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# SCIENCE: BIOLOGY

**EXAM BOARD: AQA** **COURSE CODE: 8461**

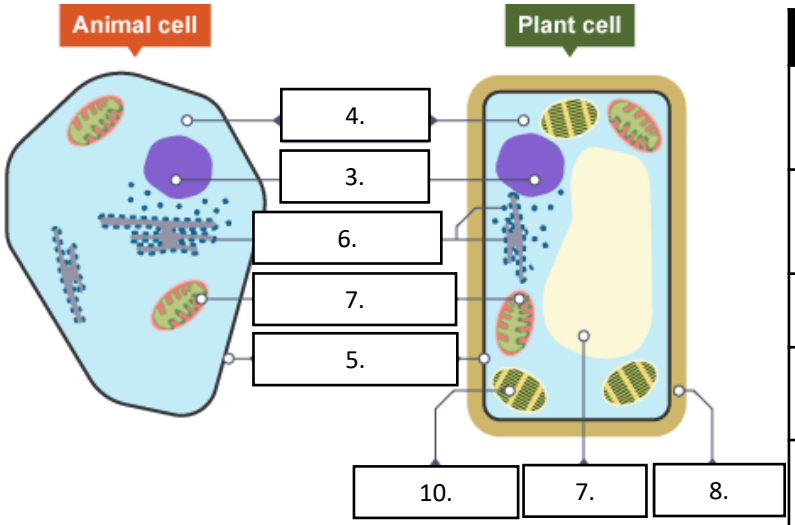
| TOPIC NUMBER | TOPIC |
|---|---|
| 1 | CELL BIOLOGY |
| 2 | ORGANISATION |
| 3 | INFECTION AND RESPONSE |
| 4 | BIOENERGETICS |
| 5 | HOMEOSTASIS AND RESPONSE |
| 6 | INHERITANCE, VARIATION AND EVOLUTION |
| 7 | ECOLOGY |

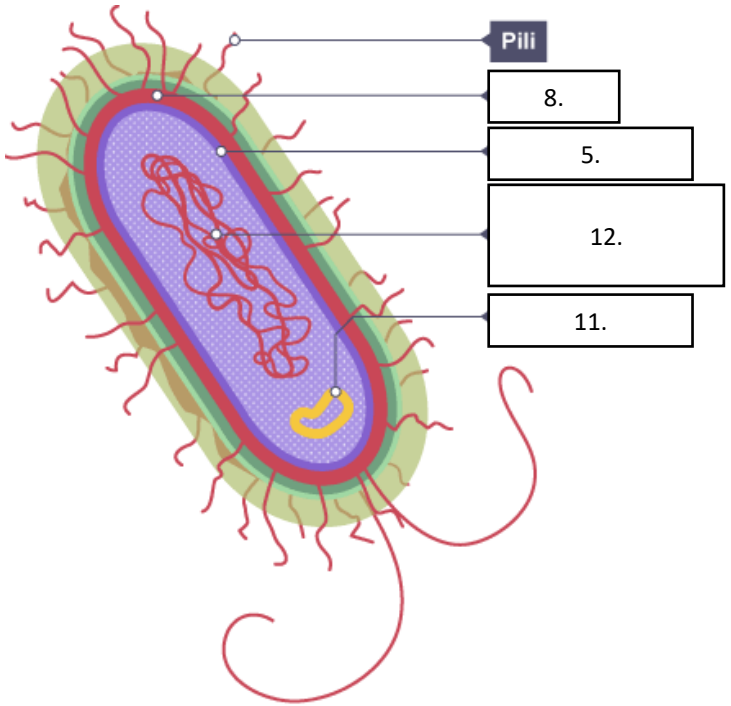
- The contents of the SP is taken directly from the exam specification.
- Learning and quizzing yourself on this information will increase your grades in science.
- Staff will set you sections to learn for homework and test you in lessons.
- The best ways to learn the information are to use 'look, cover, write, check' or to make flashcards.
- Please look after this document a replacement will incur a charge.
- Combined science students please do not learn the boxes marked 'triple only'.

Name: ..... Tutor Group: .....

# Biology Topic 1: Cell Biology

## 1. Cell structure




| Keywords | |
|---|---|
| 1. Eukaryotic | A complex cell with a nucleus (e.g. animal or plant cells). |
| 2. Prokaryotic | A smaller cell without a nucleus (e.g. bacterial cell). |
| 3. Nucleus | Contains genetic material. |
| 4. Cytoplasm | Where a cells chemical reactions happen. |
| 5. Cell membrane | Controls what goes into and out of a cell. |
| 6. Ribosome | Part of a cell where proteins are made. |
| 7.Mitochondria | Where aerobic respiration takes place. |
| 8. Cell wall | Only found in plant cells. Made of cellulose and supports the cell. |
| 9. Vacuole | Only found in plant cells. Contains cell sap. |
| 10. Chloroplasts | Only found in plant cells. Where photosynthesis takes place. |
| 11. Plasmid | Only found in bacterial cells. A small loop of DNA. |
| 12. Genetic material | Long strands of genes not tightly pack in a nucleus. |

