Nailsea School A Level Biology
Yr12
'Bridging' Tasks

General preparation for the course:

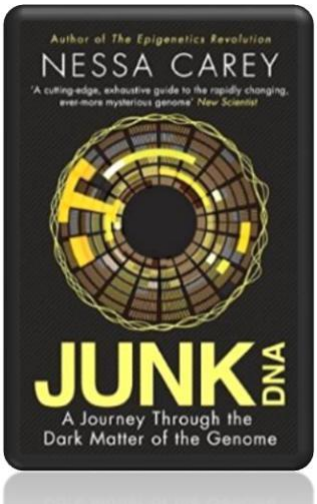
1. **Organisation**- get a large A4 lever arch ring binder + dividers.
2. **Text book** (essential) - buy this text: Toole and Toole (2015): AQA Biology A level Year 1 and AS (Oxford) **ISBN: 9780198351764.**
3. CGP Head start to A Level Biology (recommended) – buy and use this revision guide to highlight key points and use it to support your work with transition tasks.
   ISBN: 978-1782942795

This is currently free to download on the kindle store so I would heavily recommend doing this!!
https://www.amazon.co.uk/Head-Start-level-Biology-Level-ebook/dp/B00VE2NIOI

4. Print off p10-34 of the new specification from the AQA website (recommended). Put in the front of your folder and highlight key words. (Get ahead and start a glossary)
   http://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

- If you have any issues with the work please email myself ismith@nailseaschool.com (Miss Smith) or Dr Pierpoint lpierpoint@nailseaschool.com

Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology.

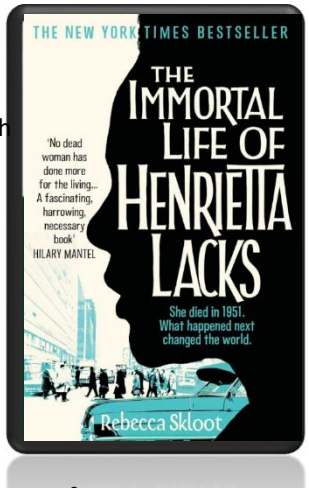


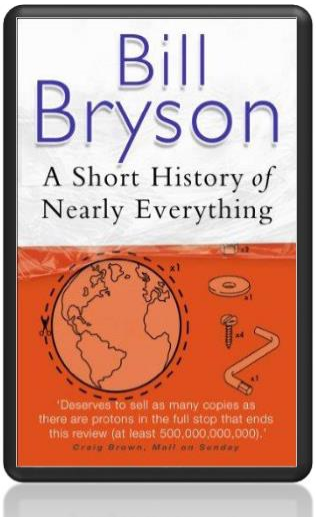
Junk DNA

Our DNA is so much more complex than you probably realize, this book will really deepen your understanding of all the work you will do on genetics.

Science and ethics
The immortal life of Henrietta Lacks

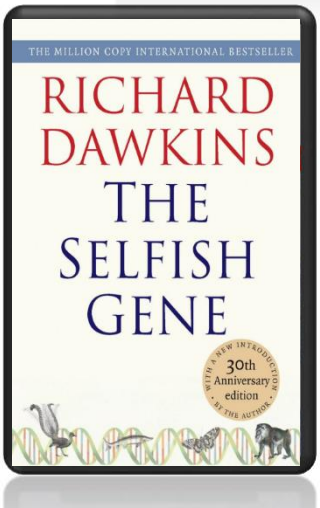
Examines the ethics of research and consent. It specifically looks at the use of HeLa cells which are used across labs across the globe.





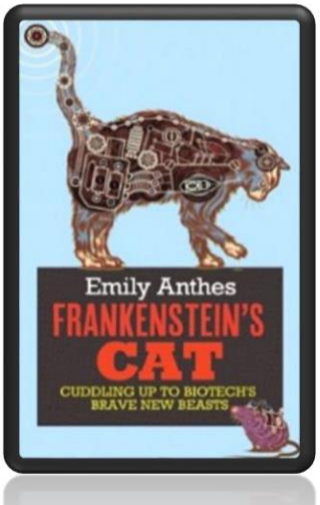
A Short History of Nearly Everything

A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science!



Selfish Gene

A challenging read but examines the ideas around altruism and DNA.



An easy read..

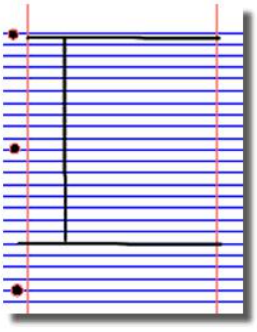
Frankenstein's Cat

Discover how glow in the dark fish are made and more great biotechnology breakthroughs.

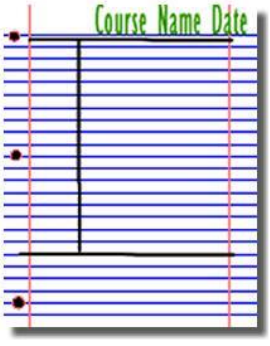
1. Research task -

Research, reading and note making are essential skills for A level Biology study. For the following task you are going to produce 'Cornell Notes' to summarise your reading.

1. Divide your page into three sections like this

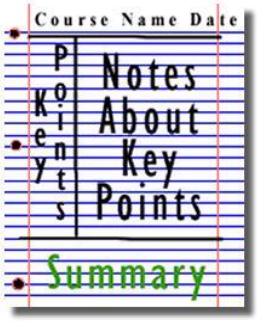


2. Write the name, date and topic at the top of the page

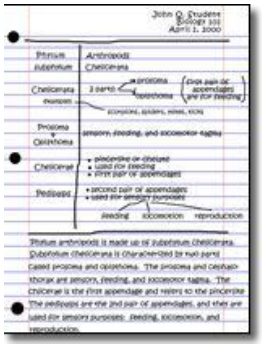


3. Use the large box to make notes. Leave a space between separate ideas. Abbreviate where possible.

4. Review and identify the key points in the left hand box



5. Write a summary of the main ideas in the bottom space



Research task -

The Big Picture is an excellent publication from the Wellcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A level.

For each of the following topics, you are going to use the resources to produce one page of Cornell style notes.

Use the links or scan the QR code to take you to the resources.

Topic 1: The Cell

Available at: http://bigpictureeducation.com/cell The cell is the building block of life. Each of us starts from a single cell, a zygote, and grows into a complex organism made of trillions of cells. In this issue, we explore what we know – and what we don't yet know – about the cells that are the basis of us all and how they reproduce, grow, move, communicate and die.

Topic 2: The Immune System

Available at:
http://bigpictureeducation.com/immune

The immune system is what keeps us healthy in spite of the many organisms and substances that can do us harm. In this issue, we explore how our bodies are designed to prevent potentially harmful objects from getting inside and what happens when bacteria, viruses, fungi or other foreign organisms or substances breach these barriers.

Topic 3: Exercise, Energy and Movement

Available at:
http://bigpictureeducation.com/exercise-energy-and-movement

All living things move. Whether it's a plant growing towards the sun, bacteria swimming away from a toxin or you walking home, anything alive must move to survive. For humans though, movement is more than just survival – we move for fun, to compete and to be healthy. In this issue we look at the biological systems that keep us moving and consider some of the psychological, social and ethical aspects of exercise and sport.

