Revision Guide

AQA GSCE Triple Biology Paper 2 Foundation

Name: Class:

10 Minutes on....

Homeostasis

Key Term	Definition	Example
Homeostasis	The regulation of internal conditions of a cell or organism to maintain optimum conditions.	Control of blood glucose levels. Water Levels Body Temperature
Receptor	Cells that detect a stimuli.	Rod and cone cells in the eye.
Stimuli	A change in the environment.	Change in temperature.
Coordination Centres	A structure such as the brain, spinal cord and pancreas which receive and process information from receptors.	Brain, spinal cord, pancreas.
Effectors	A muscle or gland that brings about a response.	Muscle or gland.

Examples of homeostasis.

Examples of homeostasis include control of blood glucose concentration, control of body temperature and control of water levels in the body.

Why homeostasis is important.

Homeostasis is important because it maintains optimal conditions for enzyme action and all cell functions.

10 Minutes on....

Nervous System

Key Term	Definition
Nervous System	A system that enables animals to react to their surroundings and to coordinate their behaviour.
Central Nervous System	The brain and spinal cord.
Sensory Neurone	Transmit impulses from receptors to relay neurones.
Synapse	A gap between neurones.
Relay Neurone	Transmit nerve impulses within the CNS.
Motor Neurone	Transmit impulses from relay neurones to effectors.

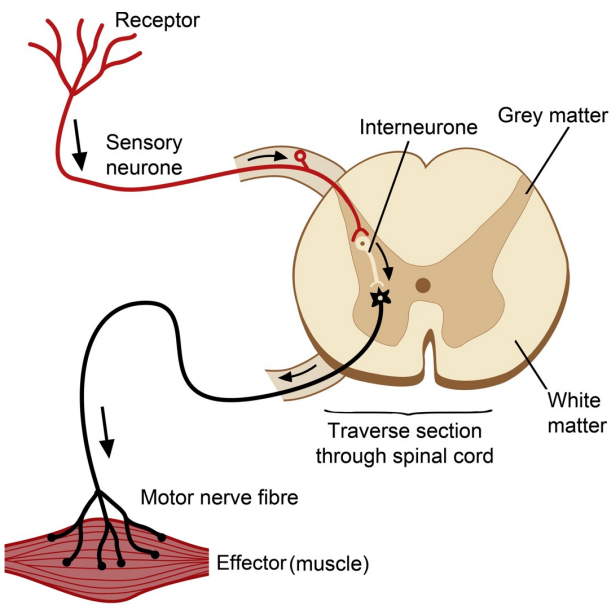
Model of a Reflex Arc

Receptor detects a change and generates an electrical impulse.

Impulse travels along the sensory neurone and crosses a synapse.

The impulse is processed by a relay neuron and the impulse then travels along a motor neurone to the effector.

The effector brings about a response.



10 Minutes on....

Reaction Time RP

A method to investigate the effect of a factor on reaction time.

1.
Person catching sits down, rests weaker arm across the table, with the hand overhanging the edge.

2.
Person dropping the ruler holds it so that the bottom end of the ruler is in line with the catches thumb and forefinger.

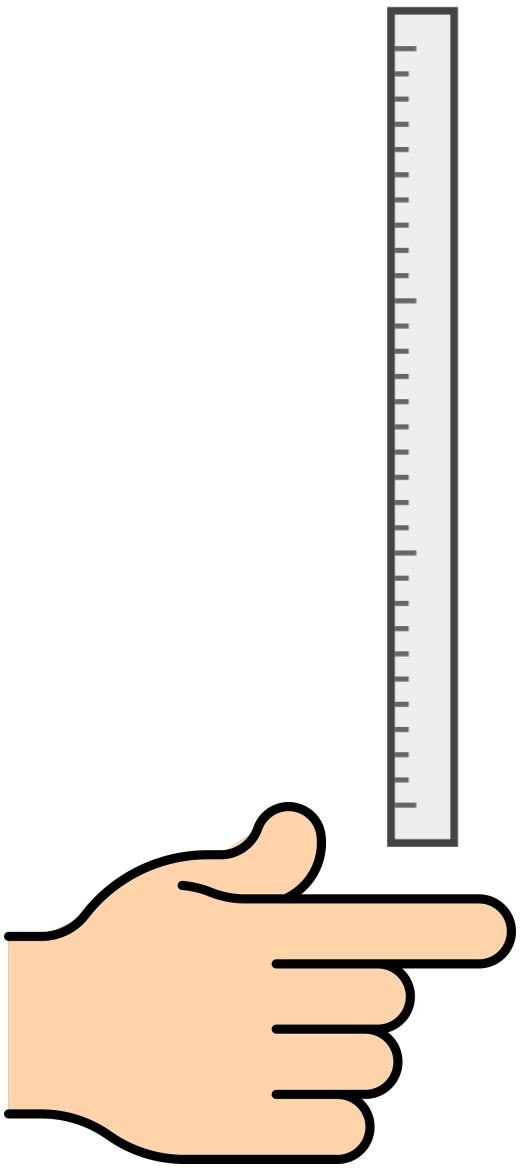
3.
Without warning the ruler is dropped.

4.
The other person catches the ruler and the distance the ruler fell is recorded.

5.
Repeat this several times.

6.
Identify outliers and calculate an average distance dropped.

7.
Convert this distance dropped to a reaction time using a table.`



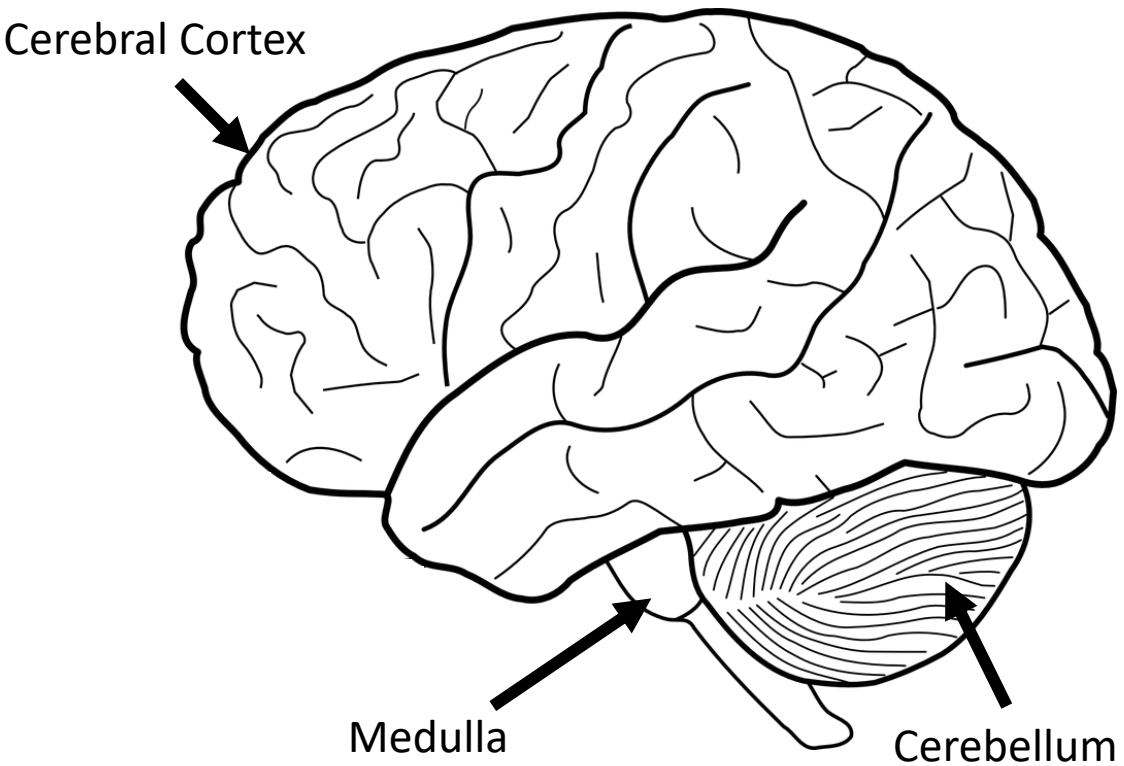
If you were investigating the effect of caffeine, you could repeat this with increasing quantities of caffeine.

10 Minutes on....

The Brain

Key Term	Definition
Brain	The brain is an organ that controls complex behaviour. It is made up of interconnected neurones and has different regions that carry out different functions.
Cerebral Cortex	The part of the brain that controls intelligence, personality and conscious thought. It is responsible for decision making.
Cerebellum	The part of the brain that controls balance, co-ordination movement and muscular activity.
Medulla	The part of the brain which controls unconscious activities such as breathing and heart rate.