## 2. Specialised cells

| Keywords | |
|---|---|
| Differentiation | A stem cell turning into a specialised cell |
| Stem cell | A special type of cell which can turn into other specialised cells |
| Adult stem cells | Can only produce certain types of cell -found in bone marrow |
| Embryonic stem cells | Can produce all types of cells - controversial |
| Meristems | Where plant stem cells are found |

| | |
|---|---|
| Sperm cells | Take male DNA to the egg<br>• Tail to help it swim<br>• Lots of mitochondria for energy |
| Nerve cells | Carry electrical signals around the body<br>• Long to cover long distances<br>• Branches to connect to other cells |
| Muscle Cells | Muscle cells contract<br>• Long so have space to contract<br>• Lots of mitochondria for energy |
| Root hair cells | Root hair cells absorb water and minerals<br>• Long hairs<br>• Big surface area for absorption |
| Phloem Cells | Phloem cells transport sugars (plants)<br>• Long tube joined end to end |
| Xylem cells | Xylem cells transport water (plants)<br>• Long tubes joined end to end<br>• Hollow so water can flow through |

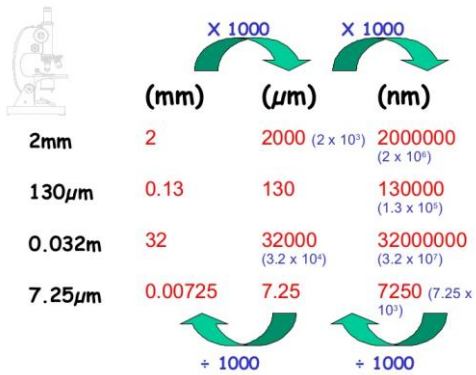
## 3. Comparing types of microscope

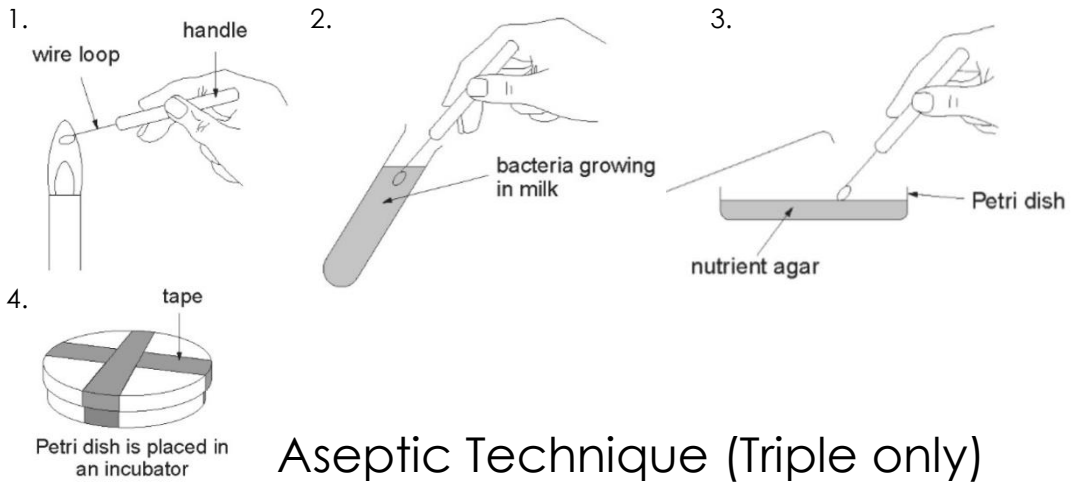
| Type of microscope | Advantages | Disadvantages |
|---|---|---|
| Light microscope | 1. Cheaper<br>2. Can see colours<br>3. Can see live specimen | 1. Lower magnification |
| Electron microscope | 1. Expensive<br>2. Higher magnification (x1000 more) | 1. Can only see dead specimen<br>2. No colour |

## 4. Calculating magnification

$$\text{magnification} = \frac{\text{size of image}}{\text{actual size of object}}$$

$$\text{actual size of object} = \frac{\text{size of image}}{\text{magnification}}$$




Aseptic Technique (Triple only)

## 5. Culturing micro-organisms TRIPLE ONLY

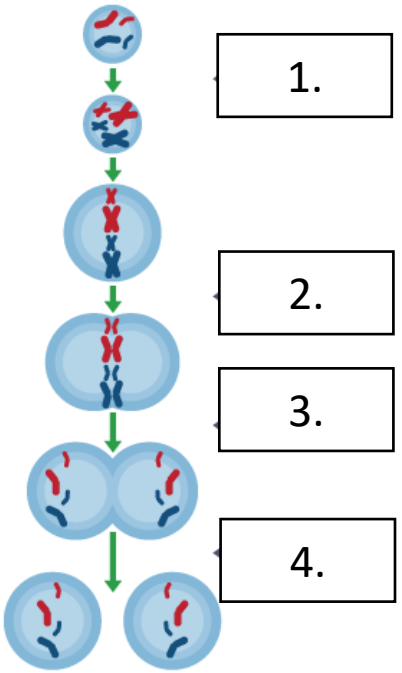
| Keywords | |
|---|---|
| Binary fission | "Splitting in two" how bacteria divide every 20 mins |
| Agar gel | A gel of nutrients bacteria can grow on |
| Nutrient broth | A liquid bacteria grow well in |
| Colony | A group of bacteria making a small circular shape |
| Inoculating loop | A metal loop use to transfer microorganisms |
| Petri dish | A small plastic dish used for growing microorganisms |
| Aseptic | Free from bacteria and viruses |
| Incubator | Device kept at constant temperature to help the microorganisms grow |

