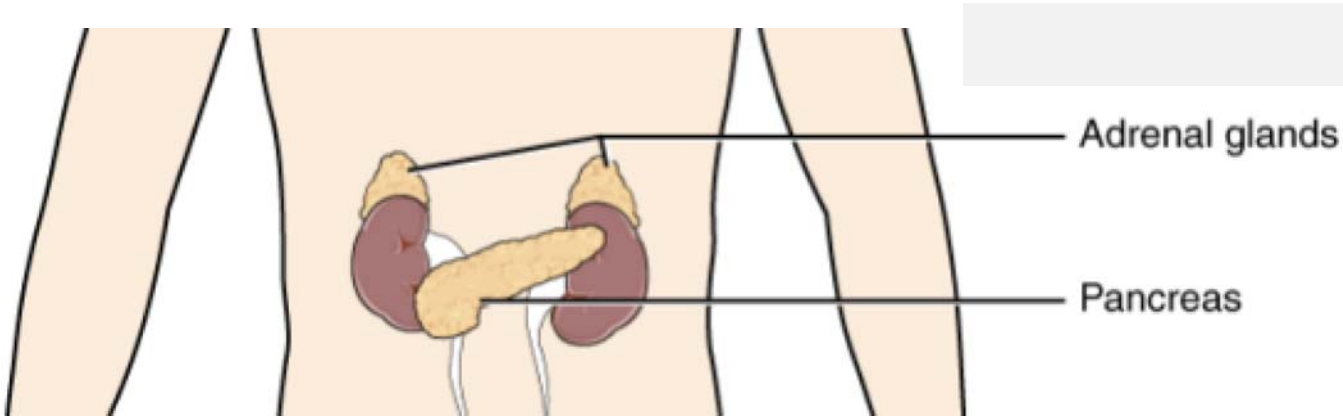


The **pituitary gland** in the brain is often called a 'master gland' as it it **produces** and **secretes many** hormones into the blood.
The hormones are **released** in **response** to **changes** in **body conditions**.
These hormones released act on **other glands** to stimulate other hormones to be released to bring about effects that regulate the body.

Hormones released by the pituitary gland

Hormone	Target	Effect
Anti-diuretic hormone (ADH)	Kidney	Controls water levels in the blood
Thyroid-stimulating hormone (TSH)	Thyroid	Stimulates the thyroid gland to secrete thyroxine
Luteinising hormone (LH)	Ovaries	Stimulates egg release and progesterone production in the ovaries
Follicle-stimulating hormone (FSH)	Ovaries	Stimulates egg ripening and oestrogen production (in ovaries)
Prolactin (PRL)	Breasts	Stimulates the breasts to produce milk
Growth hormone (GH)	All cells in the body	Stimulates growth and repair

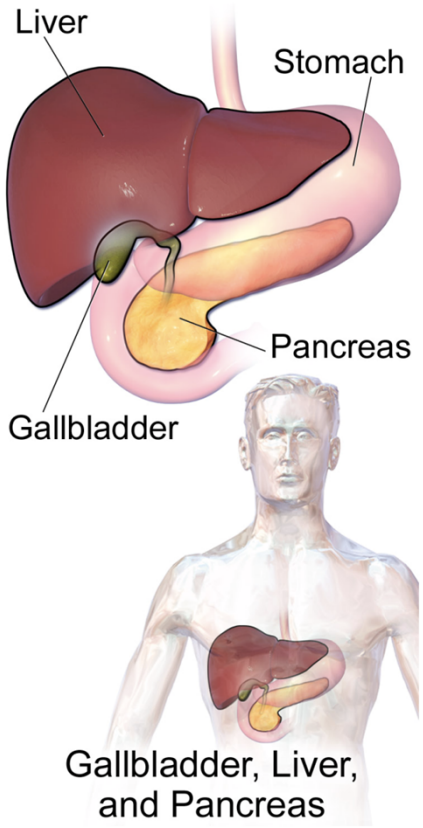
Hormonal coordination in humans Part 1 - Human endocrine system



The **pancreas** produces and secretes the hormones **insulin** and **glucagon.** These hormones **regulate** the **blood glucose** concentration. **Insulin reduces** the concentration and **glucagon increases** the concentration of the glucose in the blood

Hormonal coordination in humans Part 1 - Control of blood glucose concentration

Blood glucose concentration is **monitored** and **controlled** by the **pancreas**.



Blood glucose concentration TOO HIGH

↓

The PANCREAS releases insulin

↓

GLUCOSE is moved from the blood into the cells

↓

LIVER and MUSCLE cells convert excess GLUCOSE into GLYCOGEN for storage

Hormonal coordination in humans Part 1 - Control of blood glucose concentration

Diabetes is a condition that causes a person's **blood sugar level** to become **too high.**

Type 1 diabetes

- A **disorder** in which the pancreas **fails to produce enough insulin**.
- The lack of insulin **causes uncontrolled high blood glucose** levels.
- **Type 1** is normally **treated with insulin injections.**

Type 2 diabetes

- A **disorder** where the **body cells no longer respond to insulin** produced by the pancreas.
- **Obesity is a risk factor for Type 2 diabetes.**
- **Type 2** is normally **treated by controlling the carbohydrate in the diet and by exercise.**

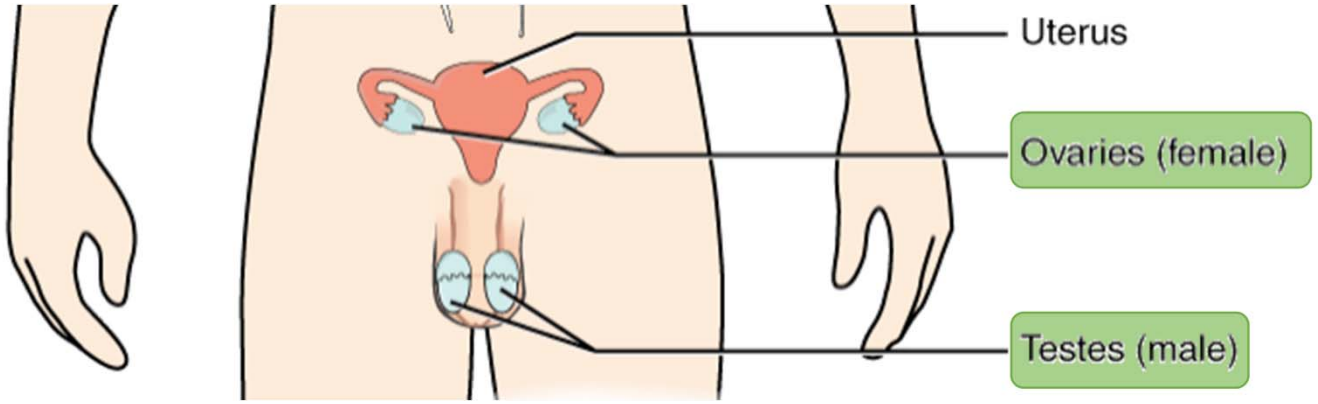
Recall it …

Human Reproduction

Use the information in the following page(s) to answer these questions …

1. Which hormone is produced by the testes? Describe what it does?
2. Which hormones are produced by the ovaries? Describe what they do?
3. What is puberty? Describe both male and female secondary sexual characteristics?
4. What is the menstrual cycle? Describe the role of FSH, Oestrogen, LH and Progesterone in the menstrual cycle? Where are they produced? What do they do?
5. Describe the following methods of contraception – pill, injection/implant, spermicides, barrier methods, intrauterine device, abstaining and sterilisation?

Hormonal coordination in humans Part 3 - Hormones in human reproduction



FEMALE: The **ovaries** produces and secretes the hormones **oestrogen** and **progesterone.**
Oestrogen controls the development of secondary sexual characteristics in females and inhibits FSH and stimulates the pituitary gland to produce LH.
Progesterone maintains the lining of the uterus during the menstrual cycle.

