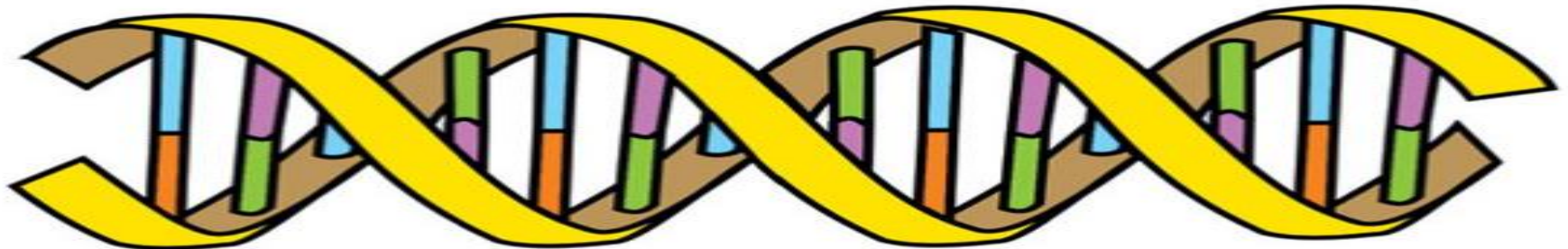




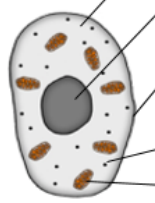
GCSE Science

Biology

Knowledge Organiser



Key Concepts in Biology



cytoplasm	<i>site of chemical reactions in the cell</i>	gel like substance containing enzymes to catalyse the reactions
nucleus	<i>contains genetic material</i>	controls the activities of the cell and codes for proteins
cell membrane	<i>semi permeable</i>	controls the movement of substances in and out of the cell
ribosome	<i>site of protein synthesis</i>	mRNA is translated to an amino acid chain
mitochondrion	<i>site of respiration</i>	where energy is released for the cell to function

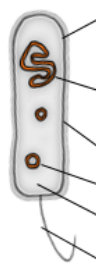
animal cell

Eukaryotes complex organisms

plant cell

contains all the parts of animal cells plus extras

Edexcel GCSE Biology Key Concepts Part 1



cell membrane	<i>site of chemical reactions in the cell</i>	gel like substance containing enzymes to catalyse the reactions
bacterial DNA	<i>not in nucleus floats in the cytoplasm</i>	controls the function of the cell. Can be found as chromosomal DNA and plasmid DNA (small rings).
cell wall	<i>NOT made of cellulose</i>	supports and strengthens the cell
cytoplasm	<i>semi permeable</i>	controls the movement of substances in and out of the cell
flagella	<i>whip like tail</i>	allows the bacterial cell to move
ribosome	<i>site of protein synthesis</i>	mRNA is translated to an amino acid chain

Bacterial cells are much smaller than plant and animal cells

Prokaryotes simpler organisms



permanent vacuole	<i>contains cell sap</i>	keeps cell turgid, contains sugars and salts in solution
cell wall	<i>made of cellulose</i>	supports and strengthens the cell
chloroplast	<i>site of photosynthesis</i>	contains chlorophyll, absorbs light energy

Specialised cells

egg		<i>fertilised by a sperm</i>	nutrients in the cytoplasm, haploid nucleus and changes in the cell membrane after fertilisation
sperm		<i>fertilise an egg</i>	streamlined with a long tail acrosome containing enzymes large number of mitochondria, haploid nucleus
Ciliated epithelial cell		<i>push and move mucus</i>	Thin layer of moving hairs on the surface of the cells called cilia.

decreasing size and scale

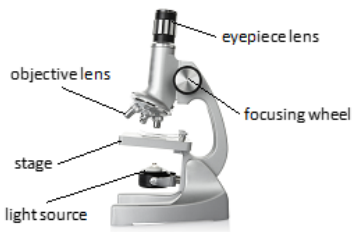
PREFIXES		
Prefix	Multiple	Standard form
centi (cm)	1 cm = 0.01 m	$\times 10^{-2}$
milli (mm)	1 mm = 0.001 m	$\times 10^{-3}$
micro (μm)	1 μm = 0.000 001 m	$\times 10^{-6}$
nano (nm)	1nm = 0.000 000 001 m	$\times 10^{-9}$
pico (pm)	1pm = 0.000 000 000 001m	$\times 10^{-12}$

Microscopy

$$\text{magnification } M = \frac{\text{size of image I}}{\text{real size of the object A}}$$

Estimates can be useful when you only have a sample of what you are counting e.g. the number of red blood cells in a blood sample

Many of the structures found in cells were not able to be seen before the development of electron microscopes e.g. ribosomes



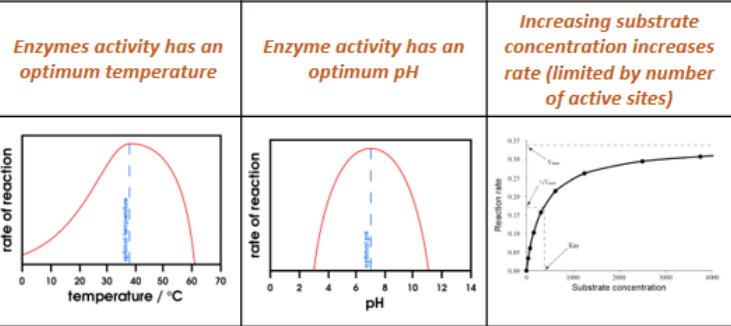
Feature	Light (optical) microscope	Electron microscope
Radiation used	Light rays	Electron beams
Max magnification	~ 1500 times	~ 2 000 000 times
Resolution	200nm	0.2nm
Size of microscope	Small and portable	Very large and not portable
Cost	~£100 for a school one	Several £100,000 to £1 million plus

Key Concepts in Biology

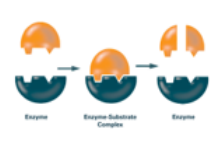
Enzymes catalyse (increase the rate of) specific reactions in living organisms.

The rate of a reaction can be measured by how fast reactants are used up or by how fast products are formed.

The activity of enzymes is affected by changes in temperature, pH and substrate concentration



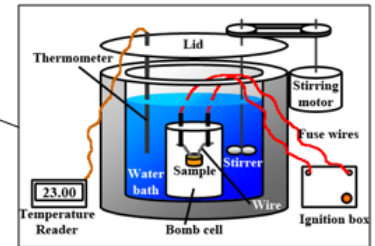
The 'lock and key theory' is a simplified model to explain enzyme action



Enzymes catalyse specific reactions in living organisms due to the shape of their active site.

Calorimetry

The energy in food can be calculated by how much it heats up water when it burns in a calorimeter.



Calculate percentage gain/loss of mass in osmosis.

$$\% \text{ change in mass} = \frac{(\text{final mass} - \text{initial mass})}{\text{initial mass}} \times 100$$

The greater the difference in concentrations the faster the rate of diffusion.

Osmosis

Transport in cells

Diffusion <i>No</i> energy required	<i>Movement of particles in a solution or gas from a higher to a lower concentration</i>	E.g. O ₂ and CO ₂ in gas exchange, urea in kidneys. Factors that affect the rate are concentration, temperature and surface area.
Osmosis <i>No</i> energy required	<i>Movement of water from a dilute solution to a more concentrated solution</i>	E.g. Plants absorb water from the soil by osmosis through their root hair cells. Plants use water for several vital processes including photosynthesis and transporting minerals.
Active transport <i>ENERGY</i> required	<i>Movement of particles from a dilute solution to a more concentrated solution</i>	E.g. movement of mineral ions into roots of plants and the movement of glucose into the small intestines.

Enzymes


Edexcel GCSE Biology Key Concepts Part 2

Digestive enzymes speed up the conversion of large insoluble molecules (food) into small soluble molecules that can be absorbed into the bloodstream.

Large changes in temperature or pH can stop the enzyme from working (denature).

Temperature too high	pH too high or too low
----------------------	------------------------

Enzyme changes shape (denatures) the substrate no longer fits the active site.

Carbohydrases (e.g. amylase)		Made in salivary glands, pancreas, small intestine	Break down carbohydrates to simple sugar (e.g. amylase breaks down starch to glucose).
Proteases		Made in stomach, pancreas	Break down protein to amino acids.
Lipases		Made in pancreas (works in small intestine)	Break down lipids (fats) to glycerol and fatty acids.

The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used for respiration.

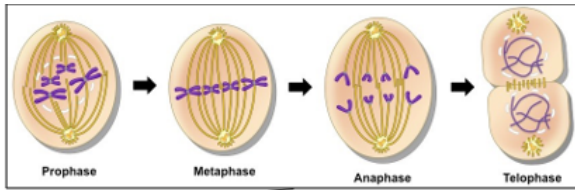


1. What part of a microscope do you look through?
2. Which part of a microscope do you use to get a clear image?
3. A microscope has a $\times 5$ eyepiece lens and a $\times 5$ objective lens. What is the total magnification?
4. How many millimetres are there in a metre?
5. What unit is 1000 times smaller than a millimetre?
6. What is the unit symbol for a nanometre?
7. Name one part you could find in a plant cell but not an animal cell.
8. What process happens in a mitochondrion?
9. What is one function of a plant cell's permanent vacuole?
10. In which part of a plant cell is cell sap stored?
11. In which part of a cell would you find chromosomes?
12. What is a picture taken with a microscope called?
13. List three sub-cellular structures that are usually found in animal cells.
14. List three sub-cellular structures found in plant cells but not in animal cells.
15. Which cell structure controls what enters and leaves the cell?
16. Which cell structure controls how the cell works?
17. In which cell structure does respiration mainly take place?
18. Which plant cell structure contains chlorophyll?
19. Describe the function of the structure that surrounds plant cells, but not animal cells.
20. What is the function of ribosomes?
21. What are gametes?
22. A bacterium is $20\ \mu\text{m}$ long. How long is it in metres?
23. A bacterium is $5\ \mu\text{m}$ wide. How wide is it in nanometres?
24. What part of an animal cell controls the cell's activities?
25. What do ribosomes make?
26. Name one part that a plant cell might have but an animal cell would not.
27. What do bacteria use to move themselves?
28. Animal and plant cells are eukaryotic. What word describes bacterial cells?
29. Name one structure that an animal cell would have but a bacterial cell would not.
30. What is $1 \times 10^6\ \text{m}$ written as an ordinary number?
31. Egg cells also contain protein. Which cell structure makes proteins?



32. In which system of the body is food broken down?
33. In which organ of the body is digested food absorbed?
34. Which group of molecules help to digest food?
35. Which two kinds of subunits form lipids fats and oils?
36. Which kind of large biological molecule are enzymes?
37. Which subunits make up enzymes?
38. Amylase is a kind of enzyme. Where is it found in humans?
39. What is the substrate for amylase?
40. What are the subunits of enzymes?
41. Which kind of large organic molecule does a protease digest?
42. Which kind of enzyme would break down a food stain made by sunflower oil?
43. What is the name of the part of an enzyme into which the substrate fits?
44. Which term describes an enzyme in which the active site has permanently changed shape?
45. Give two examples of changes in the cell environment that could cause the active site to change shape.
46. Name two substances that plants take in from the soil through their roots.
47. There is a 5% sucrose solution and a 10% sucrose solution. Which solution has the higher concentration of sucrose?
48. Two beakers contain the same volume of solution. One is a 10% sodium chloride solution, the other is a 5% sodium chloride solution. Which beaker contains more water molecules?
49. What is a prokaryotic cell?
50. What is a eukaryotic cell?
51. Which of the following is the smallest unit: picometre, micrometre, millimetre, nanometre?

Cells & Control



Mitosis occurs during growth, repair, replacement of cells. Asexual reproduction occurs by mitosis in both plants & simple animals producing genetically identical clones.

MITOSIS produces two genetically identical DIPLOID CELLS

Stage 1	Interphase (not part of mitosis)	Before mitosis: Increase the number of sub-cellular structures e.g. ribosomes, mitochondria. DNA replication makes copies of chromosomes.
Stage 2	Prophase	Nucleus breaks down and spindle fibres appear.
Stage 3	Metaphase	Chromosomes are lined up on spindle fibres on the equator (middle) of the cell.
Stage 4	Anaphase	Chromosome copies are separated and pulled to opposite ends of the cell.
Stage 5	Telophase	A new nuclear membrane forms around each set of chromosomes.
Stage 6	Cytokinesis	Cell surface membrane forms to separate the cells (+new cell wall in plants).

Cells divide in a series of stages to produce two daughter cells, each with identical set of chromosomes to the parent cell (in the nucleus).

MITOSIS is part of THE CELL CYCLE

Cancer

The result of changes in DNA that lead to uncontrolled growth and division

Growth in organisms	Growth in plants	Cell division and differentiation, elongation (cells increase in length)
	Growth in animals	Cell division and differentiation.

