Whitley Academy

Biology Paper 1 (H) Knowledge Recall Booklet

Paper Biology 1H   8464/B/1H

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
- 4.4.1 Photosynthesis

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

- Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
- Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme.
- 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 – 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
 IODINE SOLUTION	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	 BIURET'S SOLUTION	Protein	1.) Add Biuret's to the solution/ suspension to be tested and look for a colour change.	Turns purple with protein
 BENEDICT'S SOLUTION	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)	 Sudan III	Lipid (Fats)	Grind food with water in a pestle and mortar Add 3 drops of Sudan II Shake gently	A red layer appears

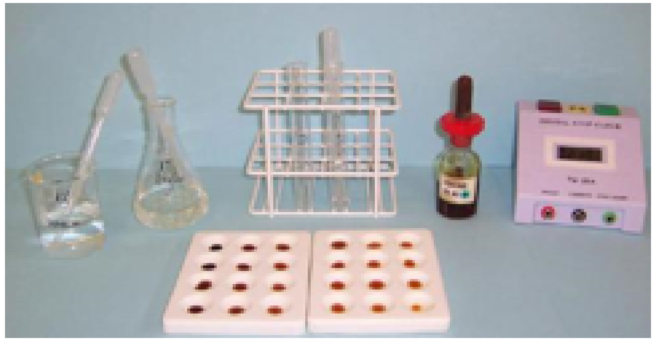
Required Practical – Food test

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: Effect of pH on Amylase digestion



Scientific Background

- Amylase is an enzyme found in the salivary glands and small intestine. It breaks down starch into sugars
- Starch turns iodine blue/black. If starch is not present the iodine remains brown
- Amylase will have an optimum pH. This is the pH at which it breaks down starch the quickest

a. State the Independent, Dependent and Control Variables

Independent Variable = pH

Dependent Variable =Time taken for amylase to break down starch to glucose

Control Variables = volume of amylase, volume of starch, volume of pH solution.

Method

1. Place single drops of iodine solution in rows on the tile.
2. In a test tube rack Label 5 test tubes with the pHs to be tested
3. Use the syringe to place 2 cm^3 of 1% amylase into the test tube.
4. Add 1 cm^3 of the required pH solution to each test tube using a syringe.
5. Place the rack with your test tubes in water bath and leave for a few moments so they can come up to the required temperature
6. Use another syringe to add 2 cm^3 of starch to the amylase/ buffer solution to the first test tube only, start the stop clock and leave it on throughout the test. Mix using a plastic pipette.
7. After 30 seconds, use the plastic pipette to place one drop of the mixture on the first drop of iodine. The iodine solution should turn blue-black. If the iodine solution remains yellow the reaction is going too fast and the starch has already been broken down. Squirt the rest of the solution in the pipette back into the test tube.
8. Wait another 30 seconds. Then remove a second drop of the mixture to add to the next drop of iodine.
9. Repeat step 7 until the iodine solution and the amylase/ pH/ starch mixture remain yellow.
10. Count how many iodine drops you have used, each one equaling 10 seconds of reaction time.
11. Repeat from step 6 for the second pH and so on
12. Record your results in the table that you have drawn. You can obtain three sets of data for this investigation by obtaining the data from two other groups.

Table 1

pH	Time when no starch was detected in minutes
5.0	7.0
5.5	4.5
6.0	3.0
6.5	2.0
7.0	1.5
7.5	1.5
8.0	2.0

The optimum pH is 7.0-7.5 because that is the shortest time for when there in no starch (iodine solution goes orange / brown).

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?

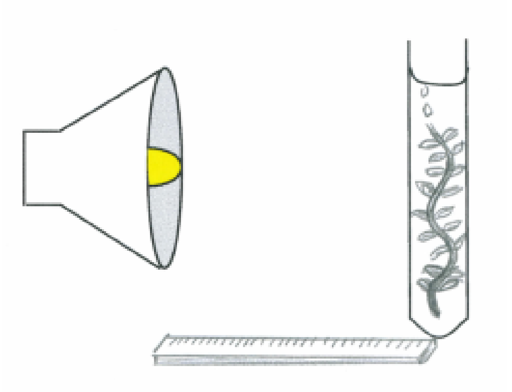
Required Practical – How does light intensity affect the rate of photosynthesis

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.

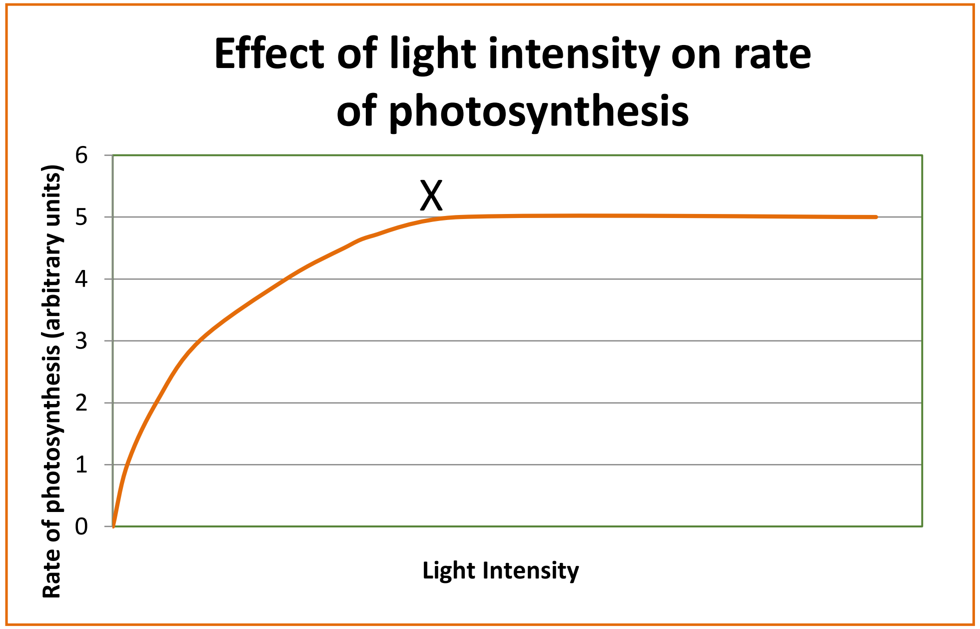


Why is an LED lamp used?
LED lamps produce less heat and this reduces the effect of temperature on the experiment.

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.



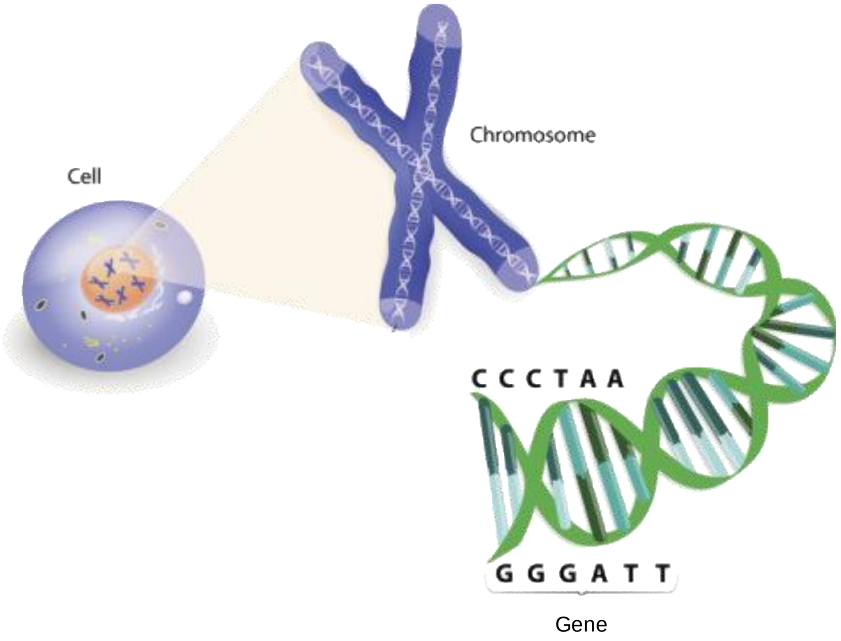
Cell Division

Recall it ...