MALE: The **testes** produce and secrete the hormone **testosterone**, it controls the development of secondary sexual characteristics in males

Hormonal coordination in humans Part 3 - Hormones in human reproduction

Puberty is the stage in life when a child's body develops into an adult's body. The **changes take place gradually**, usually between the ages of 10 and 16. Changes occur at puberty because of **hormones:**

Testosterone - produced by the testes - controls the development of male secondary sexual characteristics

Oestrogen - produced by the ovaries - controls the development of female secondary sexual characteristics

Female secondary sexual characteristics	Male secondary sexual characteristics
Breasts develop	Voice deepens
Hips get wider	Body becomes more muscular
Ovaries start to release eggs	Testes start to produce sperm
Pubic and underarm hair grows	Facial, pubic, underarm and body hair grows
Sexual organs grow and develop	Sexual organs grow and develop

Hormonal coordination in humans Part 3 - Hormones in human reproduction

The menstrual cycle lasts 28 days: It is the reproductive cycle in women, it is brought about by ***hormones*****. Oestrogen** is the **main female reproductive hormone.** At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation and it occurs half way through the cycle.

Hormone	Produced in...	Causes...
FSH Follicle stimulating Hormone	**Pituitary Gland**	**Stimulates egg ripening and oestrogen production (in ovaries)**
Oestrogen	**Ovaries**	**Lining of the womb to develop. Stimulates pituitary gland to make LH**
LH Luteinising hormone	**Pituitary Gland**	**Stimulates egg release and progesterone production in the ovaries**
Progesterone	**Ovaries**	**Maintains the lining of the womb**

Hormonal coordination in humans Part 3 - contraception

Controlling fertility – Contraception Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

These include:

- **The pill -** oral contraceptives that contain hormones **(oestrogen)** to **inhibit FSH** production so that **no eggs mature**

- **Injection, implant or skin patch** of slow release **progesterone** to inhibit the **maturation** and **release of eggs** for a number of **months** or **years**

- **Spermicidal agents** which kill or disable sperm

Hormonal coordination in humans Part 3 - contraception

Controlling fertility – Contraception Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

- **Barrier methods** such as **condoms** and **diaphragms** which prevent the sperm reaching an egg

- The 'coil', **intrauterine devices** which prevent the implantation of an embryo or release a hormone

- **Abstaining** from intercourse when an egg may be in the oviduct

- **Sterilisation** or **vasectomy** - surgical methods of male and female sterilisation.

Recall it …

Reproduction, Meiosis and Mitosis

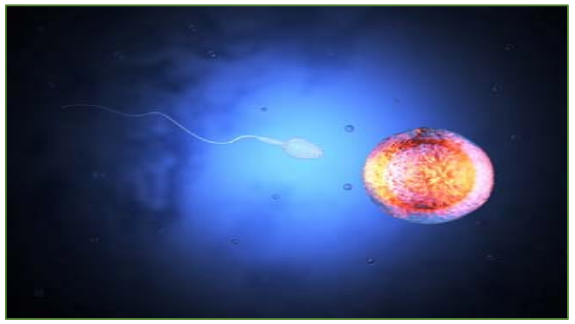
Use the information in the following page(s) to answer these questions …

1. What is the difference between sexual and asexual reproduction?
2. Why does sexual reproduction lead to offspring that are varied?
3. What is meiosis? Describe the steps involved in meiosis?
4. What happens to the chromosome number during meiosis and fertilisation?
5. What is fertilisation? What does mitosis do after fertilisation?

Inheritance part 1 – Reproduction

Sexual reproduction involves the joining of **male** and **female** gametes.
A **gamete** is the scientific term for a sex cell.
In animals, the gametes are the **sperm** and the **egg** cells.
In flowering plants, the gametes are the **pollen** and the **egg** cells.

In sexual reproduction, **mixing** of **genetic information** occurs which leads to **variety** in the offspring.
Every new **offspring** formed is **unique**.
The gametes are produced by **meiosis**.



Asexual reproduction involves only **one parent**. There is **no fusion** of gametes. **No mixing** of genetic information occurs. **All** offspring are genetically **identical** (called **clones**). Only **mitosis** is involved.

Inheritance part 1 – Meiosis

Meiosis leads to **non identical** cells being formed.
Mitosis leads to **identical** cells (clones) being formed.

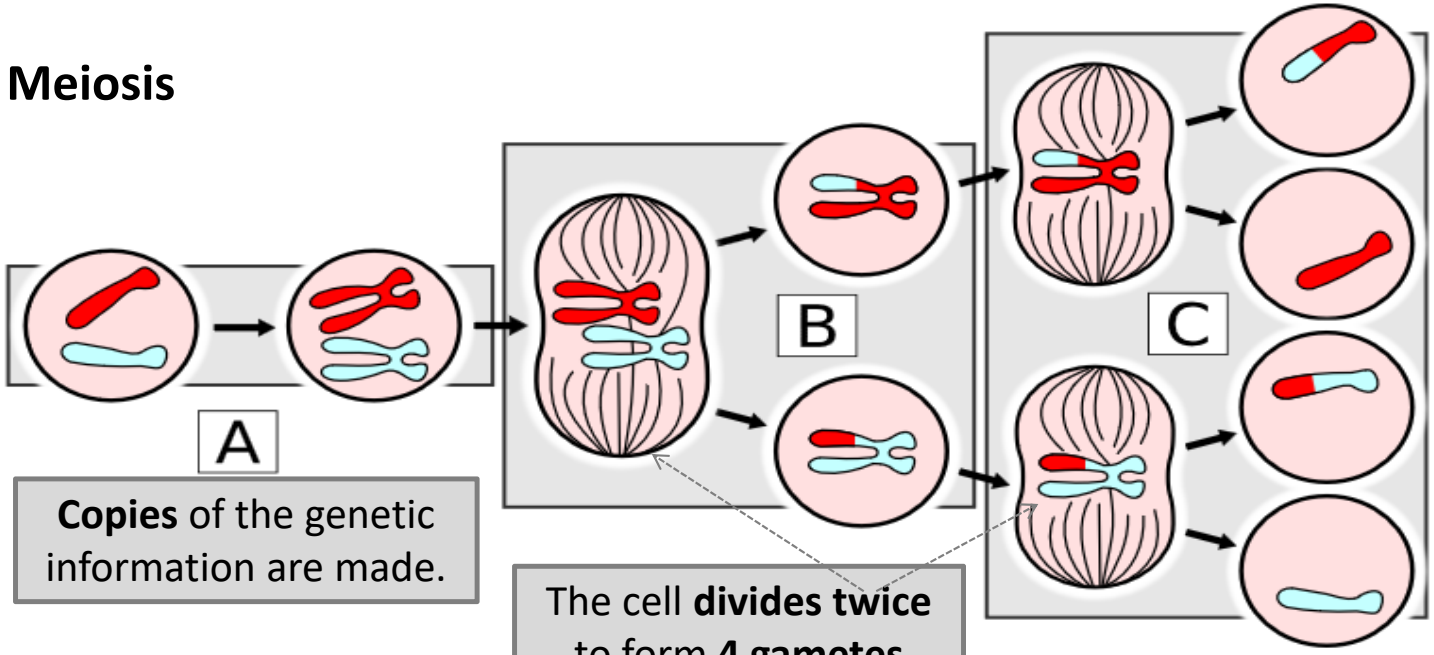
Cells in the **reproductive organs** divide by **meiosis** to form **gametes**. In animals, the reproductive organs are the **ovaries** and **testes**.

Meiosis is sometimes called **reduction division** because it **halves the number of chromosomes** in the gametes. When male and female gametes fuse during **fertilisation,** the number of chromosomes are restored.

This brother and sister have the same parents, but they look different. They show **variation** because of meiosis.