| Aseptic technique | |
|---|---|
| prep | All agar plates and broth must be sterilised before use |
| 1. | The inoculating loop must be sterilised by passing through a flame |
| 2. | Sample to be cultured is taken using the loop |
| 3. | Sample spread on agar in petri dish |
| 4. | Dish sealed shut with tape and incubated at 25° C |

| 6. Cell division | |
|---|---|
| Keywords | |
| Chromosomes | Long strands of DNA containing genes. Found in 23 pairs in a human |
| Cell cycle | The process the cell goes through to divide |
| Mitosis | A type of cell division that creates 2 identical daughter cells |
| Therapeutic cloning | Using an embryo create to have the same genes as the patient. Controversial |

| 8. Transport in cells | | |
|---|---|---|
| Keywords | Definition | Examples |
| Diffusion | The passive movement of a substance from an areas of high concentration to an area of low concentration | • Oxygen and carbon dioxide in the lungs<br>• Perfume in a room |
| Osmosis | The movement of **water** molecules across a partially permeable membrane from a less concentrated solution to a more concentrated solution. | • Water uptake in plants<br>• Water absorption in the intestine |
| Active transport | Movement of a substance from a lower concentration to a higher concentration, against the concentration gradient. **Uses energy.** | • Mineral absorption by roots<br>• Glucose absorption by the intestine |
| Surface area to volume ratio | The surface area divided by the volume expressed as a ratio | All high<br>• Unicellular organisms<br>• Alveoli in the lungs<br>• Villi in the intestines |

| 7. Stages of mitosis | |
|---|---|
| 1. | The cell grows and copies all its DNA, mitochondria and ribosomes |
| 2. | The nucleus dissolves and the copied chromosomes pair up |
| 3. | The chromosomes are pulled to opposite sides of the cell |
| 4. | The cytoplasm and cell membrane divides making two identical cells |




| 9. Factors that effect the rate of diffusion/osmosis | |
|---|---|
| Speed up | Slow down |
| High concentration gradient | Low concentration gradient |
| High temperature | Low temperature |
| High surface area of membrane | Low surface area of membrane |

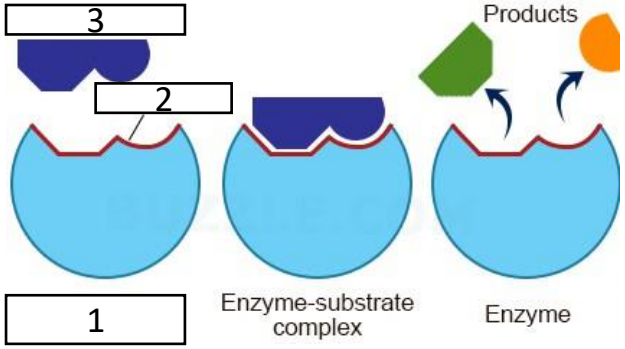
# Biology Topic 2: Organisation

## 1. Principle of organisation

| Level | Definition | Examples |
|---|---|---|
| Cell | Basic building blocks of all living organisms | Cheek Muscle |
| Tissue | Group of cells with a similar structure and function | Glandular Epithelial |
| Organ | A group of tissues performing specific functions | Stomach Pancreas |
| Organ system | A group of organs which work together to form organisms | Digestive system |

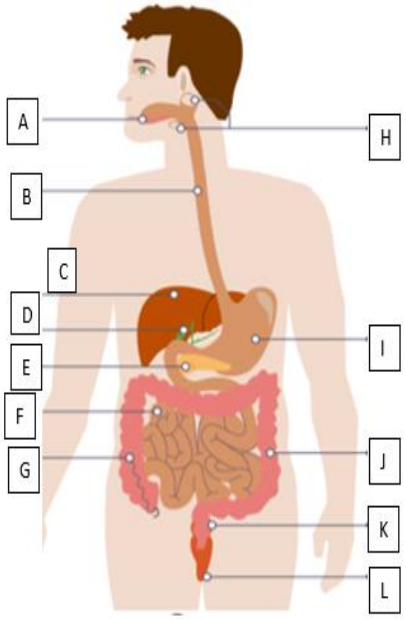
## 3. Enzymes

| | | |
|---|---|---|
| 1 | Enzyme | A biological catalyst. One type of enzyme does one specific reaction |
| 2 | Active site | The area of the enzyme with the specific shape to make the reaction happen with the substrate(s) |
| 3 | Substrate | The chemical(s) which are involved in the enzyme catalysed reaction |




| | |
|---|---|
| Denature | When an enzyme has its shape changed so it no longer works |
| Caused by: | • Temperature<br>• pH |