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

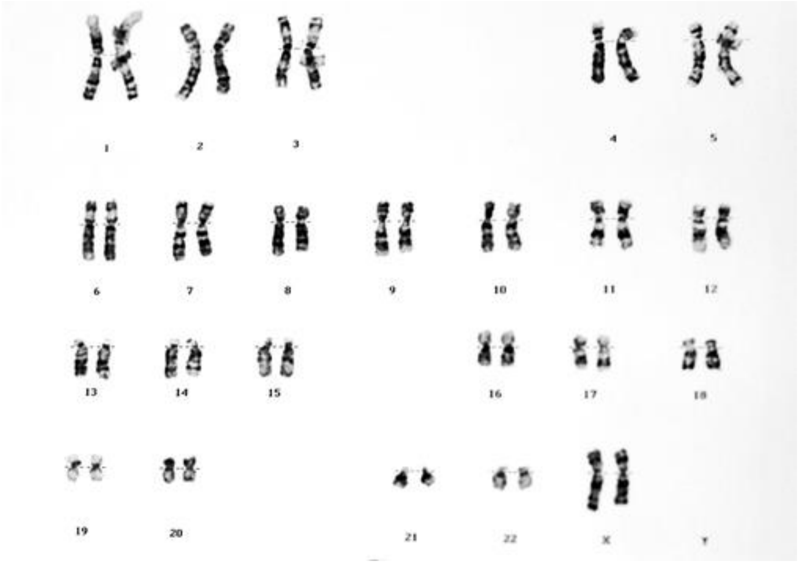
1. What are does a nucleus contain?
2. What are chromosomes?
3. How many chromosomes are there in the body cells and sex cells?
4. What is a gene?
5. What is DNA?
6. Describe the three stages of the cell cycle?

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.

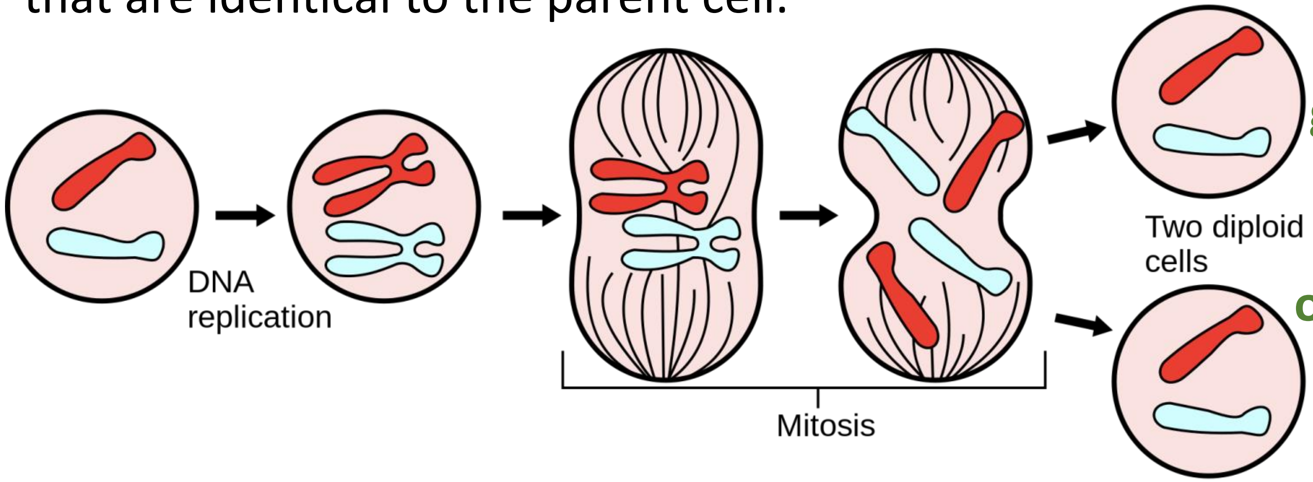
Cell division - Mitosis and the cell cycle

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 …

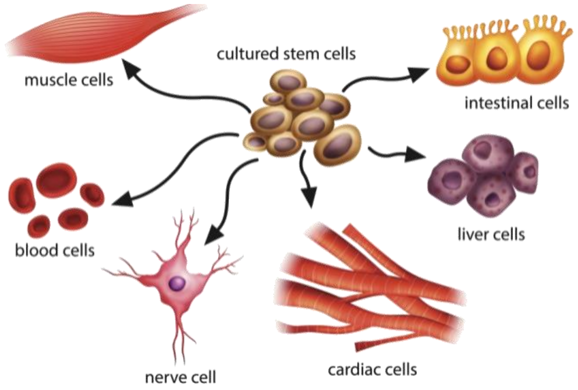
Use the information in the following page(s) to answer these questions …

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.

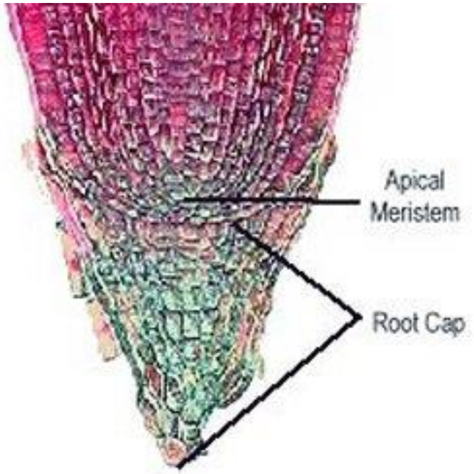
Human embryo stem cells: can be cloned and made to **differentiate** into **most** different types of human cells.
Human adult stem cells: can form **many** (but not all) types of cells including blood cells.
Human stem cells can be used to help treat diseases like diabetes and paralysis.



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

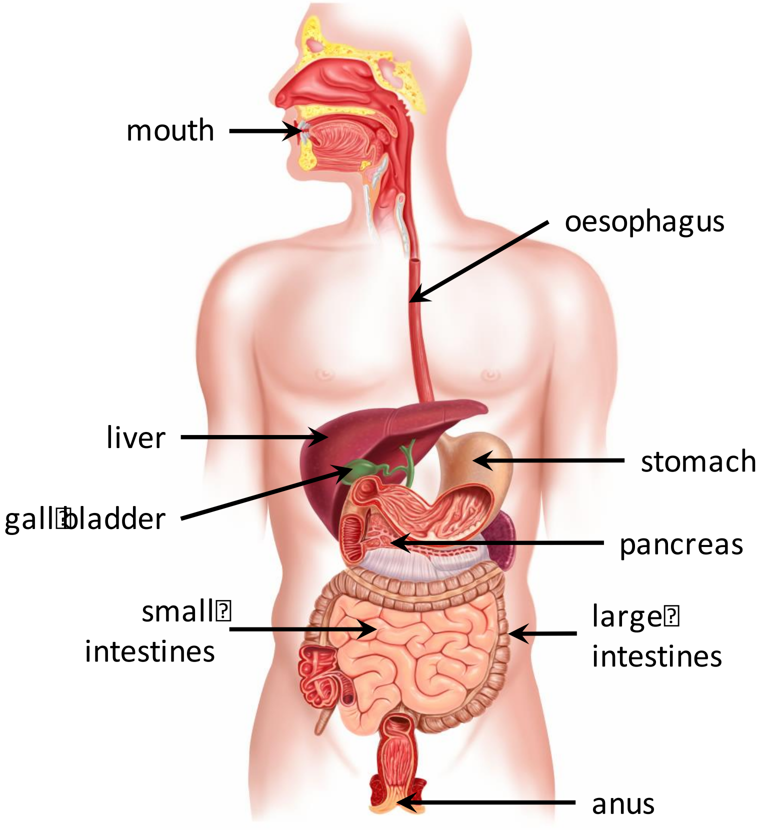
Recall it …

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.



[Video - Digestion and Enzymes]

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).