Cell division and growth

Edexcel GCSE Biology Cells and Control Part 1

Percentile charts can be used to monitor growth

The 50th percentile (bold line) is the median (average) growth of the population at that age. Half will be below and half above.

how a cell changes and becomes specialised so that different cells can carry out different functions.

Cell differentiation

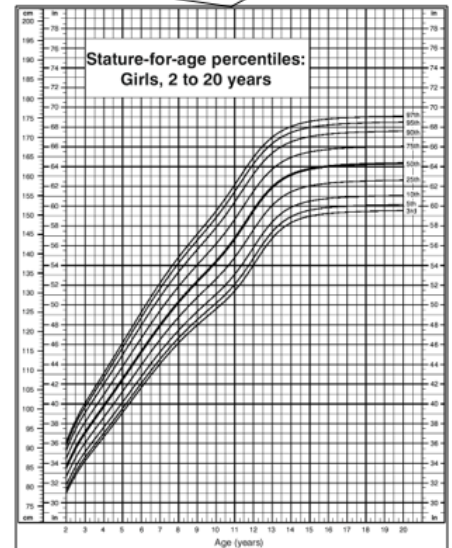
Divides to form more cells of the same type, and can differentiate to form many other cell types.

Undifferentiated cell of an organism

STEM CELLS

Human Embryonic stem cells	Can be cloned and made to differentiate into any cell type	Therapeutic cloning of stem cells to produce new tissue uses same genes so the body does not reject the tissue. Can be a risk of infection
Adult stem cells	Can form into surrounding human cells e.g. blood cells	Tissue made from adult stem cells is matched to avoid rejection, risk of infection. Only a few types of cells can be formed.
Meristems (plants)	Can differentiate into any plant cell type throughout the life of the plant.	Used to produce clones quickly and economically, e.g. rare species, crop plants with pest /disease resistance

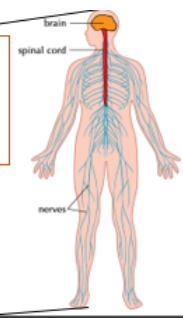
Treatment with stem cells may be able to help conditions such as diabetes and paralysis. Some people object to the use of stem cells on ethical or religious grounds



Cells & Control

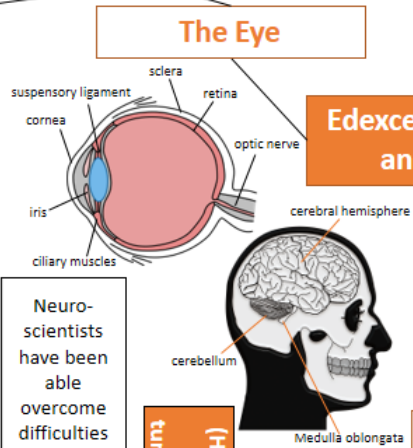
Sense organ containing receptors sensitive to light intensity and colour

The human nervous system



Structures of the eye

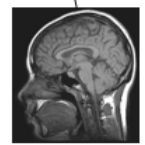
Retina	Light sensitive cell layer made of rod (light intensity) and cone (red, green, blue colour perception) cells.
Optic nerve	Carries impulse to brain.
Cornea	Transparent layer that covers the pupil and iris.
Iris	Controls size of pupil and the amount of light let in the eyes
Lens	Changes thickness to refract and focus light onto the retina.



Edexcel GCSE Biology Cells and Control Part 2

Neuroscientists have been able to overcome difficulties of accessing brain tissue in the skull using CT and PET scanning

(HT) The complexity and delicacy of the brain makes treating brain tumours/spinal injuries very difficult



Colour blindness is when cones in the retina do not work properly and some colours cannot be detected.

The brain controls complex behaviour. It is made of billions of interconnected neurones.

(HT) Adult stem cells cannot be differentiated to form neurones in the spinal cord and brain to repair damage/disease

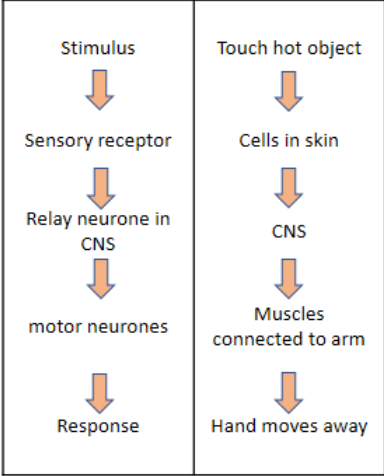
Structure and functions

Sensory receptor	Detect stimuli e.g. Pressure cells in skin
Sensory neurone	Long axon carries impulse from receptor to spinal cord.
Synapse	Gap where neurones meet. Chemical message using neurotransmitter.
Relay neurone in CNS	Allows impulses to travel between sensory and motor neurones in the spinal cord.
Motor neurone	Long axon carries impulse from receptor to effector.
Effector	Muscle or gland that carries out response.

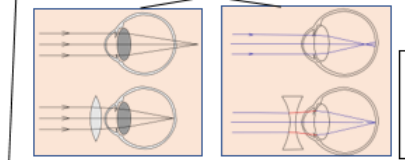
Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS)

The CNS is the brain and the spinal cord.

Reflex actions are automatic and rapid; they do not involve the conscious part of the brain and can protect humans from harm.



Hyperopia (long sightedness)	Myopia (short sightedness)
Lens can not be made thick enough. Treated using a convex lens so the light is focused on the retina.	Lens too thick. Treated using a concave lens so light is focused on the retina.



Cataracts are caused by protein build up in the lens blocking light entering the eye. They can be removed with surgery and an artificial lens inserted.

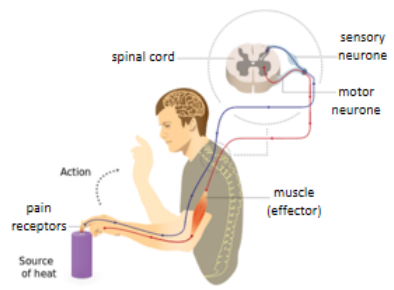
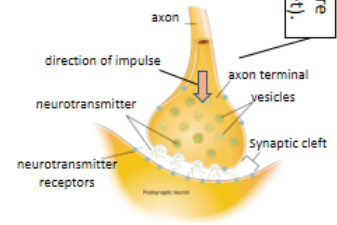
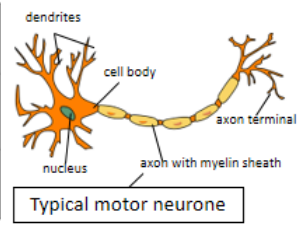
The brain has different regions that carry out different functions.

Cerebral hemispheres	Largest part of the human brain. Higher thinking skills e.g. speech, decision making.
Cerebellum	Balance and voluntary muscle function e.g. walking, lifting.
Medulla oblongata	Involuntary (automatic) body functions e.g. breathing, heart rate.

Neurone structure

Axon	Carries electrical impulse to axon terminals.
Dendron	Carries electrical impulse from receptor cells in sensory neurones.
Myelin sheath	Insulates the electrical impulse in the neurone.

Synapse (gap where two neurones meet).





52. What is the function of the jelly coat around an egg cell?
53. Describe the basic function of a light microscope.
54. Why do we need new cells?
55. In human cells, what is a chromosome?
56. List three main features that are usually found in animal cells.
57. Which cell structure controls what enters and leaves the cell?
58. Which cell structure controls how the cell works?
59. In which cell structure does respiration mainly take place?
60. Describe one feature of a human sperm cell that is different from other human cells.
61. Describe the function of the feature of the sperm cell you described in question 5.
62. What type of cell division forms two identical daughter cells?
63. In which stage of the cell cycle are the chromosomes duplicated?
64. In which stage of the cell cycle, at the end of mitosis, does the one cell divide into two?
65. What term describes a cell that has two sets of chromosomes?
66. List three main features that are usually found in both plant and animal cells.
67. List three features found in plant cells but not in animal cells.
68. Define the term 'growth'.
69. Which cell structure in plants contains chlorophyll?
70. What is the function of the cell structure that contains chlorophyll?
71. Many plant cells have a large structure filled with sap. Name this structure.
72. Give two functions of the cell structure filled with sap.
73. Name the structure that surrounds all plant cells
74. Describe the function of the structure that surrounds plant cells but not animal cells.



75. How are roots adapted to absorbing water and mineral salts from the ground?
76. Where are plant meristems found?
77. What happens in a plant meristem?
78. What type of cell is found in meristems?
79. What happens during cell differentiation?
80. Why is cell differentiation important to plants and animals?
81. A root hair cell is a specialised cell. What is its function?
82. How is a root hair cell specialised to carry out its function?
83. What is the function of a xylem vessel?
84. Explain how one specialisation of a xylem vessel helps it carry out its function.
85. Name one feature, other than mass, that could be measured to show growth in a plant.
86. Name the type of cell division that cells use to make identical copies of themselves.
87. What type of cell has the ability to differentiate into specialised cells?
88. In what organ system would you find nerve cells?
89. Are nerve cells diploid or haploid?
90. What part of a nerve cell contains chromosomes?
91. What part of a nerve cell makes proteins?
92. Nerve cells require a lot of energy. What cell structure would you expect them to have a lot of?
93. What is a nerve cell specialised to do?
94. List your senses.
95. State the name of one organ in the nervous system.
96. What type of cells detect stimuli?
97. In which sense organ would you find receptor cells that detect sound waves?
98. What are the electrical signals used in the nervous system called?
99. List, in order, the organs that an impulse goes through from the hand to the brain.
100. What are the two long 'arms' of a sensory neurone called?
101. List, in order, the parts of a sensory neurone that an impulse goes through.
102. Why are sensory neurones so long?
103. What is the name of the fatty sheath that can surround dendrons and axons?
104. What does the myelin sheath do?
105. An effector is part of the body that carries out a response due to a stimulus. Suggest the name of one effector.

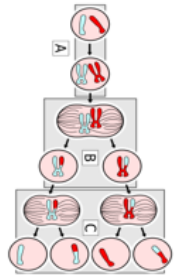
Genetics

Meiosis halves the number of chromosomes

Gametes are made in reproductive organs (in animals ovaries and testes)

Cells divide by meiosis to form gametes

Copies of the genetic information are made.
The cell divides twice to form four daughter cells each with half the number of chromosomes.
All haploid gametes are genetically different from each other.



(Biology HT) A sequence of 3 bases is the code for a particular amino acid. The order of bases controls the order in which each amino acids combine and fold to produce a specific shaped protein such as enzymes..

Genetic variants.	In non coding DNA	Affects phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced.
	In coding DNA	Affects phenotype by altering the sequence of amino acids and therefore the activity of the protein produced.

Making new proteins (protein synthesis) transcription and translation

Composed of chains of amino acids. A sequence of 3 bases (codon) codes for a particular amino acid.

RNA polymerase binds to non-coding DNA located in front of a gene.

↓
RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene.

↓
mRNA moves from the nucleus and attaches to a ribosome in the cytoplasm.

↓
Ribosomes translate each triplet of bases (codons) into specific amino acids according to mRNA template

↓
Amino acids are transferred to the ribosome by tRNA.

↓
Amino acids are linked together to form polypeptides.

In DNA the complementary strands C, A, T, G always link in the same way. C always linked to G on the opposite strand and A to T.

Gametes join at fertilisation to restore the number of chromosomes

The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed

Meiosis

DNA and the genome

Sexual and asexual reproduction

Advantages and disadvantages of sexual and asexual reproduction (Biology only)

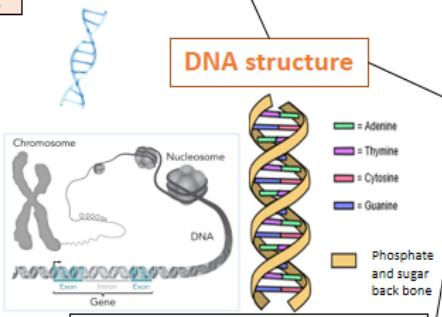
Reproduction advantages/disadvantages	
Sexual	Asexual
Needs two parents.	Only one parent needed (quicker).
Produces variation in the offspring.	Identical offspring (no variation).
If the environment changes variation gives a survival advantage by natural selection.	Vulnerable to rapidly changing conditions due to lack of variation.
Negative mutations are not always inherited.	Negative mutation can affect all offspring.
Natural selection can be speeded up using selective breeding to increase food production.	Food/medicine production can be extremely quick.

Genetic material in the nucleus is composed of a chemical called DNA.

DNA structure
Polymer made up of two strands forming a double helix.
Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.

Edexcel GCSE BIOLOGY, GENETICS Part 1

DNA structure

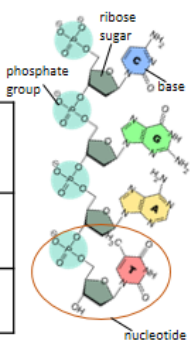


(HT only) Not all parts code for proteins. Non-coding parts can switch genes on and off. Mutations may affect how genes are expressed.

