

TRANSITION BOOKLET YEAR 11 INTO YEAR 12

I am delighted you have chosen to study Biology A level next year at The Bishops' High School. A level Biology at Bishops' is an exciting, challenging and immersive subject that you will find both interesting and fulfilling. You will learn about the natural world and all the living things in it, from the largest mammal down to microscopic viruses! You will discover how the human body works, how we have evolved and how our own DNA can be altered in innovative research.

Biology is a subject that can lead to exciting degree courses leading to fulfilling important careers in medicine, veterinary science, research, Pharmacology, Marine biology, Biotechnology, forensic science, Zoology, and many many more.

To hit the ground running in September I thought I would give you some information about what you will be studying in this two-year course.

In addition, I have put together some information pages about each topic you will cover in the first year, some useful websites and clips to watch and some tasks I would like you to complete before September. These tasks are important to complete so that you have the correct level of background knowledge needed to start the course.

Qualification at a glance

Specification: - Edexcel Level 3 Advanced GCE in Biology B (9BI0)

Assessment: - Edexcel Level 3 Advanced GCE in Biology B consists of three externally examined papers and the Science Practical Endorsement.

- Students are expected to carry out 16 core practical experiments that are identified in the content.
- Students complete three exam papers in May/June
 - Paper 1 – Advanced Biochemistry, Microbiology and Genetics, covers topics 1-7, worth 30%
 - Paper 2 – Advanced Physiology, Evolution and Ecology, covers topics 1-4 and 8-10, worth 30%
 - Paper 3 – General and practical principles in Biology, topics 1-10, analysis of data, experimental methods and statistical analysis, worth 40%

Year 12

In the first year of the qualification, you will cover four topics, along with core practical related to these topics

Topic 1 – Biological molecules

Topic 2 – Cells and viruses

Topic 3 – Classification

Topic 4 – Exchange and transport

Year 13

In the second year of the qualification, you will cover six topics, along with core practical related to these topics

Topic 5 – Energy for biological processes

Topic 6 – Microbiology and pathogens

Topic 7 – Modern genetics

Topic 8 – Origins of genetic variation

Topic 9 – Control systems

Topic 10 – Ecosystems

Useful websites

Details about specification: - <https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-b-2015.html>

Details about degree courses: - <https://digital.ucas.com/search>

Details about careers: - <https://www.prospects.ac.uk/graduate-jobs>

Revision notes: - <https://www.physicsandmathstutor.com/biology-revision/a-level-edexcel-b/>

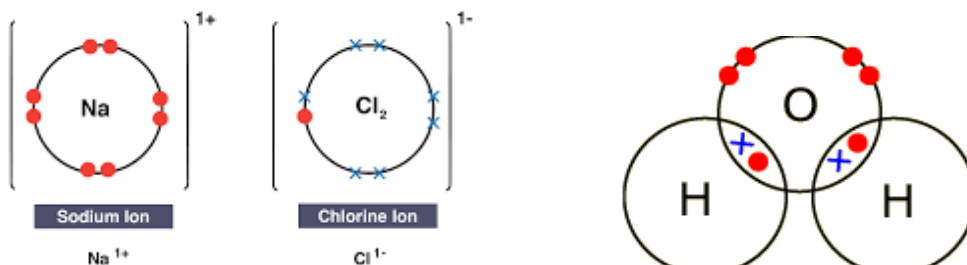
Topic 1 – Biological molecules

Ionic and covalent bonds

Ionic bonding – The atoms involved in the reaction donate or receive electrons. The atom that gains electrons becomes a negative ion (anion).

The other atom loses electrons and becomes a positive ion (cation)

Covalent bonding – The atoms involved in the reaction share electrons



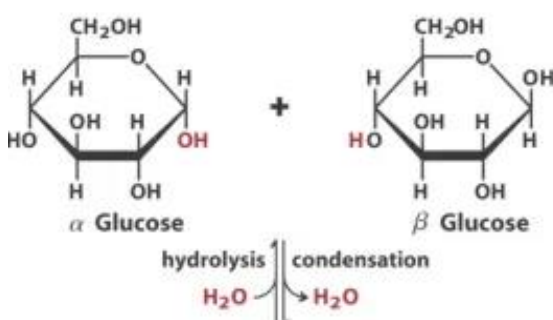
Carbohydrates

Carbohydrates are important in cells as usable energy. The three main groups of carbohydrates are-

Monosaccharides – simple sugars, such as ribose, glucose and fructose

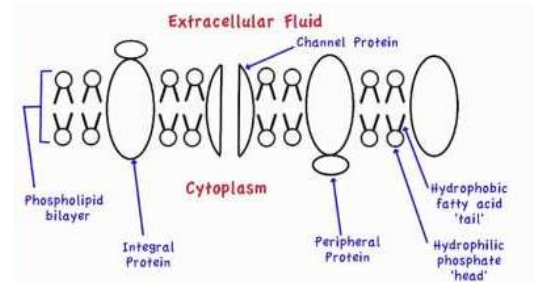
Disaccharides – Double sugars such as sucrose, Maltose and lactose. Two Monosaccharides can be joined together to make a Disaccharide in a Condensation reaction and split again using a Hydrolysis reaction.

