Whitley Academy

Biology Paper 1 (F) Knowledge Recall Booklet

Paper Biology 1F 8464/B/1F

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

- 4.1.2 Cell division
- 4.2.2 Animal tissues, organs and organ systems
- 4.3.1 Communicable diseases
- 4.4.1 Photosynthesis

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

- Required practical activity 1: use of a light microscope.
- Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
- Required practical activity 5: investigate the effect of light on the rate of photosynthesis of an aquatic plant such as pondweed.

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

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

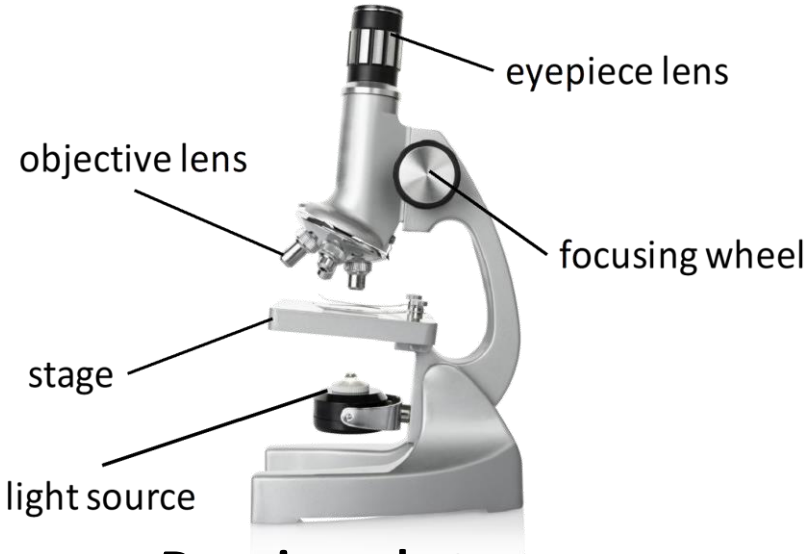
Required Practical – Using a light Microscope

Recall it …

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

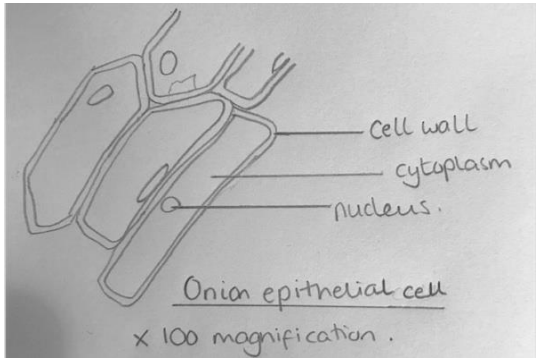
1. Write a method of how to create a wet mount slide
2. Write a method of how to focus a slide under a microscope
3. Sketch a microscope and label all the parts
4. Make a list of rules for drawing images under a microscope

Required Practical – Using a Light Microscope



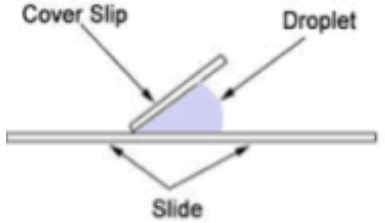
Drawing what you see

- **Clear line drawing – no shading**
- **Label main cell structures**
- **Add a title and the magnification.**



Making a wet mount slide e.g. onion cells

- Place a thin section of the **specimen** onto slide.
- Place a drop of water in the middle of the slide or stain the specimen.
- Gently lower cover slip onto the specimen without trapping air bubbles.



- Soak up any excess liquid with a paper towel.
- Switch on the light source and place your slide on the stage.
- Use the lowest objective lens and turn the focusing wheel to move the lens close to the slide.
- Slowly adjust the focusing wheel until you can see a clear image.
- Increase the magnification by changing the objective lens and re-focus.

See GCSE Practical Guide - Biology – Microscopy on Huddle - Microscopy Practical guide

Required Practical – Food test

Recall it …

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

1. Describe the test for starch, and the colour change
2. Describe the test for protein and the colour change
3. Describe the test for reducing sugar and the colour change
4. Describe the test for fat and the colour change

Required Practical – Food Tests

BIOCHEMICAL (FOOD) TESTS

CHEMICAL	TESTS FOR ...?	HOW TO CARRY OUT THE TEST	RESULT	CHEMICAL	TESTS FOR ...?	HOW TO CARRY OUT THE TEST	RESULT
	Starch	1.) Add the iodine solution directly to the substance to be tested (in solid or liquid form) and look for a colour change.	Turns blue black with starch		Protein	1.) Add Biuret's to the solution/ suspension to be tested and look for a colour change.	Turns purple with protein
	Reducing Sugar	1.) Add Benedict's to the solution/ suspension to be tested. 2.) Heat for 2 mins in a water bath at boiling point and look for a colour change.	Turns brick red with reducing sugars (green/ yellow/ orange if less sugar present)		Lipid (Fats)	Grind food with water in a pestle and mortar Add 3 drops of Sudan II Shake gently	A red layer appears

Required Practical – Light intensity and Photosynthesis

Recall it …

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

1. What are the variables for the experiment?
2. Write a description of the method to the experiment?
3. Why is the pond weed put into sodium hydrogen carbonate solution?
4. What is the advantage of using an LED bulb?
5. Sketch a graph of what you would expect to find?
6. Explain the results?

Required Practical – How does light intensity affect the rate of photosynthesis

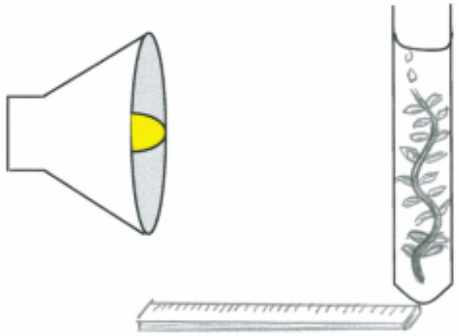
Water plants produce **bubbles of oxygen** when they photosynthesise. The bubbles can be **counted** over time and used to **calculate** the **rate** of photosynthesis. video

Investigating the effect of light intensity on photosynthesis in pondweed.

1. Fill a boiling tube with 0.2% **sodium hydrogen carbonate solution**.
2. Freshly cut a **10 cm piece of pondweed** and place it in the boiling tube with the cut end at the top.
3. Set up an **LED lamp** at a distance of **10 cm** to the boiling tube and leave to settle for 5 minutes.
4. **Start** the stopwatch and count the number of **bubbles** released in **one minute**.
5. Repeat twice and calculate the mean number of bubbles.
6. Repeat steps 1-6, altering distance of the lamp so it is 30 cm, 40 cm and 50cm away from the boiling tube.

Why do we use sodium hydrogen carbonate solution?

This provides excess dissolved carbon dioxide for the plant to use in photosynthesis so it is not a limiting factor.



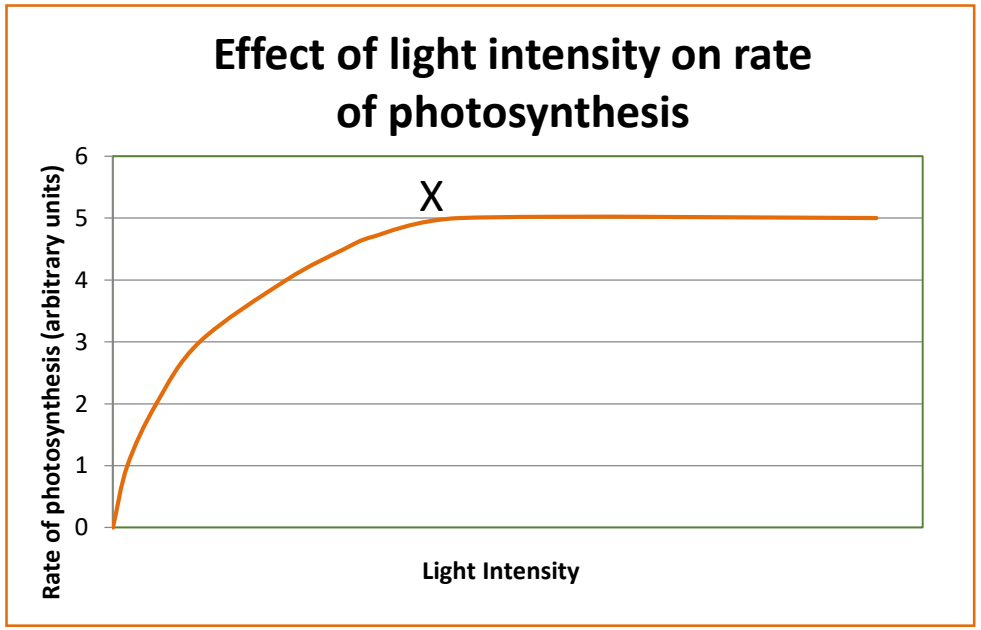
Why is an LED lamp used?

LED lamps produce less heat and this reduces the effect of temperature on the experiment.

Required Practical Results – Light intensity and Photosynthesis

The **amount of light** a plant receives affects the rate of photosynthesis. Plants found in areas of lower light do not tend to grow as tall.
Light intensity decreases as the distance between the plant and the light source increases.

The graph shows that as **light intensity increases** so does the **rate** of photosynthesis up to a point. At **point X** another **factor** is **limiting** the rate of photosynthesis. This could be carbon dioxide concentration, temperature or amount of chlorophyll.
Light intensity is a limiting factor.



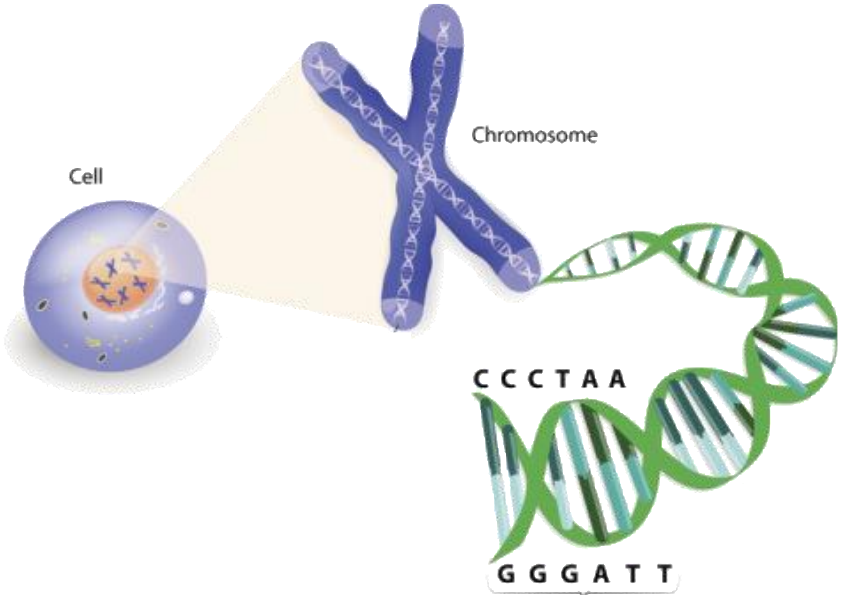
Cell Division

Recall it …

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

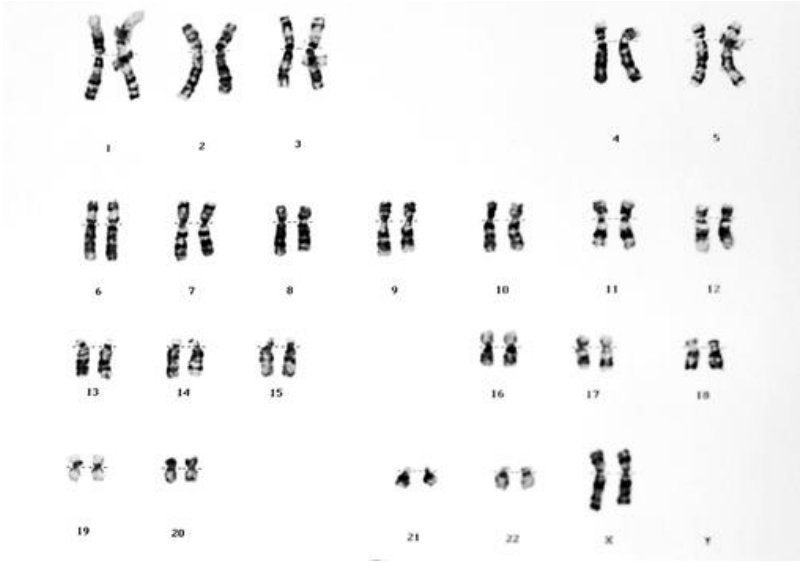
1. What are does a nucleus contain?
2. What are chromosomes?
3. How many chromosomes are there in the body cells and sex cells?
4. What is a gene?
5. What is DNA?
6. Describe the three stages of the cell cycle?