Topic 4: Populations
Available at:
http://bigpictureeducation.com/populations

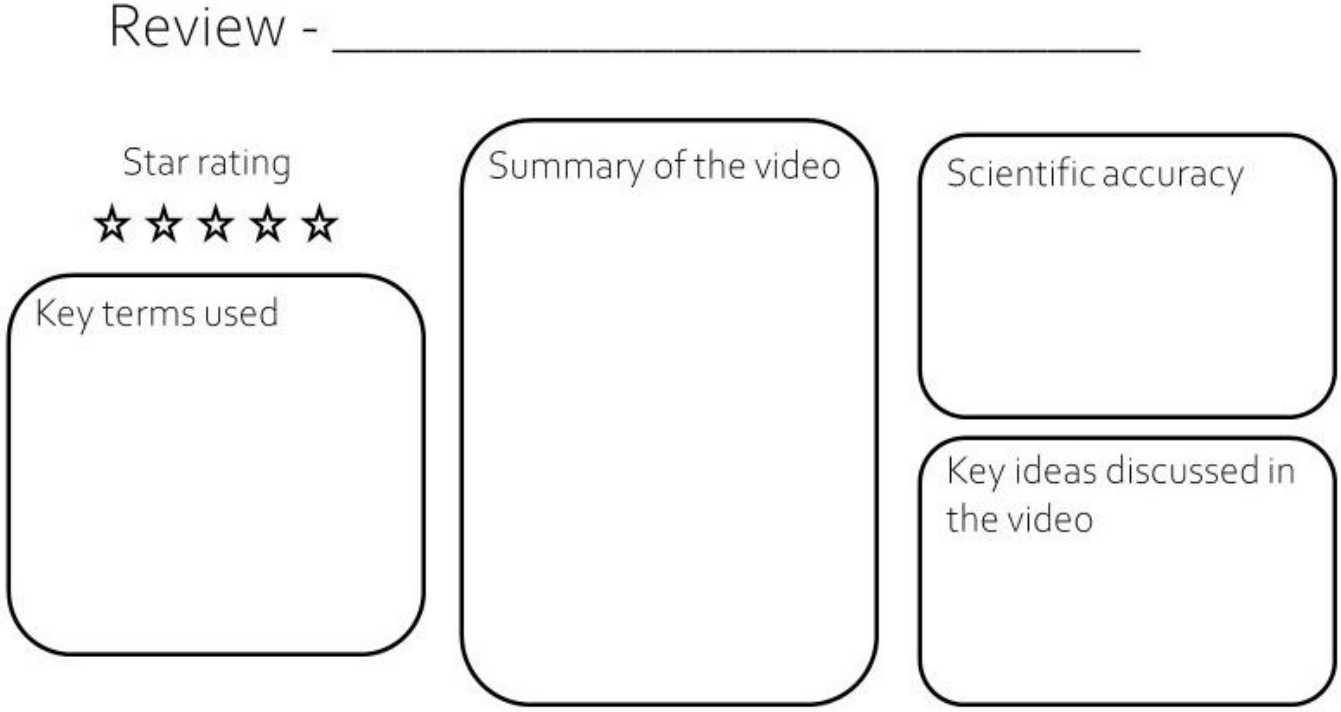
What's the first thing that pops into your mind when you read the word population? Most likely it's the ever-increasing human population on earth. You're a member of that population, which is the term for all the members of a single species living together in the same location. The term population isn't just used to describe humans; it includes other animals, plants and microbes too. In this issue, we learn more about how populations grow, change and move, and why understanding them is so important.

Topic 4: Health and Climate Change
Available at: http://bigpictureeducation.com/health-and-climate-change

The Earth's climate is changing. In fact, it has always been changing. What is different now is the speed of change and the main cause of change – human activities. This issue asks: What are the biggest threats to human health? Who will suffer as the climate changes? What can be done to minimise harm? And how do we cope with uncertainty?

2. Watch and write a review

Pick 3 of these links to watch/listen to and write a review on it.



Review - _____

Star rating

☆ ☆ ☆ ☆ ☆

Key terms used

Summary of the video

Scientific accuracy

Key ideas discussed in the video

Review - _____

Star rating

☆ ☆ ☆ ☆ ☆

Key terms used

Summary of the video

Scientific accuracy

Key ideas discussed in the video

Virology & Global Health	• Explained: The Next Global Pandemic (20 mins)[Text Wrapping Break]https://www.netflix.com/watch/81062202?trackId=13752289&tctx=0%2C3%2C0d03e68c-6321-41f2-9dfa-11f336ddc8ca-52560540%2C%2C • The Life Scientific - viruses: https://www.bbc.co.uk/programmes/m0009b2t
Key Biological Concepts	• Podcast - *'In Our Time - Microscopes'* https://www.bbc.co.uk/programmes/b03jdy3p • Podcast - '*In Our Time - Enzymes'* https://www.bbc.co.uk/programmes/b08rp369
Cells and Control	• TEDx - *Animations of unseeable biology https://www.ted.com/talks/drew_berry_animations_of_unseeable_biology?language=en* • *TEDx - A look inside the brain in real time https://www.ted.com/talks/christopher_decharms_a_look_inside_the_brain_in_real_time#t-179742*

	• In Our Time - Free Radicals[Text Wrapping Break]https://www.bbc.co.uk/programmes/m0000xqd • In Our Time - The Brain https://www.bbc.co.uk/programmes/b00b54yx
Genetics	• In Our Time: Genetic Mutation https://www.bbc.co.uk/programmes/b008drvm
Natural Selection & Genetic Modification	• Can Science Make Me Perfect? https://www.bbc.co.uk/iplayer/episode/b0b6q3qy/can-science-make-me-perfect-with-alice-roberts • Explained: Designer DNA (20 mins)[Text Wrapping Break]https://www.netflix.com/search?q=science&jbv=80216752&jbp=2&jbr=1 • Unnatural Selection (short series) https://www.netflix.com/watch/80208833?trackId=13752289&tctx=0%2C0%2C8bd41505-055d-4d08-a8c9-e71150318bb2-44683054%2C%2C • In Our Time: Neanderthals https://www.bbc.co.uk/programmes/b00sq1nv • The Life Scientific: evolution of cancer https://www.bbc.co.uk/programmes/m0003ks6
Health & Disease	• CrowdScience: How did humans discover medicine?[Text Wrapping Break]https://www.bbc.co.uk/sounds/play/w3csz1v9 • CrowdScience: Is vaping bad for your health? https://www.bbc.co.uk/sounds/play/w3cswvx3 • In Our Time: Penicillin https://www.bbc.co.uk/programmes/b07dnnkm • In Our Time: The Origins of Infectious Disease https://www.bbc.co.uk/programmes/b011pldm
Plants	• TEDx - *How can we make crops survive without water? https://www.ted.com/talks/jill_farrant_how_we_can_make_crops_survive_without_water#t-16976* • Podcast: Plants, from roots to riches[Text Wrapping Break]https://www.bbc.co.uk/programmes/b048s3my/episodes/downloads
Exchange & Transport	• In Our Time: Discovery of Oxygen https://www.bbc.co.uk/programmes/b0088nql • In Our Time: The Heart https://www.bbc.co.uk/programmes/p003c1bh

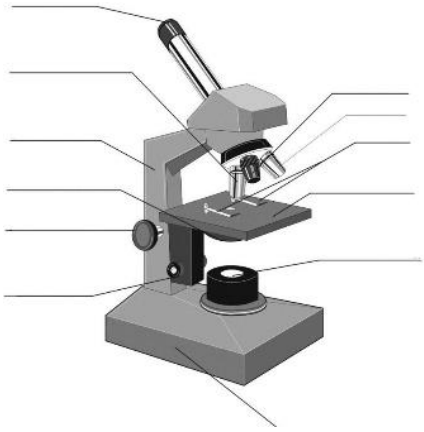
3. Content review

Read, highlight and answer the questions. This content is all selected to help bridge the gap from GCSE to A Level.

Microscopes;

The Light microscope allows you to view animal cells. It can magnify up to 1500 times. Some organelles such as mitochondria, chloroplasts, vacuoles, cell walls, cell membranes and nuclei are visible. Staining makes these organelles visible.