Polysaccharides – Most complex carbohydrates with many monosaccharides joined together. These include sugars such as cellulose, starch and glycogen.



Lipids

Fats and oils are an important group of lipids; Lipids form an integral part of all **cell membranes**, the **phospholipid bilayer**



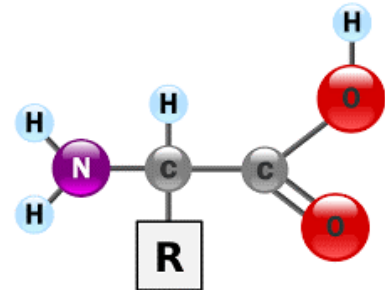
Proteins

About 18% of your body is made of protein, hair, skin, nails, enzymes, hormones,

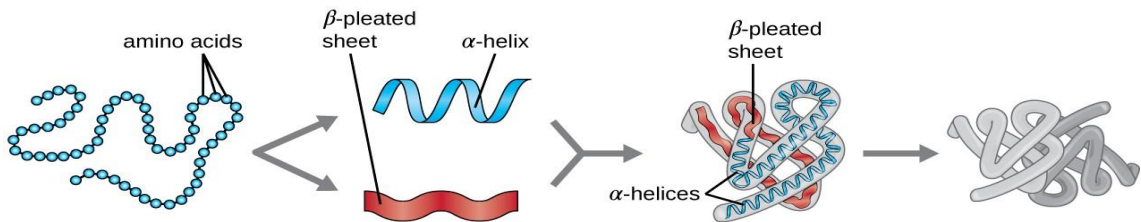
Antibodies and haemoglobin.

Proteins are made of **amino acids** joined by a condensation reaction and a peptide

Bond is formed. Many amino acids join in this way to form a **polypeptide chain**.

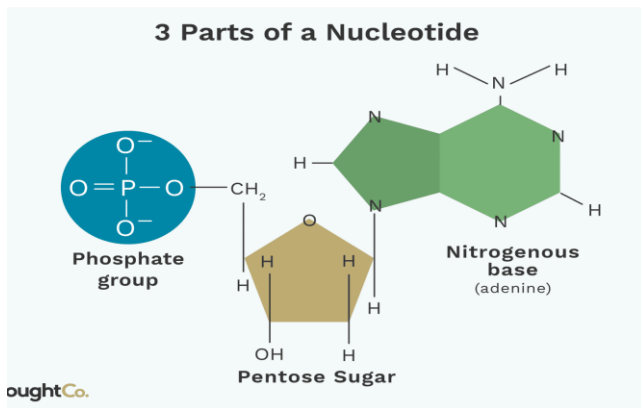


Proteins can be described by their **primary, secondary, tertiary and quaternary structure**.



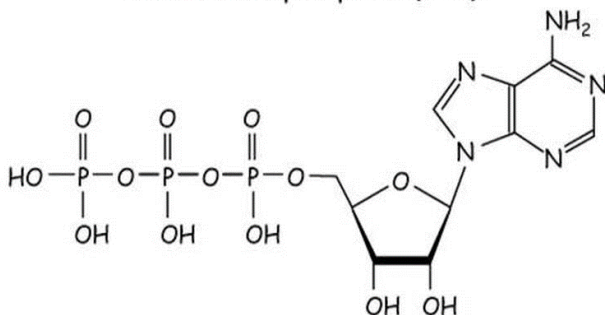
Nucleotides

Nucleotides are key biological molecules they provide energy in the form of **ATP** and the building blocks of **DNA and RNA**