## 2. Digestive System

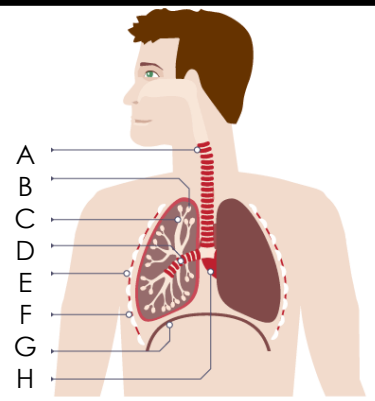



| | | | |
|---|---|---|---|
| **A** | **Mouth**: mechanical breakdown/chew food | **G** | **Appendix**: useless organ which harbours bacteria (good and bad) |
| **B** | **Oesophagus** (gullet): push chewed food to stomach | **H** | **Salivary Glands**: produce saliva with amylase enzymes to breakdown starch |
| **C** | **Liver:** makes bile | **I** | **Stomach**: Partial digestion of food/mechanically churns food with HCl and protease enzymes |
| **D** | **Gall Bladder**: stores bile which breaks down fats (lipids) and neutralises the HCl(stomach acid) | **J** | **Large Intestine**: re-absorption of water |
| **E** | **Pancreas**: production of digestive enzymes | **K** | **Rectum**: muscular section of the large intestines |
| **F** | **Small Intestine:** absorption of small soluble particles | **L** | **Anus**: where faeces leaves the body |

## 3. Types of enzyme

| Name | Breaks down | Into | Produced in |
|---|---|---|---|
| Carbohydrase (eg amylase) | Carbohydrates (eg starch) | Simple sugars | Mouth<br>Pancreas<br>Small intestine |
| Protease | Protein | Amino acids | Stomach<br>Pancreas<br>Small intestine |
| Lipase | Fats (lipids) | Fatty acids and glycerol | Pancreas<br>Small intestine |

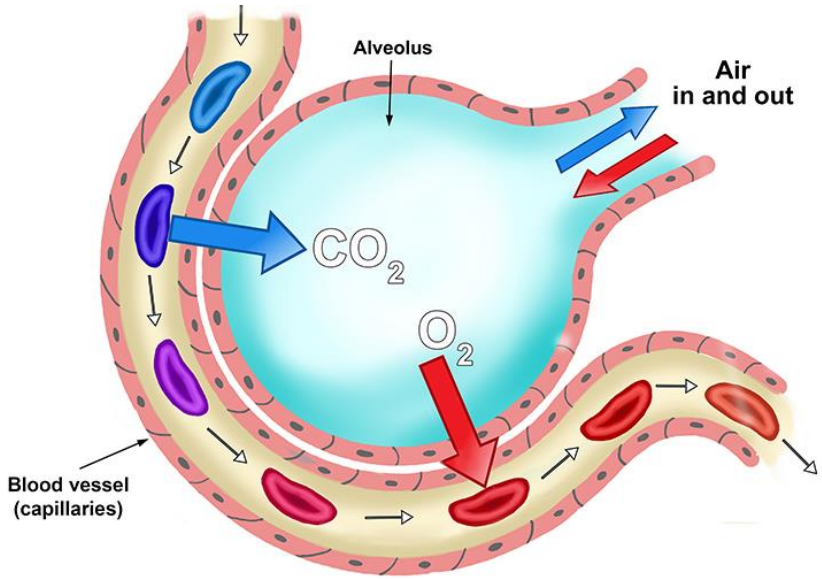
## 4. Respiratory system




| | |
|---|---|
| A | Trachea |
| B | Alveoli |
| C | Bronchiole |
| D | Right bronchus |
| E | Ribs |
| F | Intercostal muscles |
| G | Diaphragm |
| H | Heart |

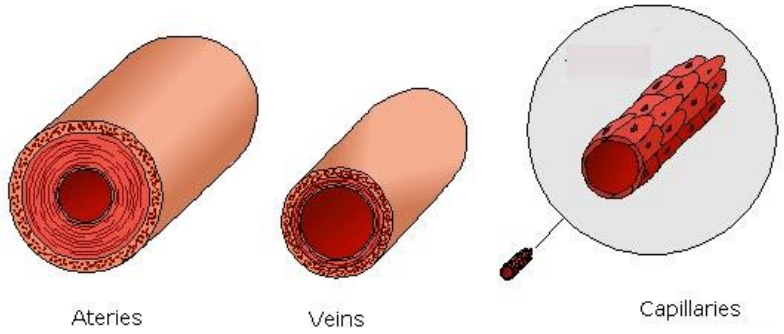
## 5. Adaptation to gas exchange: Alveoli

| | |
|---|---|
| Thin walls | Capillary wall one cell thick |
| Moist layers | From mucus in alveoli |
| Large surface area | Many alveoli |
| High concentration gradient | Blood enters with low $O_2$ and high $CO_2$ |