Cell division - Chromosomes



The **nucleus** of a cell contains the **instructions** for **making proteins** and new cells. In the nucleus there are structures called **chromosomes**. The chromosomes are made of coiled strands of **DNA** molecules. A section of DNA that codes for a specific protein or characteristic is called a **gene**.

In **human body cells** the **chromosomes** are normally found in **pairs**. The karyotype diagram below shows the **23 chromosome pairs** for a female human.



Human have are around **24,000 genes** and there are up to **2,000 genes** in **one** human chromosome.

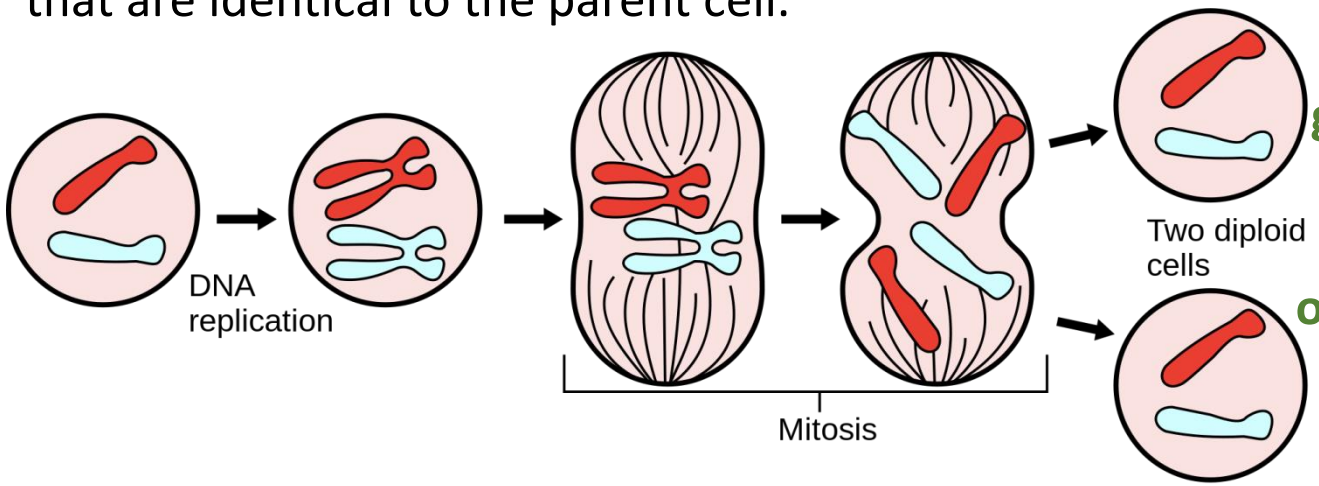
Cell division - Mitosis and the cell cycle

In the **cell cycle,** cells divide in a series of **stages**. The **genetic material** is **doubled** and then **divided** into **two identical cells**.

Stage 1 – Growth: Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria.

Stage 2 - DNA synthesis: The DNA replicates to form two copies of each chromosome.

Stage 3 – Mitosis: One set of chromosomes is pulled to each end of the cell and the nucleus divides. Then the cytoplasm and cell membranes divide to form two cells that are identical to the parent cell.



Mitosis occurs during growth and to repair or replace damaged cells. Asexual reproduction occurs by mitosis in both plants and simple animals.

Cell Division: Stem Cells

Recall it …

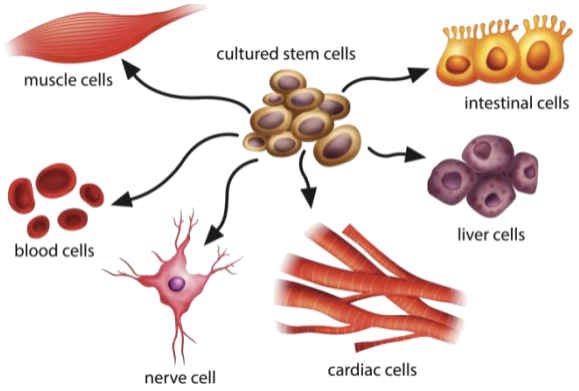
Use the information in the following page(s) to answer these questions …

1. What are stem cells?
2. What is the difference between adult stem cells and embryonic stem cells?
3. What is therapeutic cloning?
4. Give the arguments for and against therapeutic cloning?
5. What are plant stem cells called? Where are they found?
6. Explain how plant stem cells are used?

Cell division - Stem Cells - animals

Stem cells are undifferentiated cells within an organism. They can produce other stem cells that can then differentiate into many different types of cells.

Human embryo stem cells: can be cloned and made to **differentiate** into **most** different types of human cells.
Human adult stem cells: can form **many** (but not all) types of cells including blood cells.
Human stem cells can be used to help treat diseases like diabetes and paralysis.



Embryos produced by **therapeutic cloning** have the **same genes as the patient**. This means stem cells from the embryo are **not rejected by the patient's body.** This is why they can be used for medical treatments.

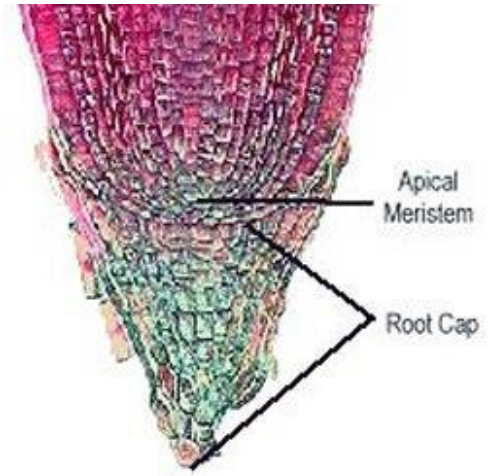
The **risks** of using stem cells risks such as **transfer** of **viral infections**.

Some people have objections to stem cell use for **ethical** and **religious** reasons.

During Fertility treatment doctors usually fertilise many more eggs than are going to be used. The **embryos** then formed are used to **obtain** stem cells. In the UK **scientists** can use these embryos for **research** but only under **very strict guidelines**.

Cell division- Stem Cells - plants

Most types of **PLANT** cells can **differentiate throughout their life** cycle.
Undifferentiated stem cells in **plants** are grouped together in **structures called meristems.** The undifferentiated cells can then specialise e.g. root hair cell, xylem or phloem cells.



Stem cells from **meristems in plants** can be used to produce **clones of plants** quickly and economically.

- **Rare species:**
  can be cloned to protect from extinction.
- **Crop plants:**
  with special features such as disease resistance can be cloned to produce large numbers of identical plants for farmers.
  e.g. potatoes, strawberries and dates

Digestion

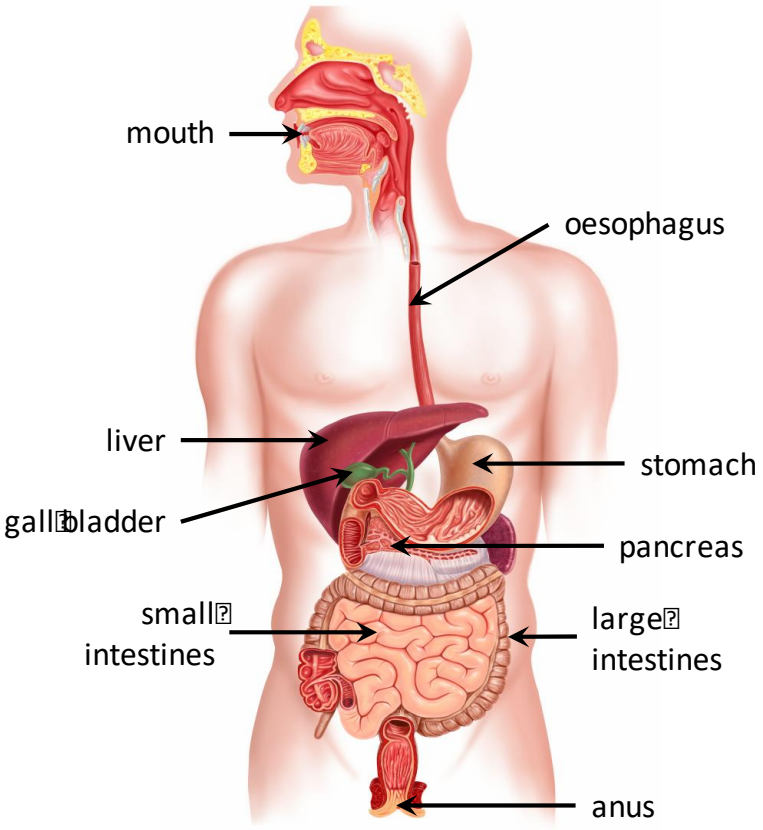
Recall it …

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

1. What is digestion?
2. What does amylase do? Where is it released from?
3. What does protease do? Where is it released from?
4. What does lipase do? Where is it released from?
5. What is the lock and key theory?
6. Sketch and describe the lock and key theory?
7. What is the active site? Describe it's shape?

Animal tissues, organs and organ systems Part 1 - The human digestive system

The **digestive system** is an example of an **organ system** where **different** organs **work together** to digest and absorb food.



Digestion is where **large insoluble molecules** are **broken down** into **smaller soluble ones that can be absorbed into the bloodstream.** Digestion occurs in the **GUT** (tube from the mouth to the anus) and it relies on **ENZYMES** (biological catalysts).

Activity - Digestive Enzymes

Digestive Enzyme	Where released?	Breakdown what?
Amylase	Salivary glands and pancreas	Carbohydrates into simple sugars
Protease	Stomach and pancreas	Proteins into amino acids
Lipase	Pancreas	Fats and oils (lipids) into fatty acids and glycerol

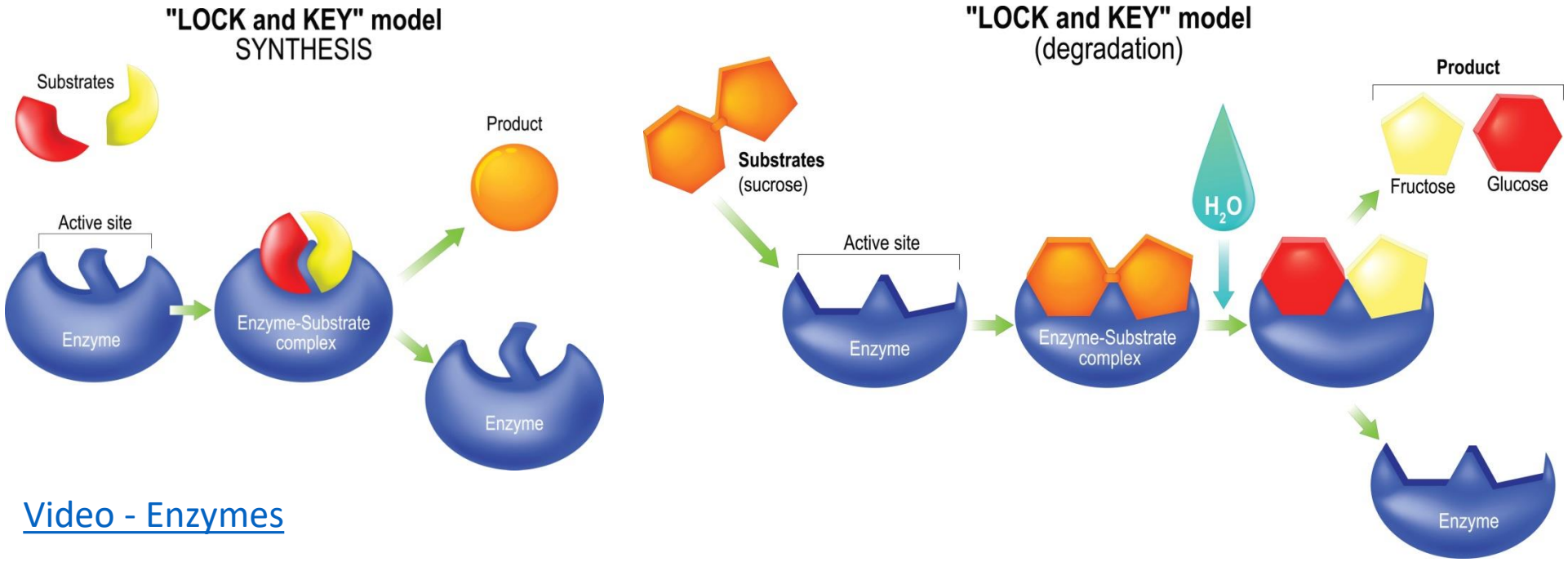
Video - Digestion and Enzymes

PiXL - Required Practical Guide Food Tests

Animal tissues, organs and organ systems Part 1 - The human digestive system

'Lock and Key theory' – is a **model** to explain **enzyme action**

Enzymes are made of **proteins** and are **biological catalysts** - substances that **increase** the rate of **chemical reactions** without being **used up**. The shape of the **active site** of the enzyme is specific for each substrate (substance the enzyme acts on).