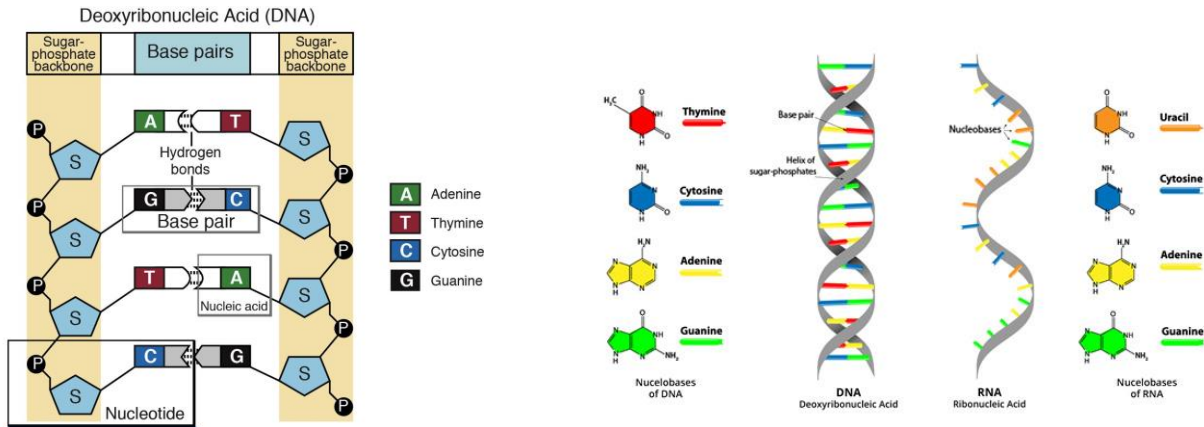


Adenosine triphosphate (**ATP**) provides energy for the cell; it is a nucleotide with **three phosphate groups** attached. The potential energy in the phosphate bonds is available to cells.

Adenosine triphosphate (ATP)

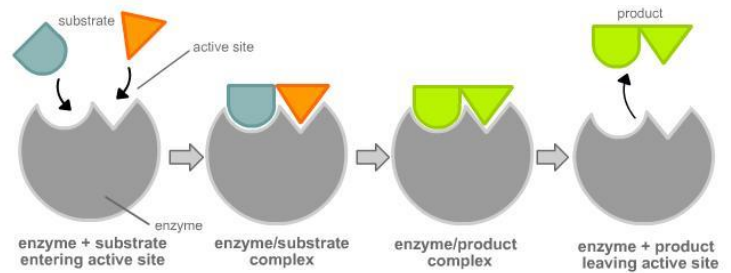


DNA and RNA are molecules of inheritance. Long chains of nucleotides containing bases **C, G, A and T** join together to form DNA and chains of nucleotides containing **C, G, A and U** make RNA.

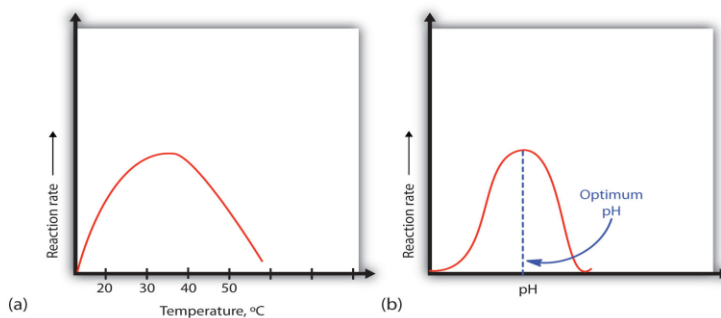
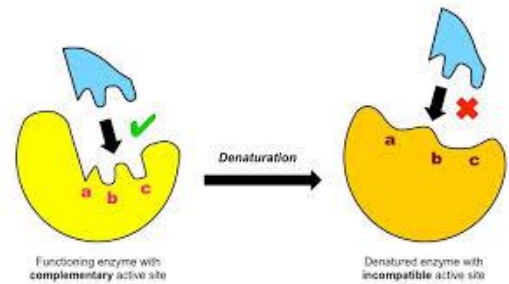


Enzymes

Enzymes are **biological catalysts** that change the rate of a reaction without changing the substances produced. Enzymes are long chains of amino acids (proteins). The **lock and key hypothesis** is a simple model that explains how enzymes catalyse reactions



Enzymes are effected by **temperature and ph**. Temperatures above 40oC and pH out of optimum range for that particular enzyme because the enzyme to be **denatured**, the active site changes shape so the substrate no longer fits and the enzyme is unable to catalyse the reaction



Task

For each of the Biological molecules; carbohydrates, lipids, proteins, nucleotides and enzymes, create a fact sheet (one side of A4) with diagrams and brief explanations of their structure, key features and their importance in living things.

Useful websites and clips to watch

Some of this maybe in a lot of detail, remember at this stage we just want a brief over view on your fact sheet, you will learn about these molecules in a lot more detail back at school.

<https://www.youtube.com/watch?v=t3VPjObFd0I&safe=true>

<https://alevelnotes.com/notes/biology/biological-molecules/biological-molecules>