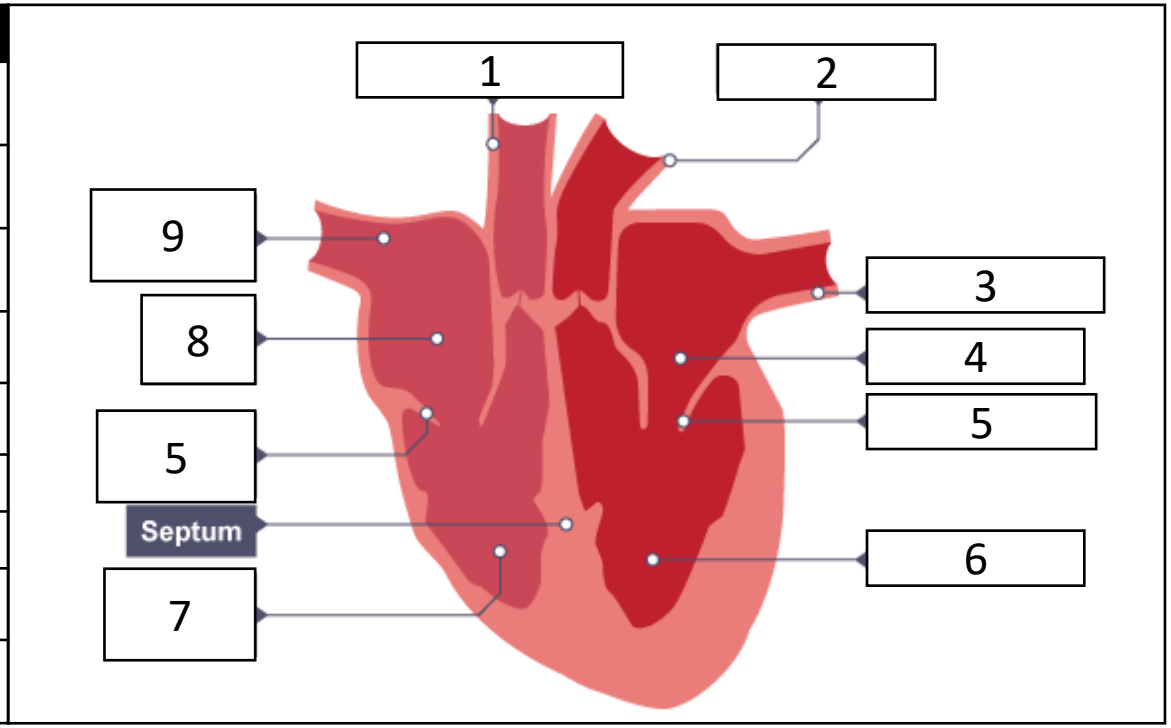



## 6. Blood vessels

| Name | Lumen (hole) size | Walls | Muscles |
|---|---|---|---|
| Arteries | Small | Thick | Yes |
| Veins | Large | Thin | No |
| Capillaries | Very small | 1 cell thin | No |



| 7. The heart | | |
|---|---|---|
| 1 | Pulmonary artery | Carries deoxygenated blood to the lungs |
| 2 | Aorta | Carries oxygenated blood to the body |
| 3 | Pulmonary vein | Brings oxygenated blood from the lungs |
| 4 | Left atrium | Pushes blood to left ventricle |
| 5 | Heart valve | Prevents backflow of blood |
| 6 | Left ventricle | Pumps blood to body |
| 7 | Right ventricle | Pumps blood to lungs |
| 8 | Right atrium | Pushes blood into right ventricle |
| 9 | Vena cava | Brings deoxygenated blood from body |

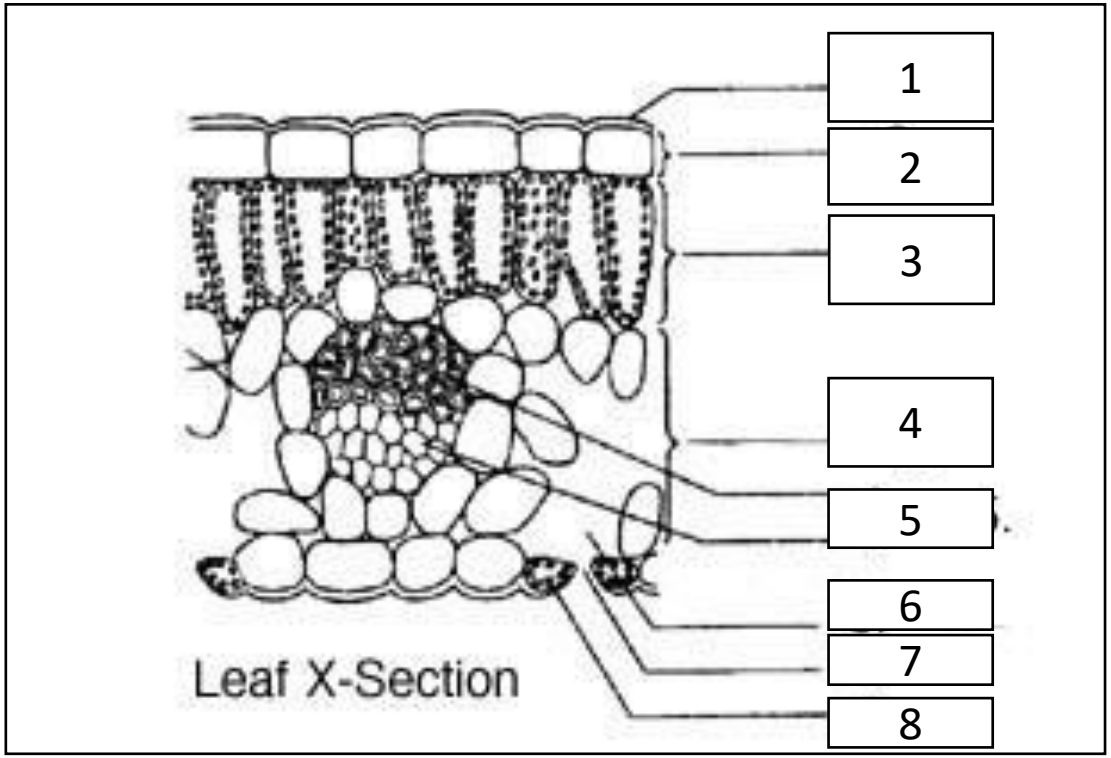



| 8. Blood | |
|---|---|
| Components | Function |
| Red blood cell | Carries oxygen |
| White blood cell | Fights infection |
| Platelets | Blood clotting |
| Plasma | Liquid that contain the other components and dissolved substances like urea |