Label and annotate the diagram

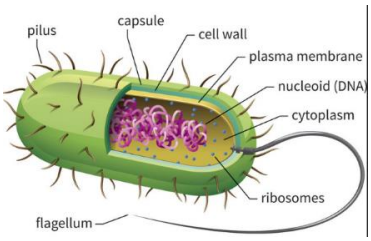


The electron microscope; invented in 1950s it allows a much higher magnification (500 000x) and better resolution, allowing greater detail to be seen. Electron microscopes allowed detailed ultrastructure of the cell to be seen, such as ribosomes and the inside of mitochondria and chloroplasts. The image is called an ELECTRON MICROGRAPH.

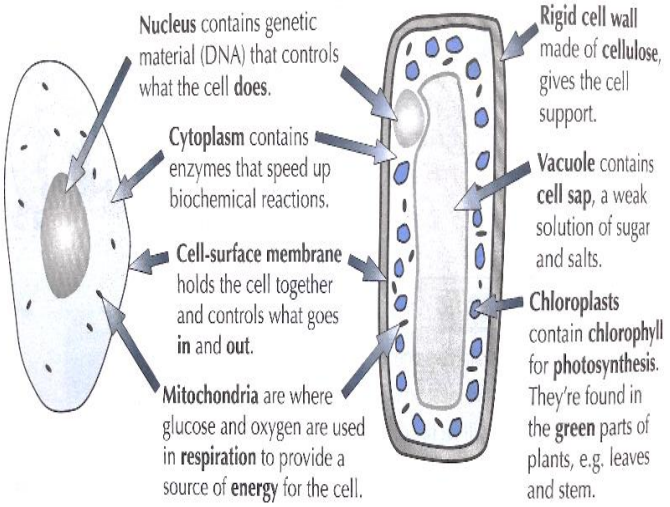
Eukaryotes and prokaryotes;

Prokaryotes are singled celled organisms such as bacteria.

Usually much smaller than eukaryotic cells (1/10th the size), do not contain a nucleus, chloroplasts or mitochondria, DNA can be found floating free in the cytoplasm or in loops called Plasmids, some have flagellum for movement.



Eukaryotic cells are more complex and can be single cellular or multi cellular organisms.



Questions;

Name 3 things visible with a light microscope in both animal and plant cells._____
_____

Name 4 organelles that both plant and an animal cell have. _____
_____

What is the calculation used to calculate the magnification of an object? _____
_____

What is the function of the mitochondria? _____

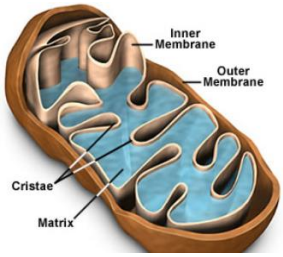
Cell structure;

Nuclei: controls the cell function, containing the DNA which is the coded information for the production of proteins.

During cell division the chromosomes become shorter and thicker and can be seen with a light microscope. The chromosomes will then make a copy of themselves, one copy for each cell produced during cytokinesis.

Nuclei have a double membrane called the nuclear envelope.

Mitochondria: can be seen with a light microscope, however, greater internal detail can be seen using an electron microscope.



The mitochondria's function is to carry out aerobic respiration.

The energy released is used to form molecules of ATP.

ATP is used in the cells to provide energy for muscular contractions, active transport as well as anabolic and catabolic reactions.

Cell wall: the plant cell wall is made up of cellulose Molecules laid side by side to form microfibrils.

These provides rigidity and support for the cell.

Questions;

Name 2 molecules that make up the cell membrane.

_____

Describe the membranes of the mitochondria.

_____

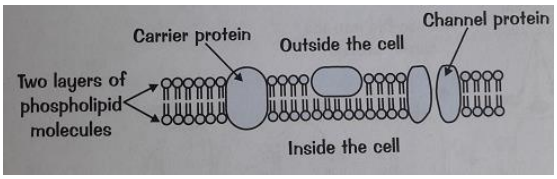
What is the name of the molecule that provide energy to the cell? _____

What term is used to describe water concentration?

_____

Cell structure;

Cell surface membrane: Found around every cell, it allows the movement of substances into and out of the cell. It is a partially permeable membrane and will prevent certain substances from entering.



It is made up of a double layer called the PHOSPHOLIPID BILAYER. These are molecules closely packed together in a mosaic pattern. Within the bilayer are large proteins which are also responsible for transport and for cell recognition.

Transport into and out of cells

There are 4 modes of transport you need to be aware of;

Diffusion; can be gas or liquid particles. They move from an area of high concentration to an area of low concentration down a concentration gradient. Small molecules such as oxygen, water and carbon dioxide can pass through the phospholipid bilayer.

Osmosis; occurs only with water. The water particles move from an area of high water concentration to an area of low water concentration, down a concentration gradient, across a partially permeable membrane. NO ENERGY IS REQUIRED. You will be required to refer to water potential in AS level not water concentration.

Facilitated diffusion; Some particles are too large to fit through the phospholipid bilayer and therefore require a carrier protein to assist. The protein carriers are within the bilayer and they change shape when they come into contact with a specific molecule (i.e. Glucose). NO ENERGY IS REQUIRED.

Active transport; This moves substances for an area of low concentration to an area of high concentration against a concentration gradient. ENERGY IS NEEDED for this to occur. Specific carrier proteins are also required these can be called 'pumps'.

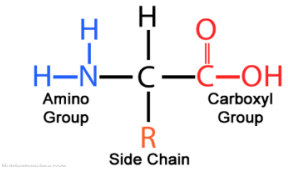
Proteins;

Proteins are made of long chains of amino acids, up to several hundred long. There are only 20 different amino acids and the combination of these 20 produce a wide range of complex proteins. Protein structures are held together with strong bonds called PEPTIDE bonds. The order of the amino acids determines the structure and how it works.

All amino acids have the same structure with one variation on the R group.

Contains; Hydrogen, oxygen,

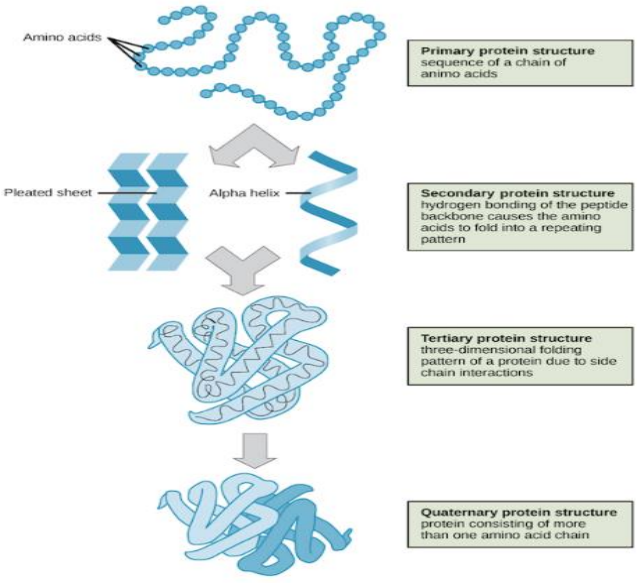
Nitrogen and carbon.



Proteins structure;

The order of the amino acids forms the PRIMARY STRUCTURE. The protein chain can then **coil** or **fold** into **pleats** which are held together by weak hydrogen bonds to for the SECONDARY STRUCTURE.

Enzymes have a further folding held together with stronger disulphide bonds. This is the TERTIARY STRUCTURE. If the structure is almost spherical it is called a **globular protein**.



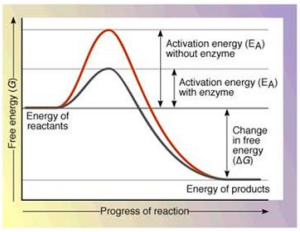
Enzymes; Help to speed up biochemical reactions.

Metabolism is the sum of all the biochemical reactions that occur per second and a single chain of these reactions is called a metabolic pathway.

Enzymes are biological catalysts and increase the rate of reactions.