This is the process a cell goes through to produce gametes:

Meiosis



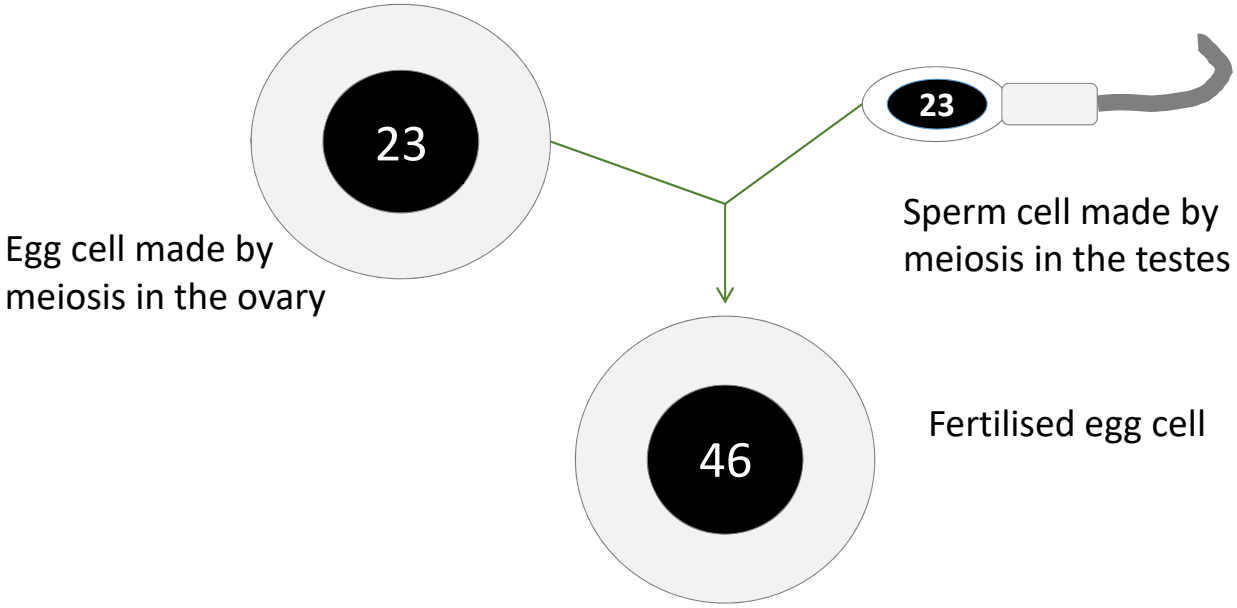
Copies of the genetic information are made.

The cell **divides twice** to form **4 gametes** each with a **single set** of **chromosomes**. This is **half** the number of the **original** cell.

All **4 gametes** are **genetically different** from each other and to the parent.

Inheritance part 1 –Meiosis

A cell in the testes has **46** chromosomes. When this cell undergoes meiosis it produces 4 gametes each with **23** chromosomes. The same process occurs in the ovary to produce egg cells.
The male and female gametes join at **fertilisation** to restore the normal number of chromosomes.
The fertilised egg cell now contains **46** chromosomes.

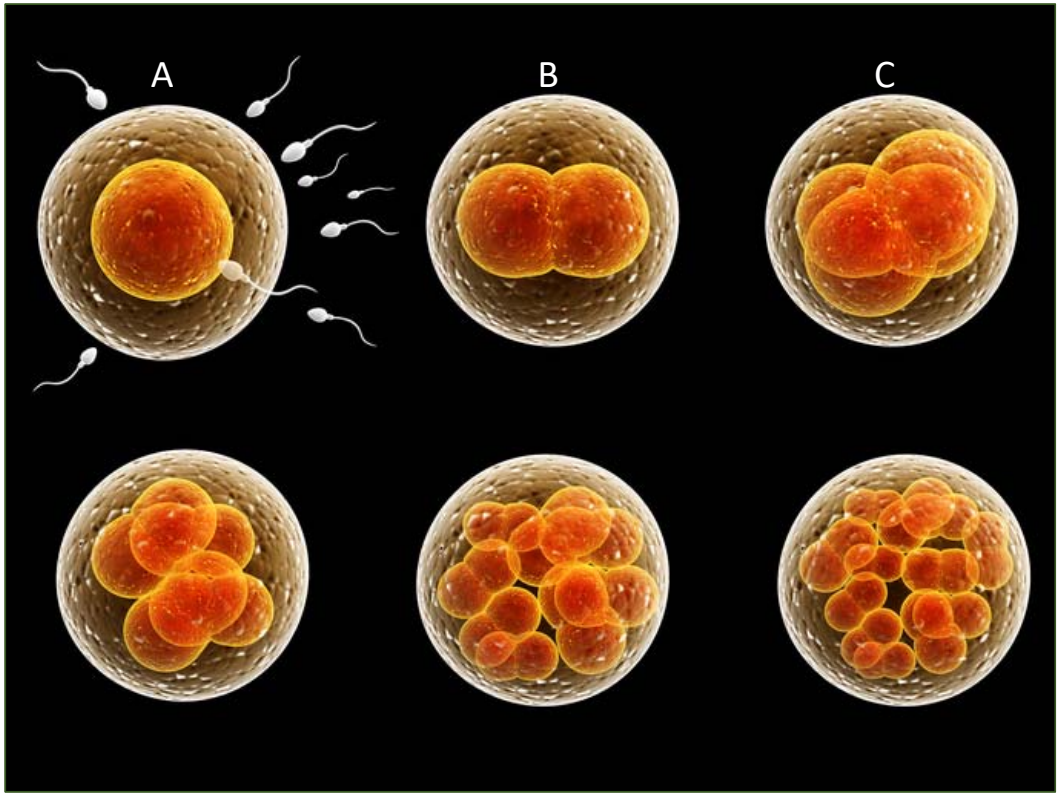


Inheritance part 1 – Mitosis

A Fertilisation occurs. The genetic material from the sperm and egg combine to form a **unique** cell.

B The fertilised cell divides by **mitosis** to form **2 identical cells.**

C Both cells divide by mitosis to form 4 identical cells.



Mitosis continues and a ball of identical cells is formed. This is now called an embryo. Cells now begin to differentiate into different types of cell.

Recall it …

DNA and the genome

Use the information in the following page(s) to answer these questions …

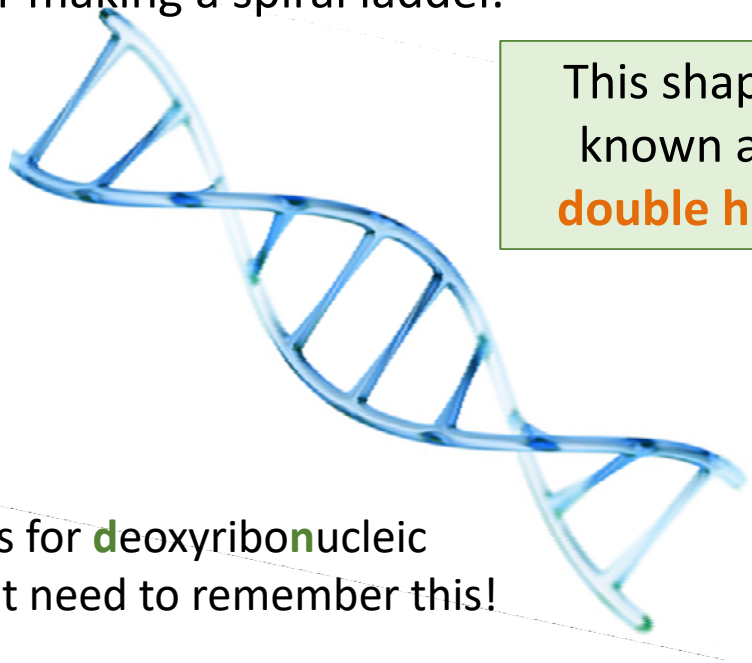
1. Describe the structure of DNA?
2. Name the thread like structures found in the nucleus which are made up of DNA? How many pairs of chromosomes are found in normal body cells? Is this the same in all living things?
3. Describe what a gene does?
4. What is genome?
5. What is the human genome project? How has the human genome project helped?

Inheritance part 1 – DNA and the Genome

The **genetic material** in the nucleus of most cells is made from a chemical called **DNA**.

DNA is a **polymer** made from two strands which twist around each other making a spiral ladder.

A **polymer** is a large molecule made from many **smaller** molecules called **monomers**.