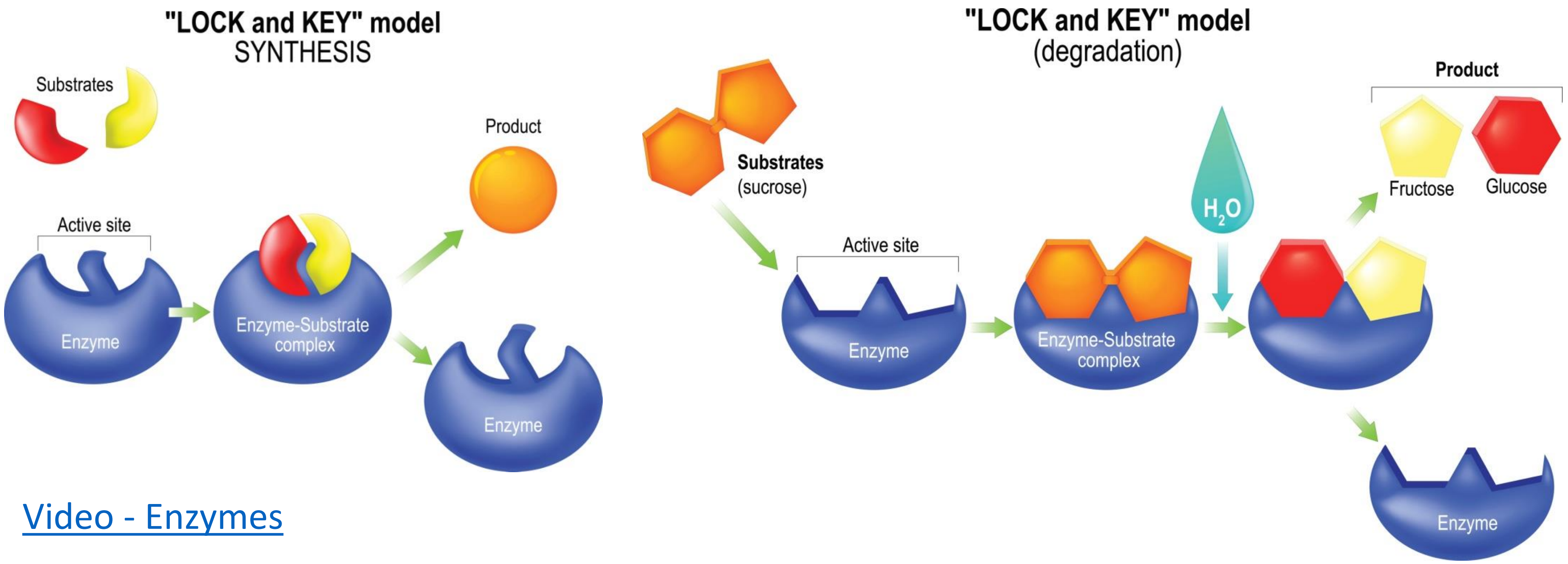
[Activity - Digestive Enzymes]

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

[PiXL - Required Practical Guide Food Tests]

‘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 …

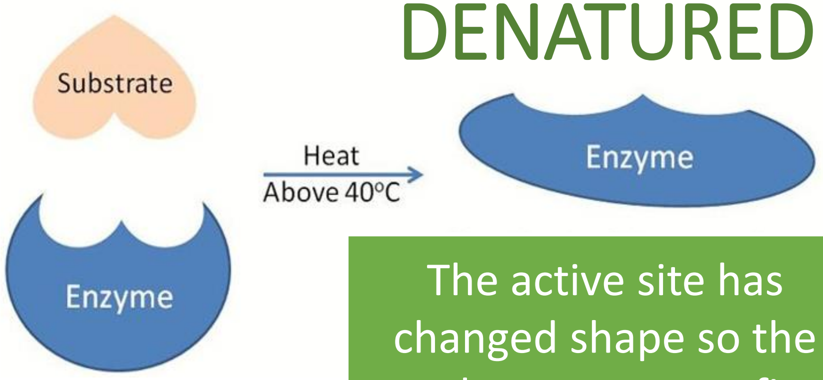
1. Where is bile made? Where is it stored?
2. Describe what bile does?
3. Name two factors that affect enzyme activity?
4. Explain how temperature affects enzyme activity?
5. Explain how pH affects enzyme activity?

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)

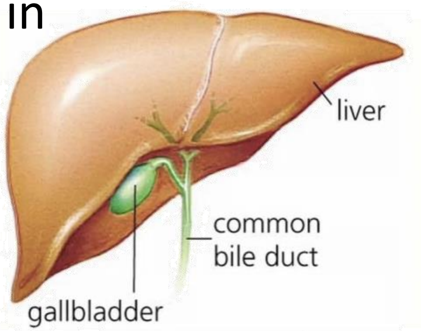
DENATURED



The active site has changed shape so the substrate cannot fit

Digestion and **pH. The 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 …

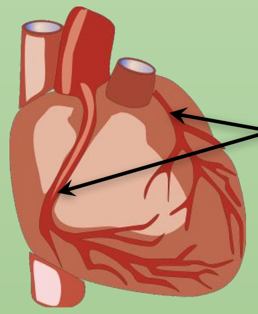
1. Sketch a diagram of the heart, labelling the chambers and blood vessels?
2. What is double circulation?
3. What is the pacemaker? Where is the pacemaker?
4. What are coronary arteries?
5. Describe what happens at the lungs?
6. Describe the structure and function of arteries?
7. Describe the structure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

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

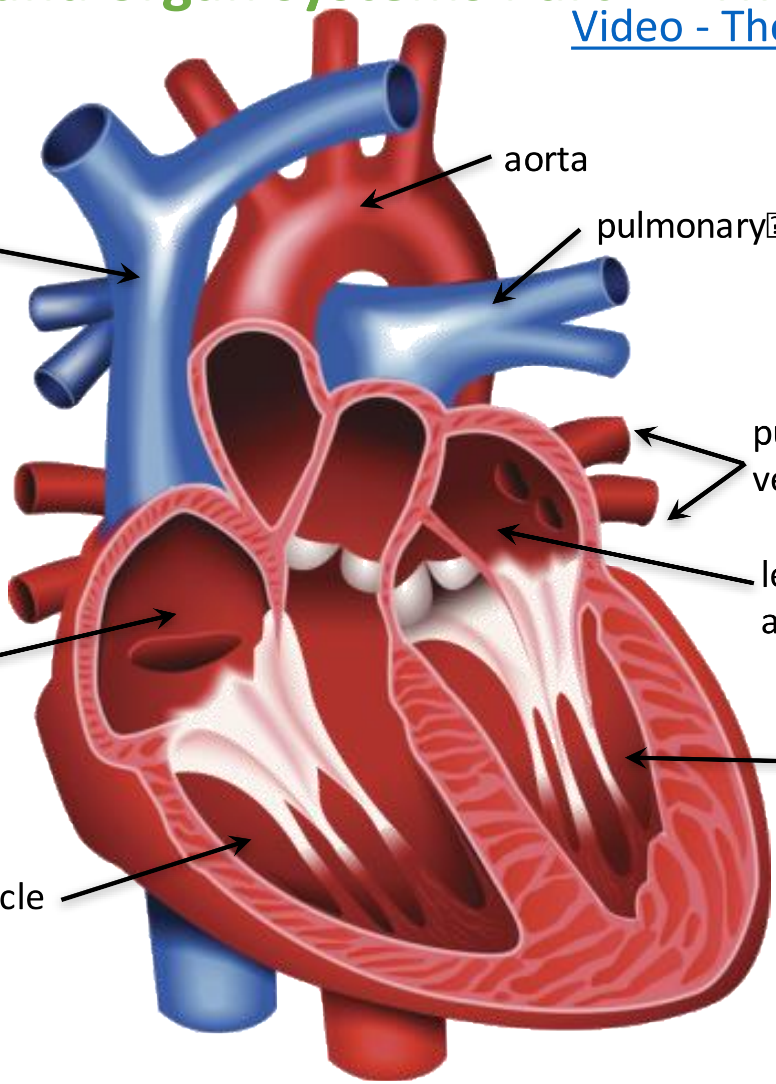
[Video - The heart]

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.