Protein synthesis (Biology HT only)

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T

Repeating nucleotide units.



Extracting DNA
DNA can be extracted from fruit
Dissolve salt and washing up liquid together with a mashed up sample of fruit (kiwi fruit is good) and place in a 60°C water bath for 15 minutes.
Filter and add protease solution to the filtrate in a boiling tube. Tilt the boiling tube and carefully add ice cold ethanol.
The white layer that forms at the interphase is DNA and can be pulled out on a glass rod

Genetics

The genome is the entire DNA of an organism.

All genetic variation arises in mutation, most have no effect on phenotype, some influence but very rarely a single mutation determines phenotype.

The whole human genome has now been studied.

It is of great importance for future medical developments

Searching for genes linked to different types of disease.
Understanding and treatment of inherited disorders.
Tracing migration patterns from the past.

(Biology HT) Some disorders are inherited on the chromosomes that determine sex (sex linked genetic disorders)

Colour blindness in men.

The X chromosome carries one normal or one faulty allele (the normal is dominant). The shorter Y chromosome does not carry the allele and so X chromosome allele is always expressed in men.

One pair of chromosomes carry the genes that determine sex

	Female	Male
	XX	XY
Gametes	X	Y
X	XX	XY
X	XX	XY

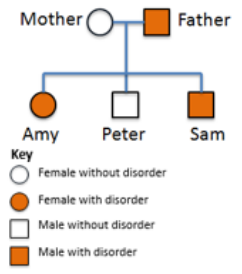
The probability of a male of female child is 50%. The ratio is 1:1

Variation: difference in the characteristics of individuals in a population may be due to

- Genetic causes (inheritance)
- Environmental causes (condition they have developed in)

A combination of genes and environment

There is usually extensive genetic variation within the population of a species e.g. hair colour, skin colour, height that can also be affected by environment e.g. nutrition, sunlight.



Using a family tree: If the father was homozygous dominant then all of the offspring would have the disorder. He must be heterozygous

Inherited disorders

Variation

EDEXCEL GCSE BIOLOGY GENETICS Part 2

The understanding of genetics (biology only)

Gregor Mendel
In the mid 19th century carried out breeding experiments on plants

Inheritance of each characteristic is determined by units that are passed on to descendants unchanged.

Chromosomes had not yet been discovered so the mechanism for inheritance was still unknown.

Define terms linked to genetics	Definition
Gamete	Sex cells produced in meiosis.
Zygote	Single cell that results from fusion of egg and sperm cell.
Chromosome	A long chain of DNA found in the nucleus.
Gene	Small section of DNA that codes for a particular protein.
Allele	Alternate forms of the same gene.
Dominant	A type of allele – always expressed if only one copy present and when paired with a recessive allele.
Recessive	A type of allele – only expressed when paired with another recessive allele.
Homozygous	Pair of the same alleles, dominant or recessive.
Heterozygous	Two different alleles are present 1 dominant and 1 recessive.
Genotype	Alleles that are present for a particular feature e.g. Bb or bb
Phenotype	Physical expression of an allele combination e.g. black fur, blonde hair, blue eyes.

Some characteristics are controlled by a single gene e.g. fur colour, colour blindness.

The alleles present, or genotype operate at a molecular level to develop characteristics that can be expressed as a phenotype.

Most characteristics are as a result of multiple genes interacting.

Sex determination

Blood groups
<i>Determined by multiple alleles (A,B,O) and codominance</i>
AO, AA blood group A
BO, BB blood group B
OO blood group O
AB blood group AB. A and B are codominant

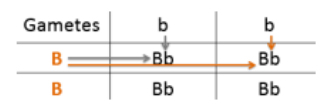
Genetic inheritance

Dominant and recessive allele combinations

Dominant	Recessive
Represented by a capital letter e.g. B.	Represented by a lower case letter e.g. b.
3 possible combinations: Homozygous dominant BB Heterozygous dominant Bb Homozygous recessive bb	

Using a punnet square (using mouse fur colour as an example)

Parent phenotype	Black fur	White fur
Parent genotype	BB	bb
What gametes are present	In each egg B	In each sperm b



The probability of black fur offspring phenotype is 100%. All offspring genotypes are heterozygous (Bb).

Crossing two heterozygous mice (Bb)

Gametes	B	b
B	BB	Bb
b	Bb	bb

The probability of black fur is 75% and white fur 25%. The ratio of black to white mice is 3:1



106. What molecule forms the genome of an organism?
107. Where are genes found?
108. What does a gene carry the instructions for?
109. A protein is made by linking together smaller molecules. What are these smaller molecules called?
110. What is any molecule made of repeating units called?
111. A human cell contains 46 strands of DNA. Is it diploid or haploid?
112. Are the cells produced by meiosis haploid or diploid?
113. Are the cells produced by mitosis haploid or diploid?
114. What shape is DNA?
115. What is a chromosome made out of?
116. What shape is a DNA molecule?
117. What part of a DNA strand contains the instructions for a protein?
118. What are the letters of the bases that form the DNA code?
119. How do these bases pair up in DNA?
120. Apart from bases, what other parts are needed in a DNA molecule?
121. What is one phosphate group, one sugar and one base called?
122. Why is DNA a polymer?
123. Why are proteins polymers?
124. What is a zygote?
125. Why do people have naturally different colours of hair?
126. What are different versions of the same gene called?
127. What sort of variation do alleles cause in organisms?
128. When we consider one gene, what word is used to say that both alleles are the same?
129. If a dominant allele has the letter A, how would you show that an organism is heterozygous?
130. What word describes the characteristics caused by the alleles of a gene?
131. What word describes the alleles of a gene found in an organism?
132. What word describes an allele that only has an effect if an organism has two copies?
133. A genotype is written QQ. What does this tell you?
134. What is a probability?
135. If the occurrence of an event has a probability of 1, what does this mean?
136. Name the two types of cell division.
137. Which type of cell division produces sex cells?
138. What happens to the chromosomes in a nucleus just before cell division starts?
139. Which subunits are proteins made of?
140. Name the four bases in DNA.



141. What is the name given to part of a DNA molecule that codes for a protein?
142. Why do different pieces of DNA produce different proteins?
143. What is the phenotype of an organism?
144. What is the genotype of an organism?
145. Is human eye colour coded for by one gene or many genes?
146. One gene codes for the cell membrane protein CFTR. There are many alleles for the CFTR gene. How many alleles do you have for the CFTR gene in one of your body cells?
147. A mutation of the CFTR gene can lead to the disorder cystic fibrosis. What is a mutation?
148. Cystic fibrosis is an inherited disorder. What does that mean?
149. What research, finished in 2003, was the first effort to map a complete human genome?
150. How could a map of a person's genome help identify diseases they might develop?
151. How could a map of a person's genome help identify which medicines they should be given?
152. Many mutations have no effect on the phenotype. Explain why.

Natural Selection & Genetic Modification



Charles Darwin	Theory of evolution by natural selection.	Individual organisms within a particular species show a wide range of variation for a characteristic.
		Individual most suited to the environment are more likely to breed successfully.
		Characteristics enable individuals to survive are then passed on to the next generation.

Developed since its proposal from information gathered by other scientists.

Did much pioneering work on speciation but more evidence over time has led to our current understanding.



Alfred Wallace	Independently proposed the theory of evolution by natural selection	Published joint writings with Darwin in 1858.
		Worked worldwide gathering evidence.
		Best known for work on warning colouration in animals and his theory of speciation.

Human evolution

Evidence for human evolution	
Fossils	Stone tools
<i>Ardipithecus ramidus</i> 'Ardi' from 4.4 million years ago	Earliest simple stone tools from 3.3 million years ago.
<i>Australopithecus afarensis</i> 'Lucy' from 3.2 million years ago	
Leakey's discovery of <i>Homo habilis</i> from 1.6 million years ago	The age of different layers of rock can be dated. Stone tools found in those layers are the same age.

Evidence from around the world, experimentation, geology, fossils, discussion with other scientists (Alfred Wallace) lead to:

Theory of evolution (Biology only)

EDEXCEL GCSE NATURAL SELECTION AND GENETIC MODIFICATION PART 1

Charles Darwin 'On the Origin of the Species' (1859)	Published the theory of evolution by natural selection	Slowly accepted; challenged creation theory (God), insufficient evidence at time, mechanism of inheritance not yet known.
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Both Darwin and Wallace's work contributed to the modern science of genetics and 'molecular biology'.

The full human classification

Classification of living organisms

Carl Linnaeus classified living things	Kingdom	Animalia
	Phylum	Chordata
	Class	Mammalia
	Order	Primates
	Family	Hominidae
	Genus	<i>Homo</i>
	Species	<i>sapiens</i>

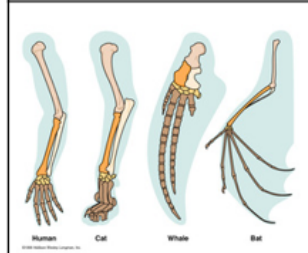
The five kingdoms are animals, plants, fungi, protista, prokaryotes

Carl Woese	3 domains instead of kingdoms based on genetic analysis.
	Archaea (primitive bacteria), true bacteria, eukaryota.

Evidence for evolution

Evidence for evolution from anatomy (Biology only)

The pentadactyl limb
Darwin suggested that the five finger (pentadactyl) limb found across many vertebrates suggest a common ancestor.



Selective breeding

Selective breeding
Choosing parents with the desired characteristics from a mixed population
Chosen parents are bred together.
From the offspring those with desired characteristics are bred together.
Repeat over several generations until all the offspring show the desired characteristics.

Choosing characteristics

Desired characteristics are chosen for usefulness or appearance	
Disease resistance in food crops.	
Animals which produce more meat or milk.	
Domestic dogs with a gentle nature.	
Large or unusual flowers.	

Antibiotic resistant bacteria	Mutations produce antibiotic resistant strains which can spread	Resistant strains are not killed.
		Strain survives and reproduces.
		People have no immunity to strain and treatment is ineffective.

Antibiotic resistance in bacteria provides evidence for evolution.

Evolution is widely accepted. Evidence is now available as it has been shown that characteristics are passed on to offspring in genes.

Natural Selection & Genetic Modification

(Biology only) Solutions to growing human populations	Fertilisers	Advantages: Increases the growth and yield of crop plants.
		Disadvantages: Excess fertiliser can run off into lakes and rivers and cause pollution leading to the death of other plants and animals.
	Biological control	Advantages: Insects can be used to control weed populations. No herbicides are necessary.
		Disadvantages: Introduced insects can compete for non weed plants and disrupt other species food chains.

Risks and benefits (practical and ethical)	
Genetic engineering	Risks: Seeds from GM plants can be very expensive. Some people think eating GM plants is bad for health although there is no evidence to support this view.
	Benefits: decreased use of herbicide with increase in yield from food crops. Medicines tailored for individuals.
Selective breeding	Risks: alleles that may be useful in future may be bred out. Populations with low variation can be vulnerable to genetic diseases.
	Benefits: Increased growth and yield of plants and animals for food.

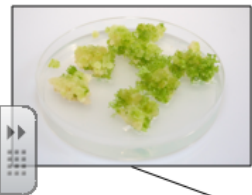
Advantages and disadvantages of genetic engineering	
Advantages	Modification of crop plants e.g. insect resistance from <i>Bacillus thuringiensis</i> .
	Modification of bacteria to produce human hormones e.g. human insulin made by bacteria.
Disadvantages	Resistant crops could pass on genes to wild plants affecting food chains.
	Insulin produced using GM bacteria is not identical to human insulin and not everyone can use it.

EDEXCEL GCSE NATURAL SELECTION AND GENETIC MODIFICATION PART 2

Agricultural solutions

Risks and benefits

Genetic engineering

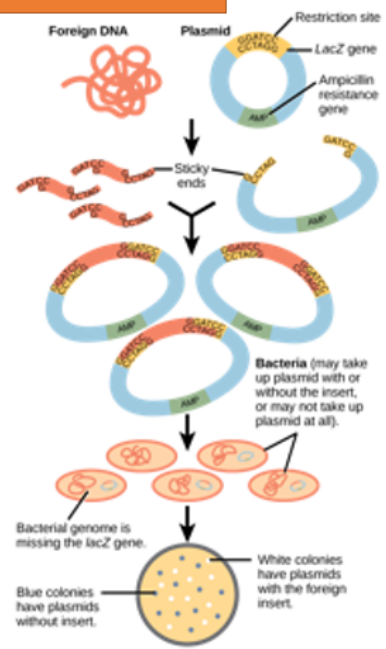


Tissues cultures

Modification of the genome of an organism to introduce desirable characteristics

Cloning techniques in plants/animals

Tissue culture	Small groups of cells to grow new plants in nutrient solution or solid agar.
	Advantage: Important for preservation of rare plants and commercially in nurseries.
Tissue culture	Small groups of human cells used to grow new tissues.
	Advantage: matched tissues can be grown that are not rejected by the body's immune system.