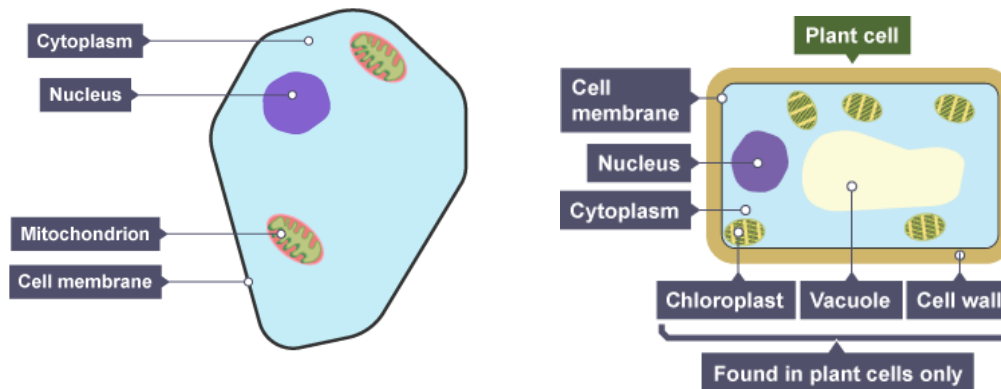
[https://pmt.physicsandmathstutor.com/download/Biology/A-level/Notes/Edexcel-B/01-Biological-Molecules/Summary%20Notes%20-%20Topic%201%20Edexcel%20\(B\)%20Biology%20A-level.pdf](https://pmt.physicsandmathstutor.com/download/Biology/A-level/Notes/Edexcel-B/01-Biological-Molecules/Summary%20Notes%20-%20Topic%201%20Edexcel%20(B)%20Biology%20A-level.pdf)

Topic 2 – Cells and Viruses

Eukaryotic cells

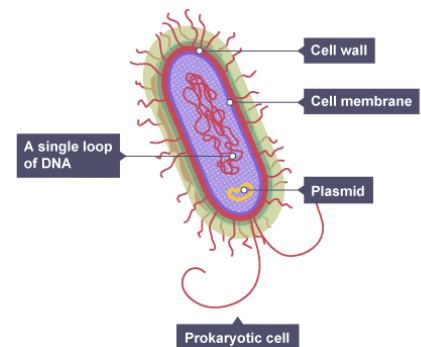
Cells of animals, plants and fungi are called eukaryotic cells. They contain membrane bound organelles such as a nucleus and mitochondria.

Animal cells - Almost all animals and plants are made up of cells. Animal and plant basic structures are shown below-



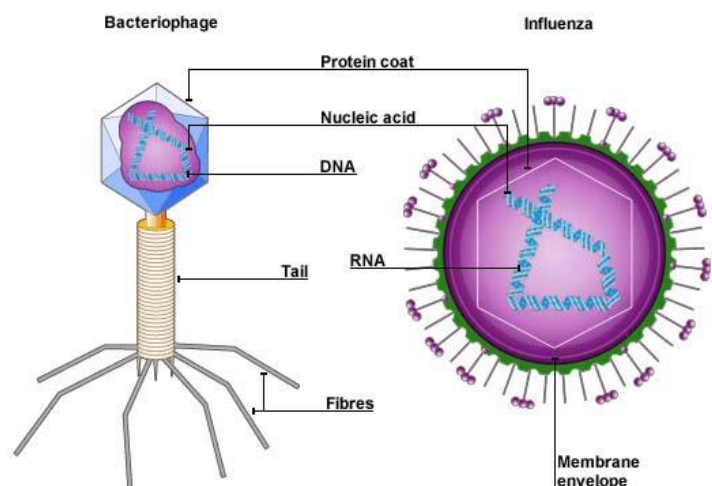
Prokaryotic cells

Bacteria are amongst the simplest of organisms - they are made of single cells. Their cell structure is simpler than the cells of eukaryotes and cells are smaller, most are $0.2\text{ }\mu\text{m}$ - $2.0\text{ }\mu\text{m}$. These cells do not contain membrane bound organelles such as a nucleus and mitochondria. Bacterial cells are called prokaryotic cells.



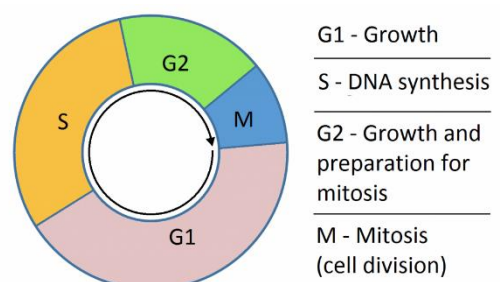
Viruses

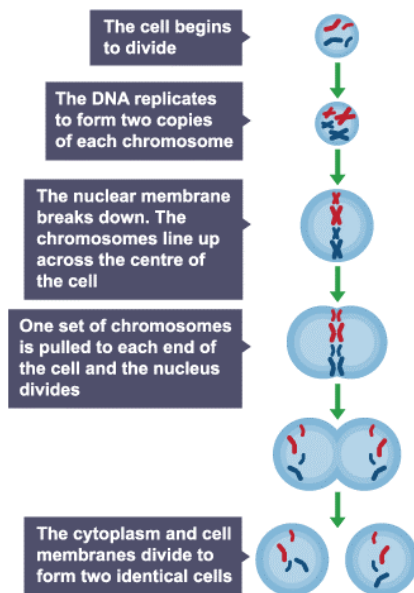
Viruses can be classed as obligate intracellular parasites, meaning they can only exist and reproduce as parasites in the cells of other living organisms. They all cause damage and disease of some sort. They can withstand extreme conditions and there are very few drugs that have any effect of viruses.