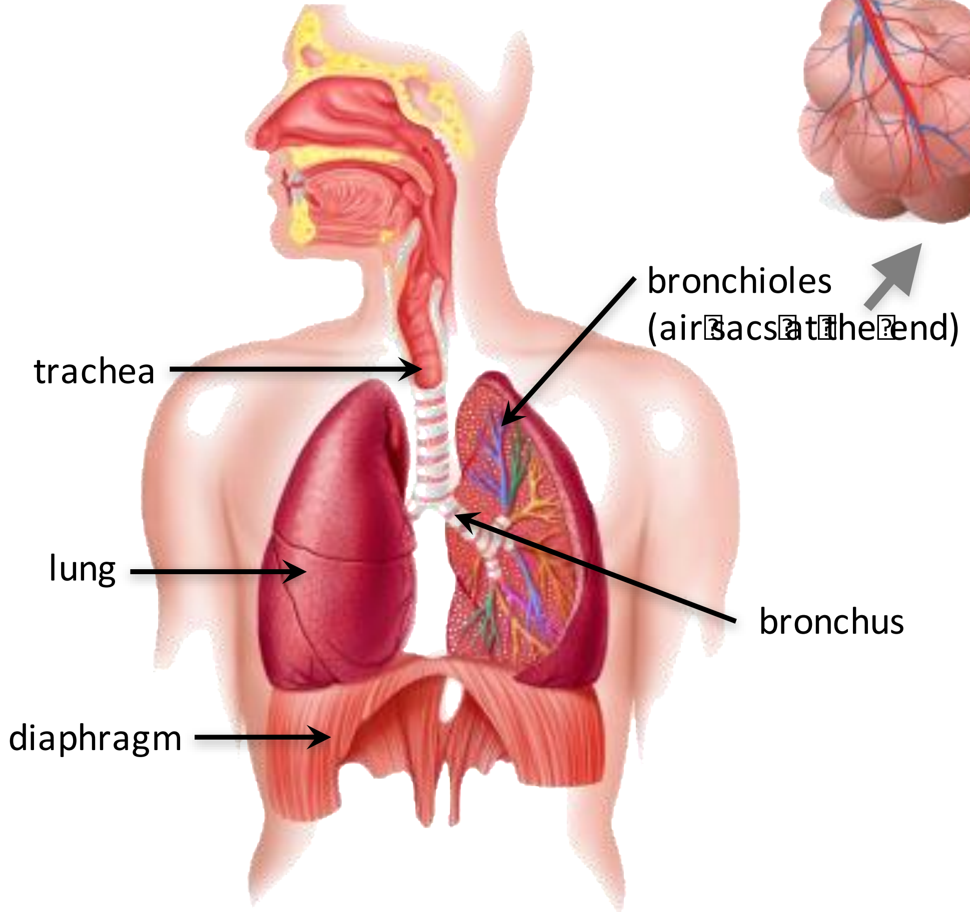


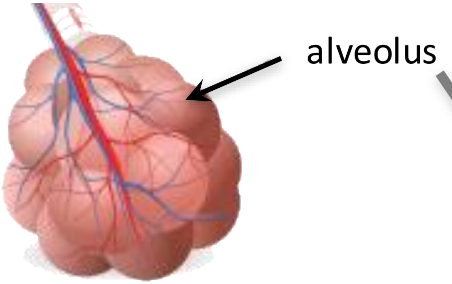
Coronary arteries supply **oxygen** rich blood to the heart **muscle.**



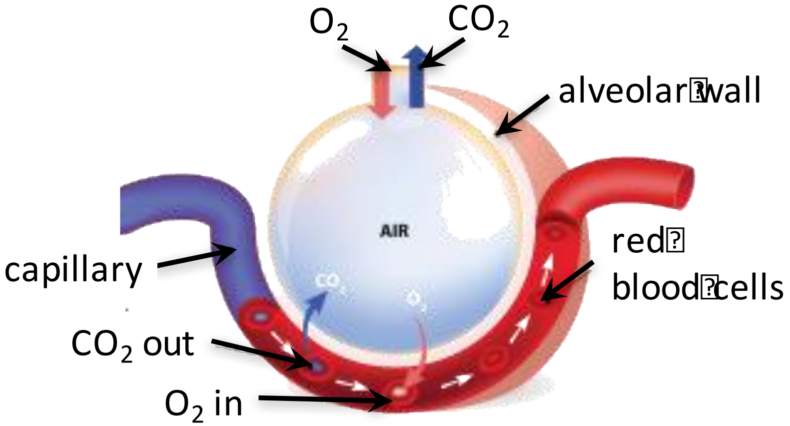
The **natural resting heart rate** is **controlled** by a group of cells in the **right atrium (pacemaker)**. Artificial **electrical** pacemakers are used to **correct irregularities** in the heart rate.

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





[Video - Lungs]

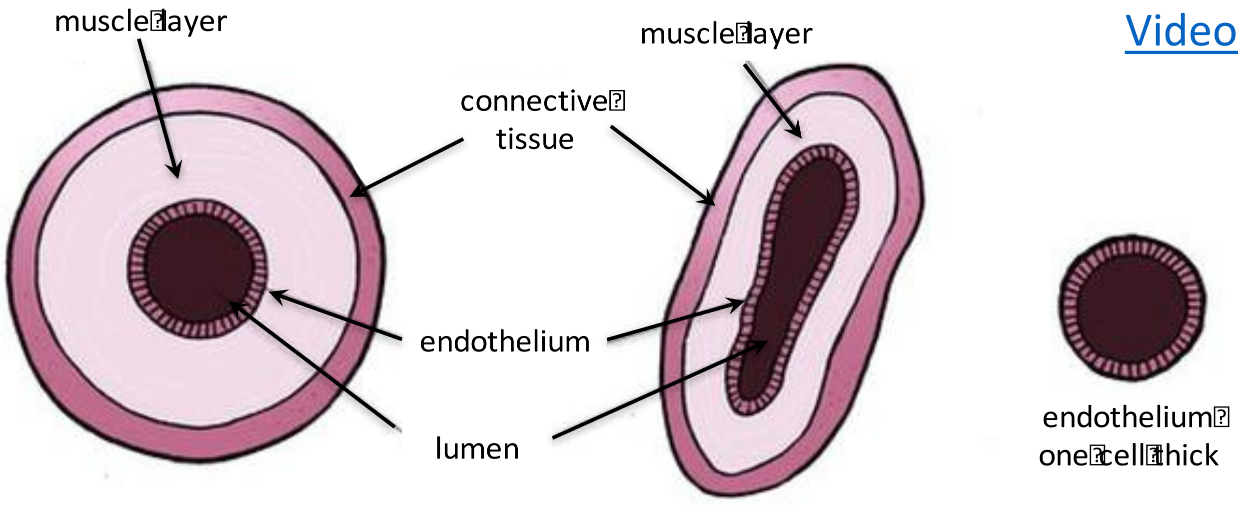


gas exchange in an alveolus

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

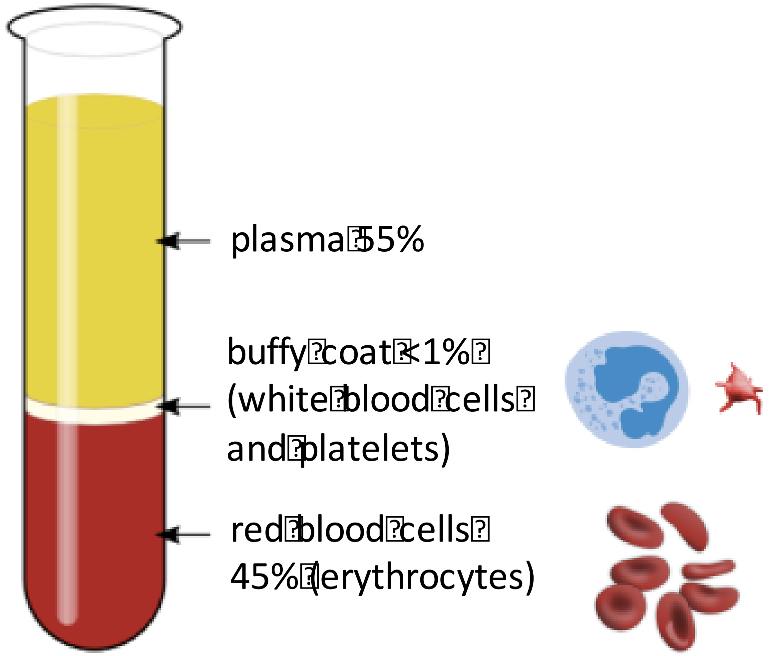
Recall it ...