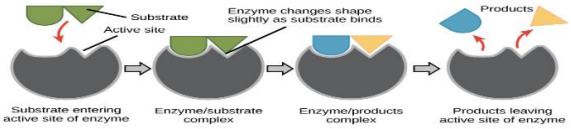
Reactions that release energy need an input energy to start.

The input energy is called the ACTIVATION ENERGY. Enzymes reduce the activation energy.



Enzymes are proteins; enzymes are globular proteins with a specific order of amino acids that determines what the enzyme does.

Enzymes can be catabolic (break substrates down) or anabolic (build substrates up). Enzymes have a specific site into which the substrates can attach itself, this attachment site is called the **active site.** The active site is **complementary** to the shape of the substrate. Once they attach together they form the **enzyme substrate complex**. The substrate then breaks bonds or makes bonds (depending on the type of enzyme) and the product leaves the active site. The active site is now able to accept another substrate.



Denaturing enzymes; Enzymes have a specific tertiary shape held in place by weak hydrogen bonds and stronger disulphide bonds. These bonds can be broken by an increase in temperature (kinetic energy) or a change in pH (H^+ in acid or OH^- in alkali disrupt the bonds).

Useful enzymes; Digestive enzymes are catabolic, breaking down food into smaller molecules. Enzymes are also needed in DNA replication, building up molecules (DNA polymerase).

Questions;

What types of bond hold together the secondary structure? _____ The tertiary structure? _____

How many amino acids are there and what elements are found in them? _____

Explain why denatured enzymes will not function. _____

_____

What is activation energy? _____

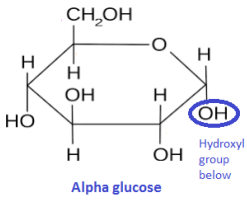
Carbohydrates;

Three elements make up the carbohydrate molecule – carbon, hydrogen and oxygen.

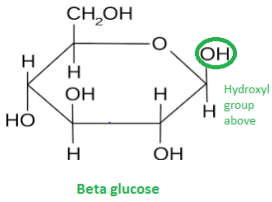
There are several types of carbohydrates;

Sugars; Small, sweet, water soluble molecules. Can be **monosaccharides** or **disaccharides**. Monosaccharides are single units from which disaccharides are built. **Glucose** and **Fructose** are monosaccharides and join together to form the disaccharide sucrose. The joining together of 2 monosaccharides occurs to release a molecule of **water** this is called a **condensation reaction.**

Glucose occurs in 2 forms alpha (**α)** glucose and beta (**β)** glucose.



Alpha glucose

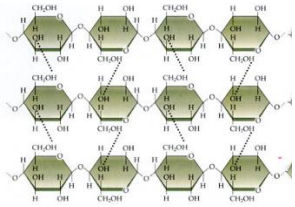


Beta glucose

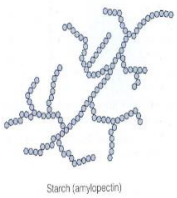
Starch; A **POLYSACCHARIDE** (a large molecule –polymer, made up of monomers). Two different polysaccharides of glucose are used to make starch- **amylose** and **amylopectin**. Starch is insoluble so it is a good storage molecule in plants.

Cellulose; a polymer of glucose. Bonding is different in cellulose, molecules are bonded in a long straight line with **hydrogen** bonds between the strands. It forms **microfibrils** to provide strength to plant cell walls.

Cellulose



Amylopectin



Amylose

Questions;

Describe the difference between a triglyceride and a phospholipid. _____

_____

Describe the difference between Starch and cellulose.

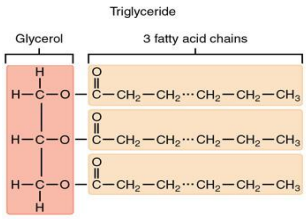
_____

_____

What bonds hold Cellulose microfibrils together? _____

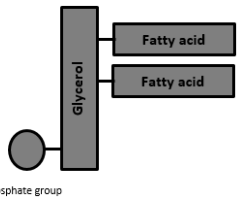
Lipids;

Three elements make up the lipid molecule – carbon, hydrogen and oxygen. Lipids are fats and oils, predominantly made up of a group of lipids called **triglycerides**. These contain a molecule of **GLYCEROL** with 3 **fatty acids**.



The fatty acid is a long chain of carbon atoms with an acid (-COOH) group. Hydrogen atoms are attached to the carbons by single bond. A single bond forms a **saturated** lipid. If there is a double bond then the lipid is **unsaturated**, many double bonds forms a **polyunsaturated** lipid.

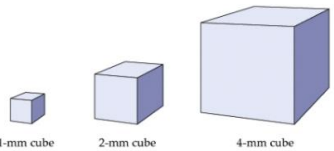
Cell membranes are formed from phospholipid. They do not have 3 fatty acid chains but 2 fatty acid chains and a phosphate group.



Exchange surfaces;

All good exchange surfaces require adaptations to make the exchange efficient. The smaller the object the quicker exchange is able to occur due to it having a large surface area to volume ration, however larger, more complex organisms have a much smaller surface area to volume ratio.

The larger the object the lower the surface area to volume ratio.



Surface area	6 sides × 1^2 = 6 mm^2	6 sides × 2^2 = 24 mm^2	6 sides × 4^2 = 96 mm^2
Volume	1^3 = 1 mm^3	2^3 = 8 mm^3	4^3 = 64 mm^3
Surface area-to-volume ratio	6/1	3/1	1.5/1

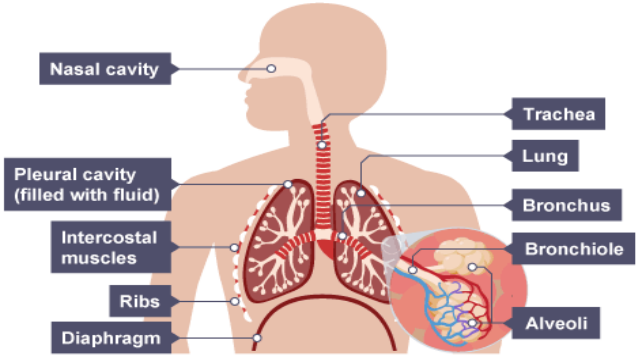
To overcome this, multicellular organisms have highly adapted exchange organs. Adaptations include;

- Folded to increase the surface area to volume ratio for a faster exchange.
- A good blood supply to maintain the concentration gradient.
- One cell thick (thin) to reduce diffusion distance.

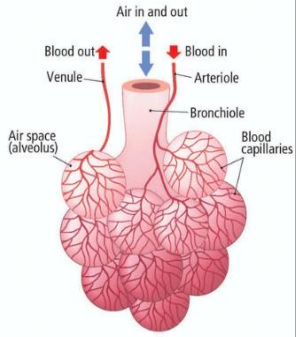
Materials that need to be exchanged between the cell and he environment include; heat, oxygen, water, carbon dioxide, nutrients and other waste products such as urea. The adaptations allow MORE substances to be

Gas exchange in animals;

Lungs; Multi cellular organisms have evolved a **complex blood supply system** and a large gas exchange system (**lungs**). The lungs contain millions of tiny air sacs called ALVEOLI which are then folded to further increase the surface area of the lung.

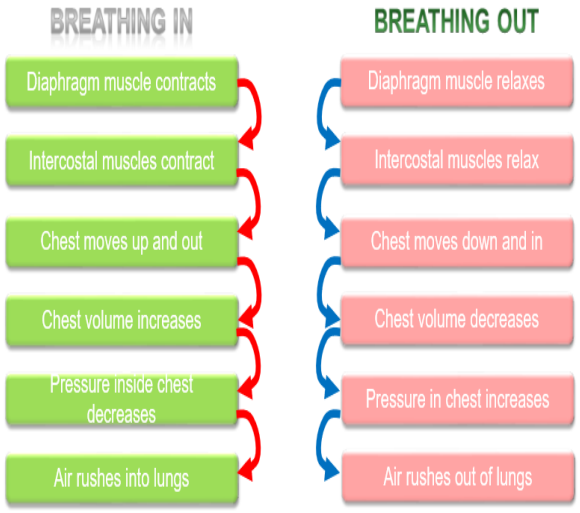


The alveoli are further adapted by having a single flattened layer of **epithelial squamous cells** which reduces the diffusion distance increasing the speed of diffusion. Alveoli have a dense network of capillaries to move the blood away quickly, maintaining a steep diffusion gradient. The walls of the alveoli are fully permeable to dissolved oxygen and carbon dioxide.