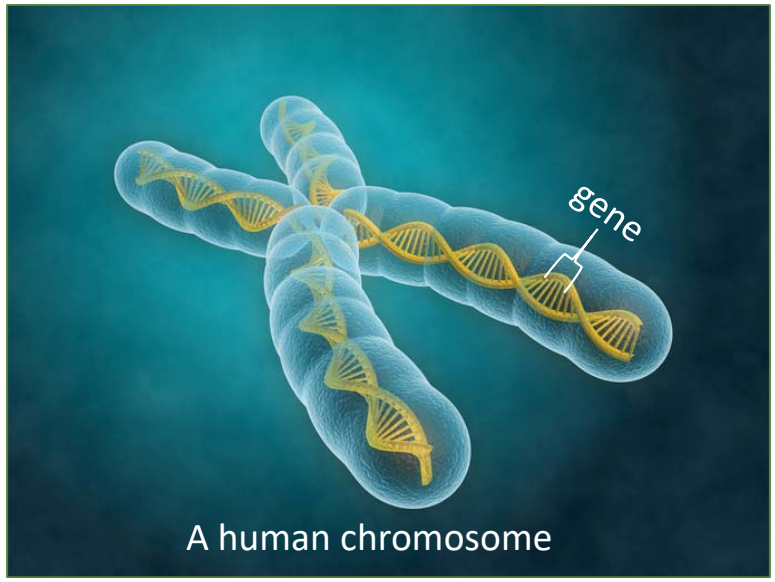


This shape is known as a **double helix**.

DNA stands for **d**eoxyribo**n**ucleic **a**cid. You don't need to remember this!

Inheritance part 1 – DNA and the genome

DNA is arranged in structures called **chromosomes** inside a cell's nucleus.



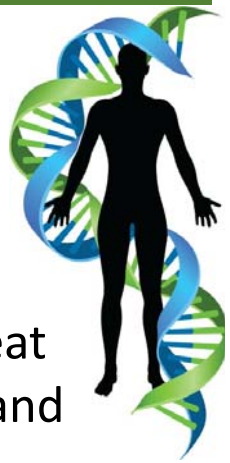
A human chromosome

A **gene** is a small section on a chromosome. Each gene **codes** for a particular sequence of **amino acids**, to make a specific **protein**.
A human has approximately 24 000 genes in total. Each single chromosome is made up of about 2000 genes.

In human body cells the **chromosomes** are normally found in **pairs**. Each cell has **23 pairs** of chromosomes.
The chromosome number varies from one organism to another.
A **horse** has **32 pairs** of chromosomes and a **housefly** has **12 pairs**.

Inheritance part 1 –DNA and the genome

The **genome** of an organism is defined as the **entire genetic material** of that organism.



The **Human Genome Project** (HGP) was an international scientific research project set up to **map all the genetic information** in a human being.

It began in 1990 and was completed in 2003. The whole **human genome has now been studied** and this will have great significance for **medicine** in the future. This work to understand the human genome is important for several reasons:

- To enable scientists to search for the **genes linked to different types of disease** to look for possible treatment or correction
- To enable doctors to better **understand and treat inherited disorders**
- To be able to trace historic **human migration patterns.**

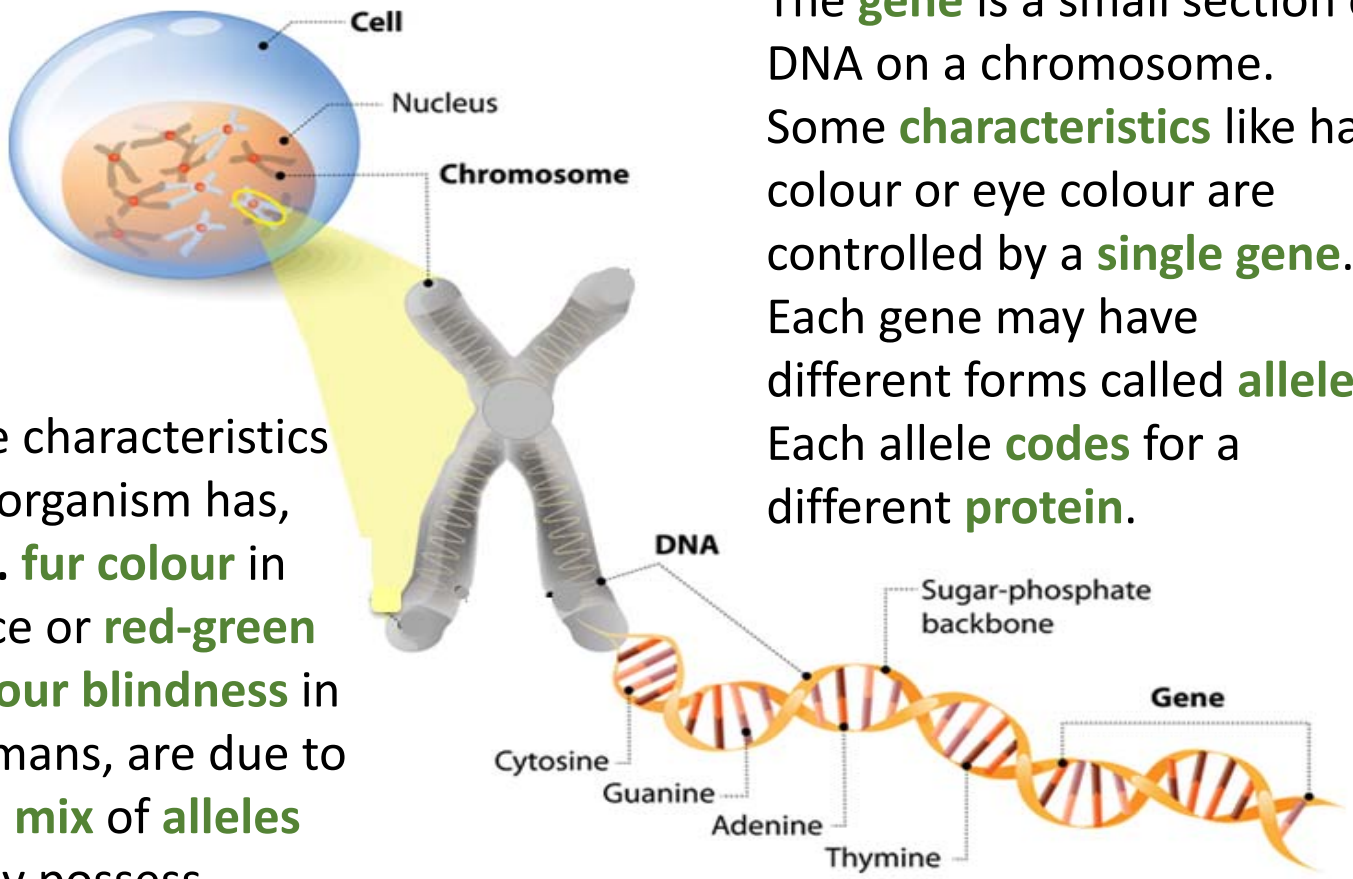
Recall it ...

Inheritance

Use the information in the following page(s) to answer these questions …

1. What is an allele?
2. What is a dominant allele – How is it represented?
3. What is a recessive allele – How is it represented?
4. What is meant by homozygous, heterozygous, genotype and phenotype?
5. A female mouse which was homozygous dominant for black fur was mated with a male mouse which was homozygous recessive for white fur. What are the possible outcomes for fur colour for their offspring?
6. Describe the causes of colour blindness, polydactyly and cystic fibrosis?
7. What is embryo screening? Describe the benefits and risks of embryo screening?
8. What is gene therapy? Describe the benefits and risks of gene therapy?

Inheritance part 2 – Genetic Inheritance



The **gene** is a small section of DNA on a chromosome. Some **characteristics** like hair colour or eye colour are controlled by a **single gene**. Each gene may have different forms called **alleles**. Each allele **codes** for a different **protein**.

The characteristics an organism has, e.g. **fur colour** in mice or **red-green colour blindness** in humans, are due to the **mix** of **alleles** they possess.

Inheritance part 2 – Genetic Inheritance

Each gene has different forms of alleles. The alleles which are present are known as the **genotype**. These are often represented as letters such as **BB**. The genotype operates at a molecular level to develop the actual characteristics seen or the **phenotype**.