Genetic engineering process (HT only)

1. Restriction enzymes are used to isolate and cut out the required gene.
2. If sticky ends of DNA on the isolated gene and the plasmid DNA match then they can be joined together.
3. DNA is joined in the plasmid DNA using the enzyme ligase – bacterial plasmid or virus.
4. Genes are transferred to plants/animals/microbes in a vector (bacteria or virus) at an early stage of development so they develop the required characteristics.

Genetically modified crops (GMO)	Crops that have genes from other organisms	To become more resistant to insect attack or herbicides.
		To increase the yield of the crop.



153. What is this a definition of: 'A group of organisms that can reproduce with one another, producing offspring that can also reproduce'?
154. What is the scientific name for the modern human species?
155. From what type of creatures are modern humans thought to have evolved?
156. What are the remains of organisms that have been turned into rock called?
157. Sedimentary rock exists in layers, one on top of another. Which layers are the youngest?
158. Which substances did early human-like animals make tools out of?
159. Why do we only find the stone tools now?
160. Which of these three species is most closely related to modern humans, and how can you tell: Homo habilis, Australopithecus afarensis, Ardipithecus ramidus?
161. On which continent are the oldest human-like fossils found?
162. What is this a definition of: 'A gradual change in the characteristics of a species over time'?
163. What is this a definition of: 'A gradual change in the characteristics of a species over time'?
164. Where does the evidence come from that humans evolved?
165. Over how many years can scientists trace human evolution?
166. Name one trend that has occurred in the bodies of human-like species as they have evolved over millions of years.
167. What are the differences in characteristics between two organisms called?
168. One type of variation is 'environmental variation', in which the environment causes variation in characteristics. What is the other form of variation called?
169. What type of variation causes some sandpiper birds to have longer beaks than others?
170. Suggest one reason why polar bears are better adapted than black bears to living in the Arctic.
171. What is the name of the scientist who is most well known for developing a theory about evolution?
172. Some scientists think that a species called Homo heidelbergensis evolved into both Homo neanderthalensis and Homo sapiens. What is a species that evolves into two species like this called?
173. What is the scientific name for modern humans?
174. What do we call the system of scientific naming?
175. Suggest the environmental change that resulted in the evolution of African elephants' large ears.



176. Suggest the environmental change that resulted in the evolution of woolly mammoths' hairiness.
177. Suggest the environmental change that resulted in the evolution of long legs in various animals.
178. What process does Darwin's theory use to explain how evolution occurs?
179. The binomial name for the African bush elephant is *Loxodonta Africana*. What genus does it belong to?
180. Humpback whales and dolphins are thought to have evolved from an animal that lived about 40 million years ago. What is an animal that evolved into different species like this called?
181. Elephants belong to the animal kingdom. What other kingdoms are there?
182. State one way in which the cells of bacteria are different to those of animals, plants, fungi and protists.
183. Cattle, wheat and mushrooms are all farmed. What kingdoms do they belong to?
184. The scientific name for cattle is *Bos taurus*. What genus do they belong to?
185. Wild yaks are *Bos mutus*. Describe some features of wild yaks.
186. *Bos mutus* and *Bos taurus* share a common ancestor about 1 million years ago. What process caused them to evolve in different ways?
187. What domain do *Bos mutus* and *Bos taurus* belong to?
188. Why are these two species in the Eukarya domain?
189. Name the other two domains.
190. The three-domain system was developed because while Archaea looked like bacteria/prokaryotes they had other characteristics more like plants and animals. What were these other characteristics?
191. There are about 800 different types of farm cattle that all belong to the same species. What is the name for different types of the same species of animal?
192. What is the name for different types of the same species of plant?
193. Different types of the same species of animal are called breeds. What are different types of the same species of plant called?



194. What term describes humans choosing certain organisms because they have useful characteristics?
195. What is the name of the process in which new breeds and varieties of organisms are created using artificial selection?
196. Give an example of a species of animal that has been produced by selective breeding.
197. What word describes all the DNA in an organism?
198. What is the name of the process in which genes from one organism are transferred into the genome of another organism?
199. What three-letter abbreviation is given to organisms that have been genetically engineered?
200. What word describes the amount of useful product that can be obtained from a farmed plant or animal?
201. Suggest a characteristic that would be useful in a new variety of lettuce.
202. Suggest a characteristic that would be useful in a new breed of sheep.

Health, Disease & The Development of Medicine

The World Health Organisation (WHO) describes health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

The presence of one disease can lead to a higher susceptibility to other diseases.

Damage to immune system	Makes it easier for other pathogens to cause disease.
Damage to body defences	Barriers and defences are damages. Pathogens can enter the body.
Damage to organ systems	Organ systems don't work as effectively leading to other diseases.

Communicable and non communicable diseases

Communicable	Non-communicable
Caused by pathogens. They can be passed from person to person.	Caused by a fault in genes or by the way we live (lifestyle)

Health

EDEXCEL GCSE HEALTH DISEASE AND MEDICINE part 1

Pathogens may infect plants or animals and can be spread by direct contact, water or air

Detection and identification of plant diseases (bio HT only)	Detection	Identification Reference using gardening manual or website, laboratory test for pathogens, diagnostic testing.
	Stunted growth	
	Spots on leaves	
	Area of decay	
	growths	
	Malformed stem/leaves	
	Discolouration	
Presence of pests		

Plants have several ways of defending themselves from pathogens and animals (Biology only)

Physical	Mechanical
Thick waxy layers, cell walls stop pathogen entry	Thorns, curling up leaves to prevent being eaten
Chemical	
Antibacterial and toxins made by plant	

Pathogen	Disease	Symptoms	Method of transmission	Control of spread
Bacteria	<i>cholera</i>	Causes diarrhoea.	Contaminated water	Vaccination, water treatment to remove bacteria.
Bacteria	<i>tuberculosis</i>	Causes lung damage.	Air borne water droplets from coughing.	Isolation of infected person, vaccination.
Fungi	<i>Chalara ash dieback</i>	Leaf loss and bark lesions.	Spores in the air.	Remove/destroy infected trees.
Protists	<i>Malaria</i>	Recurrent fever. Damage to blood and liver.	By an animal vector (mosquitoes).	Prevent breeding of mosquitoes. Use of nets to prevent bites.
Bacteria	<i>Stomach ulcers (Bio only)</i>	Pain in abdomen, damage to stomach lining.	Oral transmission.	60% already carry the bacteria.
Virus	<i>Ebola (Bio only)</i>	Internal bleeding and fever.	Contact with bodily fluids of an infected person.	Isolation of infected person. Vaccination.
Virus	<i>HIV</i>	Initially flu like systems, serious damage to immune system.	Sexual contact and exchange of body fluids.	Anti-retroviral drugs and use of condoms.
Bacteria	<i>Chlamydia</i>	Unusual discharge from genitals or anus, pain when urinating.	Unprotected sex.	Using condoms during sex.

Bacteria may produce toxins that damage tissues and make us feel ill

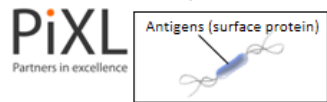
Viruses	Bacteria (prokaryotes)	Protists (eukaryotes)	Fungi (eukaryotes)
<i>e.g. cold, influenza, measles, HIV, tobacco mosaic virus</i>	<i>e.g. tuberculosis (TB), Salmonella, Gonorrhoea</i>	<i>e.g. dysentery, sleeping sickness, malaria</i>	<i>e.g. athlete's foot, thrush, rose black spot</i>
DNA or RNA surrounded by a protein coat	No membrane bound organelles (no chloroplasts, mitochondria or nucleus). Cell wall. Single celled organisms	Membrane bound organelles. Usually single celled.	Membrane bound organelles, cell wall made of chitin. Single celled or multi-cellular

Pathogens are microorganisms that cause infectious disease

Pathogens

Communicable diseases

Health, Disease & The Development of Medicine



Life cycle of a virus	
Lysogenic pathway	Lytic pathway
Virus attaches to cell and inserts genetic material	Viral genetic material can split off from bacterial chromosome.
Viral genetic material forms a circle.	
The viral genetic material uses to cell to produce new proteins and genetic material to make new viruses	Viral genetic material is inserted into the bacterial chromosome.
Cell breaks apart (lyse) to release new viruses.	Bacterium reproduces normally replicating both types of genetic material.

Specific immune system	a. Exposure to pathogen	Pathogens are identified by white blood cells by the different proteins on their surfaces ANTIGENS .
	b. Antigens trigger an immune response	Trigger causes the production of antibodies.
	c. Production of memory lymphocytes	Antigens also trigger the production of memory lymphocytes (a type of white blood cell). These cells can produce the specific antibody for a pathogen.
	d. Secondary response	Memory lymphocytes can produce specific antibodies much more quickly if the same pathogen returns.

Antibiotics	e.g. penicillin	Used to treat bacterial infection by inhibiting cells processes in the bacterium but not the host organism (human) cells. They do not work on viruses.
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EDEXCEL GCSE HEALTH DISEASE AND MEDICINE part 2

Immunisation

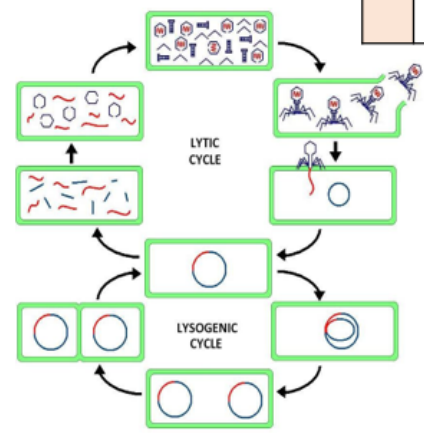
Vaccines are used to immunise a large proportion of the population (herd immunity) to prevent the spread of a pathogen

Vaccination	Small amount of dead or inactive form of the pathogen	1 st infection by pathogen	White blood cells detect pathogens in the vaccine. Antibodies are released into the blood.
		Re-infection by the same pathogen	White blood cells detect pathogens. Antibodies are made much faster and in larger amounts.

Non-specific immune systems

The human body has several chemical and physical ways of providing protection from pathogens	Nose		Nasal hairs, sticky mucus and cilia prevent pathogens entering through the nostrils.
		Trachea and bronchus (respiratory system)	Lined with mucus to trap dust and pathogens. Cilia move the mucus upwards to be swallowed.
		Stomach acid	Stomach acid (pH1) kills most ingested pathogens.
		Skin	Hard to penetrate waterproof barrier. Glands secrete oil which kill microbes.
		Lysozymes in tears	Breaks down the cell wall of some bacteria.

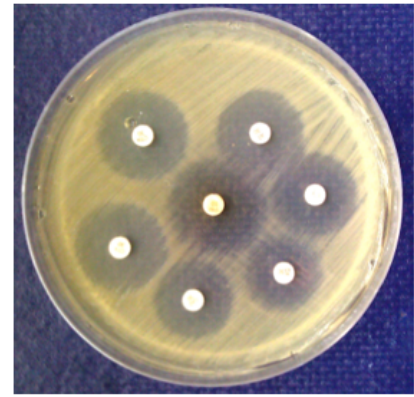
Vaccination (Biology only)	Disadvantages	A very small number of people (eg 1 in 900000 for MMR) a person may have a bad reaction to a vaccine and therefore cannot be immunised.
	Advantages	Almost everyone can be immunised (herd immunity) which protects those people who cannot have vaccines. Spread of a pathogen in a population is prevented.



Calculate cross sectional area

$$\pi r^2$$

Measure the diameter of the clear area where bacteria has not grown. Half the diameter of the clear area to find the radius.



Aseptic technique

Aseptic technique		
Autoclave	Sterile inoculating loops	Covered petri dishes and culture vials
Sterile growth medium and agar plates are sterilized by subjecting them to high pressure steam.	Sterilized before transferring microorganisms so that sample isn't contaminated.	Covered to avoid contamination by other microorganisms in the air.

Health, Disease & The Development of Medicine

Healthy weight can be calculate using waist:hip ratio and the equation for BMI.

$$BMI = \frac{mass (kg)}{(height (m))^2}$$

Non-communicable diseases are caused by the interaction of a number of factors	Disease	Interacting factors
	Cardiovascular disease	Diet, obesity, smoking, drinking alcohol, lack of exercise, genetics.
	Cancer	
	Lung disease	
	Liver disease	
	Malnutrition	

Lifestyle factors and their effects on non-communicable disease	Disease	lifestyle factors
	Obesity and malnutrition	Lack of exercise and consuming too many/too few calories through an unbalanced diet. Schools meals are balanced to combat this in young people.
	Liver disease	Large amounts of alcohol taken over a long period of time can lead to liver disease e.g. cirrhosis. The NHS spends over £500 million a year treating liver disease.
	Cardiovascular disease	Smoking leads to damage and blocking of arteries supplying the heart with oxygenated blood. WHO estimates that 6 million people die globally as a result of smoking related illnesses.