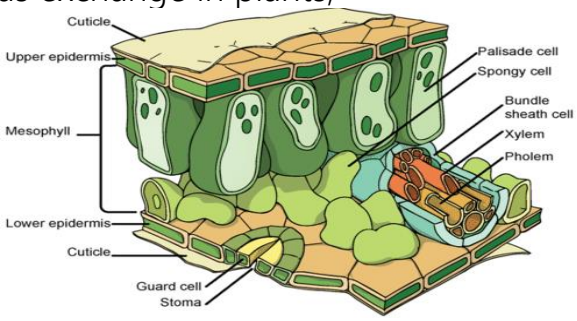


Breathing/ventilation; The process of maintaining a high concentration of oxygen inside the lungs and getting rid of the waste product carbon dioxide. Ventilation increases he rate of diffusion.

Lungs are suspended in the airtight Thorax and any change in volume will affect the pressure in the thorax.



Gas exchange in plants;



Plants also have adaptations to allow gas exchange. The leaf is an organ that is adapted to allow the movement of water from the leaf and the diffusion of carbon dioxide into the leaf. The upper mesophyll layer contains Palisade cells which are packed with chloroplasts to absorb as much energy from the sun as possible for photosynthesis. The lower part of the mesophyll layer is the spongy mesophyll which contains air spaces to facilitated the diffusion of gases into the cells and out of the cells.

The upper epidermis is covered by a waxy cuticle to prevent water loss. The lower epidermis has a specialised pair of cells called the **GUARD CELLS**. The guard cells have an uneven thickening in the cell wall which causes the cell to bend and open up a hole in the lower epidermis called the **STOMA**. The stoma allows the water vapour to move out of the leaf into the environment (**transpiration**) and carbon dioxide to move into the leaf.

Transpiration; The movement of water from the root and out of the leaf is called the transpiration stream. Water passes into the root by osmosis and then moves through the root by 3 different processes;

- The symplast pathway; water moves from root cell to root cell through the cytoplasm.
- The apoplast pathway; water moves through the cell wall, not passing over the cell membrane, carrying minerals with it through a process called **MASS FLOW**.
- The vacuolar pathway; water moves from root cell to root cell via the cytoplasm and the vacuole.

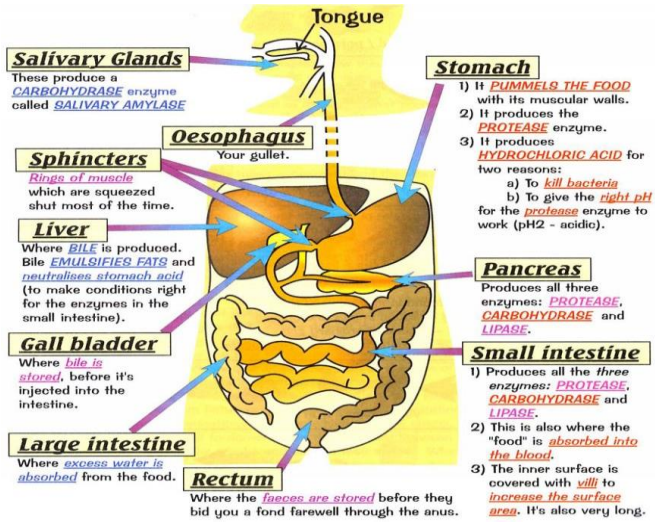
Water moves out of the leaf by diffusion into the environment. The water moves from root to leaf through a specialised tube called the **xylem**. Water is pulled up the xylem due to an attraction force between the water particles causing a tension in the xylem (**Cohesion tension**) and the attraction between the water particles and the sides of the xylem vessel (**adhesion**).

The second vessel in the plant is the **phloem** and this is responsible for **translocation**, the mass flow of substances from the leaf to the rest of the plant

Other exchange surfaces;

Digestion; The human digestive system has 3 main functions;

- Mechanical breakdown of food
- Chemical breakdown of food
- Absorption of digested food particles into the blood stream.



The digestive system contains 3 types of enzyme;

- **Carbohydrase** enzymes for breaking down complex carbohydrates into simple sugars. These are found in the mouth (amylase enzyme), the pancreas and the small intestine.
- **Protease** enzymes break down proteins into amino acids. These are found in the stomach (protease enzyme requires a pH 2 which is provided by the **hydrochloric acid**), the pancreas and the small intestine.
- **Lipase** enzymes breaks down lipids into fatty acids and glycerol. These are found in the pancreas and the small intestine.

Bile is an important chemical in digestion. Bile is made in the liver and stored in the gall bladder. It has 2 roles;

1) Makes the digested food, leaving the stomach, slightly alkali for enzymes to work in.
2) It emulsifies the lipids, breaking them up into small droplets to increase the surface area for lipase to digest.

Questions;

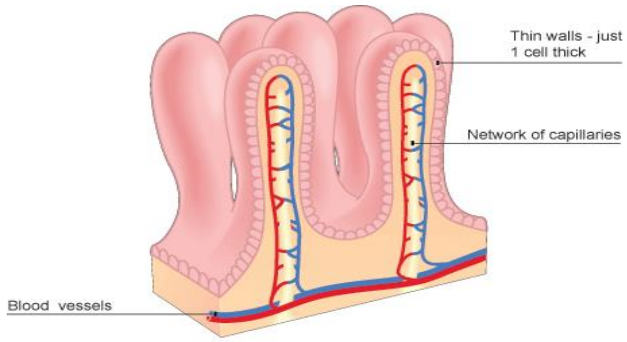
What are the features that makes a surface better adapted for exchange? _____

What is transpiration? _____

What is translocation? _____

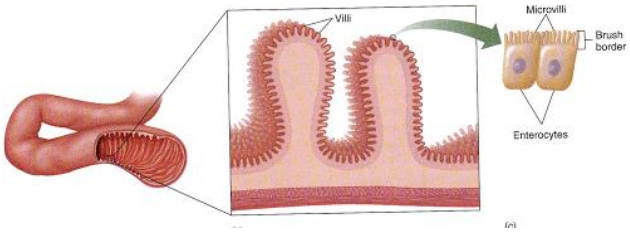
Other exchange surfaces:

All of the digested food is now small enough to pass through the wall of the small intestine into the blood stream.



As an exchange surface it displays the same characteristic adaptations as the lung; Large surface area to volume ratio, good blood supply and one cell thick.

Microvilli; the walls of the small intestine are highly folded into villi, to increase the SA:Vol. ratio. However, this can be increase further by each individual cell having further folds called microvilli.



Questions;

What are the 3 ways water moved through the root? _____

_____

_____

What are the 3 digestive enzymes, what do they break down and where are they found?

Enzyme	Breaks down (chemical)	Into (chemicals)	Where found

What is the role of Bile? _____

_____

How is the small intestine adapted to increase the rate of diffusion of digested food products? _____

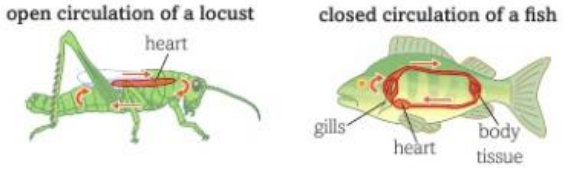
_____

_____

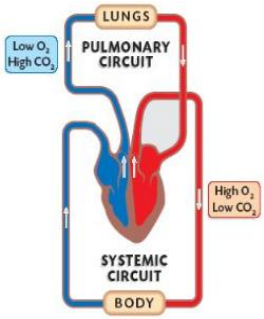
The circulatory system and blood vessels;

Large multicellular organisms have a small surface area to volume ratio and have evolved a complex circulatory system to transport chemicals around the body, this is called the **CIRCULATORY SYSTEM**.