Most genes have two possible allele variations which are known as **dominant** or **recessive.**

Dominant alleles are represented by a **capital letter** e.g. B

Recessive alleles are represented by a **lower case letter** e.g. b

There are **3** possible combinations of alleles for each gene:

Two dominant alleles	**BB**
Two recessive alleles	**bb**
One dominant and one recessive allele	**Bb**

(always place the dominant allele first and do not use bB)

Inheritance part 2 – Genetic Inheritance

Homozygous

Homo means the same. Two of the same alleles.

BB means homozygous dominant.

bb means homozygous recessive.

Genotype

This word describes the alleles which are present for a particular feature e.g. Bb.

You need to be able to use and explain these terms.

Phenotype

This word describes what can be physically seen - black fur, blonde hair, blue eyes.

Heterozygous

Hetero means different. Two different alleles are present.

Bb means heterozygous.

Inheritance part 2 – Genetic Inheritance

In a particular species of mouse, the **dominant allele** operates at a molecular level to produce proteins that make the fur black. The **recessive allele** codes for white fur.

Phenotype = black fur
Genotype = **?**
At least **one dominant** allele (B) is present because the mouse has black fur.
The mouse could be **genotype** BB **or** Bb.

KEY
Use B and b to represent the dominant and recessive alleles.
B = allele for black fur
b = allele for white fur

Phenotype = white fur
Genotype = bb
We know there are **no dominant** alleles present because the fur is white.

A recessive allele is only expressed if two copies are present and therefore no dominant allele present.

Inheritance part 2 – Genetic Inheritance

Genetic cross

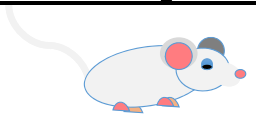
A **genetic cross** is a way of **modelling** the **potential outcome** from mating two parents where the **phenotype and genotype** are **usually known**. We use characteristics which are controlled by **a single gene** as it is easy to see the effect in the next generation and beyond.

A typical exam question might ask:

A female mouse which was **homozygous dominant** for black fur was mated with a male mouse which was **homozygous recessive** for white fur.

What are the possible outcomes for fur colour for their offspring?

What do we know?



Parent phenotype:	Black fur	White fur
Parent genotype:	BB	bb

What gametes will be present?

in each egg	in each sperm
B B	b b

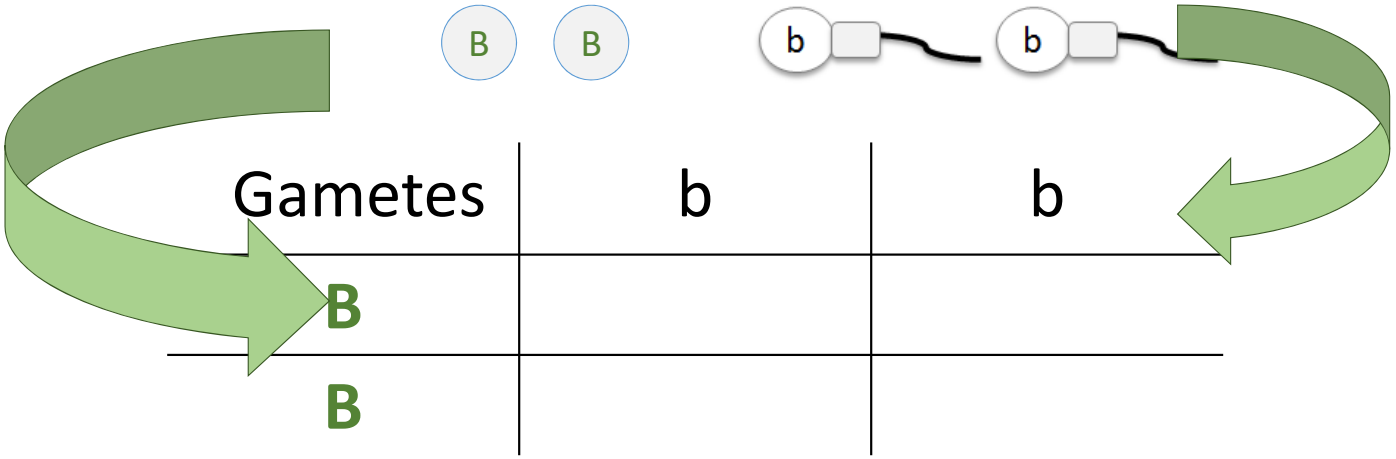
Inheritance part 2 – Genetic Inheritance

The Punnett Square

Reginald Punnett was a British geneticist who is most famous for creating the Punnett square diagram as a tool to predict the probability of genotypes in future offspring.

Parent phenotype: Black fur White fur

Parent genotype: BB bb

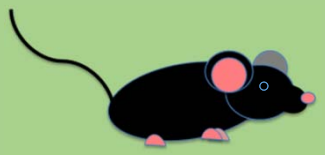


Inheritance part 2 – Genetic Inheritance

If an egg containing a dominant allele (B) is fertilised by a sperm with a recessive allele (b) then the result is an offspring with genotype Bb.

Gametes	b	b
B	Bb	Bb
B	Bb	Bb

The possible offspring all have the **genotype Bb**.
This is described as **heterozygous**.



The **phenotype** of all offspring from these parents will be **black fur** because one dominant allele is always present.

Inheritance part 2 – Genetic Inheritance

The **characteristic** of being a **tall** plant **or** a **short** pea plant is controlled by a **single gene**.
We will use the letter T to represent the gene for the purposes of a genetic diagram.
The allele which produces tall plants is **dominant** so we use **T**.
The allele for short plants is **recessive** so we use **t**.

Explain what would occur :

a) If two homozygous dominant plants were crossed.

The genotype for a homozygous tall plant is TT

Punnett square

Gamete	T	T
T	**TT**	**TT**
T	**TT**	**TT**

The genotype of **all** the future offspring will be TT and their phenotype will be **tall**. These parent plants will never produce short plants when crossed.

b) If two heterozygous plants were crossed.

The genotype for a heterozygous plant is Tt

Punnett square

Gamete	T	t
T	**TT**	**Tt**
t	**Tt**	**tt**

The **ratio** of **tall** plants to **short** plants likely to be produced is **3:1.**
In any four offspring, one would expect 1 homozygous dominant, 2 heterozygous and 1 homozygous recessive.

Inheritance part 2 – Genetic Inheritance

Explain what would occur :

c) If a homozygous dominant plant and a homozygous recessive plant were crossed.

The **genotype** for a homozygous dominant plant is TT.
The **genotype** for a homozygous recessive plant is tt.

Punnett square

Gamete	t	t
T	**Tt**	**Tt**
T	**Tt**	**Tt**

The genotype of **all** the future offspring will be Tt and their phenotype will be **tall**. All offspring will be heterozygous. The probability of getting a tall plant is described as 1 or 100%.

b) If two homozygous recessive plants were crossed.

The **genotype** for a homozygous recessive plant is tt.

Punnett square

Gamete	t	t
t	**tt**	**tt**
t	**tt**	**tt**

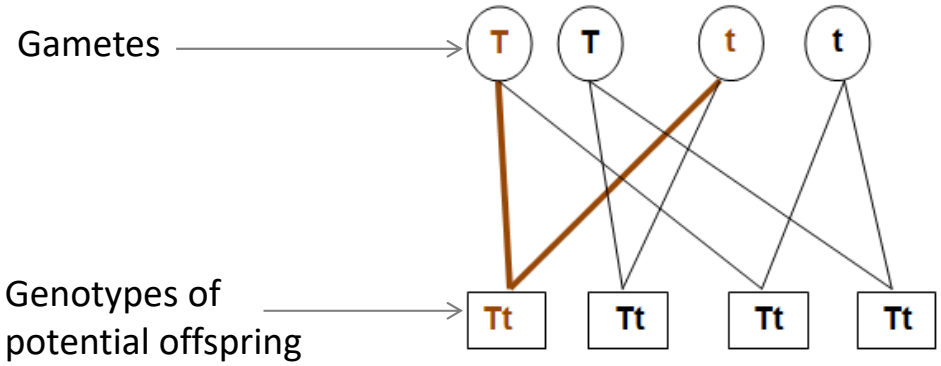
All future offspring will be **homozygous recessive**. Their **phenotype** will be **short.** These parents will **never** produce tall plants.

video

Inheritance part 2 – Genetic Inheritance

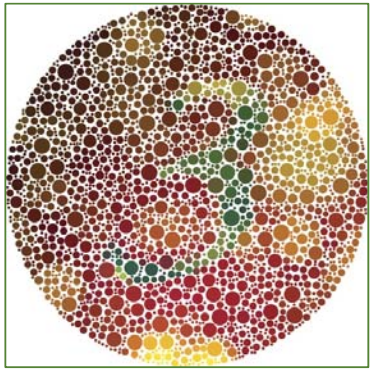
Not all exam questions use the Punnett square layout to find out possible genotypes. The basic principle is always the same.