Video - Enzymes

The **products** of digestion are used to **build** new **carbohydrates**, **lipids** and **proteins** in the body. Some **glucose** is used in **respiration**.

PiXL - Required Practical Guides - Enzymes

Digestion

Recall it …

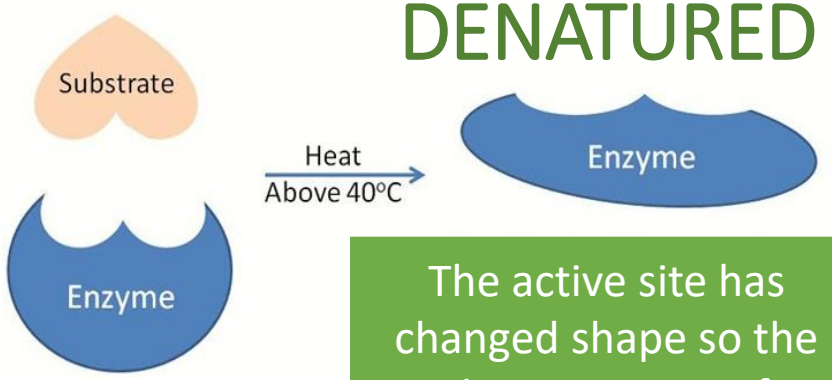
Use the information in the following page(s) to answer these questions …

1. Where is bile made? Where is it stored?
2. Describe what bile does?
3. Name two factors that affect enzyme activity?
4. Explain how temperature affects enzyme activity?
5. Explain how pH affects enzyme activity?

Animal tissues, organs and organ systems Part 1 - The human digestive system

Enzyme activity is affected by **temperature** and by **pH**. Specific conditions are needed to keep enzymes working at their best. OPTIMUM CONDITIONS! Enzymes control the chemical reactions in the body this is known as metabolism.

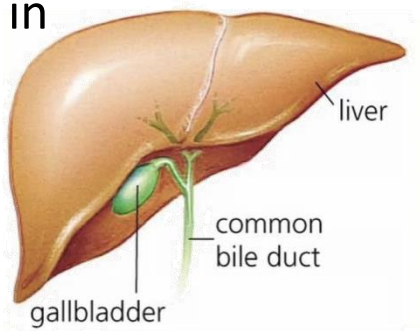
In enzyme reactions, **increasing the temperature** will initially increase the **rate of reaction** due to increased **collisions** between the enzyme and substrates. **BUT** if the **temperature** is **too high** the **enzyme** will **denature** (NB: denature NOT die/killed)



The active site has changed shape so the substrate cannot fit

Digestion and **pH. T**he **stomach** releases acid. The enzymes made in the **stomach** work best in **acidic** conditions. The **enzymes** made in the **pancreas** and small **intestine** work best in **alkaline** conditions.

Bile is **made** in the **liver** and **stored** in the **gall bladder**. It is alkaline to **neutralise** hydrochloric **acid** from the **stomach**. It also **emulsifies fat** to form small droplets which **increases** the **surface area.**



The alkaline conditions and large surface area **increase the rate of fat breakdown** by lipase.

The Heart and Blood Vessels

Recall it …

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

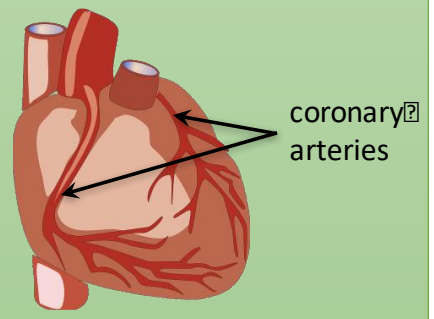
1. Sketch a diagram of the heart, labelling the chambers and blood vessels?
2. What is double circulation?
3. What is the pacemaker? Where is the pacemaker?
4. What are coronary arteries?
5. Describe what happens at the lungs?
6. Describe the structure and function of arteries?
7. Describe the structure and function of veins?
8. Describe the structure and function of capillaries?

Animal tissues, organs and organ systems Part 2 - The heart

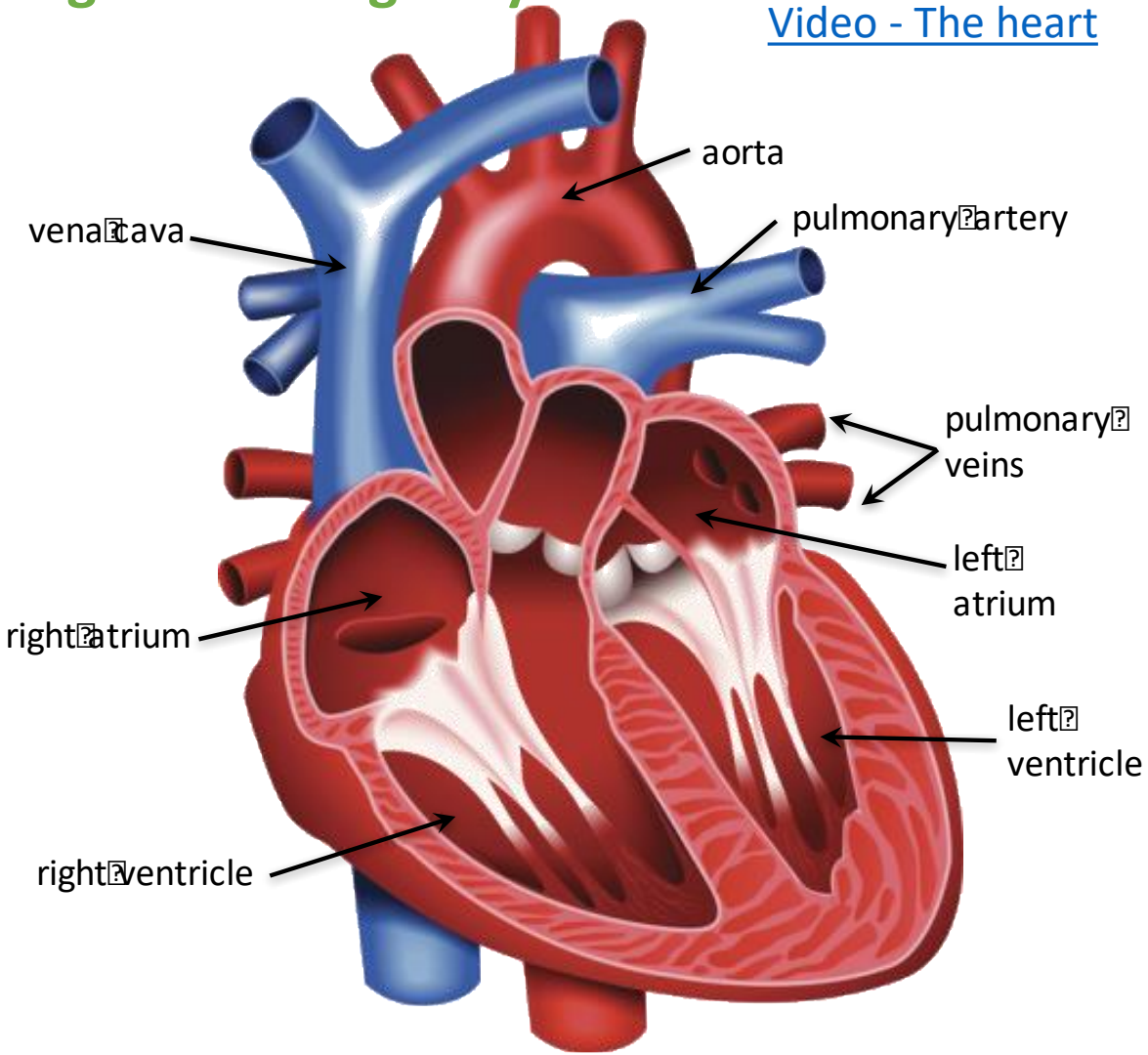
Video - The heart

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

1. The **right ventricle** pumps blood to the lungs where gas exchange takes place
2. The **left ventricle** pumps blood around the rest of the body.

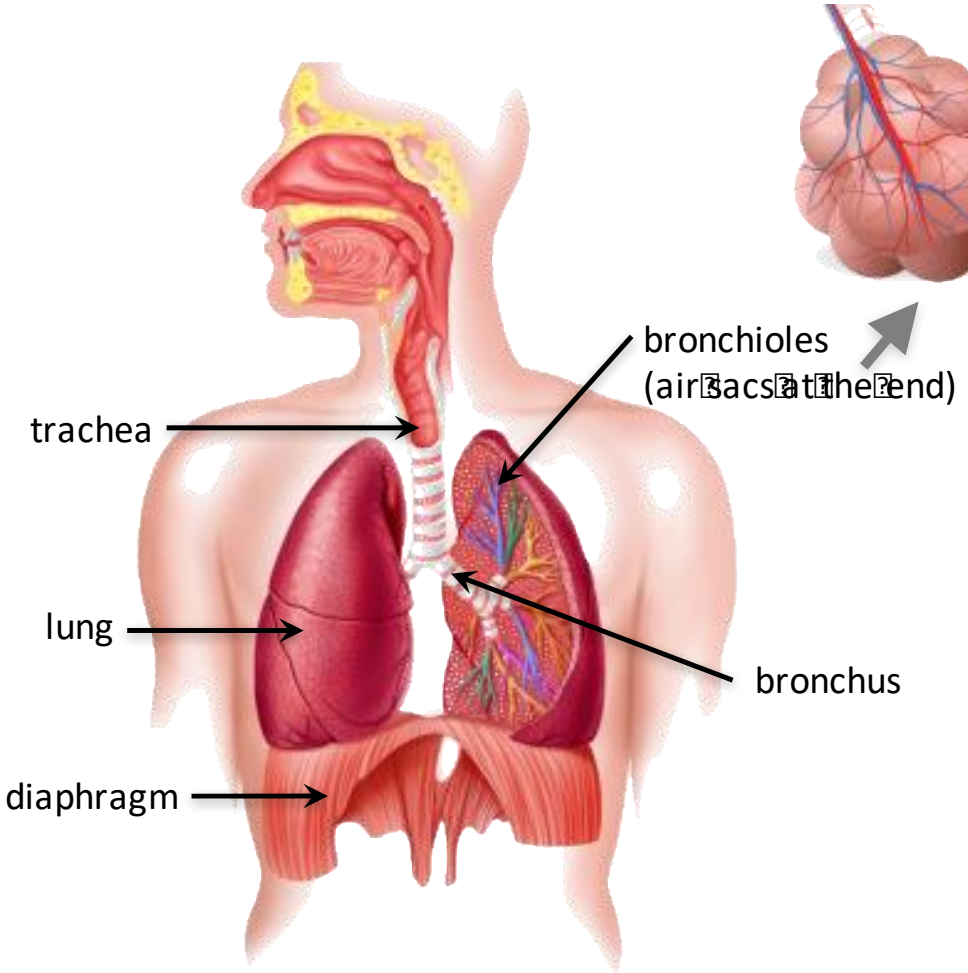


Coronary arteries supply **oxygen** rich blood to the heart **muscle.**

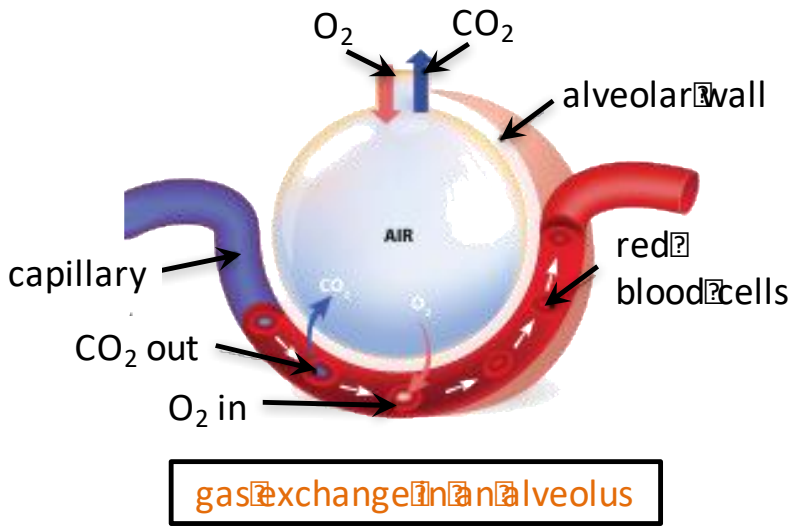


The **natural resting heart rate** is **controlled** by a group of cells in the **right atrium (pacemaker)**. Artificial **electrical** pacemakers are used to **correct irregularities** in the heart rate.