Labelled diagram of the brain

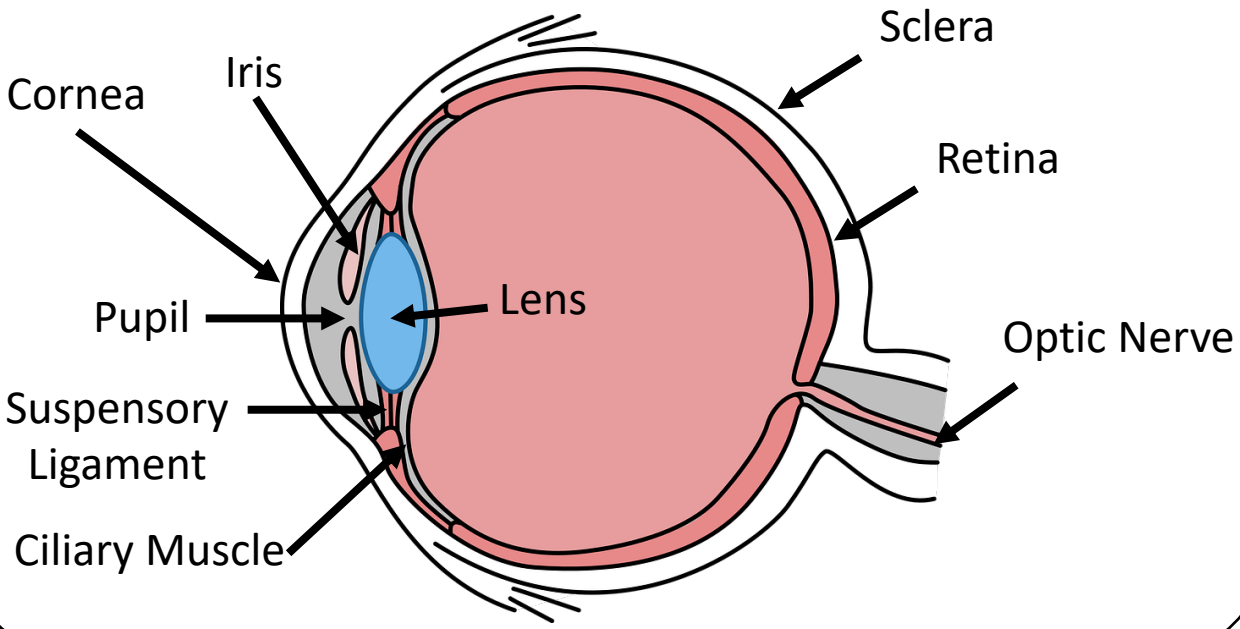


10 Minutes on....

The Eye

Key Term	Definition
Eye	A sense organ containing receptors sensitive to light intensity and colour.
Retina	Group of cells that detect light.
Optic Nerve	Carries impulses from the eye to the brain.
Sclera	White outer layer of the eye that protects it from injury.
Cornea	Refracts light as it enters the eye.
Iris	Coloured part of the eye that controls how much light enters the pupil.

Labelled diagram of the eye.



10 Minutes on....

Focusing The Eye

Key Term	Definition
Accommodation	The process of changing the shape of the lens to focus on near or distant objects.
Myopia	Short sightedness. This is when rays of light are brought into focus Infront of the retina.
Hyperopia	Long sightedness. This is when rays of light are brought into focus behind the retina.

How the eye focuses on a near object.

The ciliary muscles contract and the suspensory ligaments loosen. The lens is then thicker and refracts light rays strongly.

How the eye focuses on a far object.

The ciliary muscles relax, and the suspensory ligaments are pulled tight. The lens is then pulled thin and only slightly refracts light rays.

How defects of the eye can be treated.

Eye defects can be treated with spectacle lenses which refract light rays of light so that they focus on the retina. Other technologies to treat defects of the eye now include hard and soft lenses, laser surgery which changes the shape of the cornea and replacing the lens of the eye.

10 Minutes on....

Control of Body Temperature

Key Term	Definition
Thermoregulatory Centre	An area in the brain that contains receptors sensitive to the temperature of the blood
Vasoconstriction	The narrowing (constriction) of blood vessels by small muscles in their walls
Vasodilation	The widening (dilation) of blood vessels by the relaxation of small muscles in their walls

How the body responds when body temperature increases.

If the body temperature is too high, blood vessels dilate (vasodilation) and sweat is produced from the sweat glands. Both these mechanisms cause a transfer of energy from the skin to the environment. When the sweat evaporates from the skin, for example, heat from the body is transferred to the surroundings helping the body to cool. The dilated blood vessels cause more heat to be carried by the blood to the skin, where it can be lost to the air.

How the body responds when body temperature decreases.

If the body temperature is too low, blood vessels constrict (vasoconstriction), sweating stops and skeletal muscles contract (shiver). The constricted blood vessels reduce the amount of heat being carried by the blood to the skin and so it reduces the amount of energy that is lost to the surroundings. Shivering is a muscle activity that generates heat and warms the body. During shivering the muscles make very rapids contractions. This means the muscle cells respire more which releases more heat.

10 Minutes on....

Endocrine System

Key Term	Definition
Endocrine System	A system composed of glands which secrete chemicals called hormones into the bloodstream.
Master Gland	A gland that controls the function of other glands.
Pituitary Gland	A small master gland attached to the base of the brain that is important in controlling growth and development.
Pancreas	A leaf shaped gland behind the stomach that releases digestive enzymes and the hormones insulin and glucagon.
Thyroid	A gland in the neck that makes the hormone thyroxine.
Adrenal Gland	A located at the top of each of each kidney which releases adrenaline
Ovary	A gland found in the female reproductive system that secretes oestrogen and progesterone.
Testes	A gland found in the male reproductive system that secretes testosterone.

How the endocrine system works.

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 are slower but act for longer.

10 Minutes on....

Control of Blood Glucose

Key Term	Definition
Pancreas	A leaf shaped gland behind the stomach that releases digestive enzymes and the hormones insulin and glucagon.
Insulin	A hormone produced by the pancreas that causes glucose to move from the blood into cells.
Glycogen	A hormone produced by the pancreas that causes glycogen to be converted into glucose.

What happens when blood glucose levels rise.

If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.

10 Minutes on....

Diabetes

Diabetes	Description	Treatment	Prevention
Type 1	A disorder in which the pancreas fails to produce sufficient insulin. It is characterised by uncontrolled high blood glucose levels	Insulin injections	Can't be prevented.-
Type 2	In Type 2 diabetes the body cells no longer respond to insulin produced by the pancreas.	A carbohydrate controlled diet and an exercise regime are common treatments.	Eat a healthy balanced diet and exercise regularly.

Risk factors of Type 2 diabetes.
Obesity, family history, age

Comparing Type 1 and Type 2 diabetes.

Type 1 diabetes usually appears early in life while type 2 diabetes appears later. Type 1 is a genetic disease while Type 2 diabetes is linked to lifestyle and develops over time. Type 1 diabetes cannot be prevented while Type 2 diabetes can be prevented through making changes to lifestyle. A risk factor for both is a family history. In type 1 diabetes the body produces little or no insulin, while in type 2 diabetes insulin is produced, but the body cells do not respond to it.

10 Minutes on....

Water Balance

Ways that water is lost from the body.

Water is lost from the bodies in different ways for example:

- Water leaves the body via the lungs during exhalation.
- Water, ions and urea are lost from the skin in sweat.

There is no control over water, ion or urea loss by the lungs or skin. Excess water, ions and urea are removed via the kidneys in the urine. It is important that we control how much water is in the body because if body cells lose or gain too much water by osmosis they do not function efficiently.

How the kidneys work.

The kidneys regulate the water content in the blood and they remove the toxic waste products of metabolism. The kidney has lots of structures called nephrons. These nephrons start in the cortex of the kidney and loop down into the medulla and back to the cortex. The nephron regulates the level of water, and salts and removes urea from the blood.

What happens during kidney dialysis.

During dialysis Unfiltered blood that is high in urea is taken from a blood vessel in the arm, mixed with blood thinners or an anti-coagulant to prevent clotting, and pumped into the dialysis machine. Inside the machine the blood and dialysis fluid are separated by a partially permeable membrane the blood flows in the opposite direction to dialysis fluid, allowing exchange to occur between the two where a concentration gradient exists. Dialysis fluid contains:

- A glucose concentration similar to a normal level in the blood
- A concentration of ions similar to that found in normal blood plasma
- No urea

Through diffusion most of the urea in the blood is removed and the water and ion balance is restored.

10 Minutes on....

Human Reproduction

Key Term	Definition
Menstrual Cycle	The process of menstruation and ovulation in females.
Puberty	A stage of development in which reproductive hormones cause secondary sex characteristics to develop.

Hormone	Where it is Produced	What it Does
Testosterone	Testes	Stimulates sperm production.
Oestrogen	Ovaries	Involved in maintaining the uterus lining. Inhibits FSH production and stimulates production of LH.
Progesterone	Ovaries	Involved in maintaining the uterus lining. Inhibits FSH and LH production.
FSH	Pituitary Gland	Causes maturation of an egg in the ovary. Stimulates release of oestrogen.
LH	Pituitary Gland	Stimulates the release of the egg.

10 Minutes on....

Contraceptives

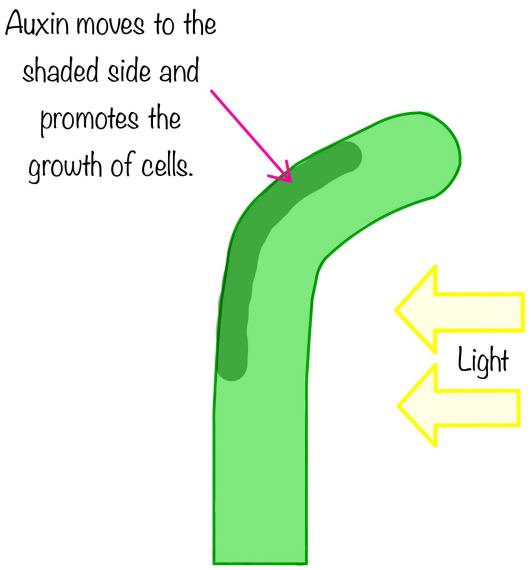
Contraceptive	Hormonal/ Non-Hormonal	What it Does	+	-
Oral	Hormonal	Contain hormones to inhibit FSH production so that no eggs mature	Can reduce some types of cancer	Risk of high blood pressure.
Injection	Hormonal	Slow release progesterone to inhibit the maturation and release of eggs for a number of months	Don't have to remember to take a pill everyday.	Side effects
Barrier Method	Non-Hormonal	Prevent the sperm reaching an egg	Easy to use	Can tear or rip.
Intrauterine Device	Hormonal	Prevent the implantation of an embryo or release a hormone	Can remain in position for a long time	Risk of ectopic pregnancy.
Spermicidal Agents	Non-Hormonal	Kill or disable sperm	Can be added to a barrier contraceptive	Can cause allergic reactions
Abstaining	Non-Hormonal	Not having intercourse when an egg may be in the oviduct	Cam be used for religious reasons.	If timings are not accurate the chance of pregnancy is high.
Surgical Methods	Non-Hormonal	Sterilisation	Effective a preventing pregnancy.	Can't be reversed

10 Minutes on....

Plant Hormones

Key Term	Definition
Phototropism	The growth of an organism in response to light. Shoots grow towards the light.
Gravitropism	The growth of parts of a plant in response to gravity. Shoots grow away from it while roots grow towards it.
Geotropism	The growth of parts of a plant in response to gravity. Shoots grow away from it while roots grow towards it.
Auxin	A hormone that promotes growth is shoots and inhibits in roots.
Gibberellins	Hormone important in the initiation of seed germination.
Ethene	Hormone that controls cell division and ripening of fruit.