A genetic diagram could also look like this:



Inheritance part 2 – Genetic Inheritance

Red green colour blindness in humans is also controlled by a single gene. It is a condition that a person is born with and is inherited from your parents. The gene is carried on the **X chromosome** and this means more **men** than women are affected.



The condition is caused by inheriting **two recessive alleles.**

Human eye colour is an example of when **multiple** genes affect the phenotype.

However, **most characteristics** are a result of **multiple genes** interacting, rather than a single gene. These are called <u>polygenic</u> features (poly = many genic= gene).
We are able to describe a **phenotype** **<u>but cannot write down a genotype</u>** because more than one gene is involved.

Inheritance part 2 – Inherited disorders

Some **disorders** are inherited. They are caused by the **inheritance** of certain **alleles**.

A child born in India currently holds the record for the most digits with 7 digits on each hand and 10 on each foot.

What do you notice about this cat?

The cat has an extra digit.

Polydactyly is an inherited disorder caused by a **dominant allele**. This condition means **extra fingers or toes** are present**.**

As polydactyly is caused by a dominant allele, it can be passed on when only one parent has the disorder.

Inheritance part 2 – Inherited disorders

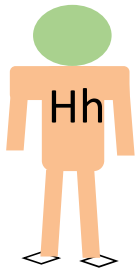
Cystic fibrosis is an inherited disorder caused by a **recessive** allele.
It affects **cell membranes** across the body.

H = healthy allele
h = CF allele

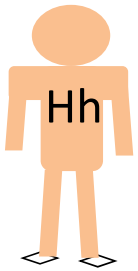
1 person **in** every **25** in the UK is statistically likely to be a **carrier** of **cystic fibrosis** (CF).

A **carrier** has **1 recessive allele** which codes for CF and **1 dominant allele** that codes for healthy cell membrane proteins.

A carrier is healthy and is unlikely to know they have the recessive allele unless they go through **screening** or have a child born with CF.



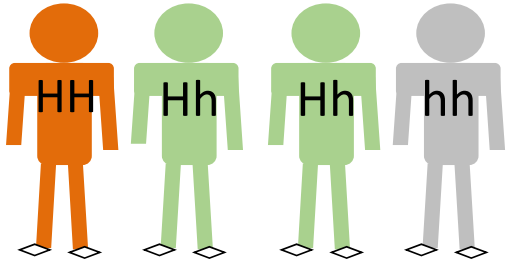
carrier father



carrier mother

Gamete	H	h
H	HH	Hh
h	Hh	hh

Possible offspring



If **two carriers** become parents there is a **1 in 4 chance** of their child having **cystic fibrosis**. This can also be described as **25% or 0.25.**

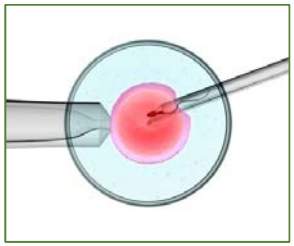
There is a **3 in 4 chance** of having a **healthy child**. This can be described as **75% or 0.75.**

There is a **1 in 2** chance of having a **healthy child** who **carries** the **recessive allele**. This can also be described as 50% or 0.5.

Inheritance part 2 – Inherited disorders

It is thought that 1 in 2500 babies born in the UK each year will have cystic fibrosis.

Screening of the embryo (or fetus) can be completed from 10 weeks of pregnancy. There is a **risk** of miscarriage with this process.
A fine needle is passed through the abdomen into the uterus and a small piece of the developing placenta is removed. This is analysed to see if alleles that cause polydactyly, cystic fibrosis or other genetic disorders are present. This testing is usually only done when there is a family history of the disorder. **Screening is costly** and **not 100% reliable**.



Embryos can be screened for parents undergoing **IVF** (in vitro fertilisation). The egg and sperm are mixed and fertilisation occurs in a laboratory. Usually several embryos are produced. The embryos are then screened. Any embryos which have the **faulty alleles** are **not implanted** into the mothers uterus. Only healthy babies will be born.

Gene therapy may be suggested for some disorders. This means **replacing** the **faulty allele** with a normal allele. This can not be done to gametes so can only occur in an individual who already has inherited the disorder. Gene therapy is still being researched and is not always successful. It is also **expensive**.

Gene therapy and embryo screening can be used to **alleviate suffering** but it is important to consider the **ethical issues** of these techniques.

Recall it ...

Inheritance

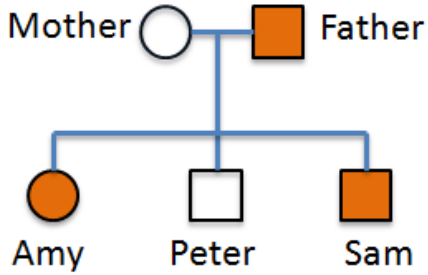
Use the information in the following page(s) to answer these questions …

1. What can a family tree tell us? How is a family tree used?
2. How can genotypes be determined using a family tree?
3. What questions can and can not be answered using genetic testing?
4. How many pairs of chromosomes would your find in a normal body cell? How is the 23rd pair different in males and females? Draw a punnet square to show the probability of a male and female?
5. A man and woman have three children – all boys. The woman is pregnant with their fourth child. ***What is the chance of the next child being a girl?***

Inheritance part 2 – Inherited disorders

A **family tree** can help to show how **genetic disorders** are inherited in a family. They can be used to work out the **probability** that a member of the family will **inherit** a disorder.
Read the **key** carefully to help you interpret a family tree accurately.

The family tree below shows the inheritance of a disorder caused by a **dominant** allele.



Key

- Female without disorder
- Female with disorder
- Male without disorder
- Male with disorder

What is the genotype of the mother? **Homozygous recessive**
What is the genotype of the father? **Heterozygous**

If the father was **homozygous dominant** then **all** the **offspring** would have the disorder. Peter does not have the disorder and is **homozygous recessive.**

Inheritance part 2 – Inherited disorders

Genetic testing can give answers to a question linked to science such as:

- What is the risk of my child having cystic fibrosis?

Genetic testing cannot give answers to questions linked to economic, social or ethical issues such as:

- *Should I have a genetic test because it may cause a miscarriage?*
- *If the embryo has a disorder should I have an abortion?*
- *Is it right that only healthy embryos are implanted in IVF?*
- *Should screening be available to everyone, not just those who can afford it or have the disorder in their family history?*
- *What if the test result is wrong?*

Different people will have different views.