Animal tissues, organs and organ systems Part 2 - The lungs and gas exchange



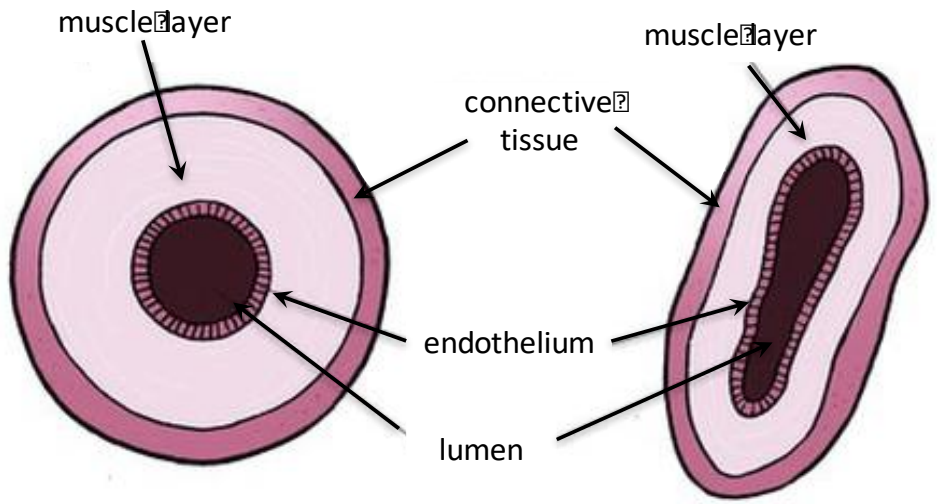
Video - Lungs



gas exchange in an alveolus

The **heart** pumps **low oxygen/high carbon dioxide** containing **blood** to the lungs. In the **lungs**, oxygen and carbon dioxide are **exchanged** in the tiny **air sacs** (**alveoli**) at the end of the **bronchial tubes**. The **alveoli** are surrounded by **capillaries.**

Animal tissues, organs and organ systems Part 2 – Blood vessels



Video - Blood Vessels

artery vein capillary

Arteries

- **Carry blood away from the heart**
- Thick muscular walls
- Small lumen (internal hole)
- Carry blood under high pressure

Veins

- **Carry blood to the heart**
- Thin walls
- Large lumen (internal hole)
- Carry blood under low pressure
- Have valves

Capillaries

- **Connect arteries and veins**
- One cell thick
- Carry blood under very low pressure

All arteries carry oxygenated blood except for the pulmonary artery.
All veins carry deoxygenated blood except for the pulmonary vein.

Blood and Problems to do with the Heart

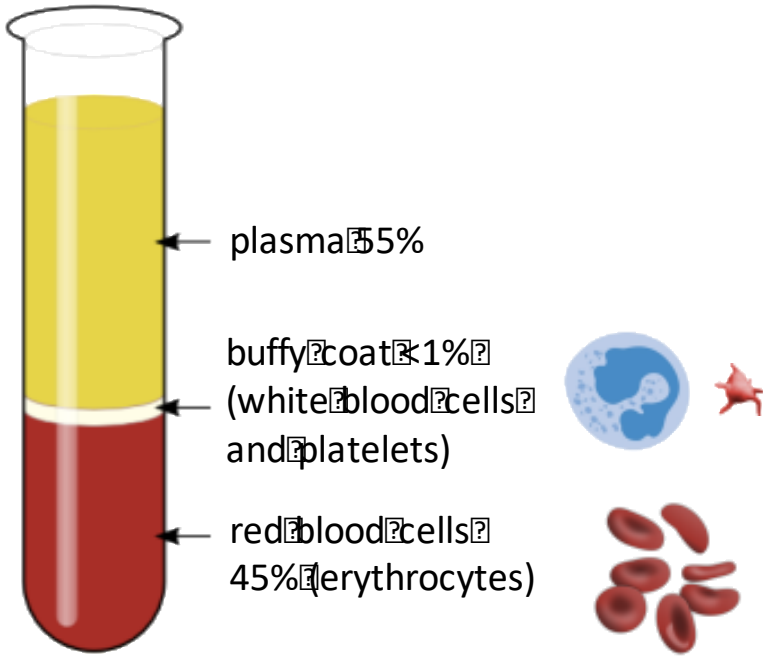
Recall it …

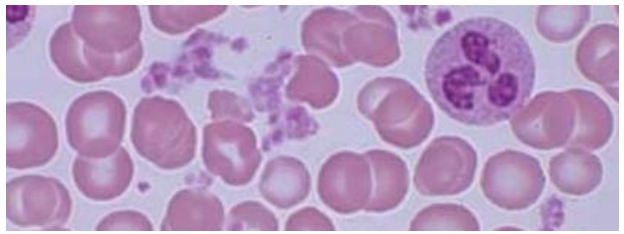
Use the information in the following page(s) to answer these questions …

1. What does blood contain?
2. What do red blood cells, white blood cells, plasma and platelets do?
3. Describe atherosclerosis?
4. What are the risk factors for atherosclerosis?
5. Describe how statins work?
6. Describe how stents work?
7. What do heart valves do? What happens when the become faulty?
8. What are the symptoms and causes of faulty heart valves?
9. What are the types of replacement valves?
10. Explain the problems and treatment for heart failure?
11. Describe the conditions that may require a heart transplant?

Animal tissues, organs and organ systems Part 2 - Blood

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





Plasma – Pale yellow fluid part of blood, transports cells, CO_2, hormones and waste.

Red blood cells (erythrocytes)
- have no nucleus (more room to carry O_2)
- contain the red pigment **haemoglobin** which carries O_2

oxygen + haemoglobin → oxyhaemoglobin

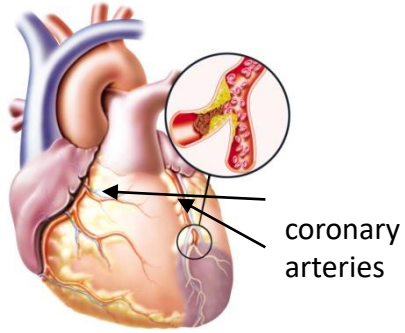
- they have a **large surface area to volume ratio** for faster diffusion of oxygen

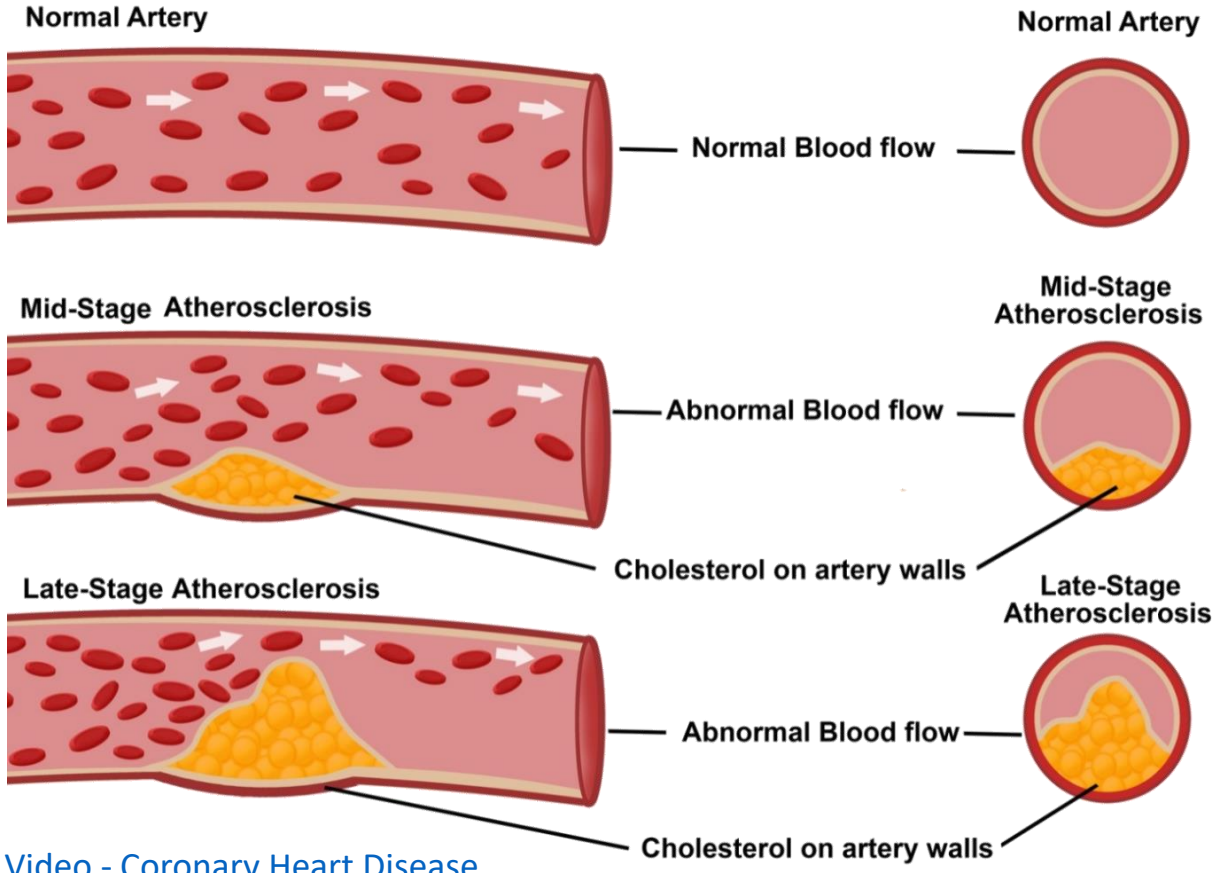
White blood cells - An important part of the **immune** system, some produce **antibodies** (proteins that bind to microbes and destroy them) and others surround and **engulf** foreign cells, all have a nucleus.

Platelets - Tiny fragments of cells (no nuclei), clump together to help form clots, protect the body by stopping/reducing bleeding.

Animal tissues, organs and organ systems Part 2 - Coronary heart disease

Atherosclerosis is a cause of **coronary heart disease (CHD)** where **layers** of **fatty material** build up inside the coronary arteries, **narrowing** them. This **reduces** the flow of blood through the coronary arteries, resulting in a **lack of oxygen** for the **heart muscle.**





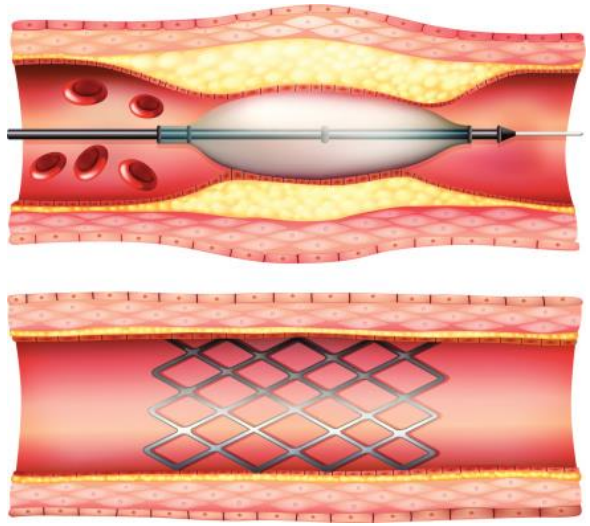
Video - Coronary Heart Disease

Risk factors for CHD:

- **Smoking and High Blood pressure:** damages the lining of the artery, leading to a build up of fatty deposits.
- **High cholesterol:** Cholesterol is a fatty substance that is carried in your blood by proteins.
- **Not enough exercise:** Increases blood pressure and cholesterol in the blood.