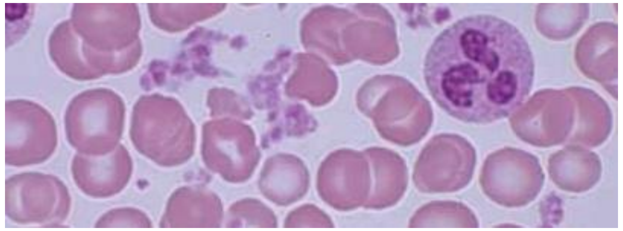
Use the information in the following page(s) to answer these questions …

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

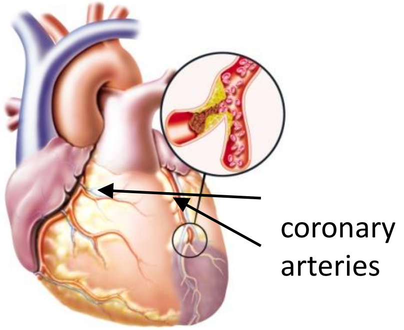
- they have a **large surface area to volume ratio** for faster diffusion of oxygen

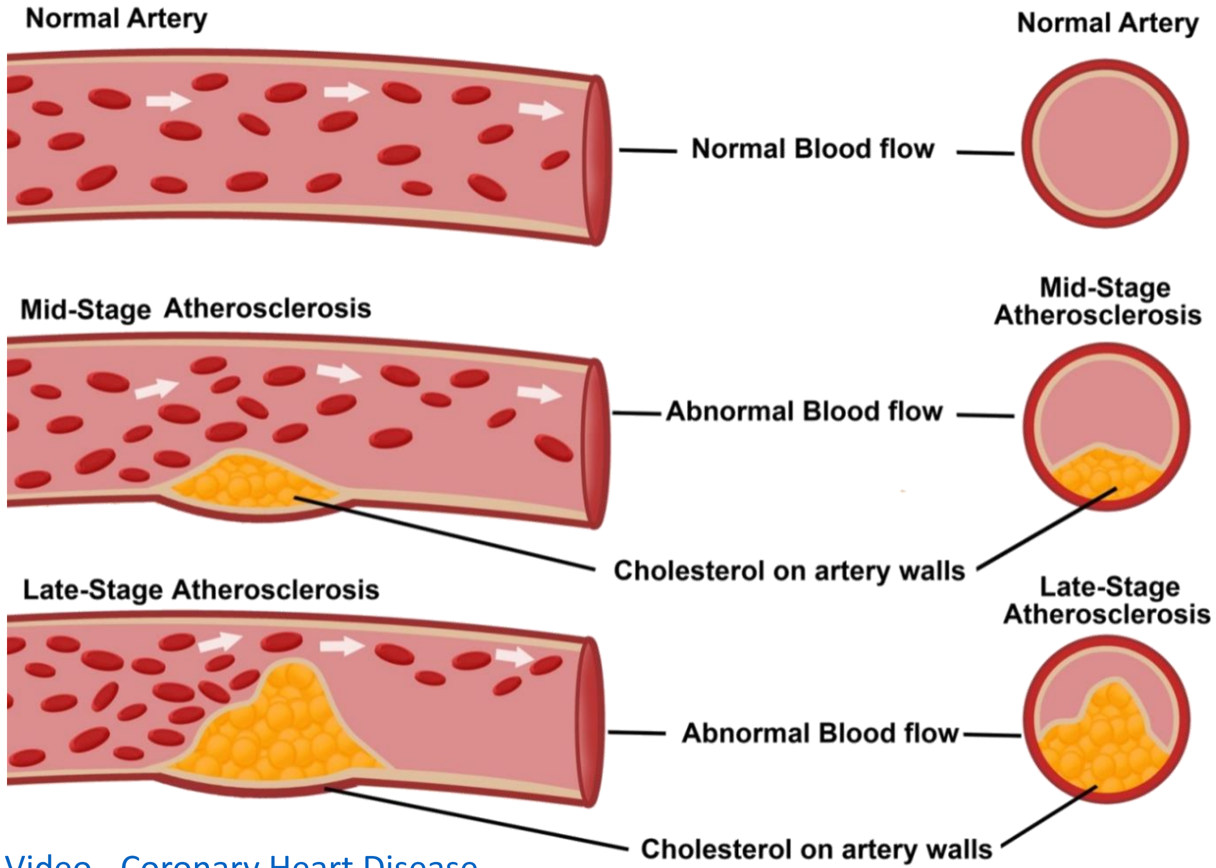
White blood cells - An important part of the **immune** system, some produce **antibodies** (proteins that bind to microbes and destroy them) and others surround and **engulf** foreign cells, all have a nucleus.

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.**





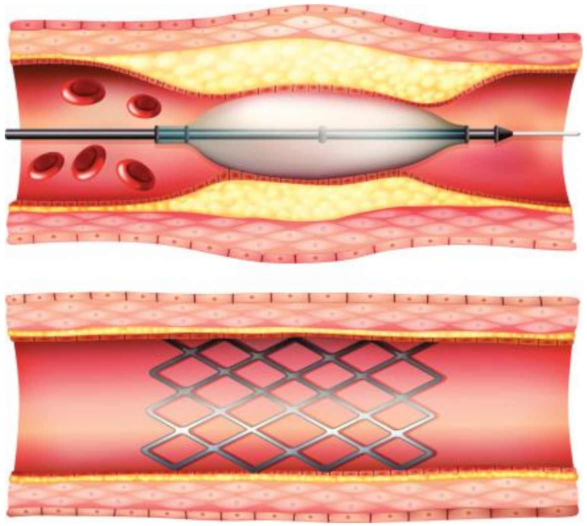
Risk factors for CHD:

- **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.

[Video - Coronary Heart Disease]

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**.

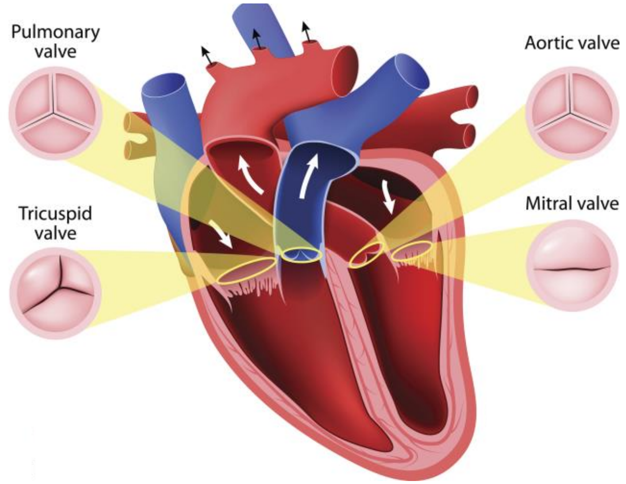
Symptoms can include:

- 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?

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.