Some organisms such as flat worms can diffuse oxygen and glucose across their surface. Less active organisms such as insects may have a much more simplified circulatory system.

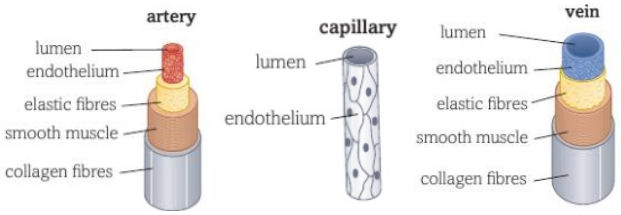


Fish have a more complex system were by the blood enters the heart once before being transported to the **systemic** system this is called a **single circulatory system**. Mammals have evolved a **double circulatory** system with a **pulmonary** and a **systemic** circuit.

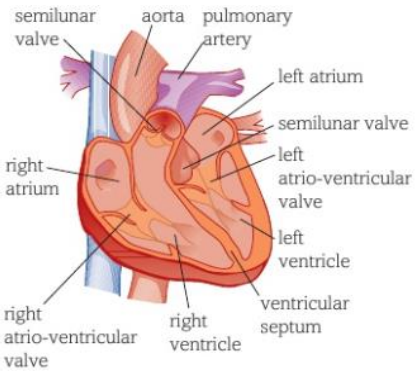


The heart pumps the deoxygenated blood to the lungs **(pulmonary system**) to pick up oxygen and removes carbon dioxide. The oxygenated blood is then returned to the heart to be pumped out to the organs (**systemic system**).

The blood travels through 3 main types of blood vessels;
1) **<u>The Arteries</u>**; carry blood **away** from the heart. They have a thick layer of **elastic tissue** and **smooth muscle**. The elastic walls **stretch** when the heart contracts and the elastic tissue **recoils** to maintain the pressure.
2) **<u>Capillaries</u>;** These consist of a single layer of **endothelial cells**. The arteries subdivide **arterioles** which further divide into thousands of capillaries. The capillaries come into close contact with body cells providing a huge surface area to volume ratio and a short diffusion distance for the exchange of oxygen, glucose, carbon dioxide, urea and other substances.
3) **<u>Veins</u>**; The capillaries start to come back together forming **venules** and then veins. Veins carry blood back towards the heart. Blood is at a lower pressure and therefore do not need such a thick layer of elastic tissue or smooth muscle. The veins contain **valves** to prevent the blood flowing backwards.



The heart;



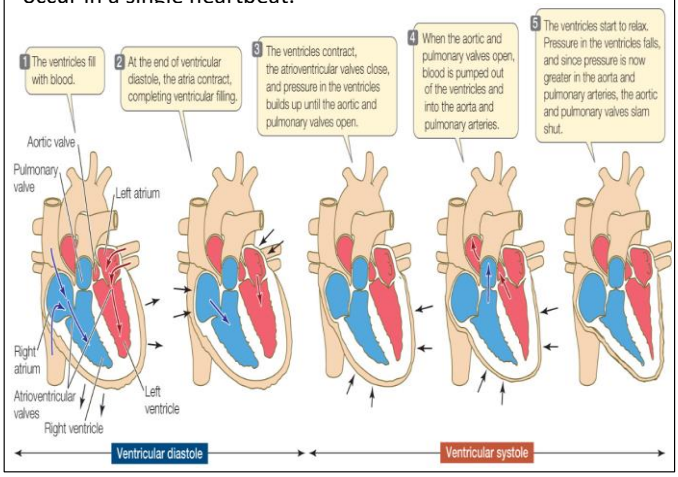
The heart has two separate pumps. The right side of the heart pumps blood to the lungs and the left side pumps blood to the body. Valves within the heart keep the blood flowing in the correct direction. Valves open and close in response to the changes of pressure inside the chambers.

The heart is made up of 4 chambers; the right **atria**, the right **ventricle**, the left **atria** and the left **ventricle**. The left side of the heart has a **thicker muscular wall** to create enough pressure to force the blood around the whole body.

The hearts contractions are initiated by a cluster of specialised cells called the **SINO-ATRIAL NODE** or the **PACEMAKER**. These cells send out electrical impulses at regular intervals.

The coronary arteries supply the muscle in the heart with blood.

The cardiac cycle; This is the sequence of events that occur in a single heartbeat.



Questions;

What is the name of the system that sends blood to body organs? _____

Which blood vessels contain valves? _____

Which blood vessel has the thickest smooth muscle and what is its function? _____

Which Valves close when the ventricles contract? _____

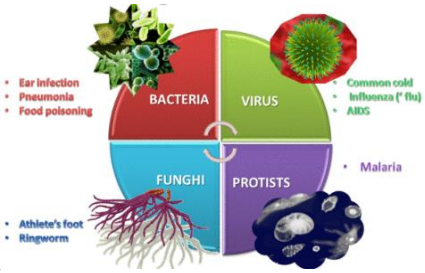
Which side of the heart is the thickest and why? _____

Disease;

Disease can be **communicable** and **non-communicable**.

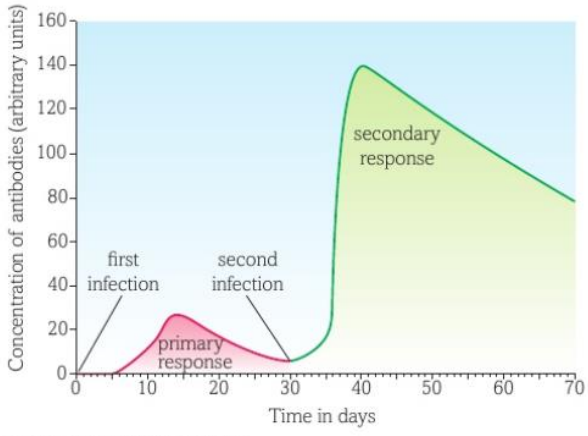
♦ Non-communicable disease are disease's which cannot be directly passed for person to person. These include cancer, heart disease, diabetes and Alzheimer's.

♦ Communicable disease are disease which can be transmitted from organism to organism. These are caused by **PATHOGENS** such as **VIRUSES**, **BACTERIA**, **FUNGI** and **PROTISTS**.



Bacteria will produce toxins. Viruses will place their genetic information into a cell and the information replicates and bursts the host cells. Fungi produce **mycelium** and **exocytose** digestive enzymes to digest the tissue it is living on; it then reabsorbs the digestive products. Protists use a host to complete an important part of its life cycle and will damage the hosts cells/organs in the process.

If the first lines of defence do not prevent the pathogen entering the body, then the bodies defence systems will be activated. All cells have a unique protein structure (**ANTIGEN**) identifying it as not self and activating the **immune system**. White blood cells will respond in different ways. First the **MONOCYTES** and **MACROPHAGES** (types of phagocyte) identify the pathogen as 'foreign'. These cells will **engulf** the pathogen and destroy it. Macrophages do not destroy all of the pathogen, it retains the antigen of the pathogen and '**presents**' it on its own surface. This is now an **ANTIGEN PRESENTING CELL** and initiates the next round of specific white blood cells. The **LYMPHOCYTES** now have 3 jobs, track down and destroy the pathogens (**T Lymphocytes**), produce antibodies (**B Lymphocytes**) and make **memory cells** to produce antibodies quickly if the pathogen enters the body again in the future.