Mitosis

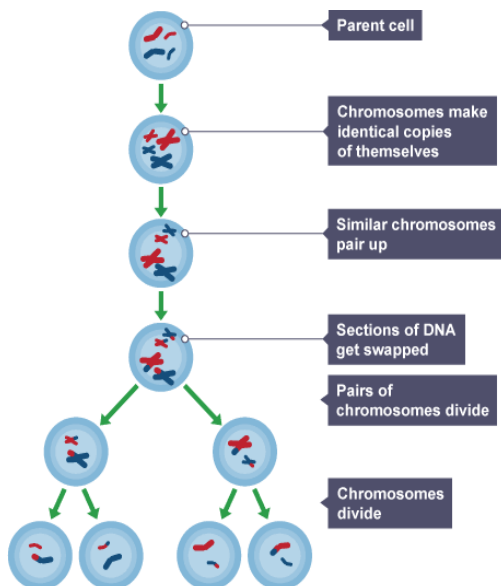
Cells divide on a regular basis to bring about growth and asexual reproduction. They divide in a sequence of events known as **the cell cycle**.





When a body cells needs to undergo cell division it does this in a process known as **mitosis**. In mitosis, **two** cells called **daughter cells** are produced, each **identical to the parent cell**.

Meiosis



Meiosis is the type of cell division that produces gametes. A human body cell contains 46 chromosomes arranged in 23 pairs. Human gametes are haploid – so their nucleus only contains a single set of 23 unpaired chromosomes.

Task

1. Draw and label a Eukaryotic cell and a prokaryotic cell adding the function of each of the organelles.
2. Write a paragraph describing the differences between Eukaryotic and prokaryotic cells
3. Create a table detailing the differences between mitosis and meiosis
4. Find out about the Coronavirus; what type of virus is it, its structure, how it is spread, incubation period, common symptoms, mortality rate, possible treatments being considered, definition of herd immunity, how a vaccine works, definition of an Epidemic and pandemic.

Useful websites and clips to watch

<https://www.bbc.co.uk/bitesize/guides/zghgpbk/revision/2>

<https://www.bbc.co.uk/bitesize/guides/z2kmk2p/revision/2>

<https://www.youtube.com/watch?v=Pxujitlv8wc&safe=true>

<https://www.youtube.com/watch?v=Ld-o5mZ3Rok&safe=true>

<https://www.ersnet.org/the-society/news/novel-coronavirus-outbreak--update-and-information-for-healthcare-professionals>