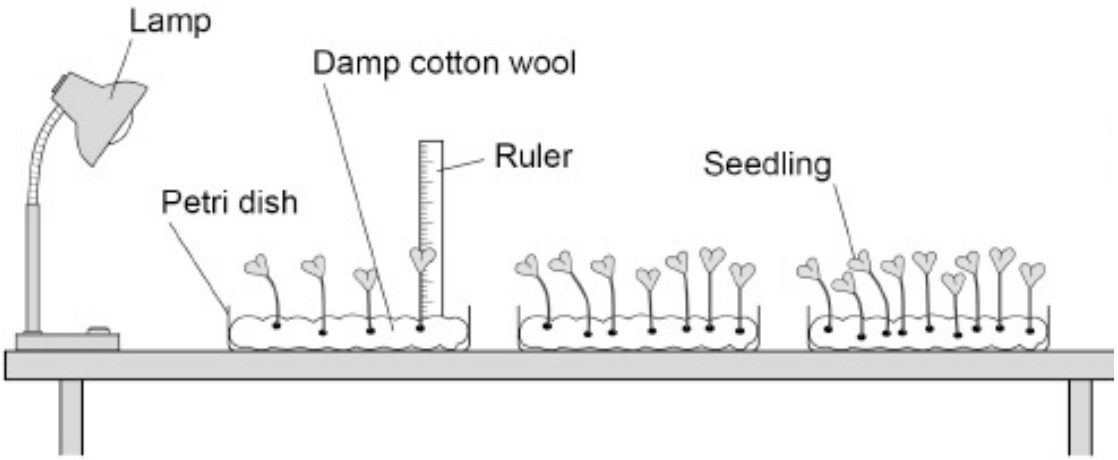
A diagram to model how phototropism occurs.



10 Minutes on....

Plant Hormones 1 RP

A method to investigate the effect of light on the growth of new seedlings.



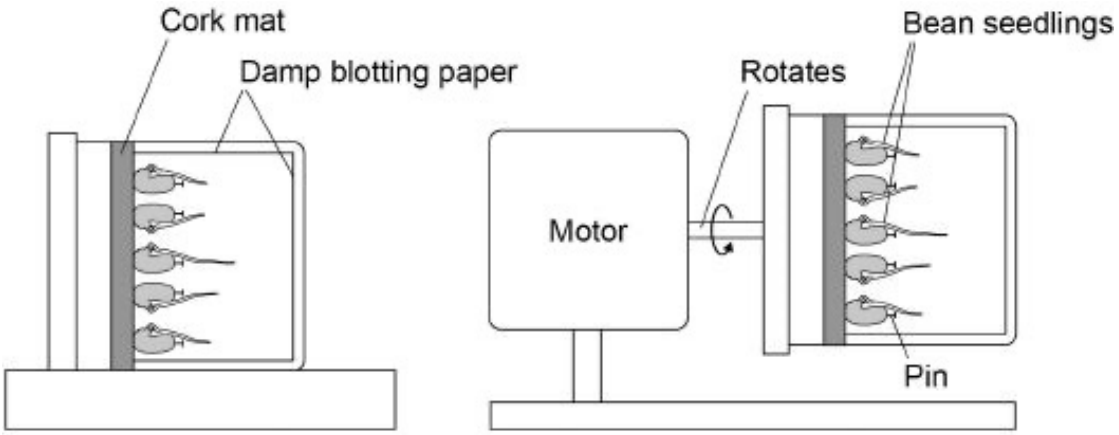
- Set up 3 petri dishes with some damp cotton wool in and 10 mustard seeds.
- Leave these dishes to allow the seeds to germinate watering equally if required.
- Once seeds have germinated check that each dish has the same number of germinated seeds. Place one dish in full light on a window, one in a dark cupboard and the other in a shady area of the room.
- Each day for a week measure the height of each seedling.
- Calculate a daily average for each location.
- Plot a graph of growth against time for each location.

Control variables include the same type of seed used, the same number of seeds in each dish and the amount the dishes are watered.

10 Minutes on....

Plant Hormones 2 RP

A method to investigate the effect of gravity on the growth of new seedlings.



Apparatus A
Stationary

Apparatus B
Rotating slowly

- Set up 2 petri dishes with some damp cotton wool in and 10 mustard seeds.
- Leave these dishes to allow the seeds to germinate watering equally if required.
- Once seeds have germinated check that each dish has the same number of germinated seeds. Place one dish stationary on its side attached to a cork mat (one directional gravity) and the second dish on cork matter that is attached to a turning motor (to model gravity in all directions).
- For a week measure the height and direction of growth of each seedling.
- Calculate a daily average for each dish.
- Plot a graph of growth against time for each location.

Control variables include the same type of seed used, the same number of seeds in each dish and the amount the dishes are watered.

10 Minutes on....

Reproduction

Key Term	Definition
Meiosis	A type of cell division that results in four daughter cells each with half the number of chromosomes of the parent cell,
Mitosis	A type of cell division in which two identical daughter cells are produced.
Sperm Cell	A male sex cell found in animals.
Egg Cell	A female sex cell.
Pollen	A male sex cell found in plants.
Sexual Reproduction	A type of reproduction in which a male and female sex cell fuse together.
Asexual Reproduction	A type of reproduction that only involves one parent.
Clone	Organism that is genetically identical to another.

Comparing sexual and asexual reproduction

- In sexual reproduction there are 2 parents while in asexual there is one.
- Sexual reproduction involves sex cells, asexual does not.
- Sexual reproduction involves meiosis and mitosis, asexual reproduction just involves mitosis.
- Offspring in sexual reproduction show genetic variation, while clones are produced in meiosis.

10 Minutes on....

Meiosis

Key Term	Definition
Meiosis	A type of cell division that results in four daughter cells each with half the number of chromosomes of the parent cell,
Gamete	Male and female sex cells.
Fertilisation	The process by which a male and female sex cell fuse together restoring the chromosome number.

Forming gametes

When a cell divides to form gametes:

- Copies of the genetic information are made
- The cell divides twice to form four gametes, each with a single set of chromosomes
- All gametes are genetically different from each other.

How fertilisation restores the number of chromosomes.

Gametes join at fertilisation to restore the normal number of chromosomes. Each sex cell has a half set of chromosomes. When two sex cells fuse together during fertilisation the chromosome number is restored. For example, an animal's body cell has 46 chromosomes while an egg and sperm cell contain just 23. When the two cells fuse together 23+23 = 46.

10 Minutes on....

Advantages and Disadvantages of Reproduction

Advantages of Sexual Reproduction	Disadvantages of Sexual Reproduction
Produces variation in the offspring. If the environment changes variation gives a survival advantage by natural selection. Natural selection can be speeded up by humans in selective breeding to increase food production.	Two parents needed, this means time and energy is spent finding a mate. Slower than asexual reproduction. If an individual becomes isolated, they will be unable to reproduce.

Advantages of Asexual Reproduction	Disadvantages of Asexual Reproduction
Only one parent needed. More time and energy efficient as they do not need to find a mate. Faster than sexual reproduction. Many identical offspring can be produced when conditions are favourable.	No variation in the offspring and so if conditions become less favourable the organism will be unable to adapt Disease will affect all the individuals in a population.

Organism	When it Reproduces Asexually	When it Reproduces Sexually
Malarial Parasites	In the human host	In the mosquito
Fungi	When it produces spores.	They produce sex cells which fuse. The offspring will have variation.
Strawberries	Strawberry plants make runners, in daffodils bulbs divide.	When they produce flowers which are pollinated.

10 Minutes on....

DNA and the Genome

Key Term	Definition
DNA	A polymer made up of two strands forming a double helix.
Genome	The entire genetic material of an organism.
Gene	A small section of DNA that codes for proteins.

Structure of DNA.

A polymer made up of two strands forming a double helix.

Advantages of studying the genome.

The whole human genome has now been studied and this will have great importance for medicine in the future. Knowledge of the genome can be useful for:

- Searching for genes linked to different types of disease
- Understanding and treatment of inherited disorders
- Use in tracing human migration patterns from the past.

10 Minutes on....

DNA Structure

Key Term	Definition
DNA	A polymer made up of two strands forming a double helix.
Nucleotides	A substance made up of a common sugar and phosphate group with one of four different bases attached to the sugar.
Amino Acid	The organic compounds which combine to form proteins.

Structure of DNA.