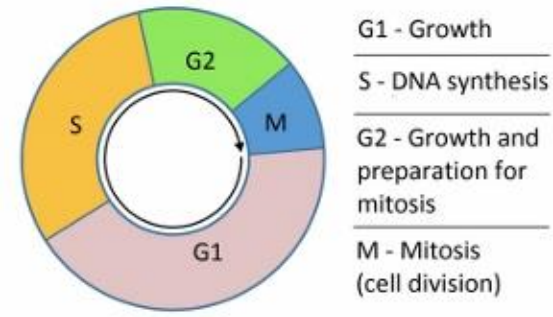


Primary and secondary response to infection.

Risk factors;

A risk factor is something that will **increase the chance** of becoming ill. Risk factors do not always lead to the disease, just increase the risk. Some risk factors are unavoidable such as genetic risk factors; genetic predisposition to producing high quantities of cholesterol, having high blood pressure or carrying the **BRCA** gene which increase the risk of breast cancer.

Other risk factors are avoidable such as; smoking, drinking alcohol, unprotected sex, high fat or high salt diet. Some risk factors (**carcinogens**) can cause DNA to mutate and cause cells to go into uncontrolled cell growth.



Questions;

What is a pathogen? _____

_____

Give 3 examples of non-communicable disease.

_____

_____

How do bacteria make us ill? _____

_____

How do viruses make us ill? _____

_____

What do monocytes do? _____

_____

_____

What do macrophages do? _____

_____

What are the 2 main types of lymphocytes?

_____

What do memory cells do? _____

_____

Look at the graph. Describe the different between the primary and secondary response. _____

_____

_____

_____

_____

DNA and protein synthesis;

DNA is a complex chemical, found in the nucleus of eukaryotes and in the cytoplasm of prokaryotes. DNA is made up of; **pentose sugar**, **phosphate** and **nitrogenous bases** forming a **NUCLEOTIDE**.

There are 4 different nitrogenous bases;

A= Adenine
T= Thymine
C= Cytosine
G= Guanine

Complementary pair;

A pairs with T
C pairs with G

The bases pair up in the formation stated above. They are held together by **hydrogen bonds**. The two strands run in opposite directions causing the molecule to spiral forming a **DOUBLE HELIX**.

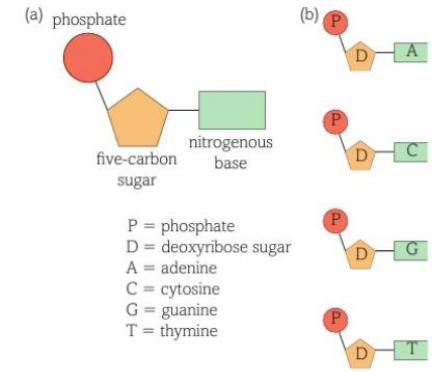
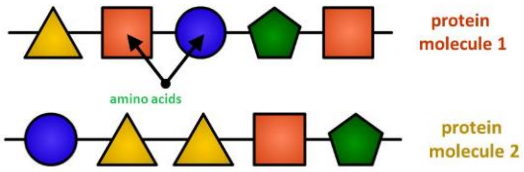


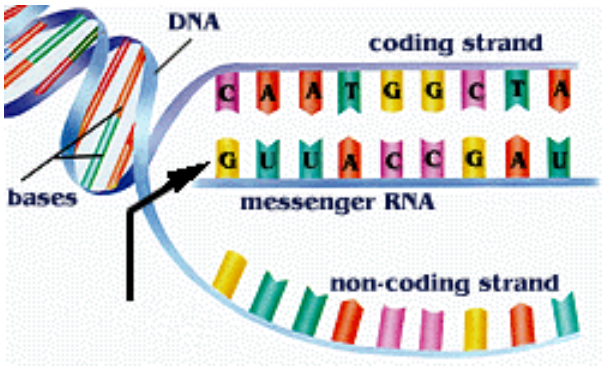
Figure 1 (a) General structure of a single nucleotide. (b) The four DNA nucleotides.

DNA controls the production of proteins. A section of DNA that codes for a protein is called a **gene**. Proteins are made up of a string of **amino acids**, each protein has a different number and order of amino acids. The proteins also have different bonds which holds the molecule in a unique shape which means all proteins have a different function.

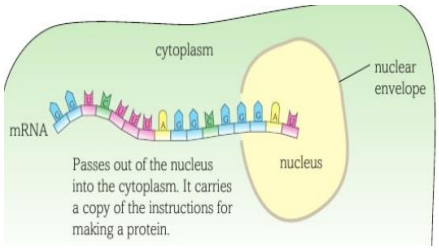


Different combinations of amino acids make different proteins.

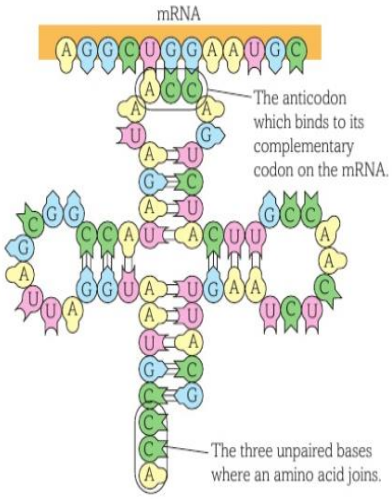
Protein synthesis; Protein synthesis occurs in the cytoplasm, carried out by **RIBOSOMES**. When a protein is required then the gene has to be copied producing a molecule called **messengerRNA (mRNA)**. mRNA is small enough to pass out of the nucleus into the cytoplasm. mRNA is a template, containing nucleotides and bases. The nucleotide on the mRNA will line up with the **complementary base**. However, on RNA there is no Thymine, RNA will have the base **URACIL** (**U**).

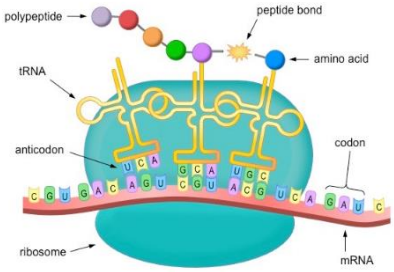


The mRNA passes out of the nucleus carrying the code for a protein. Once in the cytoplasm the mRNA binds to a ribosome.



Within the cytoplasm there is another molecule called transferRNA (tRNA). At one end, the **anticodon** is complementary to the mRNA. At the opposite end there are three **unpaired bases** which code for an **amino acid**. The amino acid is brought in to form a **peptide bond** with the amino acids brought in by the previous tRNA. This forms a **polypeptide** chain which will form hydrogen and **disulfide bonds** to form the unique protein.





Mutations: Mutations change the order of bases in the DNA. Some bases may change to a different base (**substitution**), some bases may be deleted and some bases may be added. Mutations can cause the following;

- Incorrect protein to be produces
- No change in protein being made
- Causes a harmful proteins/ no protein to be made

Questions;

What are the components of a nucleotide. _____

_____

What are the names of the 4 nitrogenous bases?

_____

What type of bonds hold the 2 strands together? _____

What is the name of a section of DNA that codes for a protein? _____

What are proteins made from? _____

DNA is too big to leave the nucleus, what is the copy of the gene called that enters the cytoplasm? _____

What organelle will this molecule attach to? _____

Which molecule has a complementary anticodon and brings in the correct amino acid? _____

4. Biology and maths

Activity: Analysing tables

Lung cancer, chronic bronchitis and coronary heart disease (CHD) are associated with smoking. Tables 1 and 2 give the total numbers of deaths from these diseases in the UK in 1974.