Drugs (including antibiotics) have to be tested and trialled before to check they are safe and effective

Discovery of new drugs

EDEXCEL GCSE HEALTH DISEASE AND MEDICINE part 3

Treating CVD

Evaluating different treatments for cardiovascular disease (CVD)		
Life long medication	Surgical procedures	Lifestyle changes
Medicines to reduce blood pressure and cholesterol. Statins for lowering cholesterol carry a small risk of developing diabetes.	A stent can be surgically inserted into blocked blood vessel. Blocked blood vessels can be bypassed with inserted blood vessels. This treatment requires life long medication.	Giving up smoking, drinking excess alcohol and taking more exercise can reduce the risk of CVD. Some patients may not stick to lifestyle changes.

New drugs are extensively tested for:	Efficacy	Make sure the drug works
	Toxicity	Check that the drug is not poisonous
	Dose	The most suitable amount to take

Monoclonal antibodies (Biology only HT)

Preclinical trials - using cells, tissues and live animals - must be carried out before the drug can be tested on humans.

Clinical trials use healthy volunteers and patients



Stage 1	Stage 2	Stage 3	Stage 4
Healthy volunteers try small dose of the drug to check it is safe record any side effects	A small number of patients try the drug at a low dose to see if it works	A larger number of patients; different doses are trialled to find the optimum dose	A double blind trial will occur. The patients are divided into groups. Some will be given the drug and some a placebo.

Double blind trial: patients and scientists do not know who receives the new drug or placebo until the end of the trial. This avoids bias.

A placebo can look identical to the new drug but contain no active ingredients

Monoclonal antibodies	Identical copies of one types of antibody produced in laboratory	1. A mouse is injected with pathogen.
		2. Lymphocytes produce antibodies (but do not divide).
		3. Lymphocytes are removed from the mouse and fused with rapidly dividing mouse tumour cells.
		4. The new cells are called hybridomas.
		5. The hybridomas divide rapidly and release lots of antibodies which are then collected.

Monoclonal antibodies can be used in a variety of ways	
Testing	Diagnosis
e.g. pregnancy test – measure the level of hormones	Can detect very small quantities of chemicals in the blood

Specific to one binding site on the antigen. Can target specific chemicals or cells in the body unlike drug and radiotherapy treatments.



203. Which cell structure is found in plant and animal cells but not in bacterial cells?
204. Give one example of a disease that can be caught from another person.
205. Give an example of a disease that is not passed from person to person.
206. Name a type of organism that can cause disease.
207. Suggest one way in which infectious diseases are spread.
208. What might a doctor give to someone who has a bacterial disease?
209. Give one symptom of flu.
210. What does the immune system do?
211. Which term describes bacteria that are not harmed by an antibiotic?
212. Describe one thing you can do to stay healthy.
213. Which term means when part or all of the body is not working properly for a reason other than injury?
214. Lung cancer, as a result of smoking, is which kind of disease?
215. Which kinds of disease do pathogens cause?
216. What is meant when two factors are correlated?
217. Give one reason why a person with one disease may be more likely to get another disease.
218. What is meant by causation?
219. The WHO definition of health includes physical well-being. Give an example of physical well-being.
220. Give an example of social well-being.
221. Give an example of mental well-being.
222. Scurvy and anaemia are non-communicable diseases. What other sort of disease can they be classified as?
223. Is alcoholic liver cirrhosis a communicable or non-communicable disease?
224. Explain your answer to the previous question.
225. Which type of disease is passed from parent to offspring in their genes?
226. What causes malnutrition?
227. What causes a deficiency disease?
228. Give one example of a deficiency disease.

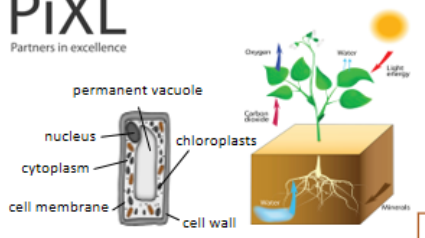


229. Give an example of a lifestyle factor that is linked to disease.
230. If the amount of alcohol a person drinks increases, how will their risk of liver disease change?
231. What is the function of the liver that makes it particularly likely to be damaged by alcohol?
232. Describe one problem that alcohol consumption causes for society.
233. What is cardiovascular disease?
234. Is cardiovascular disease communicable or non-communicable?
235. Name two ways of measuring obesity.
236. How does diet affect obesity?
237. How does exercise affect obesity?
238. How is obesity correlated with cardiovascular disease?
239. How is smoking tobacco correlated with cardiovascular disease?
240. Name two different types of treatment for cardiovascular disease.
241. What is a pathogen?
242. Are diseases caused by pathogens communicable or non-communicable?
243. Which type of pathogen is HIV?
244. Which type of pathogen causes malaria?
245. Which species is affected by chalarra dieback?
246. Which type of pathogen causes cholera?
247. Which organ does tuberculosis damage?
248. Which pathogen causes haemorrhagic fever?
249. What are the symptoms of malaria?
250. What are the symptoms of infection by Helicobacter?
251. How can the spread of chalarra dieback be reduced or prevented?
252. Why does killing mosquitoes help prevent malaria?
253. Which type of pathogen can cause stomach ulcers?
254. Which type of pathogen causes Ebola?
255. How is Ebola spread?



256. How can the spread of cholera be reduced or prevented?
257. How could the spread of tuberculosis be reduced or prevented?
258. Which term is used for organisms that spread disease from one host to another?
259. Which organism carries the pathogen that causes malaria from one host to another?
260. How does the malarial pathogen get into its host?
261. Name one part of a bacterium that is not found in virus particles.
262. How do viruses replicate?
263. Which barrier to infection covers the body?
264. Why does that barrier protect against infection?
265. How are trapped pathogens moved out of the lungs?
266. How does the chemical defence in the stomach help to protect against infection?
267. Which chemical defence against infection is found in tears and saliva?
268. How does this chemical defence protect against infection?
269. How are Chlamydia and HIV transmitted?
270. Explain one way that the spread of Chlamydia or HIV could be reduced or prevented.
271. What usually triggers an immune response?
272. What name is given to the molecules released into the blood by immune system cells?
273. Which type of blood cell is important in the immune response?
274. What name is given to the molecules on pathogens that the immune system responds to?
275. Which cells are left in the blood after an infection has been cleared?
276. What is the function of the cells left in the blood after infection?
277. Does immunity to one pathogen make you immune to other pathogens?
278. Give two ways that a secondary response differs from a primary response to an infection.
279. Which name is given to the inactive form of a pathogen used in immunisation?
280. Why are people immunised against diseases?
281. Which medicines are used to treat infections caused by bacteria?
282. When possible new medicines are being developed, what are they tested on in the first stage of testing?

Plant Structures & Functions



Respiration, stored as insoluble starch, fats or oils for storage, cellulose for cell walls, combine with nitrates from the soil to form amino acids for protein synthesis

Describe photosynthetic organisms as the main producers of food and therefore biomass

Plants use the glucose produced in photosynthesis in a variety of ways

EDEXCEL GCSE Plant Structures and Functions part 1

Photosynthetic reaction

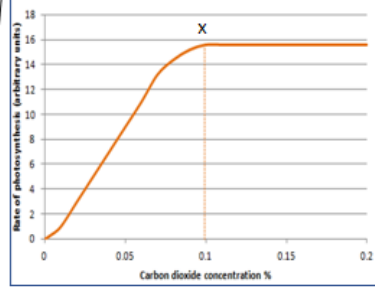
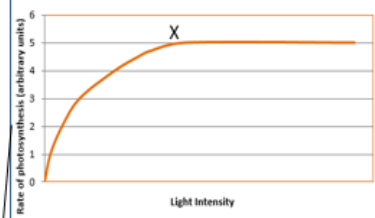
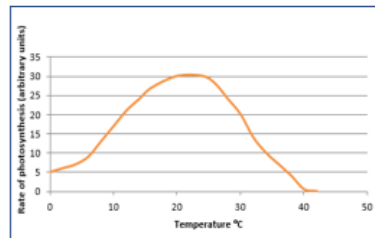
The plant manufactures glucose from carbon dioxide and water using energy transferred from the environment to the chloroplasts by light

Photosynthesis	Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)	Carbon dioxide + Water $\xrightarrow{\text{light}}$ Oxygen + Glucose
		$\text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{light}} \text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$

The rate of photosynthesis is affected by temperature, light intensity, carbon dioxide concentration.

Factor	How the rate is affected	Limiting factors (why the rate stops going up)
Temperature	As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
Light intensity	Light intensity increases as the distance between the plant and the light sources increases. As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
Carbon dioxide concentration	Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll

Rate of photosynthesis



Rate of photosynthesis HT Only

The rate of photosynthesis is proportional to light intensity. Light intensity obeys the inverse square law. This means that if you double the distance between the plant and the light source you quarter the light intensity

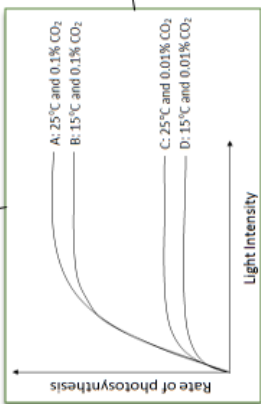
Graph lines C and D: If temperature is increased by 10°C then a slight increase in rate of photosynthesis occurs.

Explain the interactions of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis.

Graph lines A and D: If carbon dioxide concentration and temperature are increased the rate of photosynthesis increases significantly up to a point.

Graph Lines A and B: If carbon dioxide concentration is increased from 0.01% to 0.1% then a large increase in rate occurs up to a point.

Graph line A: Rate could be limited by temperature and/or amount of chlorophyll. Plant tissue can be damaged when carbon dioxide concentrations exceed 0.1%



Plant Structures & Functions

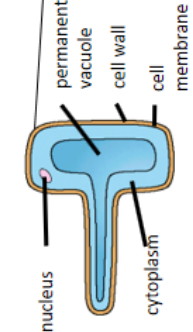
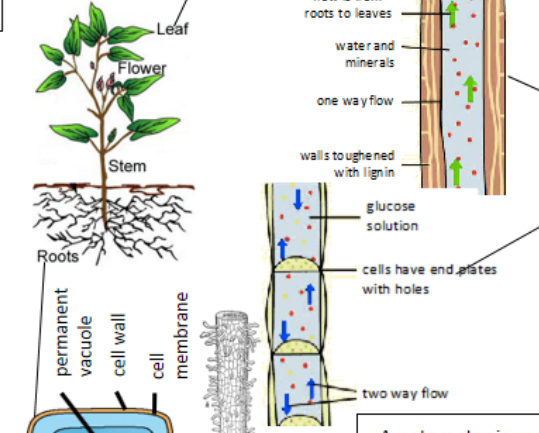
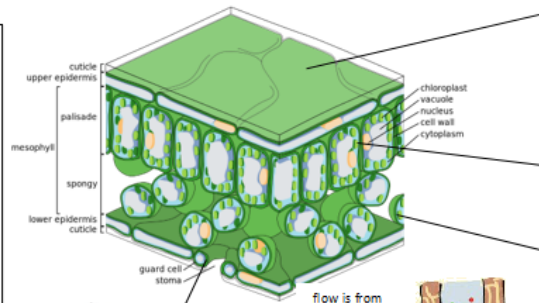
EDEXCEL GCSE PLANT STRUCTURES AND FUNCTION part 2

Plant organ systems

The roots, stem and leaves form a plant organ system for transport of substances around the plant

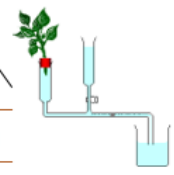
In extreme conditions (high temperature, low water) plants have adapted by reducing the size of the leaf to reduce surface area and have fewer stomata to reduce water loss

Plant hormones



Root hair cells have an increased surface area for absorbing water and mineral ions.