Animal tissues, organs and organ systems Part 2 - Coronary heart disease

Atherosclerosis (coronary heart disease) can be **treated** in two main ways by placing a **stent** in the coronary artery and/or using drugs called **statins**.



Stents are metal cylinder grids which can be **inserted** into an artery to maintain blood flow by **keeping the artery open** so that the heart continues to receive **enough oxygen** to function effectively.

Video - Stent Insertion Animation

Statins are drugs that lower harmful **cholesterol** in the blood and stop the **liver** producing too much cholesterol and reduce the rate at which it is deposited. Patients should also have a healthy diet. This **reduces** the risk of heart disease.

Animal tissues, organs and organ systems Part 2 – Faulty valves

Heart valves prevent the blood in the heart from **flowing** in the **wrong direction**. In some people heart valves may become **faulty**, preventing the valve from **opening fully** or the heart valve might develop a **leak** because it does not **close fully**.

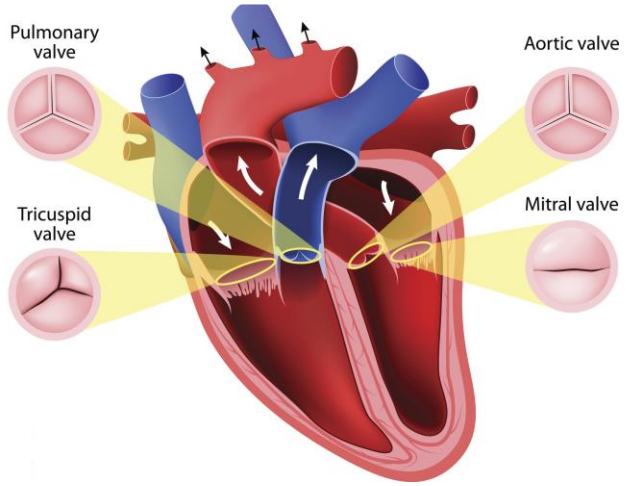
Symptoms can include:

- Being short of breath
- Swelling in the ankles and feet
- Feeling unusually tired

Causes:

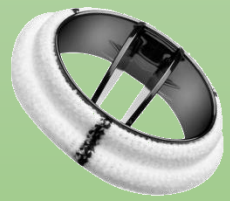
- Being born with it (congenital heart disease)
- Having had rheumatic fever
- Cardiomyopathy - a disease of the heart muscle
- Damage to the heart muscle from a heart attack
- Getting older
- Endocarditis a bacterial infection in the heart

Valves in the Heart



Faulty heart valves can be replaced by biological or mechanical valves.

biological



mechanical

Video - Heart valve Replacement Animation

Animal tissues, organs and organ systems Part 2 – Heart failure

Heart disease can lead to **heart failure**. Patients with heart failure can be given **heart** or **heart and lung transplants**. Donor hearts come from a **person who has died.** These only have a **few hours** to get to the person needing the heart. Often hearts and lungs are transplanted together. In this country you have to give **consent** for your organs to be donated.

Video - Heart Transplant (graphic)

Conditions that may require a heart transplant include:

- **Atherosclerosis** (coronary heart disease) – a build-up of fatty substances in the arteries supplying the heart
- **Cardiomyopathy** – where the walls of the heart have become stretched, thickened or stiff
- **Congenital heart disease** – birth defects that affect the normal workings of the heart

Artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery. Artificial hearts can only be used as a short term measure.

Non-Communicable disease

Recall it …

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

1. What is health?
2. What are communicable and non-communicable diseases?
3. Give examples of how disease could interact?
4. Describe some human costs of non-communicable diseases?
5. Describe some financial costs of non-communicable diseases?
6. Name the risk factors of non-communicable diseases?
7. Describe the

a) Risk factors of cardiovascular disease
b) Diseases linked to obesity
c) Diseases linked to excessive alcohol intake
d) Diseases linked to smoking
e) Risk factors for cancer

8. What is cancer? What is the difference between a begnin and malignant tumour?

Animal tissues, organs and organ systems Part 3 - Health issues

The World Health Organisation definition:
Health is a state of complete **physical**, **mental** and **social well-being** and not merely the absence of disease or infirmity.

Disease can be:

- **Communicable** – these are **infectious** diseases caused by viruses, bacteria, protists and fungi and are **spread** in animals (and plants) e.g. malaria, measles, athletes foot
- **Non-communicable** – these diseases are not caused by **infection** and cannot be **spread** e.g. heart disease, diabetes, Alzheimer's, asthma

Different **types of disease** may **interact** (work together) to make a person ill.

- **Defects in the immune system** mean that an individual is more likely to suffer from infectious diseases
- **Viruses** living in cells can be the trigger for cancers to form
- **Immune reactions** initially caused by a pathogen can trigger allergies such as skin rashes and asthma
- **Severe physical ill health** can lead to depression and other mental illness

Animal tissues, organs and organ systems Part 3 - Non-communicable diseases, the human and financial costs

Non-communicable diseases (NCDs) can have a significant **human** and **financial** cost for individuals, local communities, nationally and globally. Video - NCDs

WHO Factsheet data link

- Non-communicable diseases (NCDs) kill **40 million** people each year, equivalent to **70% of all deaths globally**
- Each year, **15 million** people die from a NCD between the ages of 30 and 69 years; over **80%** of these "premature" deaths occur in low- and middle-income countries
- **Cardiovascular diseases** account for **most** NCD deaths, or **17.7 million people** annually, followed by **cancers** (8.8 million), **respiratory diseases** (3.9million), and diabetes (1.6 million)

Human cost: lower quality of life, shorter lifespan and the families of the sufferer are also affected due to caring responsibilities, parental/partner death etc.

Financial cost: cost of health care, research into diseases, awareness campaigns. Reduced income due to inability to work, personal care costs, adaptations to the home and buying specialist equipment e.g. wheelchairs, mobility scooters etc.
Also if many people are unable to work due to NCDs the economy can be affected.

Animal tissues, organs and organ systems Part 3
- The effect of lifestyle on some non-communicable diseases

There are **other factors** that can also affect health and increase the risk of getting a disease, these can be:

- **aspects of a persons lifestyle**
  - e.g. lack of exercise, stress levels, exposure to too much sunlight, exposure to ionising radiation (e.g. X-rays, gamma rays)
- **substances (chemicals) taken into**:
  - **a persons body** – e.g. high fat/sugar diet, cigarette smoke, alcohol
  - **in their environment** - e.g. air/water pollution, asbestos, ionising radiation

These are called **RISK FACTORS**

The potential source of harm e.g. smoking, lack of exercise

The combination of the chances of the hazard causing harm and the severity of that harm

The damage to health or a disease that can occur

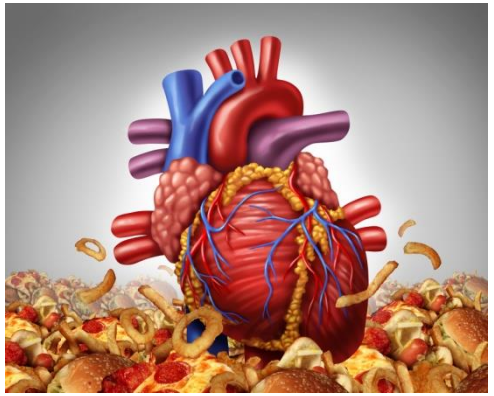
MANY DISEASES ARE CAUSED BY THE INTERACTION OF A NUMBER OF RISK FACTORS

Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

Some **RISK FACTORS** have been found to directly **cause disease.**

CARDIOVASCULAR disease:

- **Diet** – a diet high in saturated fats can increase the levels of LDL (low density lipoproteins – cholesterol plus a protein that can cause atherosclerosis)



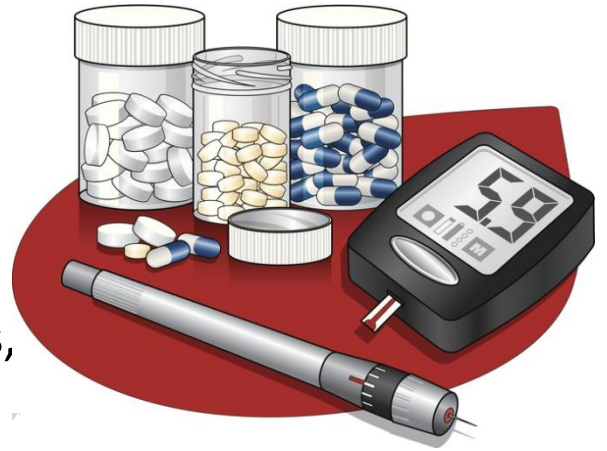
- **Smoking** – tobacco smoke **damages** the lining of the arteries leading to atherosclerosis, **carbon monoxide** in tobacco smoke reduces the amount of oxygen in the blood so the heart has to pump harder, the **nicotine** in tobacco smoke causes the heart to beat faster and raises blood pressure

- **Lack of exercise** – exercising regularly lowers blood pressure and stress

Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

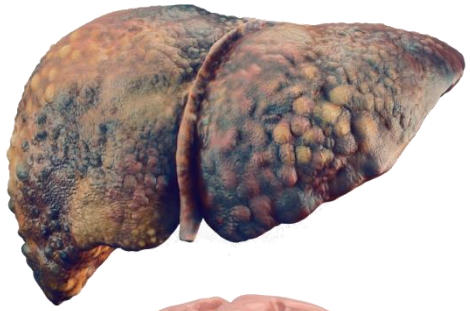
Some **RISK FACTORS** have been found to directly **cause disease.**

OBESITY is a risk factor for Type 2 diabetes:



- **Type 2 diabetes** – is where the cells in the body are less sensitive or resistant to insulin so the body cannot control the concentration of glucose in the blood correctly Video - Type 2 Diabetes
- **Obesity** increases the risk of developing type 2 diabetes, the more fat you have around your abdomen (tummy)

Alcohol is a risk factor for Liver disease and Brain damage:



- **Liver disease** – the liver breaks down toxins in alcohol, if you have too much alcohol the first stage of liver disease is when the liver becomes fatty and eventually **cirrhosis** of the liver develops if you continue to drink too much alcohol
- **Brain function damage** – alcohol affects the way the nerve cells in the brain work and the cells then become damaged. The brain mass may also shrink Video - Alcohol and the Body

Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

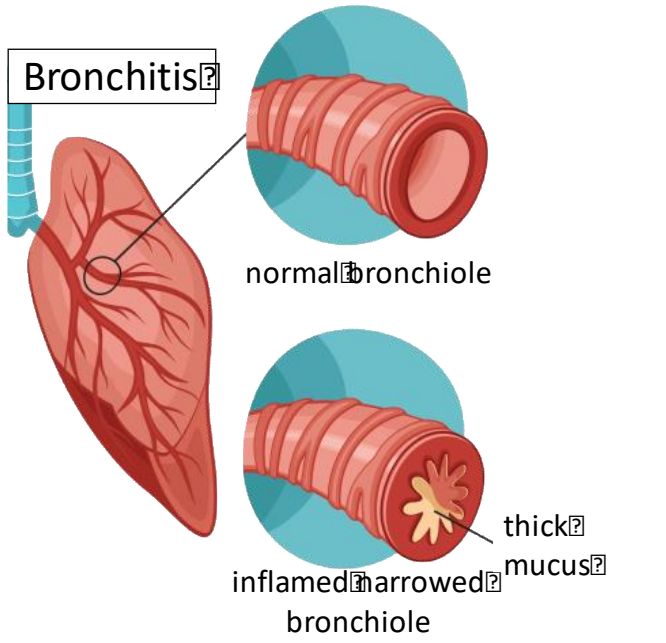
Some **RISK FACTORS** have been found to directly **cause disease.**