Table 1 Men

Age/years	Number of deaths (in thousands)		
	lung cancer	chronic bronchitis	coronary heart disease
35-64	11.5	4.2	31.7
65-74	12.6	8.5	33.3
75+	5.8	8.1	29.1
Total (35-75+)	29.9	20.8	94.1

Table 2 Women

Age/years	Number of deaths (in thousands)		
	lung cancer	chronic bronchitis	coronary heart disease
35–64	3.2	1.3	8.4
65–74	2.6	1.9	18.2
75+	1.8	3.5	42.3
Total (35–75+)	7.6	6.7	68.9

Activity: Analysing tables (continued)

1. Of the men who died aged 35-64 from one of these three causes, what percentage of them died of lung cancer?

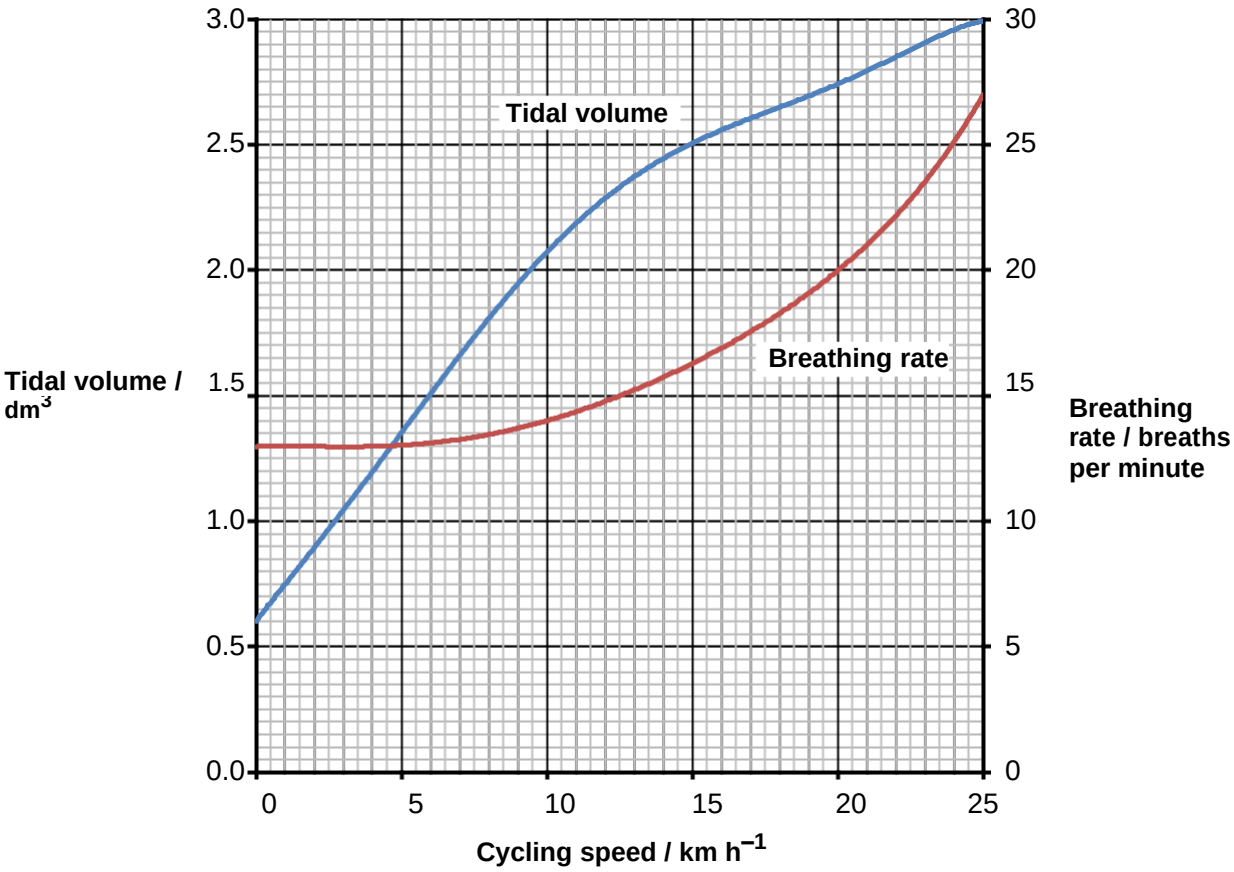
2. What percentage of deaths from chronic bronchitis in women happened to women aged 65-74?

3. Deaths from lung cancer drop as people get older. Is there a bigger percentage difference for men or women from 35-64 to 75+?

4. What fraction of coronary heart disease deaths of men over 34 are in the 75+ bracket? What about for women?

Activity-: Analysing complex graphs

The volume of air breathed in and out of the lungs during each breath is called the tidal volume. The breathing rate and tidal volume were measured for a cyclist pedaling at different speeds. The graph shows the results.



1. What was the tidal volume when the cycling speed was 17 km h^{-1}?
2. What was the breathing rate when the cycling speed was 8 km h^{-1}?
3. What was the change in breathing rate when the cyclist changed from 10 to 20 km h^{-1}? Express this as a percentage.
4. At what speed did the breathing rate start to increase?
5. The tidal volume increased linearly with cycling speed up to about 10 km h^{-1}. Calculate the increase in volume for each increase in speed of 1 km h^{-1}.
6. For this initial linear section, what is the equation of the tidal volume line? Hint: use $y=mx + c$

SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or °C). Sometimes, there are different units available for the same type of measurement. For example, ounces, pounds, kilograms and tonnes are all used as units for mass.

To reduce confusion, and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation
mass	m	kilogram	kg
length	l or x	metre	m
time	t	second	s
electric current	I	ampere	A
temperature	T	kelvin	K
amount of substance	N	mole	mol
luminous intensity	(not used at A-level)	candela	cd

All other units can be derived from the SI base units.

For example, area is measured in square metres (written as m^2) and speed is measured in metres per second (written as ms^{-1}).

It is not always appropriate to use a full unit. For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.

Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33 000 m would be quoted as 33 km.

The most common prefixes you will encounter are:

Prefix	Symbol	Multiplication factor		
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^{9}	1 000 000 000	
Mega	M	10^{6}	1 000 000	
kilo	k	10^{3}	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

Activity

Which SI unit and prefix would you use for the following quantities?

1. The time between heart beats
2. The length of a leaf
3. The distance that a migratory bird travelled each year
4. The width of a cheek cell
5. The mass of a rabbit
6. The mass of iron in the body
7. The volume of the trunk of a large tree

Sometimes, there are units that are used that are not combinations of SI units and prefixes.

These are often multiples of units that are helpful to use. For example, one litre is 0.001 m^3, or one day is 86 400 seconds.

Activity

Choose the most appropriate unit, and estimate the size of each of the following.

1. The mass of an elephant
2. The mass of an earthworm
3. The volume of water in a teardrop
4. The volume of water in a pond
5. The time taken for a sunflower to grow
6. The temperature difference between the blood in the heart and in the ear on a cold day
7. The width of a hair
8. The length that your fingernails grow each day
9. The total length of each of the hairs on your head

Activity 3

Put the following in order of size:

height of an elephant; length of DNA strand; width of a hair; height of a tree; width of a sodium ion; length of a nerve cell; length of a heart; width of a red blood cell; size of a virus; length of a finger; length of a mosquito; length of a human digestive system; width of a field; length of a water molecule.

5. Important vocabulary for practical work

You will have come across most of the words used in practical work in your GCSE studies. It is important that you use the right definition for each word.

Activity

Join the boxes to link the word to its definition.

Accurate	A statement suggesting what may happen in the future.
Data	An experiment that gives the same results when a different person carries it out, or a different set of equipment or technique is used.
Precise	A measurement that is close to the true value.
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment.
Range	Physical, chemical or biological quantities or characteristics.
Repeatable	A variable that is kept constant during an experiment.
Reproducible	A variable that is measured as the outcome of an experiment.
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.
Uncertainty	The interval within the true value can be expected to lie.
Variable	The spread of data, showing the maximum and minimum values of the data.
Control variable	Measurements where repeated measurements show very little spread.
Dependent variable	Information, in any form, that has been collected.