Topic 3 – Classification

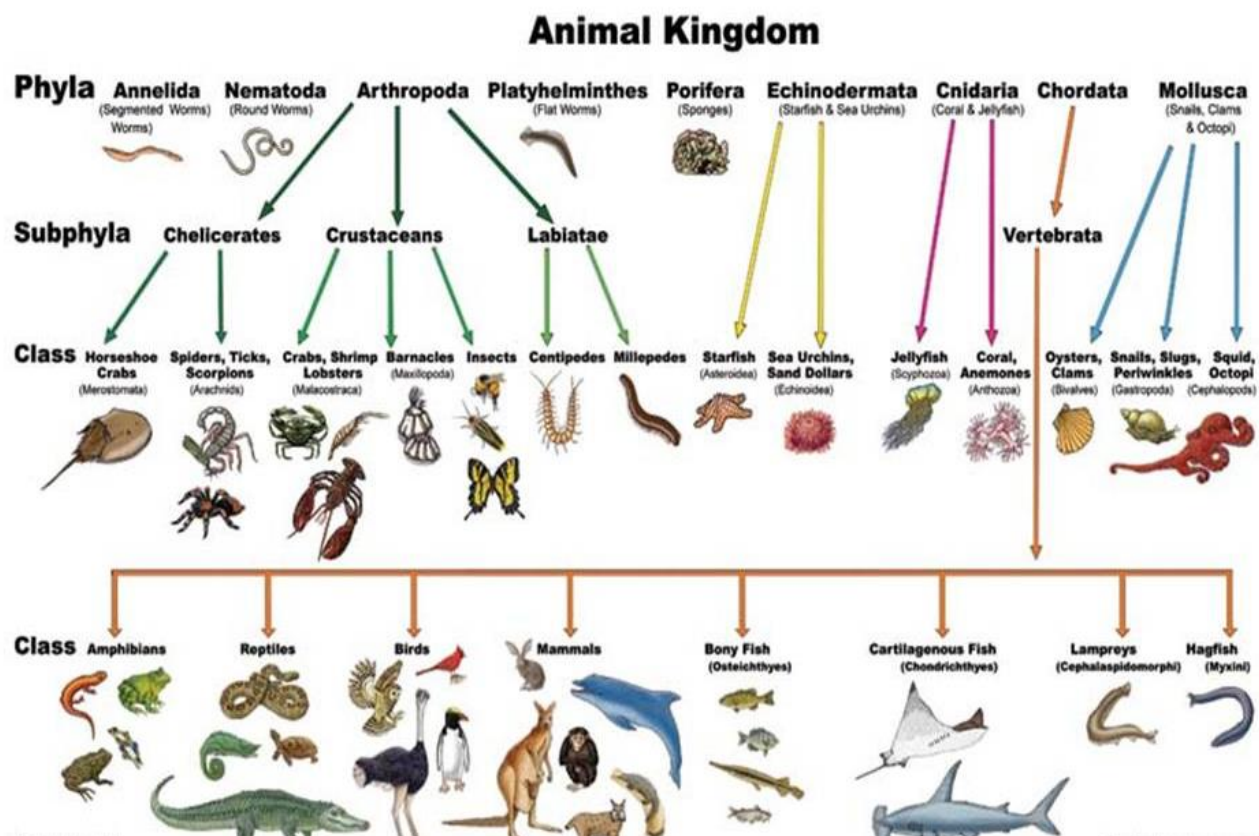
Classification

Living organisms can be classified according to their characteristics. The **binomial system** names an organism using its **genus and species**.

The first big division of living things in the classification system is to put them into one of five kingdoms. These are based on what an organism's cells are like.

The five kingdoms are; Animals (all multicellular animals), plants (all green plants), fungi (moulds, mushrooms, yeast), prokaryotes (bacteria, blue-green algae) and protocists (*Amoeba*, *Chlorella* and *Plasmodium*)

Other classification systems - Cladistics is another way to classify organisms. It can use data from DNA or RNA sequences, rather than just physical characteristics. It emphasises the evolutionary relationships between different species.



Natural selection

The basic idea behind the theory of evolution is that different species have developed over time from other life forms.

The accepted theory of **evolution** explains that it happens by natural selection. The key points are that:

- Individuals in a species show a wide range of variation and this variation is because of differences in their genes.
- Individuals with characteristics most suited to their environment are more likely to survive and reproduce. The genes that allow these individuals to be successful are passed to their offspring.
- Those that are poorly adapted to their environment are less likely to survive and reproduce. This means that their genes are less likely to be passed on to the next generation.
- Given time, a species will gradually evolve.
- Both genes and the environment can cause variation, but only genetic variation can be passed on to the next generation.

Biodiversity

Biodiversity is the total variation between all living things and can be measured to help identify species that need to be supported. Threats to biodiversity have adverse effects on the ecosystem.

There are three measurable components of biodiversity:

- genetic diversity - genetic variation of the number and frequency of alleles of a specific gene
- species diversity - the number of different species in an ecosystem and the proportion of each species in the ecosystem.
- Ecosystem diversity - Ecosystem diversity is the number of distinct ecosystems in a defined area.

Task

1. For the animal kingdom, create a classification chart detailing the main features for each of the phylum.
2. Watch the TED talks on antibiotic resistance. First **two** links below.
3. Draw a diagram to explain what speciation is and how it occurs.

Useful websites and clips to watch

<https://ed.ted.com/lessons/how-antibiotics-become-resistant-over-time-kevin-wu>

https://www.ted.com/talks/maryn_mckenna_what_do_we_do_when_antibiotics_don_t_work_any_more?language=en

<https://www.bbc.co.uk/bitesize/guides/z6trd2p/revision/1>

<https://www.bbc.co.uk/bitesize/guides/zs8wwmn/revision/1>

Topic 4 – Exchange and transport

Cell transport mechanisms

The cell membrane acts as a gatekeeper to the cell, controlling the transport of materials into and out of the cell. There are four types of transport mechanisms