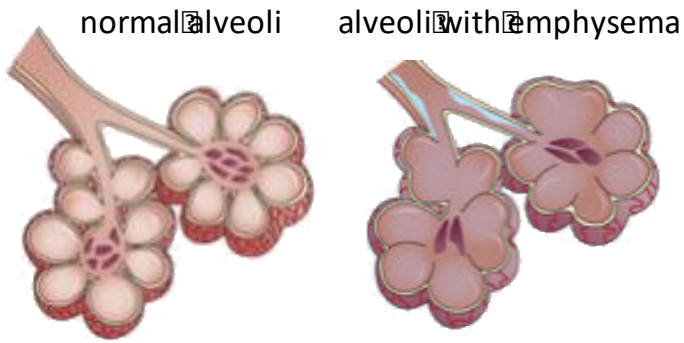
SMOKING is a risk factor for Lung disease:

- **COPD** – describes a group of lung diseases that make it difficult for people to move air in and out of the lungs

Two examples of these are:

- **Bronchitis** – the bronchi and bronchioles are **inflamed** (swollen) and excess **mucus** is produced
- **Emphysema** – this affects the **alveoli**, the walls are **broken down** and they then trap excess air





COPD **narrows** the airways and makes it difficult to get rid of CO_2 and get in the O_2 needed for respiration. **Smoking** is the main cause of COPD and is responsible for 9 out of 10 cases. Video - COPD

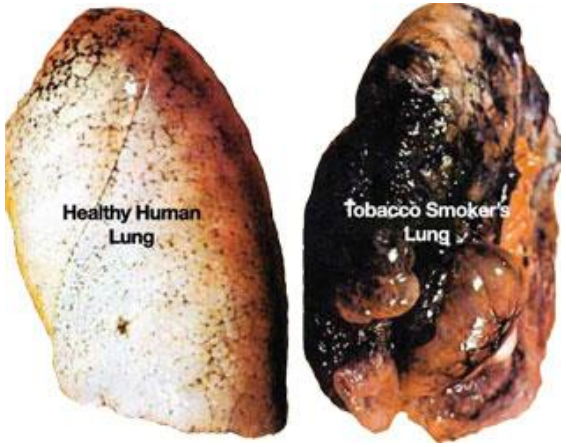
Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

Some **RISK FACTORS** have been found to directly **cause disease.**

SMOKING is a risk factor for Lung cancer:

- **Lung cancer -** is one of the **most common** and serious types of cancer. Around 44,500 people are diagnosed with the condition every year in the UK (NHS)
- **Symptoms include**:
  - a persistent cough
  - frequent chest infections
  - coughing up blood
  - breathlessness
- **Causes**: **most** cases of lung cancer are linked to **smoking 85%** (NHS), tobacco smoke contains over **60 toxic chemicals** and some of these substances are known to be **carcinogenic** (cancer causing)

If you smoke more than **25 cigarettes a day**, you are **25 times** more likely to get lung cancer than a non-smoker. Some people who have never smoked can get lung cancer too.



All cigarettes must now by law be sold in plain packaging and with graphic images and health warnings.

Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

Some **RISK FACTORS** have been found to directly **cause disease.**

Risks of SMOKING and ALCOHOL on unborn babies:

Smoking:

Tobacco smoke contains over **4000 chemicals** one of these is **carbon monoxide**, it is a toxic gas that **reduces** the amount of **oxygen** available to the unborn baby.

- **Smoking** while **pregnant** increases the **risk** of: miscarriage, premature births, sudden infant death syndrome (SIDS)

Alcohol:

Medical experts are still **unsure** how much alcohol is safe to drink while pregnant and advise pregnant woman not to drink any alcohol.

- **First 3 months** of pregnancy: – can increase the risk of miscarriage and premature birth
- **Heavy drinking** during pregnancy can lead to **foetal alcohol syndrome** (FAS) children with FAS have:
  - poor growth
  - facial abnormalities
  - learning difficulties

Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

Some **RISK FACTORS** have been found to directly **cause disease.**

CARCINOGENS as a risk for cancer:

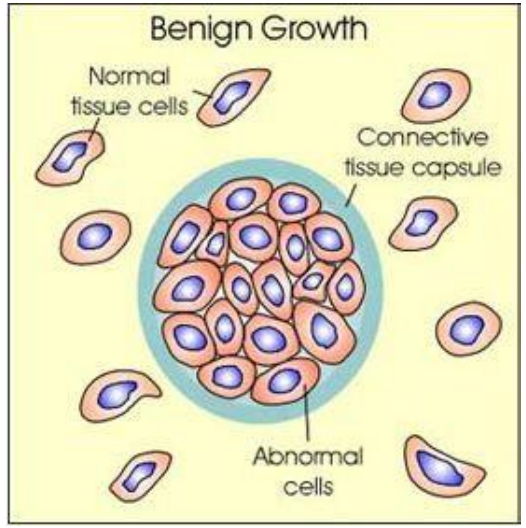
- **Carcinogen** - a **substance** or form of **radiation** that can **cause cancer**. Some carcinogens cause cancer by damaging the DNA directly, others can speed up cell division making mutations more likely
- **Tobacco** - smoke can cause cancers in the lungs, oesophagus, larynx (voice box), mouth, throat, kidney, bladder, pancreas, stomach and cervix
- **Alcohol** - is a risk factor in the following cancers - mouth, larynx, oesophagus, liver and breast
- **Occupational carcinogens** – there are over 40 known carcinogens in the work environment and these need to be carefully controlled so that workers don't get too exposed to them e.g. asbestos causes lung cancer
- **Ionising radiation** – this type of radiation can knock electrons off the atoms in DNA causing changes that can lead to cancer e.g. UV, X-rays, radon gas, radiation in medical treatments Video - UV Radiation

Animal tissues, organs and organ systems Part 3 - Cancer

Uncontrolled cell division and **growth** results in the formation of a **tumour** (mass of cells), these can be **BENIGN** or **MALIGNANT**, **not all** tumours are cancerous.

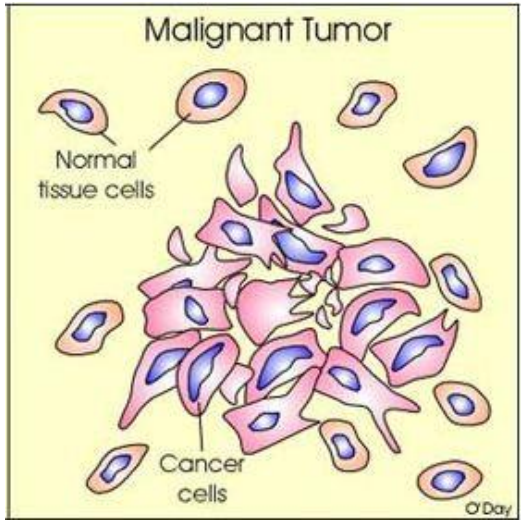
- **Benign tumours:**
  - Growths of abnormal cells
  - Contained in one area
  - Usually within a membrane surrounding the cells
  - They do not invade other parts of the body

  Video - Benign Brain Tumour



- **Malignant tumour (CANCER):**
  - Growths of abnormal cells
  - These are **cancerous**
  - Invade neighbouring tissues and spread to different parts of the body in the blood where they form secondary tumours
  - Can be caused by lifestyle or genes

  Video - What is Cancer?



Infectious diseases

Recall it …

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

1. What is a pathogen?
2. What are the differences between diseases spread by bacteria and those spread by viruses?
3. How are diseases spread?
4. What are the causes, symptoms, mode of transmission and method of transmission, and ways we can prevent

a) **Malaria** b) **Tobacco Mosaic Virus** c) **Measles** d) **Gonorrhoea** e) **Rose Black Spot** f)**Salmonella**

5. Describe the non-specific ways that the human body protects against disease?
6. Describe the three ways in which white blood cells work

Infection and Response part 1 – Infectious diseases

Pathogens are **micro organisms** that cause **infectious disease.**

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

Pathogens **depend** on the **host** to provide the suitable **conditions and nutrients** that they need to **grow and reproduce.**

Pathogens can be **bacteria, viruses, fungi** or **protists.**

Viral diseases

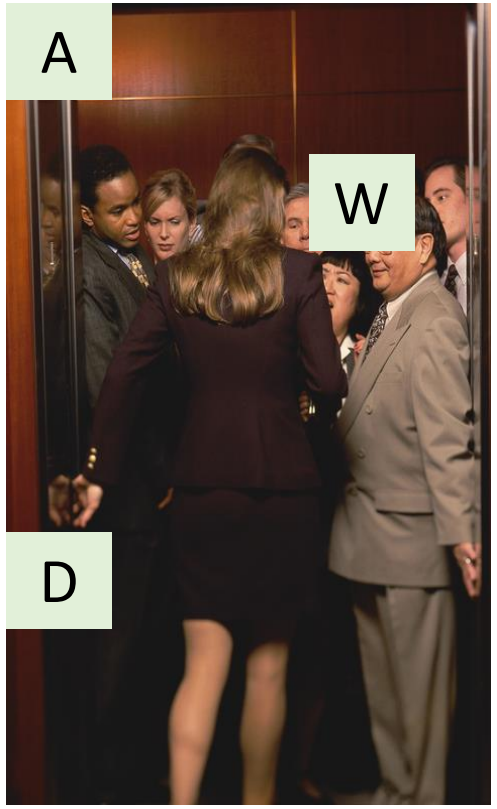
- **Viruses may reproduce rapidly**
- **Viruses live and reproduce inside cells causing damage**

Bacterial diseases

- **Bacteria may reproduce rapidly**
- **Bacteria may produce toxins that damage tissues and make us feel ill**

Infection and Response part 1 – Infectious diseases

Pathogens may **infect** **plants or animals** and can be **spread** by **direct contact (D), by water (W)** or **by air (A).**



Infection and Response part 1 – Viral diseases

Examples of Viral Diseases

Measles

- Symptoms of fever and a **red skin rash**
- Can be **fatal** if complications occur
- Spread by **inhaling** droplets containing the virus from sneezes and coughs
- It is controlled by vaccinating young children

HIV

- Initially causes a **flu-like** illness and spread by **sexual contact** or exchange of body fluids such as blood when drug users share needles
- Unless HIV is successfully controlled with **antiretroviral** drugs, the virus will attack the body's immune cells
- Late stage HIV or **AIDS** occurs when the body's immune system can no longer deal with other infections or cancers

Tobacco Mosaic virus

- Common plant virus which enters through a damaged epidermis
- Seen as a distinct **mosaic** discolouration pattern on the leaves
- Affects **growth** as **photosynthesis** cannot occur as efficiently
- Control by removing affected leaves and destroying pests which caused initial epidermal damage

Infection and Response part 1 – Bacterial diseases

Examples of Bacterial Diseases

Salmonella

- Salmonella food poisoning is spread by bacteria **ingested** in food or on food prepared in **unhygienic** conditions.
- Bacteria secrete **toxins** and cause symptoms including fever, abdominal cramps, diarrhoea and **vomiting.**
- In the UK, **poultry** are **vaccinated** against salmonella to **control** the spread of the disease.