| 9. Coronary heart disease | |
|---|---|
| Coronary heart disease (CHD) | When fatty material builds up and stops the flow of blood to the heart muscle |
| Coronary arteries | The arteries that supply the heart muscle |
| Stent | A mesh tube used to keep the coronary arteries open |
| Statins | Drugs used to reduce blood cholesterol preventing (CHD) |
| Faulty valve | When the blood flows in the opposite direction through the heart. Will need replacing with biological or mechanical valve |
| Heart transplant | When a donor heart is used to replace a faulty heart |
| Artificial heart | Short term mechanical heart used while waiting for a transplant |

| 10. Health issues | |
|---|---|
| Health | A state of physical and mental well-being |
| Disease | An abnormal condition that gives specific symptoms |
| Communicable disease | A disease which can be transferred |
| Non-communicable disease | A disease which can not be transferred |
| Lifestyle factors | Factors which can increase the chances of developing a non-communicable disease (eg smoking, diet, drugs, carcinogens) |
| Carcinogen | A substance which increases the risk of developing cancer |
| Cancer | A group of cells that divide uncontrollably |
| Benign tumour | A type of cancer contained within one area. It does not invade other parts of the body |
| Malignant tumour | A type of cancer which can invade other tissues and cause secondary tumours |

| 11. Leaf structure and functions | | |
|---|---|---|
| | Name | Function |
| 1 | Epidermis | Protective layer |
| 2 | Waxy cuticle | Prevents water loss |
| 3 | Palisade mesophyll | Contains a lot of chloroplasts. Site of photosynthesis |
| 4 | Spongy mesophyll | Full of air spaces to allow oxygen and carbon dioxide to diffuse |
| 5 | Vein | Contains xylem and phloem |
| 6 | Air space | Allows gases to pass through |
| 7 | Stomata | Hole for gases to move in and out of the leaf |
| 8 | Guard cells | Control the opening of stomata |



| 12. Plant veins | | | |
|---|---|---|---|
| Name | Carries | Direction | Name of process |
| Xylem | Water and mineral ions | From roots to leaves | Transpiration |
| Phloem | Sugar ('food') | From leaves to roots | Translocation |

| 13. Factors affecting transpiration | | |
|---|---|---|
| Factor | Affect of increasing factor | Reason |
| Temperature | Increases transpiration | Water evaporates and diffuses faster |
| Humidity (amount of water in air) | Decreases transpiration | Less space in air around leaf for water to diffuse into |
| Air movement | Increases transpiration | Water evaporates and diffuses faster |
| Sunlight | Increases transpiration | Stomata are open to let in $CO_2$ so more water escapes |

# Biology Topic 3: Infection and response

| 1. Keywords | |
|---|---|
| Communicable (infectious) disease | A disease which can be spread to others. |
| Pathogen | Micro-organisms that cause infectious disease (eg bacteria, protists, fungi and viruses). |
| Bacteria | Prokaryotic cells. Some can cause disease by making toxins. |
| Protists | Eukaryotic cells. Some can cause disease. |
| Fungi | Class of organisms that includes mushrooms. Some can cause disease. |
| Virus | The smallest organisms. Much smaller than bacteria. They reproduce inside host cells damaging them and causing disease. |
| Droplet inhalation | When a disease is spread through coughs and sneezes. |
| Direct contact | When a disease is only spread from physical contact. |
| Antibiotics | A group of chemicals which can kill bacteria (eg penicillin). |
| Antiviral drugs | A group of chemical which can prevent viruses reproducing. Hard to develop safe ones. |
| Fungicides | A group of chemicals which kill fungi. |
| Painkillers | A type of drug that treats pain symptoms but does not kill pathogens. |
| Lymphocyte | White blood cell. |

**2. Examples of infectious disease**

| | Disease | Infects | Symptoms | Spread by | Fatal | Treatment |
|---|---|---|---|---|---|---|
| Virus | Measles | Human | Fever<br>Skin rash | Droplet inhalation | Yes | vaccination |
| | HIV | Human | Reduced immune system | Unprotected sex | Yes | Antiviral drugs |
| | Tobacco mosaic virus (TMV) | Plants | Discolours leaves<br>Stunts growth | Direct contact | No | Remove infected leaves and burn |
| Bacteria | Salmonella | Human | Fever<br>Stomach cramps<br>Vomiting<br>Diarrhoea | Food | No | Take fluids to prevent dehydration |
| | Gonorrhoea | Human | Thick yellow/green discharge from vagina or penis | Unprotected sex | No | Antibiotics (if not resistant) |
| Fungal | Rose black spot | Plants | Black spots on leaves<br>Stunts growth | Direct contact | No | Fungicides |
| Protist | Malaria | Human | Fever | Mosquito bite | Yes | Drugs to kill/prevent parasite. Prevention by using nets to stop bites |