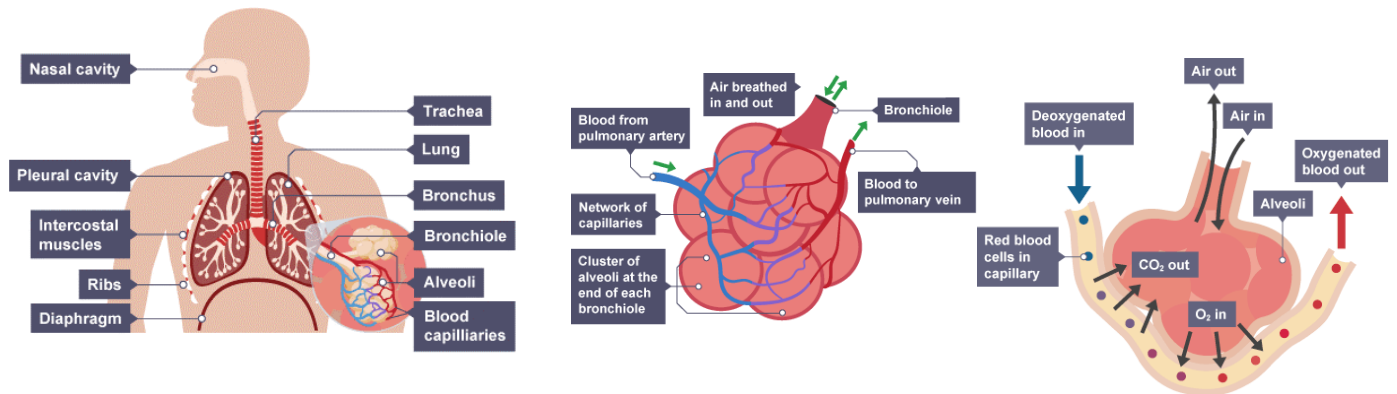
- **Diffusion** is the random movement of a substance from a region of high concentration to a region of low concentration (i.e.: down the concentration gradient). ... Substances (oxygen, carbon dioxide, dissolved nutrients and urea) can move into and out of a cell or organism via **diffusion**.
- **Facilitated diffusion** is diffusion using gated channel proteins and carrier proteins in transport.
- **Osmosis** is the diffusion of water molecules, from a region where the water molecules are in higher concentration, to a region where they are in lower concentration, through a partially permeable membrane
- **Active** transport is a process that is required to move molecules against a concentration gradient. The process requires energy (ATP).

Gas exchange

Gas exchange is essential for organisms to carry out their life process; aerobic respiration requires the intake of oxygen and the removal of carbon dioxide.

Mammals

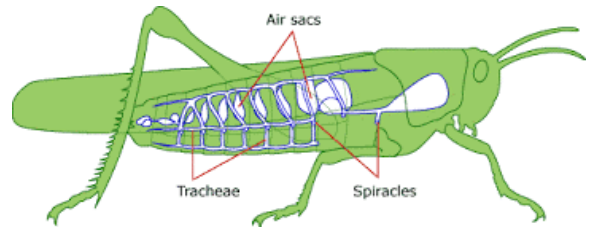
The lungs are the organs that carry out gas exchange in mammals



Insects

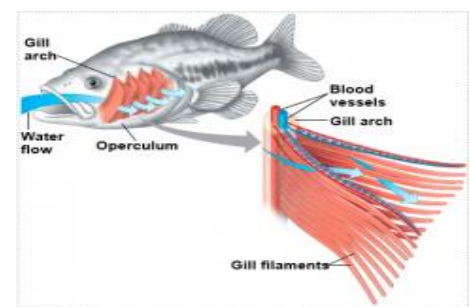
Insects also have their own system for gas diffusion and they rely on spiracles.

Spiracles are used to get air into insects. Spiracles are tiny pores on the surface of insects through which air can pass into and out of the organism. Insects use their tracheae as their gas exchange organ. The tracheae and tracheoles are lined with a single layer of cells to minimise the diffusion distance of gases. Insects use rhythmic abdominal movements to move air in and out of the spiracles. This helps to remove the carbon dioxide from the body and get oxygen into the tracheae for gas exchange.



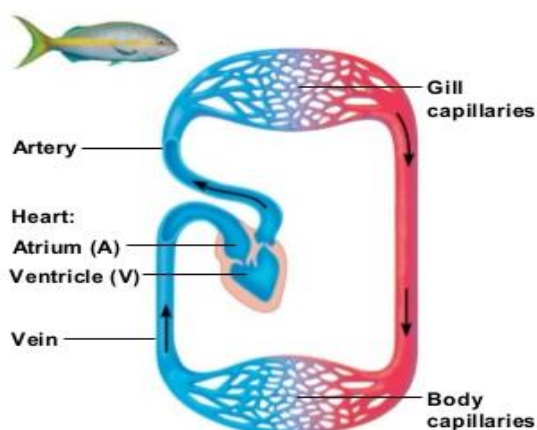
Fish

Finally, fish use gills and lamellae. Gills use a counter-current system. This ensures there is always a steep concentration gradient for oxygen to diffuse from the water into the blood. The lamellae increase the surface area of fish gills. For any exchange mechanism the larger, the surface is the faster the rate of diffusion.