A potometer is used to measure the amount of water lost over time (rate of transpiration)

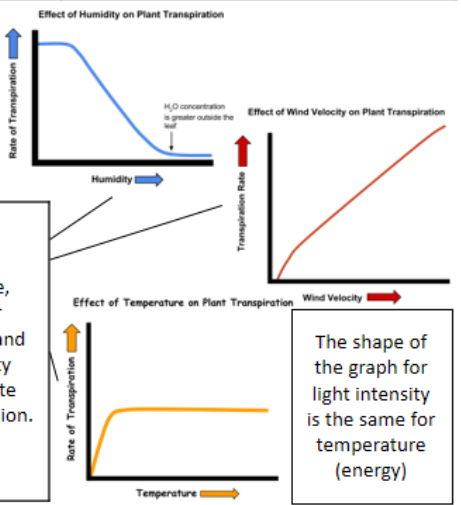


Plant tissues

Epidermal tissues	<i>Waxy cuticle (top layer of the leaf)</i>	Reduces water loss from the leaf
	<i>Guard cells and stomata</i>	Guard cells open and close the stomata to control water loss and allow for gas exchange (oxygen and carbon dioxide).
Palisade mesophyll	<i>Palisade cells</i>	Cells near the top surface of the leaf that are packed with chloroplasts that contain chlorophyll. Both adaptations maximize photosynthesis.
Spongy mesophyll	<i>Air spaces in the leaf between cells</i>	Increased surface area for gas exchange so that carbon dioxide can diffuse into photosynthesising cells.
xylem	<i>Hollow tubes strengthened by lignified dead cells adapted for the transportation of water and mineral ions through the plant in the transpiration stream</i>	Allows transport of water and mineral ions from the roots to the stem and the leaves.
phloem	<i>Cell sap moves from one phloem cell to the next through pores in the end walls</i>	Transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage (translocation).
Meristem tissue	<i>New cells (roots and shoot tips) are made here including root hair cells</i>	Root hair cells have an increased surface area for the uptake of water by osmosis, and mineral ions by active transport.

Plant responses using hormones (auxins)	<i>Light (phototropism)</i>	Light breaks down auxins and they become unequally distributed in the shoot. The side with the highest concentration of auxins has the highest growth rate and the shoot grows toward the light.
	<i>Gravity (geotropism or gravitropism)</i>	Gravity causes an unequal distribution of auxins. In roots the side with the lowest concentration has the highest growth rate and the root grows in the direction of gravity.
Plant growth hormones have commercial uses (HT only)	<i>Auxins</i>	Weed killers, rooting powders, promoting growth in tissue culture.
	<i>Ethene</i>	Control ripening of fruit during storage and transport.
	<i>Gibberellins</i>	End seed dormancy, promote flowering, increase fruit size.

Transpiration	<i>The rate at which water is lost from the leaves of a plant. The transpiration stream is the column of water moving through the roots, stem and leaves</i>	Temperature, humidity, air movement and light intensity affect the rate of transpiration.
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283. In a food chain, consumers eat other organisms. What word is used to describe organisms that make their own food?
284. What process do plants and algae use to make their own food?
285. In what sub-cellular part of a plant cell does photosynthesis occur?
286. What substance from the air do plants need for photosynthesis?
287. What substance from the ground do plants need for photosynthesis?
288. What organs do plants use to get water from the ground?
289. How are roots adapted to getting water from the ground quickly?
290. What energy-storing compound is made in photosynthesis?
291. Suggest one use for glucose in a plant.
292. In what sub-cellular part of a plant cell does respiration occur?
293. What product of photosynthesis is a gas at room temperature?
294. Plants photosynthesise. Name one other group of organisms that photosynthesise.
295. What reactant in photosynthesis is a gas at room temperature?
296. What are all the materials that make up an organism known as?
297. In what subcellular parts of plants does photosynthesis occur?
298. Where does all the energy originally come from in most food chains?
299. What polymer inside chloroplasts is made from glucose?
300. Name the main sugar that is transported around most plants.
301. How are most leaves adapted to only allow gas exchange during the day?
302. What do we mean by the 'rate' of photosynthesis?
303. What is a rate of reaction?
304. What do we call something that prevents a rate of reaction increasing?



305. If light intensity is a limiting factor, what happens to the rate of photosynthesis when it is increased?
306. When there is plenty of light and plenty of carbon dioxide, suggest one factor that could be limiting.
307. What happens to the rate of photosynthesis as a plant is moved further away from a light source?
308. What relationship is shown by a straight line through the points on a scatter graph?
309. What sort of linear relationship is shown by a straight line through the origin?
310. By what law does light intensity vary with distance?
311. What is light intensity inversely proportional to?
312. What happens to plants if they do not get enough water to fill their cells?
313. What term is used to describe the amount of a substance in a certain unit volume?
314. What term is used to describe the overall movement of particles from higher concentration to lower concentration?
315. What term is used to describe the overall movement of solvent particles from higher concentration to lower concentration through a partially permeable membrane?
316. What is the gradual change in concentration from one place to another called?
317. What process do cells use to transport substances against their concentration gradient?
318. What adaptation do some root cells have in order to increase the amount of water they can absorb?
319. Why do cells that use active transport often have a lot of mitochondria?
320. of energy.)
321. What do plants need nitrate ions for?
322. Through what vessels is water moved up a plant?
323. Through what tissue are sugars transported around a plant?



Animal Coordination & Homeostasis

EDEXCEL GCSE BIOLOGY ANIMAL COORDINATION PART 1

Response to internal and external change

Controls in the human body	Blood glucose concentration	These automatic control systems may involve nervous responses or chemical responses.
	Body temperature	
	Water levels	

The regulation of internal conditions of a cell or organism to maintain optimum conditions for function.

Homeostasis maintains optimal conditions for enzyme action (thermoregulation) and all cell functions (osmoregulation).

Homeostasis

Water and nitrogen balance (Biology only)

If body cells lose or gain too much water by osmosis they do no function efficiently.	Uncontrolled water/ion/urea loss	Water exhaled in lungs, water, ions and urea in sweat.
	Controlled water/ion/urea loss	Via the kidneys in urine.

Kidney failure is treated by organ transplant or dialysis.

Kidney function	Maintain water balance of the body.	Produce urine by filtration of the blood and selective reabsorption of glucose, ions and water.
	Acts on kidney tubules to control water levels.	Released by pituitary gland when blood is too concentrated. Water is reabsorbed back into the blood from the kidney tubules (NEGATIVE FEEDBACK).

(HT only) ADH	Acts on kidney tubules to control water levels.	Released by pituitary gland when blood is too concentrated. Water is reabsorbed back into the blood from the kidney tubules (NEGATIVE FEEDBACK).
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Thermoregulatory centre (hypothalamus)

Control of body temperature (Biology only)

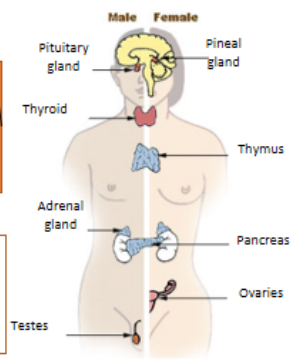
Monitoring body temperature	Thermoregulatory centre	Contains receptors sensitive to the temperature of the blood.
	Skin (dermis and epidermis)	Contains temperature receptors, sends nervous impulses to the thermoregulatory centre.

Body temperature	Too high	Blood vessels dilate (vasodilation), sweat produced from sweat glands.
	Too low	Blood vessels constrict (vasoconstriction), sweating stops, muscles contract (shivering).

(HT) Thermal energy is lost from blood near the surface of the skin, sweat evaporates transferring thermal energy.

(HT) Thermal energy loss at the surface of the skin is reduced, respiring muscles cells transfer chemical to thermal energy.

Human endocrine system



Endocrine system
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 effects are slower but act for longer.

Pituitary gland
"Master gland"; secretes several hormones into the blood
Stimulates other glands to produce hormones to bring about effects.

Control of blood glucose concentration

Negative feedback (HT only)	Adrenaline	Produced in adrenal glands, increases breathing/heart rate, blood flow to muscles, stimulates liver to convert glycogen to glucose. Prepares body for 'fight or flight'.
	Thyroxine	Produced in the thyroid gland, stimulates the basal metabolic rate. Important in growth and development.

Increasing thyroxine levels prevent the release of thyroid stimulating hormone which stops the release of thyroxine.

Blood glucose concentration	
<i>Monitored and controlled by the pancreas</i>	
Too high	(HT only) Too low
Pancreas produces the hormone insulin, glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.	Pancreas produces the hormone glucagon that causes glycogen to be converted into glucose and released into the blood.

(HT) Rising glucose levels inhibit the release of glucagon in a negative feedback system. Insulin is released to reduce glucose levels and which cause the pancreas to release glucagon

Diabetes	
Type 1	Type 2
Pancreas fails to produce sufficient insulin leading to uncontrolled blood glucose levels. Normally treated by insulin injection.	Obesity is a risk factor. Body cells no longer respond to insulin. Common treatments include changing by diet and increasing exercise.

Animal Coordination & Homeostasis

FSH and LH are used as 'fertility drugs' to help someone become pregnant in the normal way

Hormones are used in Assisted Reproductive Technology (ART) to treat infertility

In Vitro Fertilisation (IVF) treatment.

Involves giving a mother FSH and LH to stimulate the maturation of several eggs (clomifene therapy)

The eggs are collected from the mother and fertilised by sperm from the father in a laboratory.

↓

The fertilised eggs develop into embryos.

↓

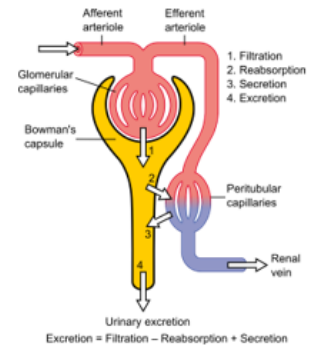
At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb).

The use of hormone to treat infertility (HT only)

EDEXCEL GCSE BIOLOGY ANIMAL COORDINATION PART 2

Structure of the urinary system	Renal veins and arteries	Carries blood to and from the kidneys.
	Ureter	Carries urine from kidney to bladder.
	Bladder	Stores urine
	Urethra	Carries urine from bladder to outside of body.
	Kidneys	Remove substances from blood to make urine.

Structure and function of the nephron in kidney	Glomerulus	Filtration of small molecules e.g. water, urea and glucose into the nephron.
	Bowman's capsule	
	Selective reabsorption of glucose	Active transport of useful substances back into the blood e.g. glucose and mineral ions.
	Reabsorption of water	Osmosis moves water back into the blood in the loop of Henle.



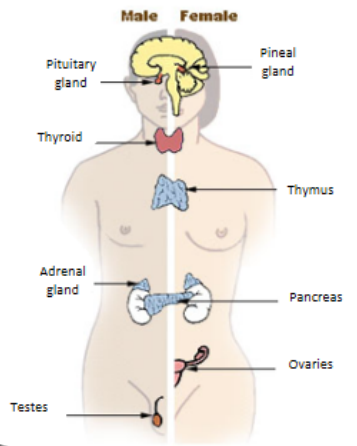
Potential disadvantages of IVF	Emotional and physical stress.
	Success rates are not high.
	Multiple births risk to mother and babies.

Contraception

Hormones in human reproduction

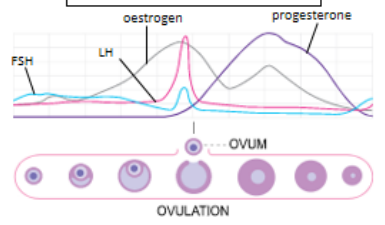
During puberty reproductive hormones cause secondary sexual characteristics to develop

Oestrogen (main female reproductive hormone)	Testosterone (main male reproductive hormone)
Produced in the ovaries. At puberty eggs begin to mature releasing one every 28 days – ovulation.	Produced in the testes stimulation sperm production.



Fertility can be controlled by hormonal and non hormonal methods	Oral contraceptives	Contain hormones to inhibit FSH production so that no eggs mature.
	Injection, implant, skin patch	For slow release of progesterone to inhibit the maturation and release of eggs for months or years.
	Barrier methods	Condoms or diaphragms which prevent sperm reaching the egg.
	Intrauterine devices	Prevent implantation of an embryo or release a hormone.
	Spermicidal agents	Kill or disable sperm.
	Surgery	Male or female sterilisation.

(HT only) a graph of hormone levels over time



Menstrual cycle	Follicle stimulating hormone (FSH)	Causes maturation of an egg in the ovary.	(HT) FSH stimulates ovaries to produce oestrogen.
	Luteinising hormone (LH)	Stimulates release of an egg.	(HT) Oestrogen stops FSH production and stimulates LH production in pituitary gland.
	Oestrogen and progesterone	Maintain uterus lining.	



324. Which cells in the nervous system detect changes?
325. Sense organs contain receptors cells. Give one example of a sense organ.
326. Which parts of the body cause the response to a stimulus?
327. Give an example of an effector.
328. In what form is information transmitted in the nervous system?
329. How are soluble chemical substances (e.g. digested food molecules) carried around the body?
330. Name one hormone produced in the male reproductive system.
331. Name one hormone produced by ovaries.
332. Which general name is given to an organ that responds to a hormone?
333. What effect do hormones have on organs that respond to them?
334. What is the name for a gland that produces a hormone?
335. Name the organ that produces oestrogen.
336. Name the organ at the base of the brain that produces many hormones.
337. What is the name for an organ that is affected by a hormone?
338. Name an organ that is affected by growth hormone.
339. How do hormones travel around the body?
340. Which hormone brings about changes in a boy's body during puberty?
341. Where is adrenalin made?
342. Describe one effect of adrenalin on the body.
343. What is the role of thyroxine in the body?
344. What name is given to a substance produced in the body that changes how its target organs work?
345. Name the endocrine gland that produces testosterone.
346. How does testosterone get from where it is made to its target organs?
347. Name the hormone that produces changes in girls as they become women.
348. H In which gland is thyroxine produced?
349. H What is the function of thyroxine in the body?
350. H Which hormone controls the fight or flight response?
351. H Which term describes when a change in a system causes the opposite change, returning the system to a normal level?
352. What name is given to the cycle of changes in a woman's reproductive system that happens every month?
353. What name is given to methods that prevent fertilisation?