| 3. Non-specific defence systems | |
|---|---|
| Skin | Physical barrier |
| Nose | Hairs trap pathogens |
| Trachea and bronchi | Mucus traps pathogens |
| Stomach | Acid destroys pathogens |

| 4. Specific defence by white blood cells | |
|---|---|
| Phagocytosis | Ingesting (take in) pathogens digesting and destroying them |
| Antibody production | Target a specific pathogen. Stick them together and target them for destruction. Gives you a 'memory' of that pathogen so you can fight it more quickly next time |
| Antitoxin production | Cancel out toxins released by pathogens |

| 5. Vaccination | |
|---|---|
| Vaccine | Small amount of dead or inactive pathogen to stimulate white blood cells to produce antibodies |
| How vaccines work: | |
| 1 | Weak or dead pathogen injected |
| 2 | White blood cells generate antibodies to destroy pathogen |
| 3 | White blood cells that make those antibodies remain and make you immune to future infections |

| 6. Drug development | |
|---|---|
| Drug/medicine | A chemical which alters the body. Often extracted from plants (eg aspirin) and microorganisms (eg penicillin) |
| Toxicity | If it is toxic |
| Efficacy | How well it works |
| Dose | How much of a drug you need to take to make it work |
| Placebo | A pill without the drug in it. Taken to check drug effectiveness |
| Double blind trials | When the doctor does not know if they are giving the medicine or a placebo. Prevents bias |

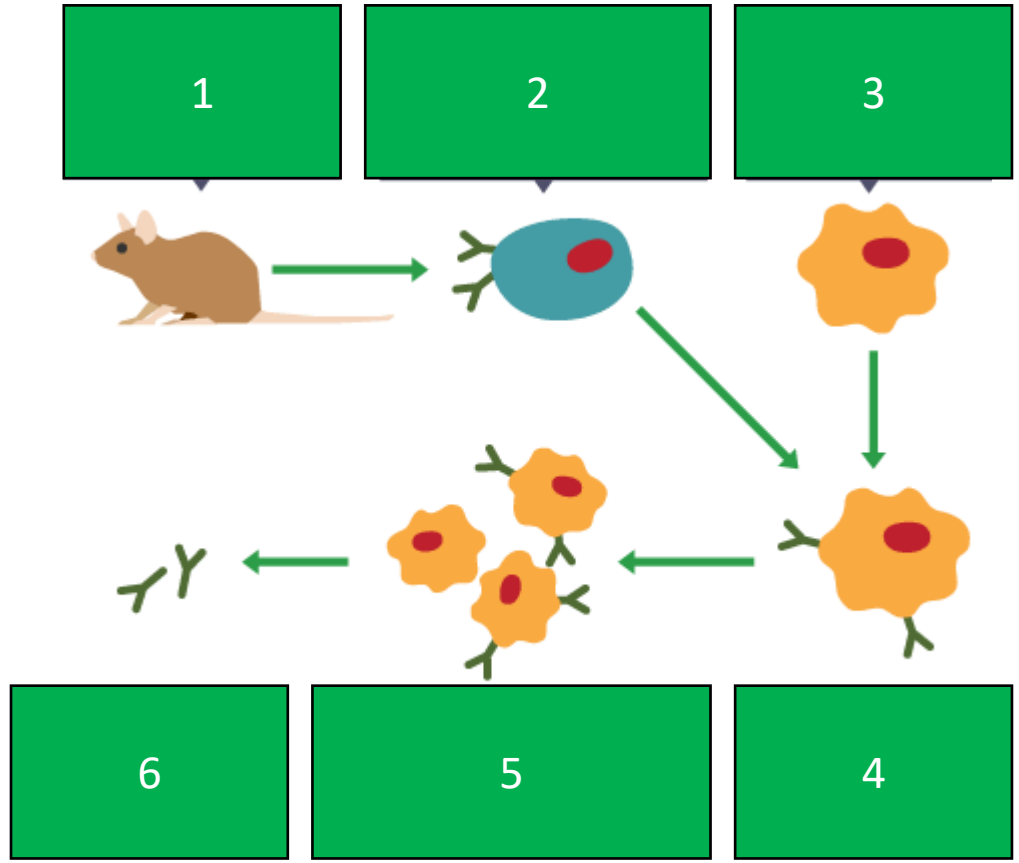
| Stages of drug development | | | Time taken (yrs) |
|---|---|---|---|
| 1 | Drug discovery | New possible medicines are identified | 4.5 |
| 2 | Preclinical trials | New drugs are tested in lab for toxicity and efficacy on cells, tissues and sometimes animals | 1.5 |
| 3 | Clinical trials | Low doses tested on human volunteers. Then patients suffering with the disease over 3 phases. These are double blind trials | 5.5 |
| 4 | Publishing results | Findings are checked by other scientists (peer review) Drug is approved by NHS | 1.5 |

## 7. Monoclonal antibodies (HT TRIPLE ONLY)

| | |
|---|---|
| What are they? | Antibodies produced from a single clone of cells. |
| Why are they useful? | Bind to only on binding site on a specific chemical or cell in the body |
| Uses | Pregnancy tests<br>Measure levels of hormones or other chemicals in blood<br>Locate specific molecules in cells<br>Treat cancer |