DNA is a polymer made up of two strands forming a double helix. The strands are made up from four different nucleotides. Each nucleotide consists of a common sugar and phosphate group with one of four different bases attached to the sugar.

Structure of a nucleotide.

A substance made up of a common sugar and phosphate group with one of four different bases attached to the sugar. The four bases are A,C,G and T.

10 Minutes on....

Genetic Inheritance

Key Term	Definition
Gamete	Male and female sex cells.
Chromosome	A structure found within the nucleus that carries genetic information in the form of genes.
Gene	A small section of DNA that codes for proteins.
Allele	Version of a gene
Dominant Allele	A variation of a gene that will produce a phenotype in the presence of other alleles.
Recessive Allele	A variation of a gene that will not produce a phenotype in the presence of another dominant allele.
Homozygous	Having two identical alleles of a particular gene.
Heterozygous	Having two different alleles of a particular gene.
Genotype	The genes an organism has.
Phenotype	The characteristic expressed because of the genes an organism has.

Examples of characteristics controlled by a single gene.
Fur colour in mice and red-green colour blindness

10 Minutes on....

Inherited Disorders

Polydactyly

Polydactyly is a genetically inherited disorder that causes an organisms to have extra fingers or toes. It is caused by a dominant allele which means you just need to inherit one allele to have the condition.

Cystic fibrosis

Cystic fibrosis is a genetically inherited of cell membranes that mainly affects the lungs and digestive system. It is caused by a recessive allele which means you just need to inherit two alleles to have the condition.

Arguments For Embryo Screening	Arguments Against Embryo Screening
Parents can be prepared emotionally and financially..	May receive a false positive or negative
Parents can make decisions from the test results.	Risk of miscarriage
Regulations are in place to prevent misuse of the screening (can't pick gender)	Ethical implications
It could stop people from suffering.	

10 Minutes on....

Sex Determination

How sex is determined.

Ordinary human body cells contain 23 pairs of chromosomes. 22 pairs control characteristics only, but one of the pairs (pair 23) carries the genes that determine sex. In females the sex chromosomes are the same (XX). In males the chromosomes are different (XY). In the egg cell there is always an X chromosome, while in the sperm cell there may be an X or a Y. If the offspring inherits a Y chromosome from the father, then they will be male, if the offspring inherits an X chromosome from the father, then they will be female.

Genetic cross to model sex inheritance.

Father / Mother	X	Y
X	XX	XY
X	XX	XY

XX: Female: 2:4 so 50% chance of offspring being female

XY: Male: 2:4 so 50% chance of offspring being male

10 Minutes on....

Variation

Key Term	Definition
Genome	The entire genetic material of an organism.
Phenotype	The characteristic expressed because of the genes an organism has.
Variation	Difference between organisms.
Mutation	A random change in genetic material that can lead to new characteristics.

Causes of variation within a population.

The genome and its interaction with the environment influence the development of the phenotype of an organism.

How a change in phenotype may occur.

Mutations occur continuously. Very rarely a mutation will lead to a new phenotype. If the new phenotype is suited to an environmental change it can lead to a relatively rapid change in the species.

10 Minutes on....

Evolution

Key Term	Definition
Evolution	A change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.
Natural Selection	A process by which a species changes over time in response to changes in the environment, or competition between organisms, in order for the species to survive.
Species	A group of organisms that can breed with one another to produce fertile offspring

Process of evolution.

The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago. Evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment.

Individuals in a species show a wide range of variation due to differences in their genes. Individuals with characteristics most suited to their environment are more likely to survive and reproduce. The genes are passed on to their offspring, which results in these specific genes becoming more common. Those that are poorly adapted to their environment are less likely to survive and reproduce. Their genes are less likely to be passed on to the next generation. Over a period of time, a species will gradually evolve.

How to determine if a new species has formed.

If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring, they have formed two new species.

10 Minutes on....

Selective Breeding

Process of selective breeding.

Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics. Humans have been doing this for thousands of years since they first bred food crops from wild plants and domesticated animals. Selective breeding involves choosing parents with the desired characteristic from a mixed population. They are bred together. From the offspring those with the desired characteristic are bred together. This continues over many generations until all the offspring show the desired characteristic.

Examples of selective breeding.

Disease resistance in food crops, animals which produce more meat or milk, domestic dogs with a gentle nature, large or unusual flowers.

Benefits of Selective Breeding.	Risks of Selective Breeding
New varieties may be economically beneficial by making more or better-quality food. Animals can be selected that cannot cause harm, for example cattle without horns.	Inbreeding can occur where some breeds are particularly prone to disease or inherited defects. Reduced genetic variation can lead to attach by diseases or insects. Rare disease genes can un unknowingly selected.

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Genetic Engineering

Examples of genetic engineering.

Examples of uses of genetic engineering include plant crops that have been genetically engineered to be resistant to diseases or to produce bigger better fruits or better shelf life. Bacterial cells have been genetically engineered to produce useful substances such as human insulin to treat diabetes.

Benefits of Genetic Engineering	Risks of Genetic Engineering
Crops can be grown that have an increased yield. Crops can be grown that are resistant to insects and herbicides. Could be used to overcome genetic disorders. Can be used to treat diabetes. Faster than selective breeding.	Ethical concerns around genetic engineering as some people think it is wrong to transfer a gene from one species to another. Concerns around possible health risks of eating genetically modified food. Gene may spread to other species.

10 Minutes on....

Cloning

Cloning Method	Description
Tissue Culture	Using small groups of cells from part of a plant to grow identical new plants.
Cuttings	An older, but simple, method used by gardeners to produce many identical new plants from a parent plant.
Embryo Transplants	Splitting apart cells from a developing animal embryo before they become specialised, then transplanting the identical embryos into host mothers.
Adult Cell Cloning	The nucleus is removed from an unfertilised egg cell. The nucleus from an adult body cell, such as a skin cell, is inserted into the egg cell. An electric shock stimulates the egg cell to divide to form an embryo. These embryo cells contain the same genetic information as the adult skin cell. When the embryo has developed into a ball of cells, it is inserted into the womb of an adult female to continue its development.

Benefits of Therapeutic Cloning	Risks of Therapeutic Cloning
May be used to cure diseases. Cells/Tissues of any type could be made. Lots of cells produced. Cells made could be used for research. Would reduce waiting time for organ transplants.	Potential life is killed. Shortage of donors. Egg collection has risks. Do not yet know risks of the procedure on the patient e.g. may cause cancer. May transfer viral infection. Poor success rate to make viable eggs.

10 Minutes on....

Theory of Evolution

Process of natural selection.

Charles Darwin traveled round the world making observations and collecting evidence. He proposed the theory of evolution by natural selection. This was:

Individual organisms with a particular species show a wide range of variation for a characteristic. Individuals with characteristics most suited to the environment are more likely to survive and breed successfully. The characteristics that have enabled these individuals to survive are then passed on to the next generation.

At the time Darwin did not know about genes. It is important when describing the process of natural selection to include genes. You could say there is variation due to mutation in genes. It is the genes that are passed on when the successful organisms breed.

Why the theory of evolution was only gradually accepted

The theory challenged the idea that God made all the animals and plants that live on Earth. There was a lack of evidence at the time the theory was published to convince many scientists and the mechanism of inheritance (genes) was not known until 50 years after the theory was published.

Theory suggested by Jean-Baptiste Lamarck

Lamarck suggested that changes in an organisms during its lifetime can be inherited. For example, if a giraffe stretched out its neck from reaching high up leaves, then its offspring would be born with the longer neck as well.

10 Minutes on....

Speciation

Process of speciation.

1. Two ancestral populations were separate or isolated from each other.
2. There is genetic variation within each population.
3. Each population is under different environmental conditions.
4. Natural selection occurs and the better adapted organisms survive to reproduce.
5. The favourable genes/alleles are passed on to offspring.
6. Eventually the two types cannot successfully reproduce to make fertile offspring and so two they are now two different species.

Work of Alfred Russel Wallace

Wallace independently proposed the theory of evolution by natural selection, and he published joint writings with Darwin in 1858. He worked worldwide gathering evidence for evolutionary theory. He is best known for his work on warning colouration in animals and his theory of speciation.

Why the theory of speciation has developed over time.

Over time we have found more evidence, and this has led to development of ideas which has resulted in our current understanding of the theory of speciation.

10 Minutes on....

Understanding of Genetics

Development of our Understanding of Genetics	Description of What Was Discovered (And How)
Mid 19th Century (Gregor Mendel)	Mendel carried out breeding experiments on plants. One of his observations was that the inheritance of each characteristic is determined by 'units' that are passed on to descendants unchanged.
Late 19th Century	The behaviour of chromosomes during cell division was observed.
Early 20th Century	It was observed that chromosomes and Mendel's units behaved in similar ways. This led to the idea that the "units", now called genes, were located on chromosomes.
Mid 20th Century	The structure of DNA was determined, and the mechanism of gene function was worked out.

10 Minutes on....

Evidence for Evolution

Key Term	Definition
Evolution	A change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.
Fossils	The 'remains' of organisms from millions of years ago, which are found in rocks
Antibiotic Resistance	Bacteria that are not killed by some antibiotics

Why the theory of evolution is now widely accepted.

Evidence for Darwin's theory is now available as it has been shown that characteristics are passed on to offspring in genes. There is further evidence in the fossil record and the knowledge of how resistance to antibiotics evolves in bacteria.

10 Minutes on....

Fossils

How fossils may form.

1. From parts of organisms that have not decayed because one or more of the conditions needed for decay are absent
2. When parts of the organism are replaced by minerals as they decay
3. As preserved traces of organisms, such as footprints, burrows and rootlet traces.

What we can learn from fossil evidence.