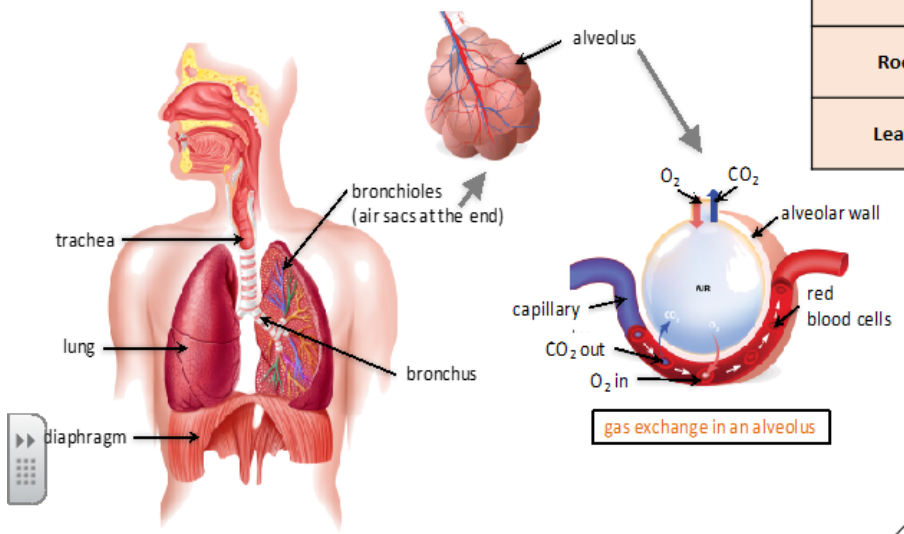


354. Which term describes the cycle of changes in a woman's body that happens about every 28 days?
355. On approximately which day of the menstrual cycle is an egg cell released from an ovary?
356. Name two hormones that help to control the menstrual cycle.
357. State where oestrogen is produced.
358. How do changes in the blood concentrations of oestrogen and progesterone trigger menstruation?
359. Which term describes any method used to reduce the chance of pregnancy?
360. Give one example of a physical barrier method of contraception.
361. Which endocrine organ produces the hormones FSH and LH?
362. A surge in blood concentration of which hormone triggers the release of an egg from an ovary?
363. Which three-letter abbreviation is used to describe a method of increasing the chance of pregnancy by fertilising an egg cell outside the body?
364. In the menstrual cycle, what usually happens at about day 14?
365. What change in the concentrations of oestrogen and progesterone causes menstruation?
366. How does use of a condom during sexual activity help to reduce the risk of pregnancy?
367. How does the combined contraceptive pill help to reduce the risk of pregnancy?
368. H A surge in concentration of which hormone triggers ovulation?
369. H Which hormone stimulates the growth and maturation of an egg follicle?
370. H Which hormone treatment can be given to women who rarely ovulate, to increase their chance of ovulation?
371. H In which ART technique is a woman given two natural hormones to cause the release of many eggs from her ovaries?
372. Name one target organ of insulin that helps to reduce blood glucose concentration.
373. What name is given to the condition in which people cannot control their blood glucose concentration properly?
374. Which term means maintaining a constant internal environment?
375. What effect does eating food have on blood glucose concentration?
376. What effect does exercise have on blood glucose concentration?
377. Which hormone(s) control(s) blood glucose concentration?
378. Which endocrine gland produces this hormone/H these hormones?
379. What happens to glucose taken into liver cells as a response to a hormone?
380. What causes type 1 diabetes?
381. What type of treatment must someone with type 1 diabetes have for the rest of their lives?
382. What causes type 2 diabetes?
383. How is type 2 diabetes correlated with body mass?

Exchange & Transport in Animals

Multicellular organisms require transport systems e.g. capillaries in animals xylem/phloem in plants because distances are too great for diffusion to be effective.

Small intestines	<i>Villi – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Lungs	<i>Alveoli – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Gills in fish	<i>Gill filaments and lamella – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Roots	<i>Root hair cells - increase surface area.</i>
Leaves	<i>Large surface area, thin leaves for short diffusion path, stomata on the lower surface to let O₂ and CO₂ in and out.</i>



Exchange surfaces and adaptations for diffusion.

Surface area to volume ratio

Large surface areas mean a large surface area to volume ratio is maintained in larger organisms e.g. alveoli in the lungs mean that the surface area is 250 times bigger than the volume.

EDEXCEL GCSE Exchange and Transport in Animals Part 1

Lungs and gas exchange

The heart pumps low oxygen/high carbon dioxide blood to the lungs

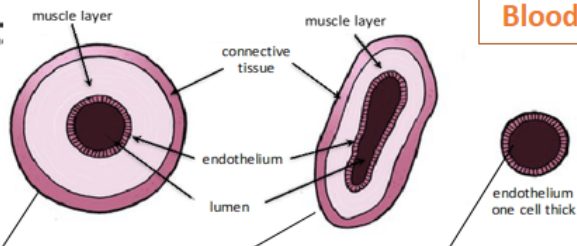
Trachea	<i>Carries air to/from the lungs</i>	Rings of cartilage protect the airway.
Bronchioles	<i>Carries air to/from the air sacs (alveoli)</i>	Splits into multiple pathways to reach all the air sacs.
Alveoli	<i>Site of gas exchange in the lungs</i>	Maximises surface area for efficient gas exchange.
Capillaries	<i>Allows gas exchange between into/out of blood</i>	Oxygen diffuses into the blood and carbon dioxide diffuses out.

Organisms need to transport substances into and out of their structures and cells e.g. oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea.

Factors affecting rate of diffusion (Biology only)		
Surface area	Concentration gradient	Diffusion distance
Increased surface area on exchange surface increases diffusion.	Diffusion is from area of high concentration to low concentration. A large difference in concentration will increase rate of diffusion.	The smaller the diffusion distance to faster the rate of diffusion,

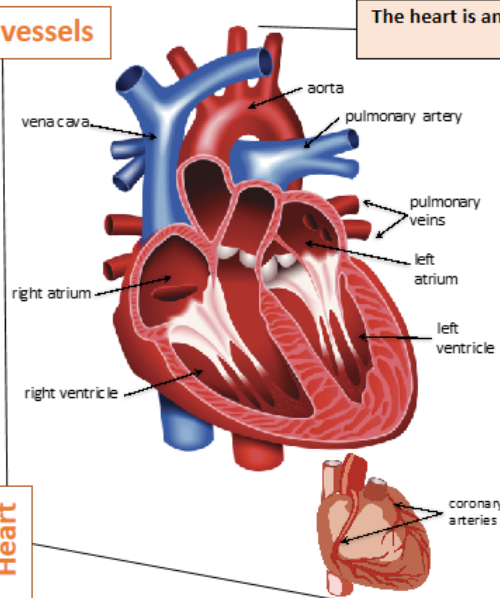
Fick's law (Biology only)	
<i>Calculate the rate of diffusion</i>	
$\text{rate of diffusion} \propto \frac{\text{surface area} \times \text{concentration difference}}{\text{thickness of membrane}}$	

Exchange & Transport in Animals



Blood vessels

Artery	Vein	Capillary
<i>Carry blood away from the heart</i>	<i>Carry blood to the heart</i>	<i>Connects arteries and veins</i>
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood (except for the pulmonary artery).	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood (except for the pulmonary vein).	One cell thick to allow diffusion, Carry blood under very low pressure.



The heart is an organ that pumps blood around the body in a double circulatory system

Different structure in the heart have different functions		
<i>Right ventricle</i>	Pumps blood to the lungs where gas exchange takes place.	
<i>Left ventricle</i>	Pumps blood around the rest of the body. Thicker cardiac muscle in the wall.	
<i>Pacemaker (in the right atrium)</i>	Controls the natural resting heart rate. Artificial electrical pacemakers can be fitted to correct irregularities.	
<i>Coronary arteries</i>	Carry oxygenated blood to the cardiac muscle.	
<i>Heart valves</i>	Prevent blood in the heart from flowing in the wrong direction.	

Heart

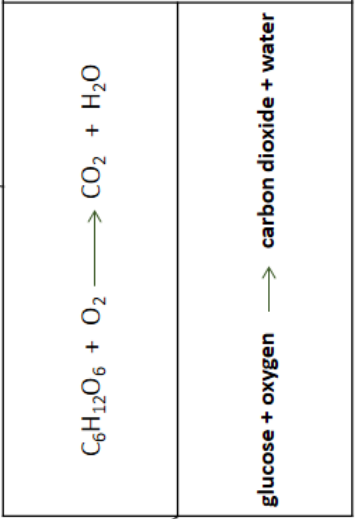
Calculate heart rate, stroke volume and cardiac output

Cardiac output = stroke volume x heart rate

Aerobic respiration

Respiration with oxygen. Occurs inside the mitochondria continuously

Glucose is oxidised by oxygen to transfer the energy the organism needs to perform it's functions.



Aerobic respiration releases a large amount of energy from each glucose molecule

Respiration

Cellular respiration is an exothermic reaction which is continuously occurring in all living cells

Anaerobic respiration

Respiration when oxygen is in short supply. Occurs during intensive exercise

During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs.

Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.

glucose → lactic acid

Anaerobic respiration releases a much smaller amount of energy than aerobic respiration.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt

EDEXCEL GCSE Exchange and Transport in Animals Part 2.

Blood

Blood is a tissue consisting of plasma, in which blood cells, white blood cells and platelets are suspended

Plasma (55%)	<i>Pale yellow fluid</i>	Transports CO ₂ , hormones and waste.
Red blood cells (erythrocytes)(45%)	<i>Carries oxygen</i>	Large surface area, no nucleus, full of haemoglobin.
White blood cells (phagocytes and lymphocytes)(<1%)	<i>Part of the immune system</i>	Some produce antibodies, others surround and engulf pathogens.
Platelets (<1%)	<i>Fragments of cells</i>	Clump together to form blood clots.



384. What do we mean when we talk about the concentration of a substance?
385. By what process do particles move from a place of greater concentration to a place of lower concentration?
386. In diffusion, do particles move up or down a concentration gradient?
387. For what process in the body do we need oxygen?
388. What gases are exchanged in the lungs?
389. What molecule is used to carry oxygen in red blood cells?
390. A cuboid has sides of 4 cm by 4 cm by 5 cm. What units would be used for its surface area?
391. A cuboid has sides of 4 cm by 4 cm by 5 cm. What units would be used for its volume?
392. A cell has a surface area of 24 cm² and a volume of 8 cm³. What is the ratio of its surface area to its volume?
393. How are the lungs adapted for efficient gas exchange?
394. Which organ excretes carbon dioxide in humans?
395. In what pocket-shaped structures does carbon dioxide excretion occur?
396. Why do alveoli have walls that are only one cell thick?
397. Which organ excretes urea in humans?
398. What do you divide surface area by to calculate a surface area : volume
399. Which have the bigger SA : V ratios, smaller cells or larger cells?
400. Does diffusion happen up or down a concentration gradient?
401. What are the smallest blood vessels in the body called?
402. What is the name of the blood vessels that carry blood away from the heart?
403. What is the function of an erythrocyte?
404. Which blood vessels take blood away from the heart?
405. Which blood vessels have thick, elastic walls?
406. Which blood vessels contain valves?
407. Through which blood vessels does diffusion of substances into and out of tissues take place?
408. Which blood cells are adapted to carry oxygen?
409. Which blood cells engulf and digest foreign cells?
410. Which component of the blood carries urea?
411. What helps to push blood along veins in the legs?
412. How many chambers does a human heart have?
413. What happens when blood is prevented from reaching heart muscles?
414. What are the lower chambers of the heart called?
415. What stops blood flowing the wrong way in the heart?
416. Which side of the heart has the thicker muscle walls?
417. What parts of the body does the right side of the heart supply with blood?
418. Which blood vessel carries blood to the left atrium from the lungs?
419. Does the pulmonary artery carry deoxygenated or oxygenated blood?
420. Why does heart rate increase during exercise?
421. Jack's stroke volume is 0.1 litres/beat and his heart rate is 50 beats per minute. What is his cardiac output?
422. What element does aerobic respiration need that anaerobic respiration does not?
423. What happens to energy in an exothermic reaction?