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**

HAZARD → **RISK FACTOR** → **HARM**

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

RISK FACTOR: The combination of the chances of the hazard causing harm and the severity of that harm

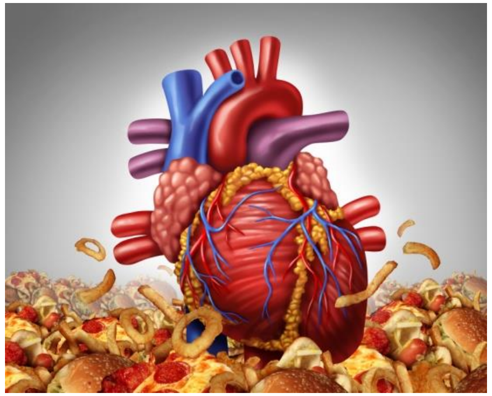
HARM: The damage to health or a disease that can occur

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)

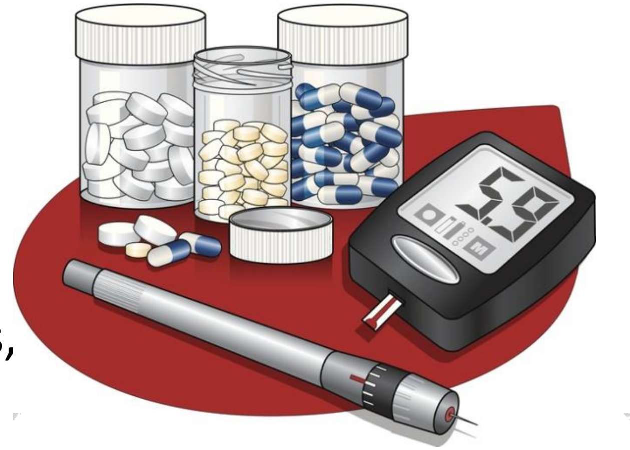
- **Smoking** – tobacco smoke **damages** the lining of the arteries leading to atherosclerosis, **carbon monoxide** in tobacco smoke reduces the amount of oxygen in the blood so the heart has to pump harder, the **nicotine** in tobacco smoke causes the heart to beat faster and raises blood pressure

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

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

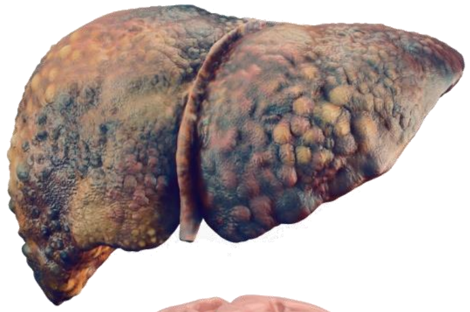
Some **RISK FACTORS** have been found to directly **cause disease.**

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

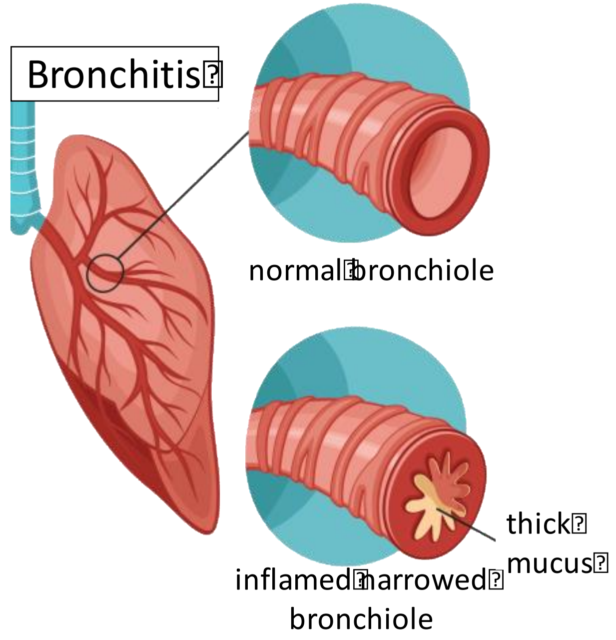
Some **RISK FACTORS** have been found to directly **cause disease.**

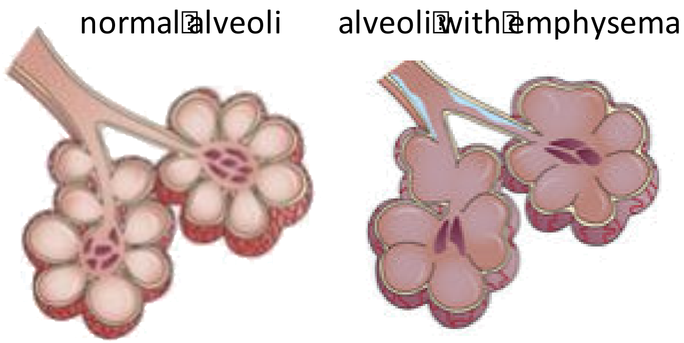
SMOKING is a risk factor for Lung disease:

- **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]

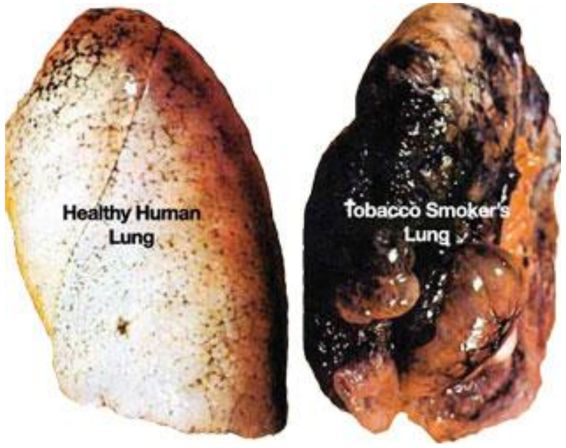
Animal tissues, organs and organ systems Part 3 - Some causes of non-communicable diseases

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.

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:

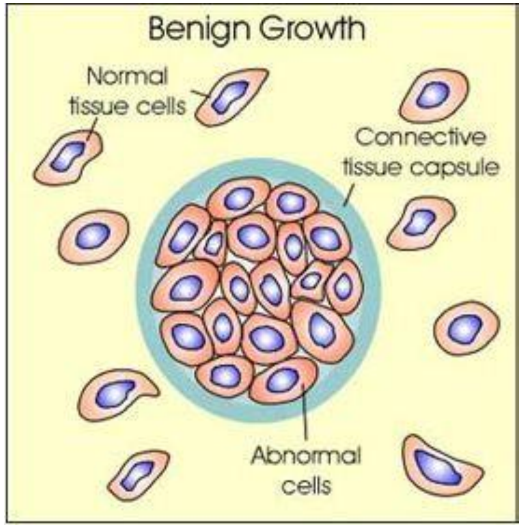
- **Carcinogen** - a **substance** or form of **radiation** that can **cause cancer**. Some carcinogens cause cancer by damaging the DNA directly, others can speed up cell division making mutations more likely
- **Tobacco -** smoke can cause cancers in the lungs, oesophagus, larynx (voice box), mouth, 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.

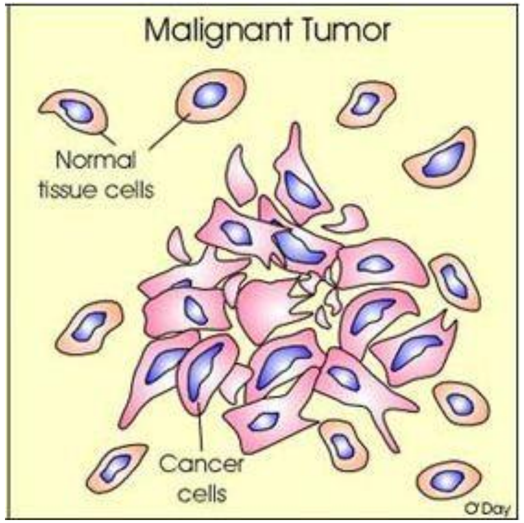
- **Benign tumours:**
  - Growths of abnormal cells
  - Contained in one area
  - Usually within a membrane surrounding the cells
  - They do not invade other parts of the body

  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?