We can learn from fossils how much or how little different organisms have changed as life developed on Earth.

Why we can't be sure about how life began on Earth.

Scientists cannot be certain about how life began on Earth because many early forms of life were soft-bodied, which means that they have left few traces behind. What traces there were have been mainly destroyed by geological activity.

10 Minutes on....

Extinction

Key Term	Definition
Extinction	When there are no remaining individuals of a species still alive.

Factor Which May Contribute Towards Extinction	Explanation
New Diseases	With the arrival of a new disease the animal will have no immunity to it. If the pathogen is deadly there can be a rapid decrease in the animals numbers.
New Predators	With the arrival of a new predator animals that it prays upon will have their decrease as there are more animals now hunting them. They will also be unaware that the new predator could eat them. The animals that already preyed upon the new predator's food will not have less to eat and so their numbers could decrease rapidly also.
New More Successful Competitors	Organisms competing with these new competitors will have less resources available as there is more competition, this will cause their numbers to decrease
Climate Change	The change in climate can lead to changes within the habitat. This means that organisms adapted to the habitat can be under new pressures and stresses as they are no longer as well adapted.
Volcanic Eruptions	There is mass destruction of the habitats in the surrounding area leading to death of animals and plants.
Collision With an Asteroid	The force of an asteroid colling with Earth could destroy habitats and kills plants and animals.

10 Minutes on....

Resistant Bacteria

Key Term	Definition
Mutation	A random change in genetic material that can lead to new characteristics.
Antibiotic Resistant	Bacteria that are not killed by some antibiotics
MRSA	A bacterium that can cause infections in different parts of the body that is resistant to common antibiotics.

How antibiotic resistant bacteria strains may emerge.

Mutations of bacterial pathogens produce new strains. Some strains might be resistant to antibiotics, and so are not killed. They survive and reproduce, so the population of the resistant strain rises. The resistant strain will then spread because people are not immune to it and there is no effective treatment.

10 Minutes on....

Classification

Key Term	Definition
Carl Linnaeus	Developed a classification system in which living things were classified into groups depending on their structure and characteristics.
Linnaean System	A system of classification in which living things are classified into kingdom, phylum, class, order, family, genus and species. Organisms are named by the binomial system of genus and species.
Archaea	Primitive bacteria that usually live in extreme environments.
Bacteria	True bacteria. They are prokaryotic cells in which their DNA is not found enclosed within the nucleus.
Eukaryota	Organisms that have eukaryotic cells. This means that their genetic material is found enclosed in the nucleus.

The Linnaean System.
A system of classification in which living things are classified into kingdom, phylum, class, order, family, genus and species. Organisms are named by the binomial system of genus and species.

The Three Domain System
This is a system of classification developed by Carl Woese. This system was created due to evidence available from chemical analysis. In this system organisms are divided into achaea, bacteria and eukaryote.

10 Minutes on....

Communities

Key Term	Definition
Ecosystem	Interaction of a community of living organisms and their environment.
Interdependence	The relationship between different species in a community in which changes to one population will cause a change to another population.
Competition	When different organisms within a community are seeking the same limited resource.
Biotic	A non-living factor which can affect a community.
Abiotic	A living factor which can affect a community.
Stable Community	A community in which all the species and environmental factors are in balance so that population size remain fairly constant.

What Animals Compete For	What Plants Compete For
Mates Territory Food	Light Space Water Mineral Ions

10 Minutes on....

Abiotic Factors

Abiotic Factor	How a Change Could Affect a Community
Light Intensity	Typically, when light intensity increases the rate of photosynthesis increases and so there will be more growth. There are however some plants that prefer shade, they will not grow as well when light intensity increases. You aren't expected to know any examples of these plants, but they may be given in the exam question, watch out for this!
Temperature	Animals and plants are adapted to survive in particular temperatures. If they are taken from this temperature and put in a different one, they will struggle to survive.
Moisture Levels	Too little water and plants and animals will die. If plants are overwatered and the moisture levels are too high the roots are unable to get oxygen from the soil, are unable to respire, die and then rot which kills the rest of the plant.
Soil pH	Some plants and aquatic organisms are adapted to survive in different pH's. Some survive in acidic conditions while others will survive in alkaline conditions. If the pH changes, the organism will struggle to survive.
Soil Mineral Content	When mineral content becomes low plants will lack the nutrients that they require to grow and survive.
Wind Direction & Intensity	Lots of organisms prefer more sheltered locations. Plant seeds are more likely to settle and germinate there, and animals which depend upon these are more likely to live close to where they grow.
Carbon Dioxide Levels for Plants	Carbon dioxide is required for photosynthesis. This means that areas with high levels of carbon dioxide have high rates of photosynthesis which results in healthy plants. If carbon dioxide is limited, then rate of photosynthesis decreases, and so plant growth will be less.
Oxygen Levels for Aquatic Animals	Water contains oxygen. This is a combination of oxygen produced by aquatic plants and oxygen that has dissolved in from the air. This oxygen is vital for organisms that live underwater as they need it for respiration. Without it aquatic animals would suffocate and die. Healthy bodies of water such as lakes and rivers have high levels of oxygen while polluted waters often have low levels of oxygen. Only certain species such as sludge worms can survive in polluted bodies of water. This pollution means that only certain **species** can survive there such as sludge worms. Sludge worms are a bioindicator species because their presence or absence informs us about the condition of the habitat. If they are present the habitat is polluted.

10 Minutes on....

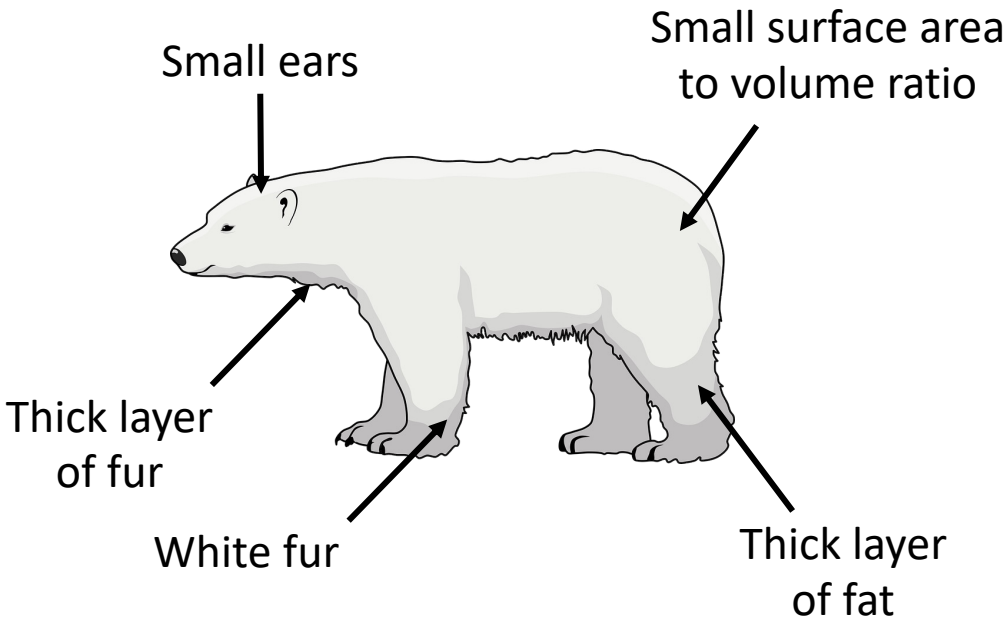
Biotic Factors

Biotic Factor	How a Change Could Affect a Community
Availability of Food	If food is plentiful then the numbers of organisms in the community should increase. The number of organisms that eat the food will increase first, followed by the predators that eat them. If availability of food is limited, then the number of organisms in the community will decrease.
New Predators Arriving	The arrival of new predators in an ecosystem can have a devastating effect to the entire ecosystem. Normally, in a balanced ecosystems, predators and prey have evolved together, their numbers increasing and decreasing in a cycle, there is a balance. A new predator arriving can destroy this balance. There could be a huge decline in the numbers of prey, which then reduces the food supply for the original predators.
New Pathogens	It is very common for organisms that are new to an ecosystem to bring pathogens with them. The organisms that live in the community may not have come across the pathogen before and so will not have immunity which can have huge consequences for them and can cause death. An example of this in recent human history is the death of Native Americans from flu when Europeans first colonised North America.
One Species Out Competing Another	The introduction of a new species into an ecosystem can result in it out-competing another native species. This can lead to the native species struggling to survive and resource. For example, red squirrels are native to the UK while grey squirrels were introduced a few hundred years ago. The grey squirrels outcompeted the red squirrels and so the numbers of red squirrels has really decreased.

10 Minutes on....

Animal Adaptations
Cold Climates

Adaptations of animals living in cold habitats.