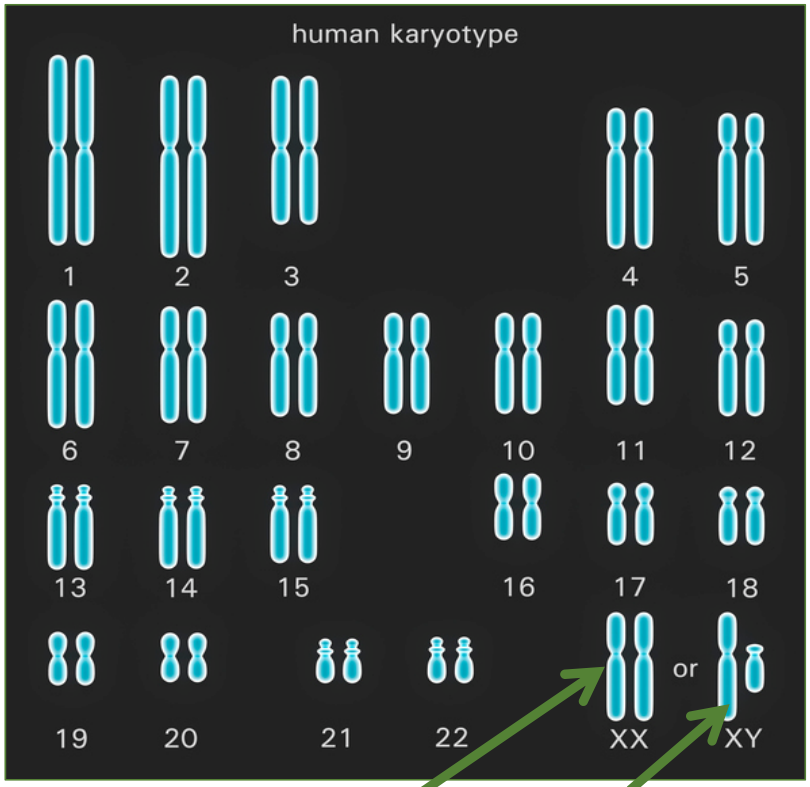
You will need to make informed decisions about the economic, social and ethical issues concerning embryo screening.

Inheritance part 2 – Sex determination

An ordinary **human body cell** contains **23 pairs** of chromosomes.
One chromosome of each pair comes from the egg and one from the sperm.

22 pairs of chromosomes control characteristics.

The **23rd pair** of chromosomes are called **sex chromosomes**. This pair carry the genes that determine sex. The sex chromosomes are **not identical** to each other and so are called **X** and **Y.**



In **females** the sex chromosomes are the same **-XX**

In **males** the sex chromosomes are different-**XY**

Inheritance part 2 – Sex determination

How is sex inherited?

The 23rd pair of chromosomes are responsible for determining the sex of a human.

The **Punnett square** is used to show the chances of an offspring being male or female.

A **woman** has the **genotype XX** and a **man** has the **genotype XY**.

Gametes	X	X
X	XX	XX
Y	XY	XY

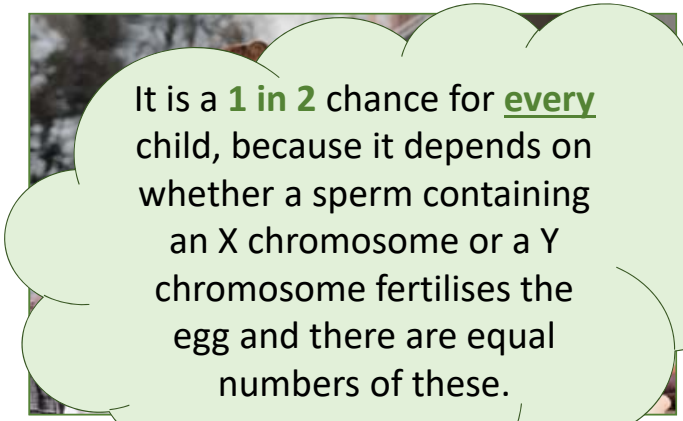
There is a **1 in 2** chance of the offspring being male or female.

This can also be described as a ratio of **1:1, 50:50** or **50%** or **0.5** of being male or female.

Inheritance part 2 – Sex determination

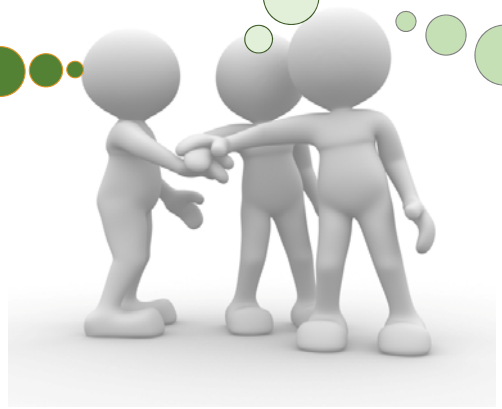
A man and woman have three children – all boys. The woman is pregnant with their fourth child.

What is the chance of the next child being a girl?



It is a **1 in 2** chance for **every** child, because it depends on whether a sperm containing an X chromosome or a Y chromosome fertilises the egg and there are equal numbers of these.

I think it is more likely to be a girl as they already have 3 boys .



I think there is **more chance** of the new baby being a boy because they **have 3 boys already**.

Ecology

Recall it …

Use the information in the following page(s) to answer these questions …

1. What is meant by a population, community and ecosystem?
2. What do animals compete for?
3. What do plants compete for?
4. What is interdependence? Give examples of interdependence?
5. What is a stable community?
6. What is an abiotic factor? Give examples?
7. What are biotic factors? Give examples?
8. What are behavioural, structural and functional adaptations? Give an example of each?
9. What is an extremophile? Give an example of an extremophile adapted to live in oceanic vents?
10. Describe what is a producer?
11. Describe what is biomass? How is biomass generated?
12. What do primary and secondary consumers feed off?
13. What are predators and prey?
14. How is carbon added to the atmosphere? How is carbon removed from the atmosphere? How is carbon locked into the soil?
15. How is water added to the atmosphere? How is water removed from the atmosphere? How does water run into the ground?

Adaptations, interdependence and competition part 1 - Communities

The different **levels of organisation** in an ecosystem are:

1 zebra	• **Organism** (an individual living thing)	
zebra herd	• **Population** (the number of a particular species living in a habitat)	
zebra buffalo	• **Community** (lots of different populations living in the area)	
Everything	• **Ecosystem** (the **interaction** of a **community** of **living** organisms with the **non-living** parts of their **environment**)	

Adaptations, interdependence and competition part 1 - Communities

To **survive** and **reproduce**, organisms require a **supply of materials** from their **surroundings** and from **other living organisms** there.

Plants in a community or habitat compete with each other for:

- Light
- Space
- Water and mineral ions from the soil

Animals in a community often compete with each other for:

- Food
- Mates
- Territory

Adaptations, interdependence and competition part 1 - Communities

Within a community each species **depends** on other species for their **survival**. This is called **interdependence.** If one species is removed it can affect the whole community.

Many flowering plants rely on insects like bees or butterflies for pollination.

Pandas rely on bamboo for food.

Animals or birds may carry plant seeds away from the parent plant to reduce competition.

Clown fish are protected from predators by the stinging tentacles of the anemone.

Adaptations, interdependence and competition part 1 - Communities

A **stable community** is one where **all** the **species** and **environmental factors** are in **balance** so that the **population** sizes remain fairly **constant**.

Competition is important in a community. It helps **maintain** the **balance**. When the weather is mild and **food is plentiful** in UK woodlands, rabbits **reproduce** and more **offspring survive** than is usual. This affects the amount of grass and vegetation being eaten by the increasing rabbit population leaving **less** for **other species**.

The fox population increases as there are plenty of rabbits for food and so more fox offspring survive. A greater number of foxes eat more rabbits and **reduce** their **population** back to normal. The fox population then slowly decreases as some foxes **starve** to death as they **compete** for food. The **balance returns** in the community.

Adaptations, interdependence and competition part 1 – Abiotic factors

'Bio' means **life** in Greek.

- Biology is the study of living organisms
- A biography is an account of someone's life

The prefix **'a'** in front of a science word often means 'not' or 'non'.

An **abiotic factor** is a **non-living factor**. Abiotic factors which may affect a community are:

- Light Intensity
- Temperature
- Moisture levels
- Soil pH and mineral content
- Wind intensity and direction
- Carbon dioxide levels for plants
- Oxygen levels for aquatic animals (living in water)

Adaptations, interdependence and competition part 1 – Biotic factors

Biotic factors means **living** factors.

Biotic factors which can affect a community are:

New predators which organisms might not be able to defend against.

Low **food availability** means organisms find it harder to survive and breed.

New pathogens being introduced and organisms having no resistance.

One species outcompeting another so the numbers are no longer sufficient to breed. In most of the UK, grey squirrels have outcompeted red squirrels.

Adaptations, interdependence and competition part 1 -Adaptations

Organisms have **features** (adaptations) which enable them to **survive** the conditions in which they normally live.

Adaptations can be:

- **behavioural** (actions an organisms takes)
- **structural** (how an organism is built)
- **functional** (how the organism works).