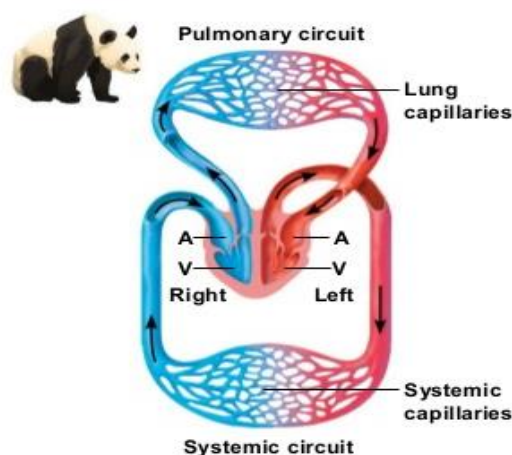
Circulatory systems

(a) Single circulation



Key
Red Oxygen-rich blood
Blue Oxygen-poor blood

(b) Double circulation

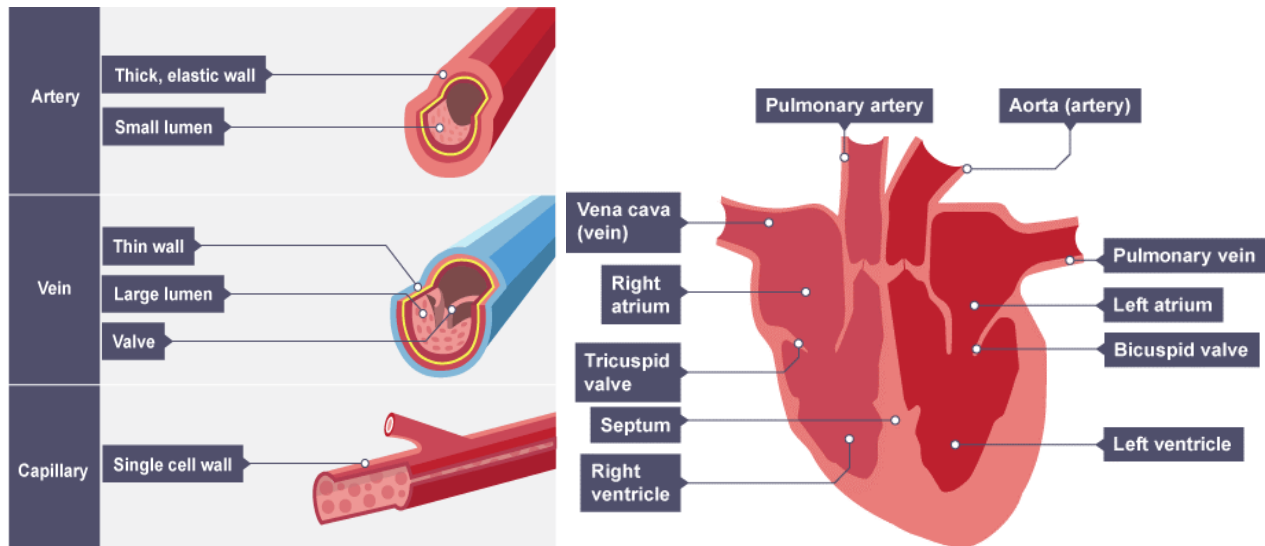


The blood

Blood transports materials and heat around the body, and helps to protect against disease. It contains:

- Plasma - is a straw-coloured liquid that makes up just over half the volume of blood.
- Red blood cells - transport oxygen for aerobic respiration.
- white blood cells – cells involved in the immune system
- platelets – parts of cells involved in blood clotting

Blood vessels and the heart



Transport in plants

Xylem and Phloem - Plants have tissues to transport water, nutrients and minerals. Xylem transports water and mineral salts from the roots up to other parts of the plant, while phloem transports sucrose and amino acids between the leaves and other parts of the plant.

Transpiration - Transpiration is **the evaporation of water** at the surfaces of the spongy mesophyll cells in leaves, followed by loss of water vapour through the stomata. Water moves through **the xylem vessels** in a continuous **transpiration stream**. Transpiration produces a tension or 'pull' on the water in the xylem vessels by the leaves. Water molecules are cohesive so water is pulled up through the plant.

Translocation - Photosynthesis produces glucose in the green parts of plants, which are often leaves. This is then converted into sucrose. The **sucrose is transported** around the plant in **phloem vessels**. It needs to be able to **reach all cells** in the plant so that the sucrose can be **converted back into glucose for respiration**. The **movement of sucrose and other substances** like amino acids around a plant is called **translocation**.

Task

1. For each type of transport mechanism draw diagrams to explain the process
2. Write a paragraph detailing the differences in gas exchange systems in mammals, insects and fish, include diagrams in your explanation.
3. Watch the 20 minute clip 'The virtual body – circulatory system' <https://www.youtube.com/watch?v=Ae0-aExa79k&safe=true>
4. Create a factsheet about the plant transport systems – transpiration and translocation

Useful websites and clips to watch

<https://www.bbc.co.uk/bitesize/guides/zhnk7ty/revision/2>
<https://www.bbc.co.uk/bitesize/topics/zw22pv4/resources/1>
<https://www.bbc.co.uk/bitesize/topics/zw22pv4>