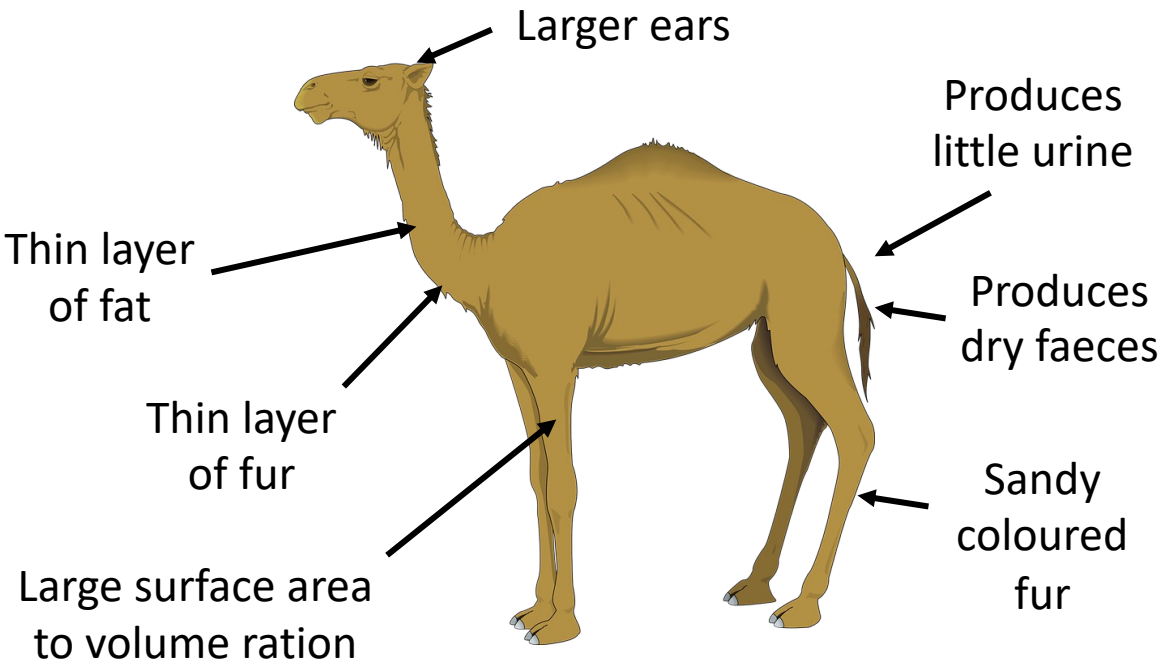


Adaptation for the Cold	How It Helps The Animal Survive
Thick fur Small ears White fur Small surface area to volume ratio Thick layer of fat	Insulation Reduced heat loss Camouflage Reduces heat loss Insulation

10 Minutes on....

Animal Adaptations
Hot Dry Climates

Adaptations of animals living in hot and dry habitats.

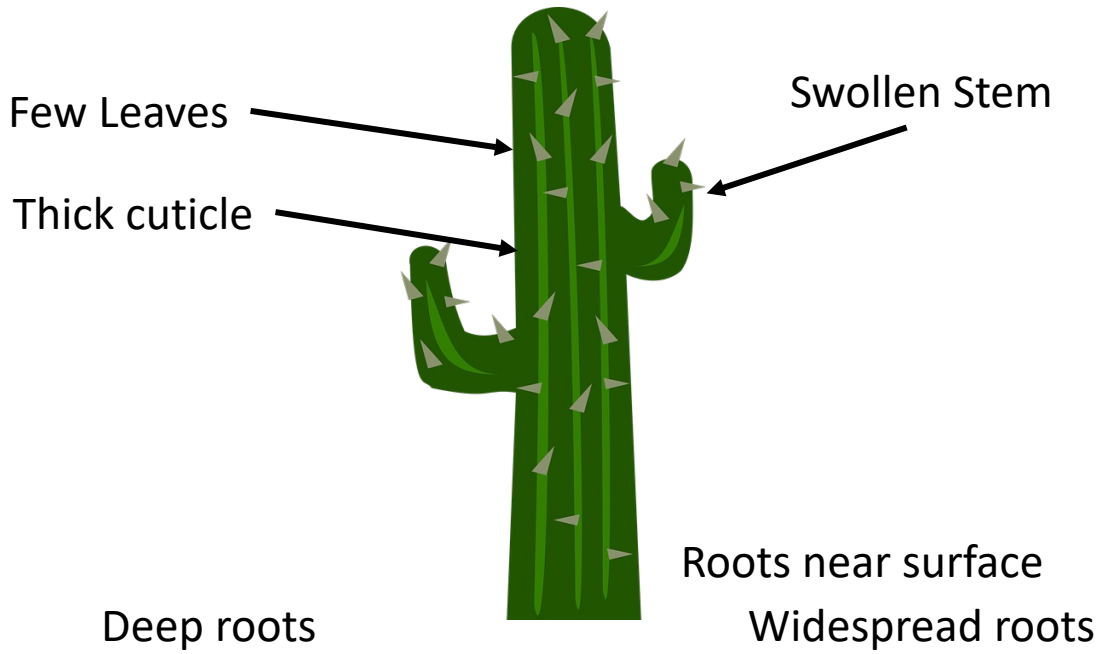


Adaptation for Survival in the Desert	How It Helps The Animal Survive
Produces little urine	Reduces water loss
Produces dry faeces	Reduces water loss
Thin layer of fur	Reduces insulation
Larger ears	Increased heat loss
Large surface area to volume ratio	Increased heat loss
Thin layer of fat	Reduces insulation
Sandy coloured fur	Camouflage

10 Minutes on....

Plant Adaptations
Hot Dry Climates

Adaptations plants have for living in hot and dry habitats.



Adaptation for Survival in the Desert	How It Helps The Plant Survive
Few leaves	Reduces water loss
Thick cuticle	Reduces water loss
Deep roots	Can reach water from deep underground
Roots near surface	Can obtain water when it rains
Widespread roots	Can obtain water from a large area
Swollen stem	To store water

10 Minutes on....

Extremophiles

Key Term	Definition
Extremophile	Organisms that live in environments that are extreme such as high temperature, pressure or salt concentration.
Deep Sea Vents	Places on the ocean floor where the volcanic gases of underground magma chambers bubble through.

Examples of extreme environments.

Examples of extreme environments include polar regions such as the Arctic and Antarctica, deserts and the deep ocean bed. Further examples include hot geothermal springs and the tops of high mountains which are at high altitudes..

Conditions around a deep-sea vent.

Deep sea vents are completely dark, and the temperature and pressure are very high.

What would happen to a normal cell if it were in very salty conditions.

In very salty conditions the concentration of the cell will be more dilute and so water will move out of the cell into the surrounding solution by osmosis. The cell will shrink, and this can affect the chemical reactions that take place in the cell.

10 Minutes on....

Levels of Organisation

Key Term	Definition
Biomass	The total quantity or weight of an organism in a given area/volume
Photosynthetic Organisms	An organism such as algae and plants which harness the suns energy to produce glucose.
Food Chain	A diagram that models feeding relationships within a community.
Producer	Organisms that photosynthesise.
Consumer	An organism that eats another organism.
Predator	Consumers that hunt and eat other consumers
Prey	Consumers eaten by predator
Stable Community	A community in which all the species and environmental factors are in balance so that population size remain fairly constant.

Labelled food chain to model a feeding relationship you may find in a garden.

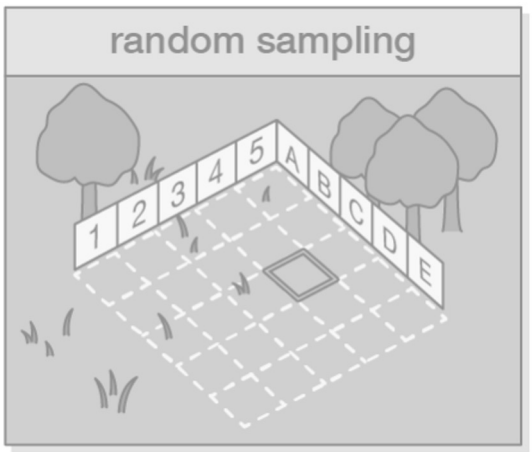
Producer → Primary Consumer → Secondary Consumer → Tertiary Consumer

Leaf → Aphid → Ladybird → Thrush

10 Minutes on....

Quadrat RP

A method to approximate the number of dandelion that are in a field.

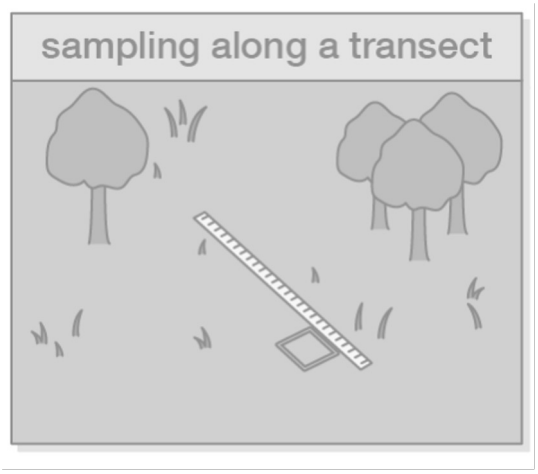


1. Measure the dimensions of the field and use this to calculate an area.
2. Place 10 0.25m^2 quadrats randomly in the field.
3. Count the number of the organism growing within that quadrat.
4. Identify outliers and calculate an average.
5. Multiply your average by 4 to find the average number of dandelions in 1m^2
6. Multiply the average number of dandelions in 1m^2 by the total area of the field.

10 Minutes on....

Transect RP

A method to investigate the effect of light on the distribution of dandelion in a field.



1.
Place a tape measure across the length of the field.

2.
Put the quadrat at the 0cm mark and count how many of that organism are within the transect.

3.
Record the abiotic conditions such as light intensity.

4.
Place a quadrat every 5m and count the number of organisms within the quadrat. Record the abiotic factors.

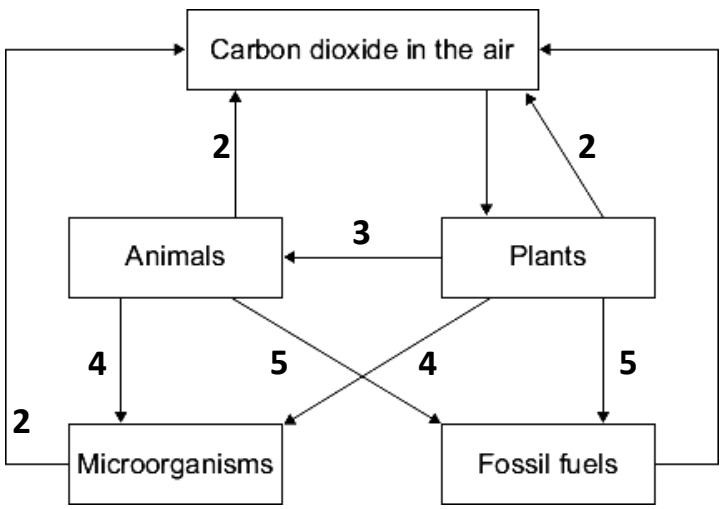
5.
Repeat these steps with 4 more transect lines.