Gonorrhoea

- Sexually transmitted disease **(STD)** caused by bacteria.
- Causes a thick yellow or **green discharge** from the **penis or vagina** and pain when urinating.
- Can be controlled with **antibiotics** or barrier methods of contraception such as a **condom.**
- Easily treated with the antibiotic **penicillin** until many **resistant bacterial** strains were found

Infection and Response part 1 – Fungal and Protist diseases

Example of a Fungal Disease

Rose Black Spot

- Purple or black spots develop on leaves
- Leaves often turn yellow and drop off
- **Photosynthesis** is reduced. Growth is affected as a result
- Fungal **spores spread** by wind or water
- Treat by **removing** infected leaves and burning them
- Spray with **fungicide** (a pesticide which is used to kill fungus)

Example of a Protist Disease

Malaria

- The malaria causing **protist** is spread by **mosquitoes** feeding on infected blood and then biting a human
- Mosquitoes are **vectors** as they pass on malaria but do not suffer themselves
- Symptoms include **recurrent fever** and malaria can be fatal
- Control the **spread** by preventing mosquitoes **breeding** and use mosquito **nets** to avoid being bitten

Infection and Response part 1 – Types of diseases

Disease	Symptom	Method of transmission	Control spread of disease by:	Caused by:
Malaria	Recurrent fever	By a vector from an infected person	Preventing breeding of mosquitoes or use of a net to prevent being bitten	**Protist**
Tobacco Mosaic Virus	Mosaic pattern on leaves	Enters via wounds in epidermis caused by pests	Remove infected leaves and control pests which are damaging leaves	**Virus**
Measles	Fever Red skin rash	Droplet infection from sneezes and coughs	Child Vaccination	**Virus**
Gonorrhoea	Green discharge from penis or vagina	Direct sexual contact or body fluids	Use of a condom and treat infected person with antibiotics	**Bacteria**
Rose Black Spot	Purple black spots on leaves	Spores carried via wind or water	Remove infected leaves and spray with pesticide	**Fungus**
Salmonella	Fever, cramp, vomiting, diarrhoea	Food prepared in unhygienic conditions or not cooked properly	Improve food hygiene, wash hands, vaccinate poultry, cook food thoroughly	**Bacteria**

Infection and Response part 1 – Human Defence Systems

The human body has several non specific ways of defending itself from pathogens getting in.

video

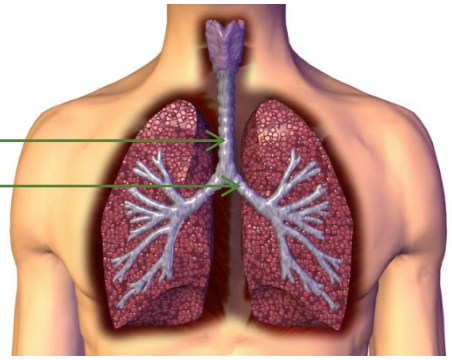
nose

Nasal hairs, sticky mucus and cilia prevent pathogens entering through the nostrils.

stomach

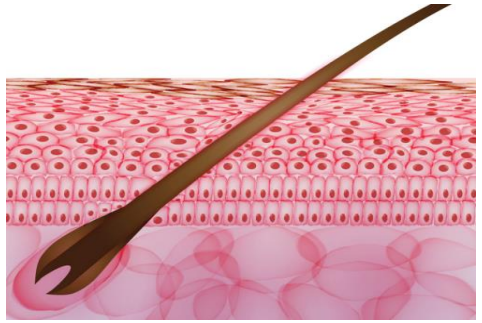
Stomach acid (pH1) kills most ingested pathogens

trachea
bronchus



Respiratory system is lined with mucus to trap dust and pathogens. Cilia move the mucus upwards to be swallowed.

skin



Hard to penetrate waterproof barrier. Glands secrete oil which kill microbes.

Infection and Response part 1 – Human Defence Systems

Sometimes pathogens gain entry to the body.
The **immune system** takes over to destroy them.
The **white blood cells** are part of the immune system. **Pathogens** are identified by white blood cells because they have different surface proteins. We call these surface proteins **antigens.**

White blood cells act in **3** ways to **defend** the body:

1. White blood cells (called **phagocytes**) engulf the pathogens and digest them. This is called **phagocytosis**. Video phagocytes
2. White blood cells (called **lymphocytes**) identify the **antigen** on the pathogen. They make **specific antibodies** to destroy the pathogens. This can take time and so an infection may occur. If a person is **infected again** by the same pathogen, the white blood cells make the **antibodies** much **faster.** Video lymphocytes
3. Bacteria may produce toxin (poison). White blood cells release specific **antitoxins** to **neutralise** the effect of the toxin.

Protection against disease

Recall it …

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

1. What is does a vaccine contain?
2. Describe how a vaccine works?
3. What is an antibiotic?
4. Why don’t antibiotics work on viruses?
5. How can bacteria become resistant to antibiotics?
6. When are painkillers used?
7. Do painkiller kill pathogens?
8. Where does penicillin come from?
9. Where does aspirin come from?
10. Where does digitalis come from?

Infection and Response part 1 – Vaccination

Communicable diseases can be dangerous leading to epidemics or pandemics. **Vaccination** can be used to **enhance** the immune system to reduce the chances of this happening. A vaccine contains a small amount of **dead or inactive** form of the pathogen that can be introduced into the body.

Lymphocyte

pathogen

White blood cells detect pathogens in the vaccine. → Antibodies are released into the blood. → Pathogens are destroyed by antibodies.

Infection and Response part 1 – Vaccination

If the body becomes **re-infected** with the same pathogen then the white blood cells are prepared.
The white blood cells can respond much more **quickly** and make **more** of the right type of **antibodies** much more quickly.

White blood cells detect pathogens. → Antibodies are made and released into the blood much faster and in larger amounts. → Pathogens are destroyed by the antibodies much faster.

This means that the person is **unlikely to suffer** the symptoms of the harmful disease.
Infection has been prevented by **enhancing** the immune system.

Infection and Response part 1 – Antibiotics

An **antibiotic** is a drug that helps to cure a bacterial disease by killing the infective bacteria **inside** the body.

Different bacterial infections need a **different** antibiotic.

Antibiotics **cannot** be used to **treat viral** pathogens.

Penicillin is a well known antibiotic medicine.

Using antibiotics has greatly **reduced** deaths.

It is difficult to develop **drugs** to kill **viruses** without harming body tissues because viruses live and reproduce inside cells.

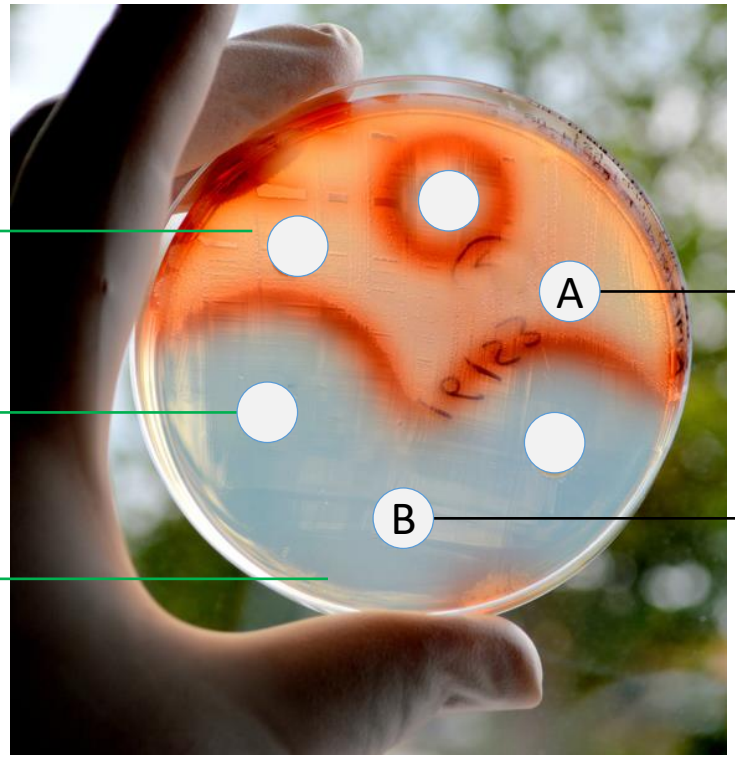
Infection and Response part 1 – Antibiotics

Bacteria can **mutate**.
Sometimes this makes them **resistant** to antibiotic drugs.
The **mutated** bacteria are **not killed**. Increasing numbers of different bacteria are becoming resistant and this is **of concern**.

Red = bacteria colonies

Disc soaked in antibiotic

Clear = no bacterial colonies



Bacteria are resistant to antibiotic A

Bacteria are killed by antibiotic B

Infection and Response part 1 — Painkillers

A doctor will **not prescribe** antibiotics for a **viral infection** as they do not work.

Antibiotics can only be used for **bacterial infections**

Painkillers, steroids or anti inflammatory medicines can be used to **relieve** the **symptoms** of viral infections. Symptoms may include: fever, muscle ache, headache or a runny nose.

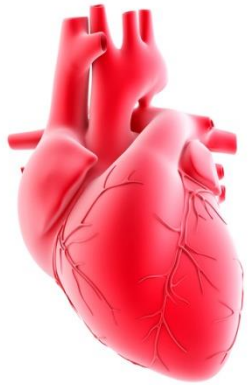
Painkillers **do not** kill pathogens.

Infection and Response part 2 – Discovery & drug development

Traditionally drugs were extracted from plants and micro-organisms. video

Aspirin is a painkiller and anti-inflammatory drug. This was first found in **willow bark**.

Foxglove plants have been a source of the drug digitalis which acts on the **heart**.



Alexander Fleming is famous for discovering ***Penicillium*** mould.

Fleming noticed the fungus on unwashed equipment and went on to discover its antibiotic properties.

Drug Development

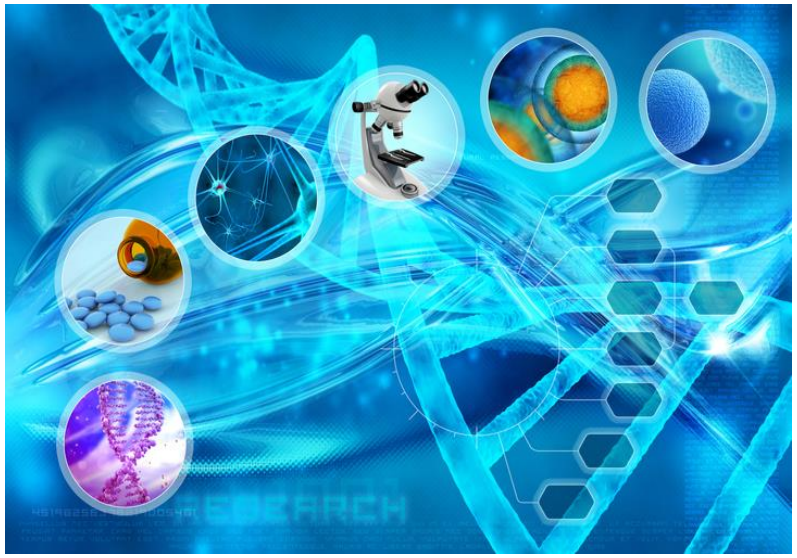
Recall it …

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

1. What is meant by a drugs a) efficacy b) toxicity c) dose
2. How are drugs tested before a clinical trial?
3. Describe the four stages of a clinical trial?
4. What is a placebo?
5. What is a double blind trial ?
6. What is the advantage of a double blind trial?

Infection and Response part 2 – Development of drugs

Most **new drugs** are **developed** and **synthesised (made)** in a laboratory by chemists in the pharmaceutical industry. The initial chemical may have been sourced from a plant.



New drugs must be tested and trialled to check:

- ✓ **Efficacy** - that the drugs work
- ✓ **Toxicity** - that the drug is not poisonous
- ✓ **Dose** - the most suitable **amount** to take

Preclinical tests must be carried out before humans are allowed to take the drug.

These preclinical tests are done on **cells**, **tissue** samples and live **animals**.

Infection and Response part 2 – Drug development

If successful the new drug will proceed to a **clinical trial**.

The stages of a clinical trial are:

Stage 1

- Healthy volunteers try small doses of the drug to check it is **safe** and has **no side effects**

Stage 2

- A small number of **patients** try the drug at a **low dose** to see if it works

Stage 3

- A larger number of patients take the new drug and different doses are trialled to find the **optimum dose**

Stage 4

- **A double blind trial** will occur to see how effective the new drug is. The patients are divided into groups

video

Infection and Response part 2 – Drug development

A **double blind trial** is carried out on **patients** who **have** the **disease** to make sure that it is actually the drug which is having an effect on the patients and not anything else.

The details of everyone taking part in the trial is entered into a computer database. The computer groups people **randomly**.

Each person receives a unique code and they receive the medicine which is labelled with the matching code.

No-one knows who is receiving the real drug or a **placebo** until the end of the trial.

The **placebo** is often the drug the patient was originally taking so they still receive medical treatment.

Photosynthesis

Recall it …

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

1. What is photosynthesis?
2. Why is photosynthesis an endothermic reaction?
3. Give the word and balanced symbol equation for photosynthesis?
4. What is a limiting factor?
5. Sketch a graph and describe how the following factors affect the rate of photosynthesis

a) Carbon dioxide concentration
b) Light intensity
c) Temperature

6. What does chlorophyll do? What is a variegated leaf?
7. Describe six ways in which the glucose produced by photosynthesis is used?