Migration or hibernation are examples of behavioural adaptation. They **increase** the **chances** of **survival** when food availability decreases in a habitat.

A duck with webbed feet, or trees having thick bark to resist fire, or cacti having needle like leaves to reduce water loss, are examples of **structural adaptations**.

Functional adaptations are not always easy to see. An example is a desert lizard producing very concentrated urine to conserve water.

Adaptations, interdependence and competition part 1 -Adaptations

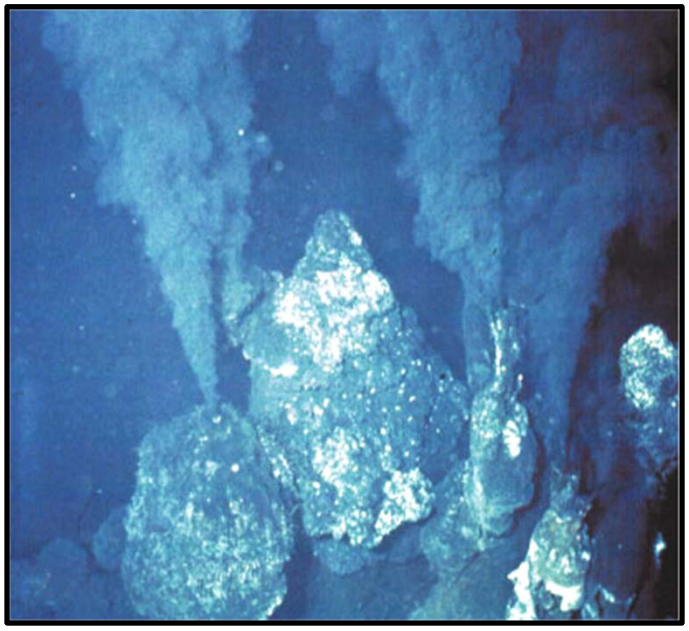
Some organisms live in environments which are very extreme, such as at **high temperature**, **pressure** or **salt** concentration.
These organisms are called **extremophiles.**

-phile means ‘a strong liking for’.
Acidophile - describes an organism that lives in acidic conditions.
Hydrophilic means water loving.

The vivid colours in this hot spring in Yellowstone National Park are the results of micro organisms living in this **extreme** environment.

Adaptations, interdependence and competition part 1 -Adaptations

A particular species of **bacteria** has been found living 2500m below the surface of the sea in **hydrothermal ocean vents**.
Temperatures are over 100°C , it is very acidic and pressures are very high. These conditions are very extreme.
These bacteria are **extremophiles**.
In order to survive, the **enzymes** found in these bacteria are specially **adapted** so they do not denature at high temperature.



Organisation of an ecosystem part 2 – Levels of organisation

Food chains are used to represent the **feeding relationships** within a **community**. **All** food chains **begin** with a **producer** which **synthesises** molecules. Molecules are made when atoms are joined by chemical bonds. This is usually a **green plant** or **alga** which makes **glucose** molecules by **photosynthesis**.

Photosynthetic organisms are the producers of **biomass** for life on Earth.

Biomass is the mass of **living material** in an organism.

Producers are eaten by **primary consumers** which in turn may be eaten by **secondary consumers** which may be eaten by **tertiary consumers**.

Organisation of an ecosystem part 2 – Levels of organisation

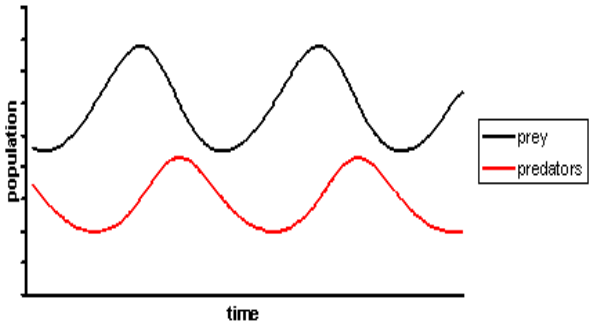
producer (grass)

primary consumer (rabbit)

secondary consumer (fox)

Consumers that **kill** **and** **eat** other animals are known as **predators** and those that are **eaten** are **prey.**

In a **stable community** the **numbers** of predators and prey **rise** and **fall** in **cycles**. The increases and decreases in predator population usually lag slightly behind that of the prey cycle.



Organisation of an ecosystem part 2 – Levels of organisation

It is important for **ecologists** to be able to determine the **distribution** and **abundance** (how many) of a **species** in an **ecosystem**. If one species is in decline, it can affect the whole ecosystem.

Sampling techniques are used to estimate the size of a population. **Quadrats** are often used to do this and they can be used in a random way or by placing them along a line through an area called a **transect**.

Quadrats are frames usually with an area of $0.25m^2$. They are placed on the ground and the organisms (usually plants) inside the frame are counted.

Quadrats are used to calculate population density, population frequency or percentage cover in an area. video

You need to be able to understand and calculate the mean, mode and median.

Link to required practical

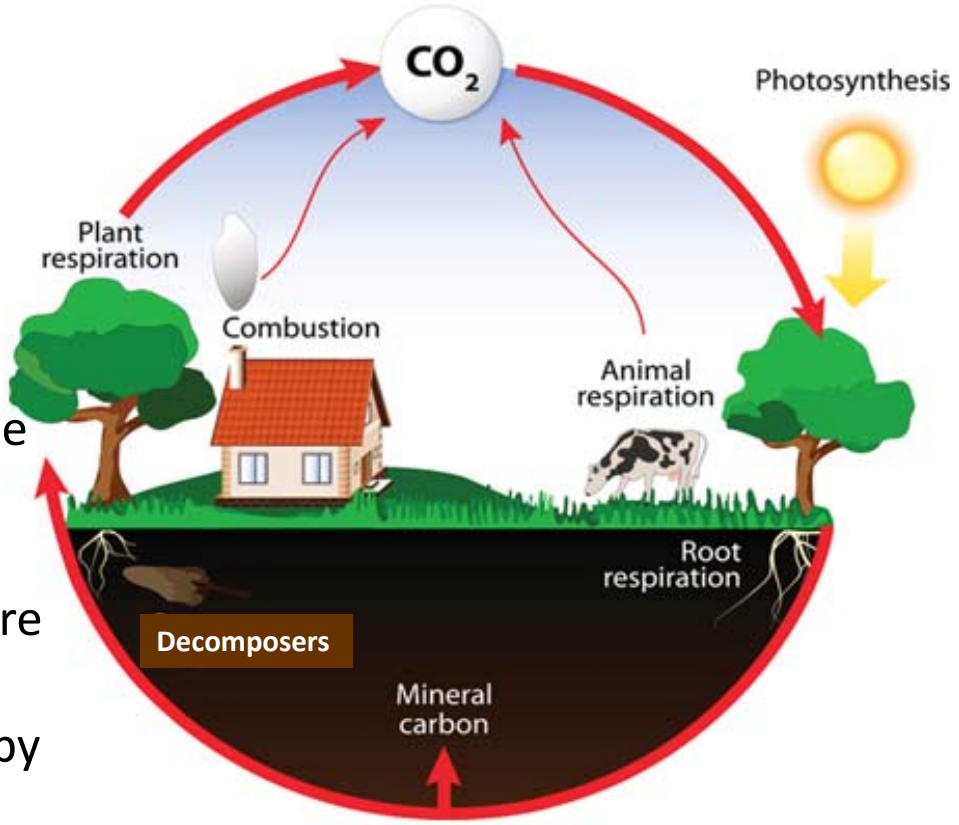
Organisation of an ecosystem part 2 – How materials are cycled.

All materials in the living world are **recycled** to provide the building blocks for **future** organisms.

The carbon cycle

returns carbon from organisms to the **atmosphere** as **carbon dioxide.**

Plants use carbon dioxide in **photosynthesis**. **Microorganisms** return carbon to the atmosphere as carbon dioxide and **mineral ions** to the soil by **decomposition**.



Organisation of an ecosystem part 2 – How materials are cycled

The **water cycle** provides **fresh** water for plants and animals on **land** before **draining** into the **seas**.
Water is continuously **evaporated** and **precipitated**.