10 Minutes on....

Carbon Cycle

Key Term	Definition
Combustion	When fuels are burned which produces carbon dioxide gas.
Respiration	A process in which glucose and oxygen react to release energy. Carbon dioxide and water are products.
Decay	The process by which organic matter is broken down by microorganisms.
Photosynthesis	The process by which carbon dioxide and water make glucose and oxygen. It takes place in chloroplasts.

Diagram to model the carbon cycle.



Key Terms	
1	Photosynthesis
2	Respiration
3	Consumption
4	Decay
5	Fossil Fuels
6	Combustion

Role of microorganisms in the carbon cycle.

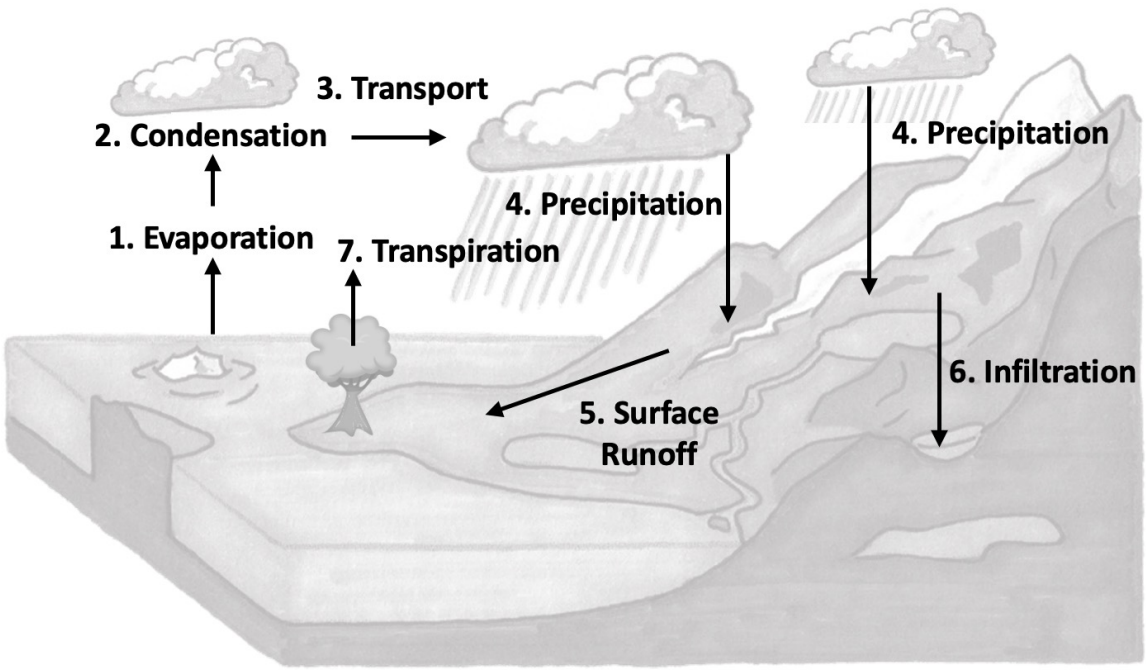
Microorganisms feed on organic matter. As they do they respire. As they respire carbon dioxide is released into the atmosphere.

10 Minutes on....

Water Cycle

Key Term	Definition
Evaporation	This is when water turns from a liquid to a gas to form water vapour. Water evaporates from all places on the Earth's surface such as puddles, ponds, rivers, lakes and oceans. Evaporation is sped up by the Sun and the wind.
Condensation	Water vapour cools and turns from a gas to liquid. This forms clouds.
Precipitation	When rain falls from the sky. Precipitation can also include snow, hail and sleet.
Transpiration	There is a constant stream of water from the plants roots to their leaves. Water evaporates from the surface of the plants leaves by transpiration.

Diagram to model the water cycle.



10 Minutes on....

Decay

Factor	Effect on Rate of Decay
Temperature	At colder temperatures decomposing organisms are less active and so the rate of decomposition remains low. This explains why we keep food in a fridge or a freezer. As the temperature increases, decomposers become more active and so the rate of decay increases. At very high temperatures decomposers will be killed and so decomposition will stop.
Water	Decomposers cannot survive when there is little or no water and so when the availability of water is very low there is no decomposition. Water is not just needed for the decomposers to survive but also for the reactions causing decay to occur. This is because decomposers secrete enzymes onto decaying matter and then absorb any dissolved molecules, without water this wouldn't happen. Overall, as the volume of available water increases, the rate of decomposition also increases.
Availability of Oxygen	Decomposers cannot survive when there is little or no oxygen and so when the availability of oxygen is very low there is no decomposition. As the volume of available oxygen increases, the rate of decomposition also increases.

How gardeners and farmers try to provide optimum conditions for decay.

Gardeners use compost bins with holes in to allow air to enter in and out. This provides a warm, moist conditions with a good oxygen supply.

Uses of anaerobic decay.

Some bacteria and fungi can break down dead matter without oxygen. This can happen in waterlogged soil and in marshes. During anaerobic decay, the greenhouse gases methane and carbon dioxide are produced. We can use the methane as a fuel. Biogas generators can be used to produce methane gas as a fuel. The biogas generators are large vessels that can be filled with animal waste or specially grown crops such as maize that will then be digested anaerobically.

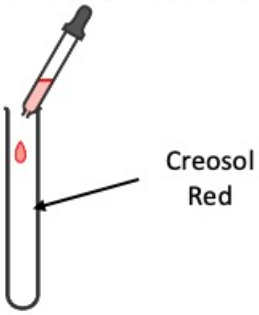
10 Minutes on....

Decay RP

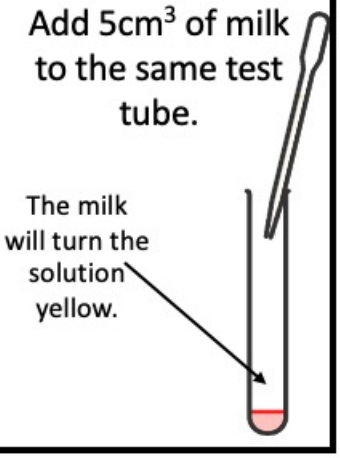
A method to investigate the effect of temperature on the rate of decay of milk.

1.
Add 5cm^3 of lipase to a test tube.

2.
Add drops of creosol red to another test tube.



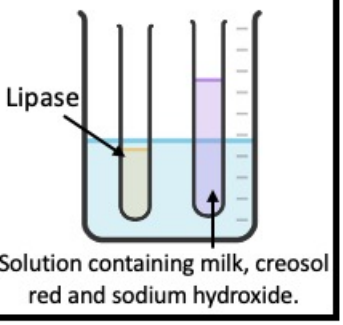
3.
Add 5cm^3 of milk to the same test tube.



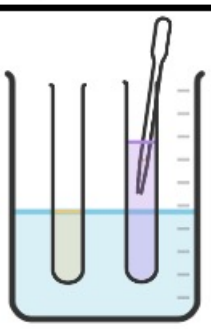
4.
Add 7cm^3 of sodium hydroxide to the same test tube.

5.
Add a thermometer to the test tube.

6.
Add both test tubes to the water bath.



7.
Remove 1 cm^3 of the lipase and add it to the milk



8.
Time how long it takes for the colour to change yellow.

9.
Repeat at different temperatures.

10 Minutes on....

Biodiversity

Key Term	Definition
Biodiversity	Biodiversity is the variety of all the different species of organisms on earth, or within an ecosystem.

Change on Earth	Effect on Biodiversity Explained
Deforestation	Deforestation destroys habitats of the organisms that live there, and it kills many species. This is reducing biodiversity and causing extinctions.
Waste	All of the above has resulted in the loss of habitats for different species, reduces biodiversity and is causing some species to become extinct.
Global Warming	Global warming is destroying habitats which is putting animals and plants at risk of extinction. Biodiversity is decreasing.

Why biodiversity is important.

A great biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment. The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are reducing biodiversity and only recently have measures been taken to try to stop this reduction.

10 Minutes on....

Waste Management

Key Term	Definition
Waste	A material that is discarded as it is not useful.

Pollution	Examples
Water	Water can become polluted by different sources including residential areas, industry and agriculture. Sewage from residential areas can contaminate water while rivers can also be contaminated from nearby farmland. Chemicals that farmers add to their fields can wash into nearby water. Examples of chemicals include pesticides, herbicides and fertilisers.
Air	Fuels are burned which releases carbon dioxide into the atmosphere. This contribute to the greenhouse effect and can cause global warming. When fuels burn sulfur dioxide and nitrogen oxides may also be produced. They may dissolve in water and cause acid rain. Acid rain can damage trees and can also lower the pH of rivers and lakes which can kill the organisms such as fish living in it. Acid rain can also react with metals and rock which causes them to change in appearance. Air pollution can also be caused by tiny particulates in the smoke which cause smog.
Land	Any rubbish that is thrown out and not recycled goes to landfill. These are large holes in the earth where rubbish is dumped. Sometimes people dump rubbish in public places to avoid paying for it to be disposed of. This is known as fly tipping.