Ecosystems & Material Cycles

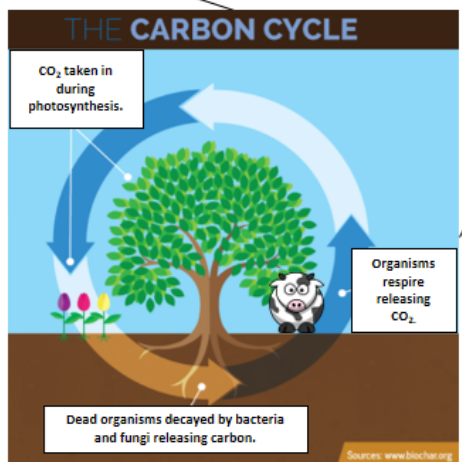
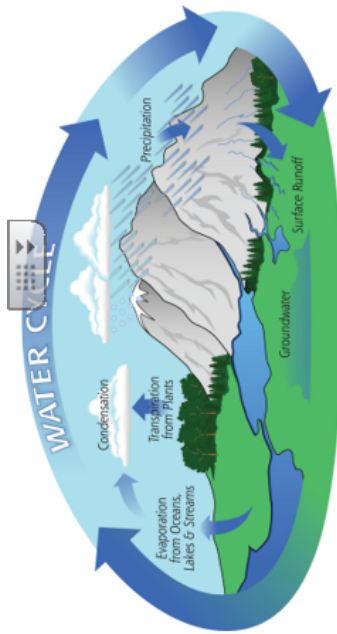
Ecosystem	Environment	The conditions surrounding an organism; abiotic and biotic.
	Habitat	Place where organisms live e.g. woodland, lake.
	Population	Individuals of a species living in a habitat.
	Community	Populations of different species living in a habitat.

Surviving and reproducing	Competition	Plants in a community or habitat compete with each other for light, space, water and mineral ions. Animals compete with each other for food, mates and territory.
	Interdependence	Species depend on each other for food, shelter, pollination, seed dispersal etc. Removing a species can affect the whole community

Organisms require a supply of materials from their surroundings and from the other living organisms.

Bacteria respire when breaking down dead organisms releasing CO₂.

In times of drought desalination plants can be used to produce potable water.



Decomposition and material cycling in abiotic and biotic systems

Interdependence and competition

EDEXCEL GCSE Ecosystems and material cycles PART 1

Parasitism and mutualism	Parasites	Parasites feed off a host causing harm to the host e.g. tape worm living inside digestive system.
	Mutualistic relationships	e.g. insects and flowers in pollination. Plant ovum are successfully fertilised, insect species receive food (nectar)

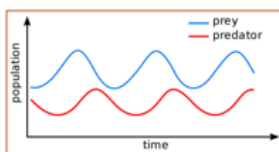
Abiotic and biotic factors.

Levels of organisation

Materials are recycled to provide the building blocks for future organisms

Food chains			
Feeding relationships in a community			
Producer	Primary consumer	Secondary consumer	Tertiary consumer
All food chains begin with a producer e.g. grass that is usually a green plant or photosynthetic algae.		Consumers that kill and eat other animals are predators and those eaten are prey.	

Photosynthetic organisms are the producers of biomass for life on Earth



In a stable community the numbers of predators and prey rise and fall in cycles.

Factors affecting rate of decay and food preservation (biology only)

Temperature, water, oxygen
Increase the rate of decay when increased. In enzyme controlled reactions raising the temperature too high will denature the enzymes.

$$\text{Rate of decomposition (biology only)} = \frac{\text{mass lost}}{\text{number of days}}$$

Abiotic	Biotic
Non-living factors that affect a community	Living factors that affect a community
Living intensity.	Availability of food.
Temperature.	New predators arriving.
Moisture levels.	
Soil pH, mineral content.	New pathogens.
Wind intensity and direction.	
Carbon dioxide levels for a plant.	One species outcompeting so numbers are no longer sufficient to breed
Oxygen levels for aquatic organisms.	

Ecosystems & Material Cycles

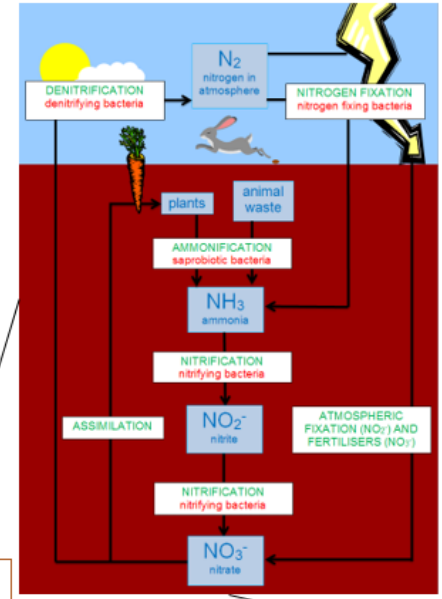
Factors affecting food security <i>Enough food is needed to feed a changing population</i>	Increasing human population
	Increased meat and fish consumption.
	New pests and pathogens affecting farming.
	Environmental changes caused by human activity.
	Cost of agriculture input.
	Use of land for biofuel production.

Food production (biology only)	
Maintaining local and global biodiversity	Conservation of animal species Protecting rare or endangered species by protecting habitats and use of breeding programmes.
	Impact of reforestation Increasing range of habitats so that an area can support a greater range of species.

Indicator species <i>Assessing levels of pollution</i>	Polluted water – blood worm, sludgeworm.
	Clean water – freshwater shrimps, stonefly.
	Air quality – lichen species, blackspot fungus

Positive and negative human interactions within ecosystems	
Fish farming	Can be used to reduce over fishing of wild species and increase biodiversity.
Introduction of non-indigenous species	Can decrease biodiversity by introducing predators where prey do not have time to adapt.
Eutrophication	Fertilisers on farm land lead to too many nutrients in water act as pollutants reducing biodiversity.

EDEXCEL GCSE Ecosystems and material cycles PART 2



Nitrates are made available for uptake by plants

Nitrate availability can also be increased by the use of fertilisers and crop rotation.

Experimental methods are used to determine the distribution and abundance of a species.

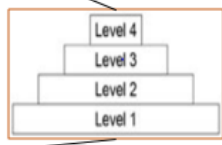


Sampling techniques	Quadrats	Organisms are counted within a randomly placed square
	Transects	Organisms are counted along a belt (transect) of the ecosystem.

Biodiversity

Biodiversity is the variety of all different species of organisms on Earth, or within an ecosystem

Trophic levels and biomass



Nitrogen cycle

Processing data	
Median	Middle value in a sample.
Mode	Most occurring value in a sample.
Mean	The sum of all the value in a sample divided by the sample number.

Decomposers break down dead plants and animal matter by secreting enzymes. Small soluble food molecules then diffuse into the microorganism.

Transfer of biomass (biology only)	
Biomass is lost between the different trophic levels	
Producers transfer about 1% of the incident energy from light for photosynthesis.	Large amounts of glucose is used in respiration, some material egested as faeces or lost as waste e.g. CO_2 , water and urea in urine.
Approximately 10% of the biomass from each trophic level is transferred to the level above.	

Trophic levels can be represented by numbers and biomass in pyramids.		
Trophic levels are numbered sequentially according to how far the organisms is along the food chain.		
Level 1	Producers	Plants and algae.
Level 2	Herbivores	Primary consumers.
Level 3	Carnivores	Secondary consumers.
Level 4	Carnivores	Tertiary consumers.



424. Which term describes organisms, such as plants or algae, that make their own food?
425. Why can plants and algae make their own food?
426. Which term describes organisms that get their food by eating other organisms?
427. Which term describes animals that eat plants or algae?
428. Which term describes animals that kill and eat other animals?
429. Name a type of diagram that shows the feeding relationships between organisms.
430. Which scientific term means all the organisms and the environment they interact with?
431. Which scientific term means all individuals of the same species living in a particular area?
432. Which piece of equipment could be used to investigate the number of plants in an area?
433. Fifty daisy plants have been found in a 10 m² sample of a 100 m² lawn. Estimate the total population of daisies in the lawn.
434. Which ecological term describes all the animals, plants, other organisms, rain, soil and other factors in a rainforest?
435. Which ecological term describes all the organisms living in a lake?
436. Groups of the same species living in different areas are different ... ?
437. In a food web, which term describes organisms that feed on plants?
438. Which term describes how one species needs other species in the same food web for its survival?
439. In a study of abundance of small plants in a field, samples are taken using which piece of equipment?
440. Name two resources that plants need from their environment.
441. Which term describes something that has been added to the environment, causing harm to the organisms?
442. Which method can be used to study the distribution of organisms in a straight line through an ecosystem?
443. Give two examples of abiotic factors that affect organisms.
444. Which term describes the non-living factors of an environment, such as temperature, light intensity and water availability?
445. For which process in plants is light intensity an important factor?
446. How could a reduction in light intensity affect primary consumers in a community?
447. Which term describes an animal that kills and eats other animals?
448. Which term describes animals that are killed and eaten by other animals?
449. Which term describes environmental harm caused by the build-up of substances?
450. Which fieldwork technique uses a quadrat to find out about the distribution of organisms across a habitat?
451. During the last 10 000 years, temperatures in the Arctic have risen. Suggest how this may have caused the extinction of woolly mammoths.
452. Which term describes the struggle between organisms for a limited resource such as food?



453. Which term describes living factors in a community that affect other organisms?
454. Is predation an abiotic or biotic factor in ecosystems?
455. Which term describes the struggle between organisms for a limited resource?
456. Give one example of a limited resource that animals might struggle with each other for.
457. Give one example of a limited resource that plants might struggle with each other for.
458. Which term means the number of different species living in an area?
459. Which cycle describes the relationship in population size of a secondary consumer and the animal species that it eats?
460. You might expect the number of predators to drop in an area if their preferred prey species declines in number. Suggest why this drop may not occur.
461. The malaria protist causes harm when it infects a human. Which term describes this relationship between the malaria protist and human?
462. How does the malaria protist benefit from being inside a human?
463. Which term describes a close relationship between two species that benefits both species?
464. Tapeworms live in the human gut, and can cause malnutrition. Which term describes this close relationship?
465. In the tapeworm/human example, which term describes the role of the human in the relationship?
466. In the tapeworm/human example, how does the tapeworm benefit from the relationship?
467. Single-celled algae live inside coral animals and share the products of photosynthesis with the animal. Which term describes this close relationship?
468. In the alga/coral example, how does the alga benefit from the relationship?
469. How would you find out whether a close relationship between two organisms is parasitic?
470. Which term means the number of different species in an area?
471. Which term describes a species living in an area it normally does not live in?
472. Which scientific term means a species that has been introduced to a new area?
473. What has been added to water that has undergone eutrophication?
474. What effect does eutrophication have on plants and algae?
475. Eutrophication of rivers and lakes can decrease biodiversity. What does this mean?
476. Much of the salmon sold in supermarkets comes from fish grown in pens or pools. What is this method of production called?
477. How can a species introduced to an area reduce biodiversity?
478. How can fish farming increase the biodiversity of wild fish communities?
479. Which term means protecting species or their habitat?
480. Which term means planting new trees in a large area where trees were cut down?
481. How can planting trees increase animal biodiversity?
482. Which term describes the protection of an organism or its habitat?



483. Which term means that all the individuals of a certain species have died out?
484. Which term means that all the individuals of a certain species may die out soon?
485. Protecting a habitat to save one particular species can have other benefits for wildlife. Describe one of those benefits.
486. Which term means to plant trees where they once grew but have been cut down?
487. Describe one benefit to wildlife of planting more trees.
488. In the water cycle, which physical process causes liquid water to change into water vapour?
489. Which process in plants takes water from the soil and passes it to the air?
490. In the water cycle, which process causes water droplets to form in clouds from water vapour in the air?
491. Give one reason why water is important to animals.
492. Name one material, other than water, that cycles through ecosystems.
493. Which process changes water on the Earth's surface into water vapour in the air?
494. Which process describes how plants absorb water from the soil and release it into the air?
495. Which process causes the formation of clouds of water droplets from water vapour in the air?
496. What is potable water?
497. Which process produces potable water from salty water?
498. Name one group of organisms that includes decomposers.
499. In what form is carbon in the atmosphere?
500. Name one carbon compound found in living organisms.
501. Which process of living organisms removes carbon from the atmosphere?
502. Which term describes an organism that breaks down dead plants or animals?
503. Which term describes the breaking down of dead plant or animal tissue?
504. Which process in living organisms adds carbon to the atmosphere?
505. Which process causes carbon to be added to the atmosphere from fossil fuels?
506. Which biotic process removes carbon from the atmosphere?
507. Name two groups of organisms that carry out the biotic process that removes carbon from the atmosphere.
508. Why do fertilisers added to fields affect plant growth?
509. Name one problem caused to the environment by spreading too much fertiliser on fields.
510. Which name is given to bacteria that convert nitrogen from the air into nitrogen compounds?
511. Name one alternative to using powdered fertiliser that a farmer could use to improve crop growth.