Bioenergetics part 1 – Photosynthetic reaction

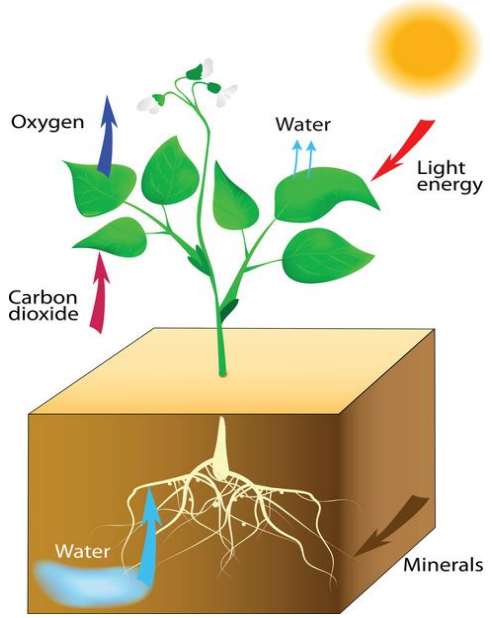
Plants make use of the **Sun's energy** to make **food** (glucose)

This process is called **photosynthesis.**

photo = light **synthesis** = to make

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

This is an **endothermic** reaction because photosynthesis needs an input of energy from the environment.



Bioenergetics part 1 – Photosynthetic reaction

The **word equation** which represents photosynthesis is:

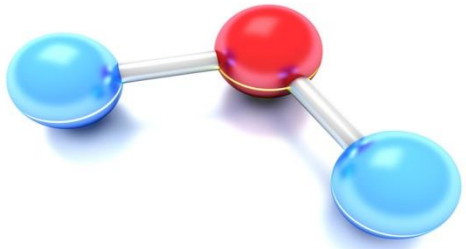
carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

The balanced **symbol equation** which represents photosynthesis is:

$$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$$

Molecule name	Chemical Symbol
Carbon dioxide	**CO_2**
Water	**H_2O**
Oxygen	**O_2**
Glucose	**$C_6H_{12}O_6$**

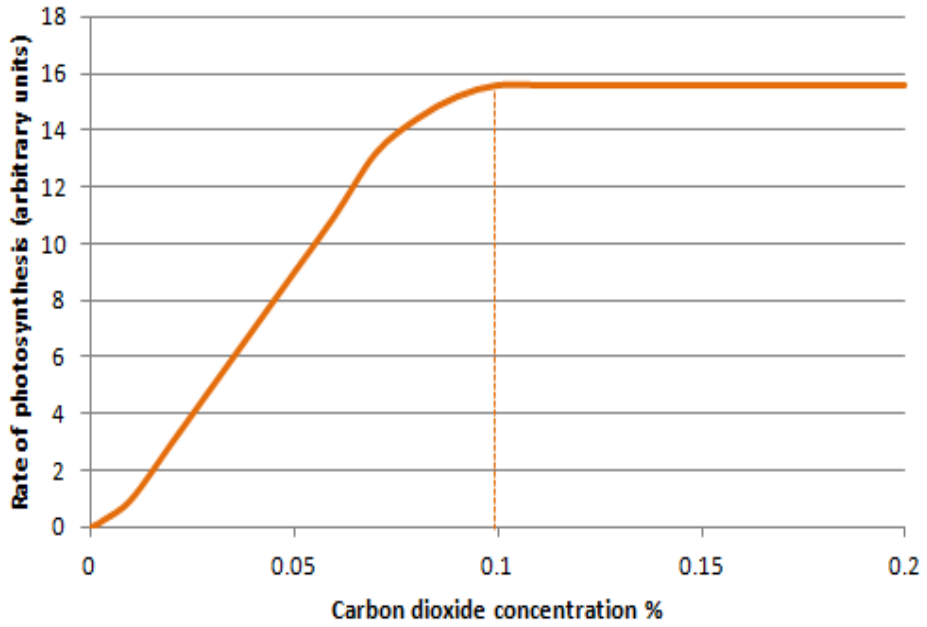
You need to be able to recognise the chemical symbols for these molecules.



Video - Van Helmont's experiments

Carbon dioxide is one of the **reactants** 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.

$$\textit{Carbon dioxide} + \text{Water} \xrightarrow{\text{light}} \text{Oxygen} + \text{Glucose}$$

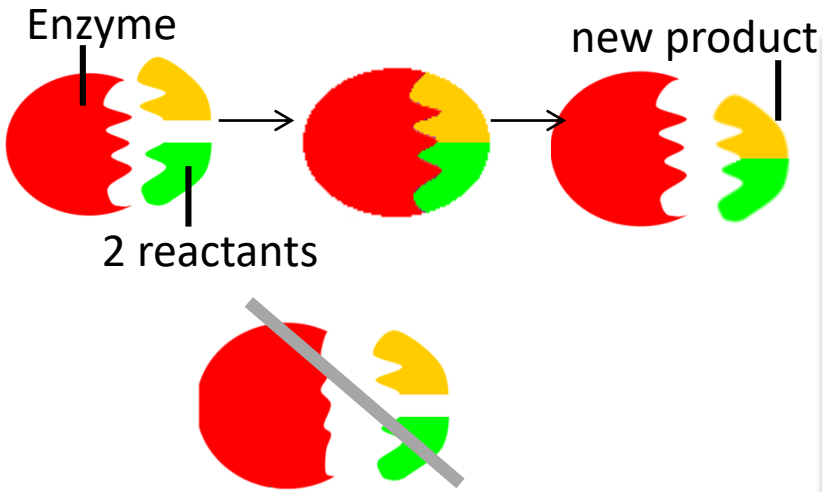


For this plant, the **maximum rate** of photosynthesis is achieved at a concentration of **0.1%** carbon dioxide.

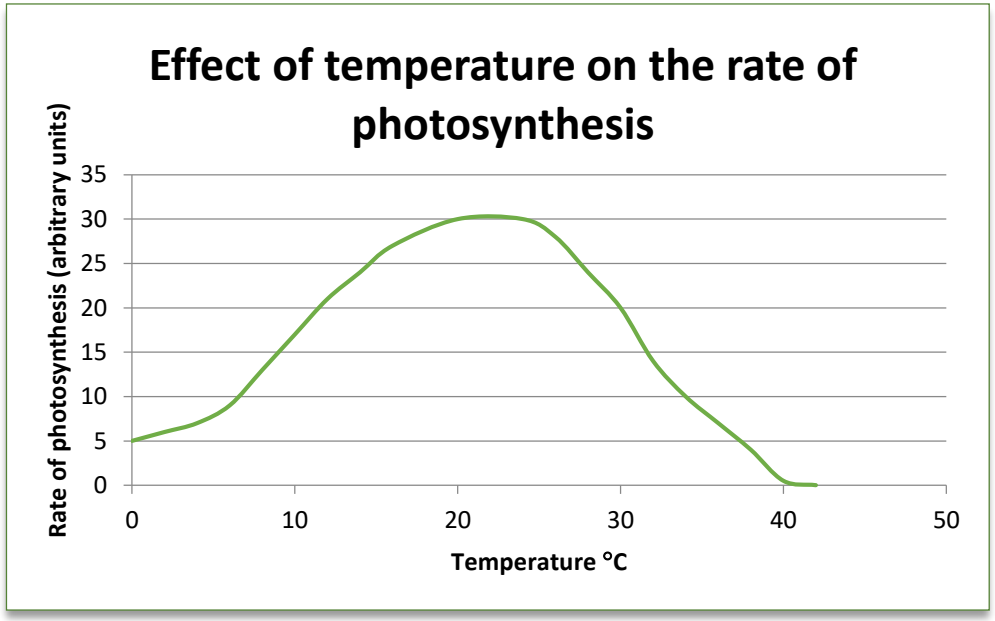
Another factor is now preventing the rate of photosynthesis from increasing. This is called a **limiting factor.**

Possible limiting factors could be **light intensity**, **temperature** or amount of **chlorophyll**.

Temperature affects the rate of all chemical reactions including photosynthesis. As the environment warms up, chemical reactions speed up. 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.
Temperature is a limiting factor of photosynthesis.



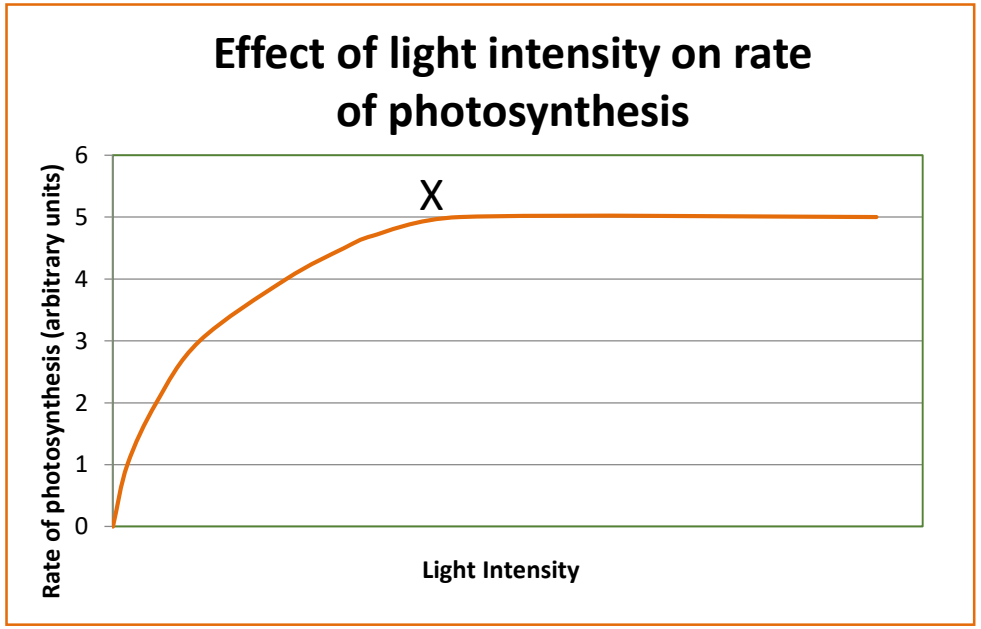
As temperature rises the enzyme is denatured. The active site is damaged so no reaction can occur.



Bioenergetics part 1 – Rate of photosynthesis

The **amount of light** a plant receives affects the rate of photosynthesis. Plants found in areas of lower light do not tend to grow as tall.
Light intensity decreases as the distance between the plant and the light source increases.

The graph shows that as **light intensity increases** so does the **rate** of photosynthesis up to a point. At **point X** another **factor** is **limiting** the rate of photosynthesis. This could be carbon dioxide concentration, temperature or amount of chlorophyll.
Light intensity is a limiting factor.

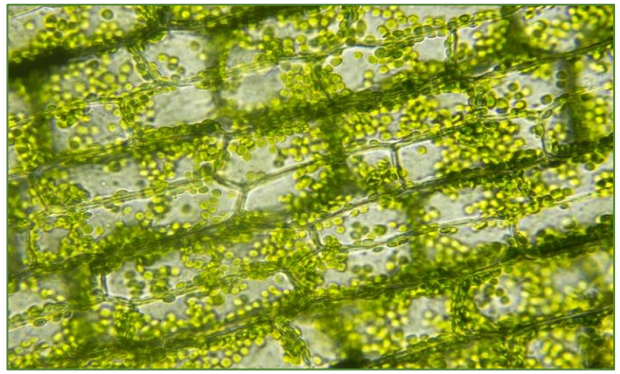


Bioenergetics part 1 – Rate of photosynthesis

If sunlight shines onto water and carbon dioxide, a reaction will **not** occur.
The energy must be transferred from the environment, to the **chlorophyll,** by light.

This energy is used to convert carbon dioxide and water into glucose and oxygen.
Chlorophyll is **essential** to the process of photosynthesis.

If there is a **reduction** in the amount of chlorophyll available to the plant then the amount of glucose made by photosynthesis will reduce. The plant will not grow as well.



Variegated leaves are white and green.
The white areas do not have any chlorophyll.

Bioenergetics part 1 – Use of glucose from photosynthesis

All living cells need energy. This energy is released from glucose by a process called respiration.

Uses of glucose made from photosynthesis

To produce **cellulose** which strengthens plant cell walls.

To be converted into insoluble starch for storage inside cells or special areas like roots or bulbs.

To be converted into **amino acids** for protein synthesis.
Glucose is combined with **nitrate** ions absorbed from the soil.
Specific amino acids join in long chains to make a named **protein**.

To produce **fat or oil** for storage.
Seeds and nuts contain lots of fat or oil as an energy store.