Why the amount of waste on Earth is increasing.

Rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used, and more waste is produced.

10 Minutes on....

Land Use

Ways humans reduce land available for animals and plants.

Humans reduce the amount of land available for other animals and plants by:

- Building
- Quarrying
- Farming
- Dumping Waste

Why the destruction of peat bogs is reducing biodiversity.

When peat bogs are destroyed this reduces the area of the habitat. This then reduces the variety of different plant, animal and microorganism species that live there which means biodiversity is reduced.

Arguments for the Destruction of Peat Bogs	Arguments Against The Destruction of Peat Bogs
The peat can from the bog can be used to make garden compost. The peat can be used as a fuel source.	The decay and burning of peat releases carbon dioxide into the atmosphere and increase global warming. Destroys habitats which can reduce biodiversity and lead to extinction of certain species.

10 Minutes on....

Deforestation

Why deforestation is occurring.

Deforestation occurs to:

- Provide land for cattle and rice fields
- Grow crops for biofuels

Advantages of Deforestation	Disadvantages of Deforestation
Provides land for farming	Decreased biodiversity
Provides land for quarrying	Destruction of habitats
Provides land for building	Disruption of food chains
To provide wood for building materials	Loss of habitats
To provide fuel	Increased carbon dioxide
To provide paper	Global warming
	Soil erosion

10 Minutes on....

Global Warming

Key Term	Definition
Global Warming	This is the increase in the mean temperature of the Earth.
Climate Change	A change in global or regional climate conditions.

Biological Consequence of Global Warming	Effect on Biodiversity Explained
Glaciers and Polar Ice Melting	Organisms that live in these areas are losing their habitat causing their numbers to decrease. Sea levels will rise causing flood and destruction of habitats elsewhere also.
Expansion of Seawater	The rising temperatures will cause the seawater to expand. This can cause flooding of of low-lying land around the world.
Extreme Weather	The extreme weather destroys habitats and so reduces biodiversity.
Changes in Animal Migration Patterns	This disrupts food chains and so puts other species who are in the same food web/chain at risk also. Biodiversity decreases.
Changes in Rainfall	Some areas will have heavier rainfall and become much wetter, while other areas will have much less rainfall and become drier. This can cause deserts to form in a process called desertification
Loss and Extinction of Animals and Plants	Other organisms may depend on these plants and animals and so they will be at risk also.
Habitats Changing	Organisms may struggle to survive in their changed habitat and so biodiversity decreases.

10 Minutes on....

Maintaining Biodiversity

Way to Maintain Biodiversity	Description	+	-
Breeding Programmes	The planned breeding of a group of animals or plants, usually involving at least several individuals and extending over several generations.	Stable, healthy populations created. It also increases the numbers of endangered organisms and organisms are protected from natural predators. Eventually we may be able to reintroduce species back into their natural habitat.	Reduced genetic variation can lead to attack by specific insects or disease, which could be extremely destructive. Rare disease genes can be unknowingly selected as part of a positive trait.
Protection and Regeneration of Rate Habitats	A management practice that looks to conserve protect and restore habitats.	Protects animals and plants that otherwise would be at risk of extinction.	It reduces land available to humans for other uses.
Reintroduction of Field Margins	Hedges are planted in areas around farmland to reintroduce some habitats back.	Increases biodiversity around the fields.	Farmers lose space to grow their crops.
Reduction of Deforestation	Strategies include planting more trees and reducing our consumption of paper.	Reduces climate change, desertification, soil erosion and it reduces greenhouse gases in the atmosphere	It reduces land available to humans for other uses and reduces wood for timber and fuel.
Reduction in Carbon Dioxide Emissions	Reducing our CO_2 emissions by changing our behaviour. For example, reducing energy consumption.	Reduces the rate of global warming and climate change.	Cost
Recycling Resources	Recycling resources rather than dumping waste in landfill. Paper, glass, plastics and metals can all be recycled rather than putting them into landfill.	Reduces the amount of waste sent to landfills and incinerators. Conserves natural resources such as timber, water and minerals.	Cost Possible release of pollutants.

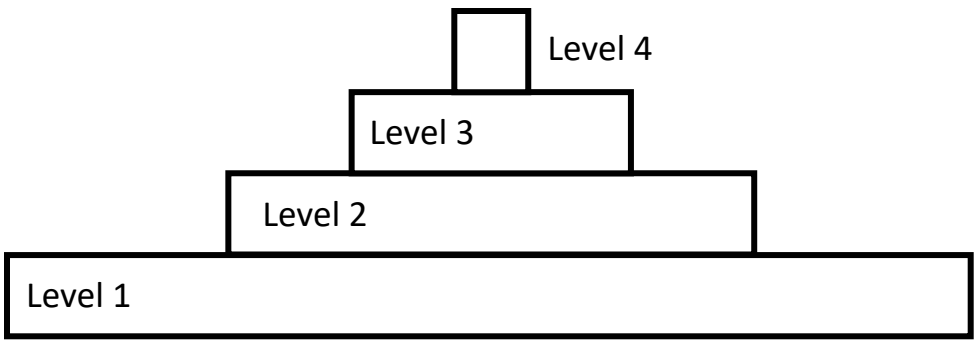
10 Minutes on....

Trophic Levels

Key Term	Definition
Apex Predator	Carnivores with no predators.
Decomposers	Organisms that break down dead plant and animal matter by secreting enzymes into the environment. Small soluble food molecules then diffuse into the microorganism.

Trophic Level	Description
Level 1	Plants and algae that make their own food. These organisms are producers.
Level 2	Herbivores that eat plants/algae. They are known as primary consumers.
Level 3	Carnivores that eat herbivores. They are known as secondary consumers.
Level 4	Carnivores that eat other carnivores. They are known as tertiary consumers.

Pyramid of biomass.



10 Minutes on....

Transfer of Biomass

Why only 10% of biomass is transferred between each trophic level.

Only around 10% of biomass is transferred to the next trophic level this is because:

- Not all ingested material is absorbed, some is egested as faeces. Bones and teeth are also not eaten.
- Some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine.

Why a shorter food chain produces a greater proportion of biomass for food for humans.

A shorter food chain has few trophic levels and so less energy is lost in waste such as faeces/urine and less energy is lost in respiration. This means that there is more biomass available for humans to eat.

10 Minutes on....

Food Security

Key Term	Definition
Food Security	Having enough food to feed a population.

Biological Factor Affecting Food Security	Description
Increasing Birth Rate	With an increasing birth rate there are more people to feed which increases the demand for food.
Changing Diets in Developed Countries	This can cause scare food resources to be transported around the world affecting food security for the country that the food was exported from.
New Pests and Pathogens	New pests and pathogens can decrease the yield of food.
Environmental Changes	Changes in rainfall or temperature can affect the growth of crops that grow in a particular area. This leads to a reduction in yield and so reduce the amount of food available.
Cost of Agricultural Inputs	Rising costs can make the production of food more expensive. The food will become more expensive to buy and so some people will be unable to afford to buy the food.
Conflict	During conflict in a country less crops may be grown and exported from these areas which reduces security for the countries where the conflict is and for all the countries, they export the food product to.

10 Minutes on....

Farming Techniques

Characteristic of Intensive Farming	How it Increases Efficiency
Movement of livestock is restricted	Less energy is lost by the organism for movement . Energy is conserved and so there is more energy available for growth.
Livestock are kept inside in a temperature-controlled environment.	The livestock will not get too hot or too cold and they do not need to use as much energy is maintaining body temperature. This reduces heat loss and so there is more energy available for growth.

Advantages of Intensive Farming	Disadvantages of Intensive Farming
Increases the yield of products from livestock that can be used as food Faster growth of livestock Livestock need less food Livestock are ready for market sooner Less predation Easier to feed livestock Easier to catch and monitor livestock	Diseases spread more rapidly Antibiotics can build up in the food chain Increased use of fossil fuels to heat area livestock are kept Can cause aggressive behaviour in livestock

10 Minutes on....

Sustainable Fisheries

Why is it important that fish stock levels are protected.
Fish stocks in the ocean are declining. It is important to maintain fish stocks at a level where breeding continues, or certain species may disappear altogether in some areas.

Method of Conserving Fish Stocks	Explanation of How This Protects Fish Stock Levels
Control of Net Size	This allows small fish to escape so that they can live long enough to breed. This maintains stock levels.
Fishing Quotes	This prevents over-fishing and ensures there are enough fish left to breed. This maintains stock levels.

Why fish stock levels are decreasing.

There is an increased demand for fish, due to a rising population on Earth and a rising number of people who eat fish. This means that there is more fishing taking place which means that fish stock levels are decreasing.

10 Minutes on....

Biotechnology

Key Term	Definition
Genetic Modification	The process of taking a gene from one species and putting it in another.
Mycoprotein	A protein rich food suitable for vegetarians.
GM Crops	Crops that have been modified to have genetics from another species.

How mycoprotein is made.

The fungus Fusarium is grown on glucose syrup in aerobic conditions. The biomass is harvested and purified.

Advantages of GM Crops	Disadvantages of GM Crops
Herbicide resistant GM crops can produce higher yields. Insect-resistant GM crops reduce the total use of pesticides. Crops can be grown with higher nutritional benefits. Crops can be grown that are hardier and resistant to poor weather.	Concerns that eating GM food can affect our health. Can cause allergic reactions GM crops might breed naturally with wild plants. Plants are sterile and so seeds need to be brought each year which increases cost. Can reduce the number of bees in areas where GM crops are growing.