Recall it … Photosynthesis

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. Why may very high intensities slow the rate of photosynthesis?
7. What is the inverse square law? How does it apply to light intensity and photosynthesis?
8. What does chlorophyll do? What is a variegated leaf?
9. Describe six ways in which the glucose produced by photosynthesis is used?

Bioenergetics part 1 – Photosynthetic reaction

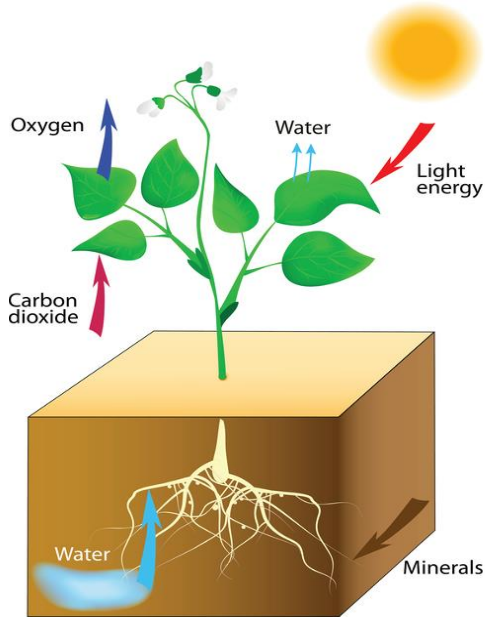
Plants make use of the **Sun's energy** to make **food** (glucose)

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:

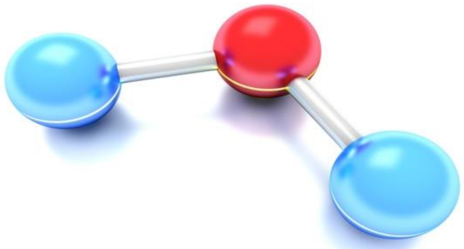
carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

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	$C_6H_{12}O_6$

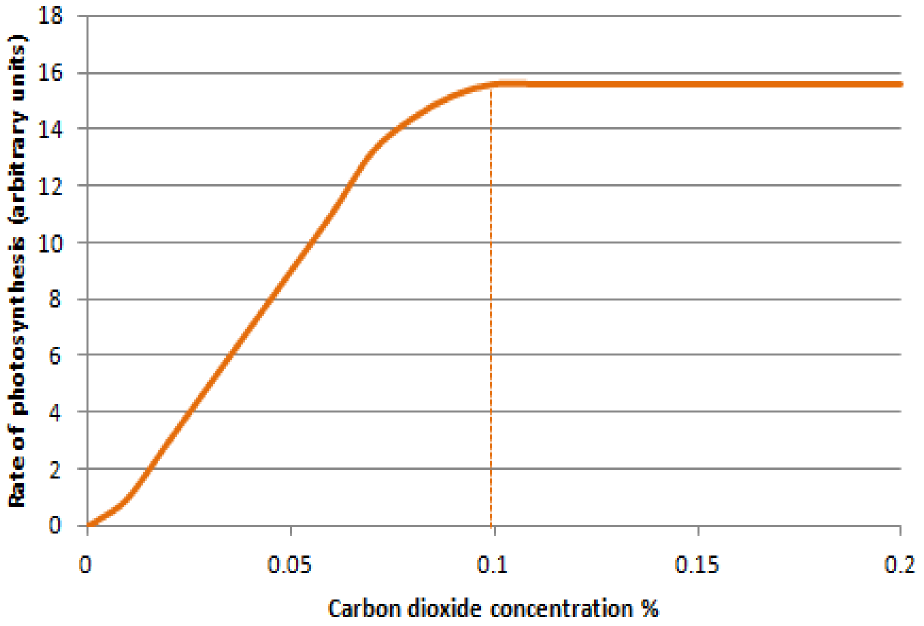
You need to be able to recognise the chemical symbols for these molecules.



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.

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

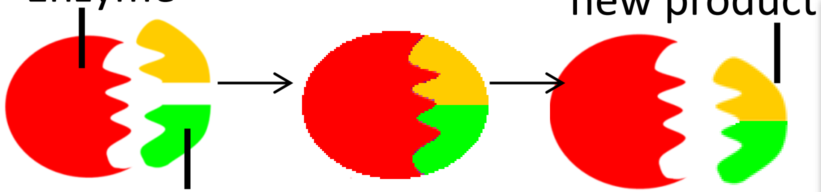


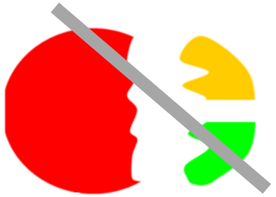
For this plant, the **maximum rate** of photosynthesis is achieved at a concentration of **0.1%** carbon dioxide.

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

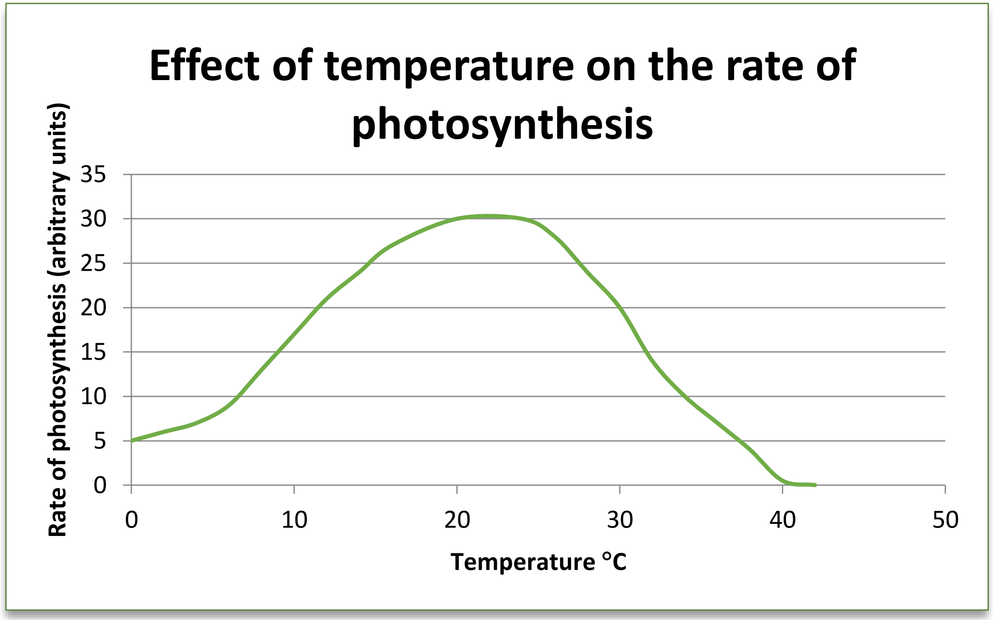
Possible limiting factors could be **light intensity, temperature** or amount of **chlorophyll**.

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.



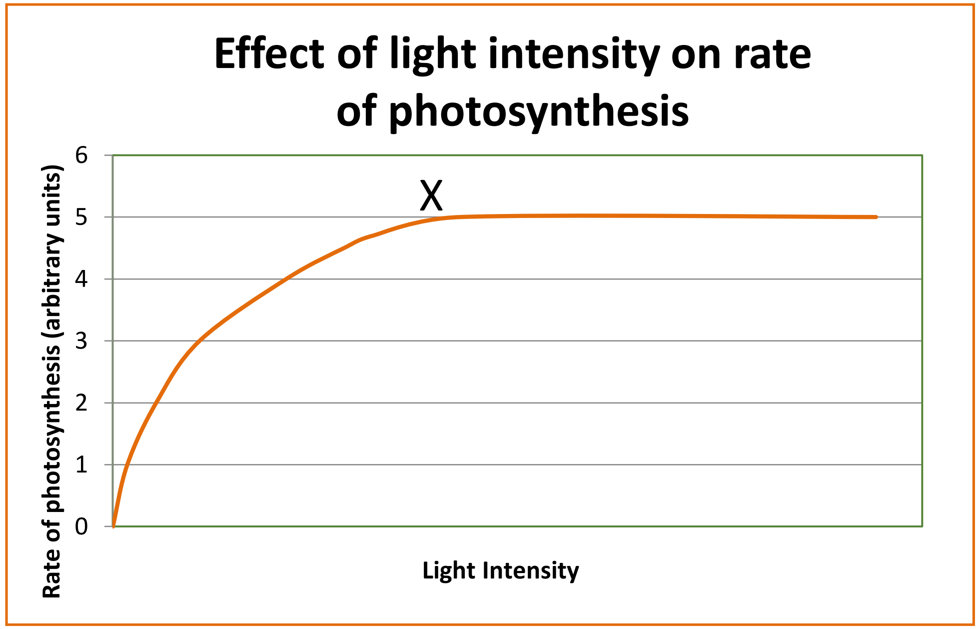
Bioenergetics part 1 – Rate of photosynthesis

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.

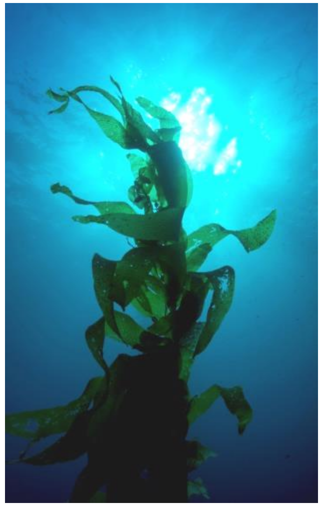


Bioenergetics part 1 – Rate of photosynthesis HT only

Light is **a limiting factor** when the light intensity is too low, but very **high light intensities** may slow the rate of photosynthesis too. This may be caused by:

a) **saturation** of the **active sites** in the enzymes catalysing the reactions,

b) bleaching of chlorophyll.



Light intensity obeys the **inverse square** law. This means if you **double the distance** between the plant and the light source you **quarter the light intensity.**

To calculate light intensity use the formula:

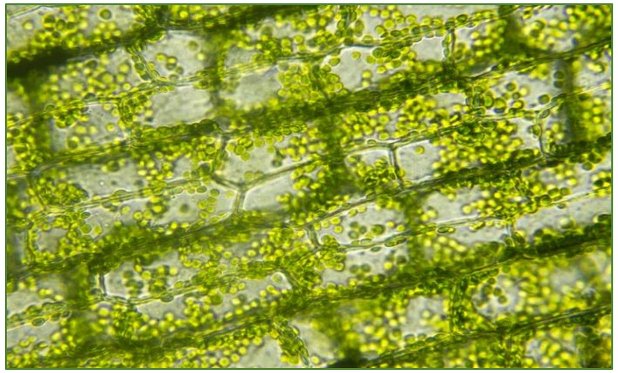
Light Intensity = 1/distance^2

Distance (d) of lamp from pond weed (m)	0.4	0.2
Light Intensity $1/d^2$	**d^2 = 0.4 x 0.4 =0.16** **$1/d^2$ = 1/0.16 = 6.25**	**25**

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.

More Photosynthesis (Higher)

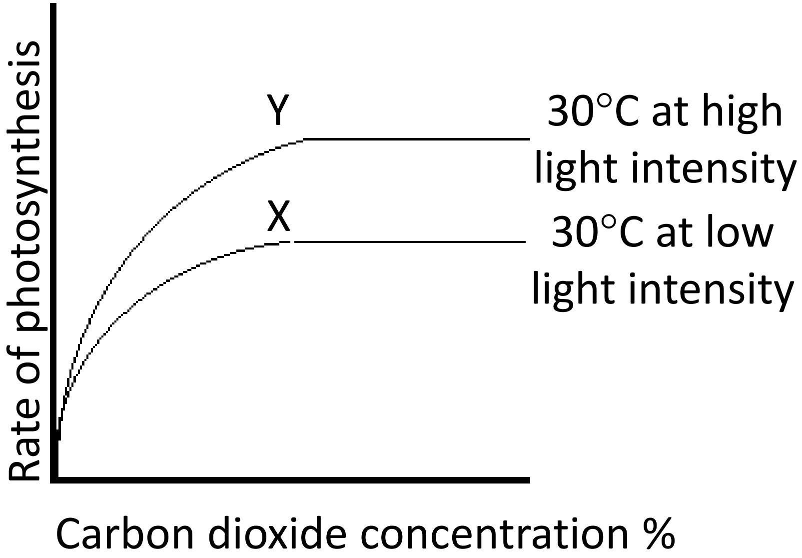
Recall it …

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

1. Describe both curves in an experiment where temperature is controlled for photosynthesis?
2. Describe curves A,B,C and D where light intensity is not a limiting factor?
3. Describe three ways in which farmer apply their knowledge of photosynthesis to improve crop yields?
4. How do farmers used computerised systems?

Bioenergetics part 1 – Rate of photosynthesis **HT only**

In **laboratory** investigations, plants experience variation in only **one** environmental factor.
Normally in **nature**, **more than one** environmental factor will vary and the rate of photosynthesis is due to the **interaction** of these factors.
Any one of the environmental factors may **limit** the rate of photosynthesis.

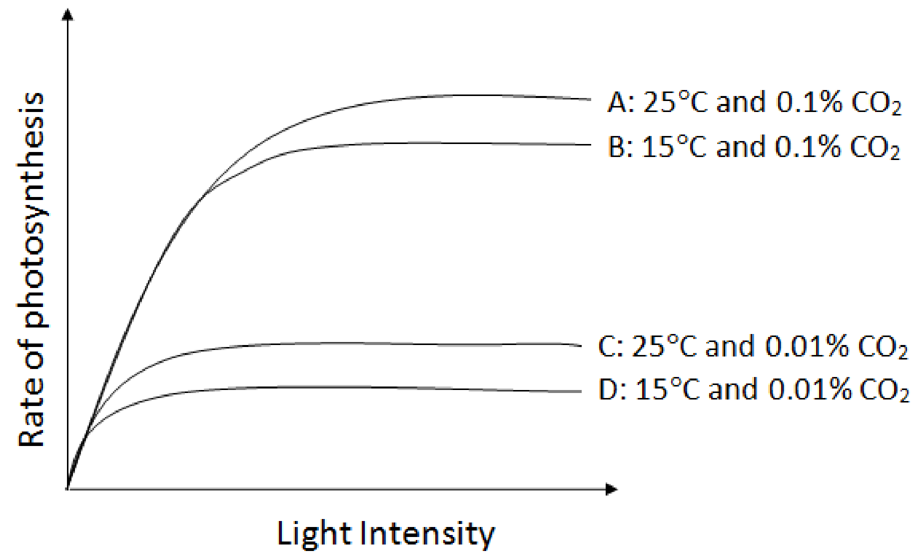


Carbon dioxide is not the limiting factor

In this experiment **temperature** is controlled.
At **low light intensity** the photosynthetic reaction becomes limited at point X.
If the light intensity is increased the reaction rate also increases.
Light intensity is therefore the limiting factor at point X.
A different factor is now limiting the rate of photosynthesis at Y.
This could be environmental **temperature** or the amount of **chlorophyll.**

Bioenergetics part 1 – Rate of photosynthesis **HT only**

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



Light intensity is <u>not</u> a limiting factor

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

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

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

Bioenergetics part 1 – Rate of photosynthesis **HT only**

Farmers apply their understanding of limiting factors to **improve** crop **yields**.
They can control conditions inside greenhouses more easily than in the fields.

- ❑ **Heating** can be used to provide optimum temperatures for maximum plant growth.
- ❑ **Artificial lighting** enhances the natural sunlight especially overnight and on cloudy days.
- ❑ **Extra carbon dioxide** gas can be pumped into the air inside the greenhouses.

In commercial greenhouses the environmental factors are often controlled by computerised systems to minimise cost. The farmer must balance the **economics** of **additional costs** of heating, lighting and computer systems to achieve maximum photosynthesis whilst still making a **profit.**

Video - Improving crop yields