### How are monoclonal antibodies made?

| | |
|---|---|
| 1 | Mouse vaccinated to start production of antibodies |
| 2 | Lymphocyte: Produce antibodies but cant divide |
| 3 | Tumour cell: No antibodies but divides |
| 4 | Cells fused to form a single hybridoma |
| 5 | Single hybridoma cell cloned to make identical cells |
| 6 | A large amount of identical antibodies collected |




## 8. Detecting plant disease (HT TRIPLE ONLY)

| | | | |
|---|---|---|---|
| Symptoms: | • Stunted growth<br>• Spots on leaves<br>• Areas of decay<br>• Growths<br>• Malformed stems and leaves<br>• Discolouration<br>• Presence of pests | Identified by: | • Reference to book or internet<br>• Taking to a lab<br>• Testing kits containing monoclonal antibodies |

| 9. Plant disease (TRIPLE ONLY) | | |
|---|---|---|
| Type | Disease | How it damages plants |
| Pest | Aphid | A insect which injects toxins into plants as they eat them |
| Fungal | Black spot | Damages leaves |
| Virus | Tobacco mosaic virus | Damages leaves |

| 10. Plant mineral deficiency (TRIPLE ONLY) | | |
|---|---|---|
| Mineral | Symptom | Reason |
| Nitrates | Stunted growth | Cant make enough protein |
| Magnesium | Chlorosis: yellow leaves | Cant make enough chlorophyll |

| 11. Plant defence responses (TRIPLE ONLY) | |
|---|---|
| Type | Examples |
| Physical | • Cellulose cell wall<br>• Waxy cuticle on leaves<br>• Layers of dead cells (bark on trees) |
| Chemical | • Antibacterial chemicals<br>• Poisons to stop animals |
| Mechanical | • Thorns and hairs stop animals<br>• Leaves which droop or curl when touched<br>• Mimicry to trick animals |



Bee orchid flower resembles a female bee closely enough to attract males in search of a mate

# Biology Topic 4: Bioenergetics

## 1. Photosynthesis

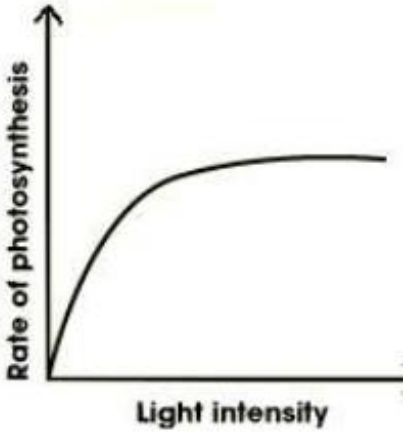
$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

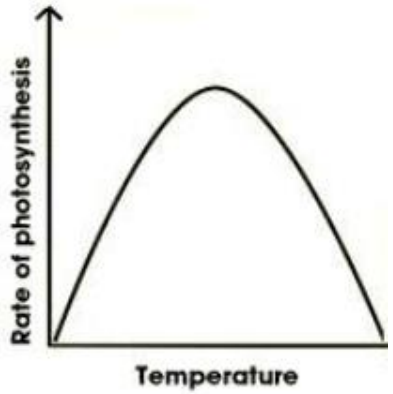
$$\text{Carbon Dioxide} + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose} + \text{Oxygen}$$

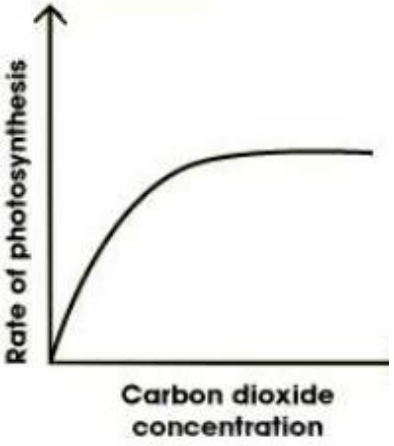
| | |
|---|---|
| Photosynthesis | An endothermic reaction where sunlight is absorbed and used to convert carbon dioxide and water into glucose and oxygen |
| Uses of glucose | • Respiration<br>• Converted into starch<br>• Produce fat or oil<br>• Produce cellulose cell walls<br>• Produce amino acids |

## 2. Rate of photosynthesis

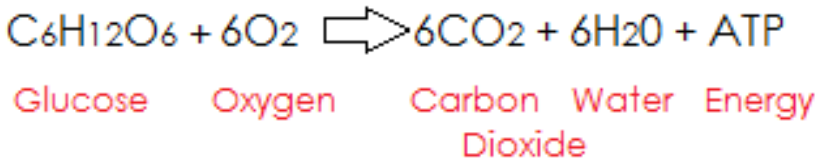
| Factor | Affect on photosynthesis | Reason |
|---|---|---|
| Light | Increases | More energy for the reaction |
| Carbon dioxide | Increases | More reactants (provided there is no limiting reactant) |
| Amount of chlorophyll | Increases | More energy for the reaction |
| Temperature | Increases then decreases | Initially more energy but then enzyme denatures |
| Limiting factor | The factor that can limit the rate of a reaction | |



| 3. Aerobic respiration | |
|---|---|
| Respiration | An exothermic reaction which continuously happens in living cells |
| Purpose | Transfer energy for:<br>• Chemical reactions<br>• Movement<br>• Warmth |
| Aerobic | With oxygen |



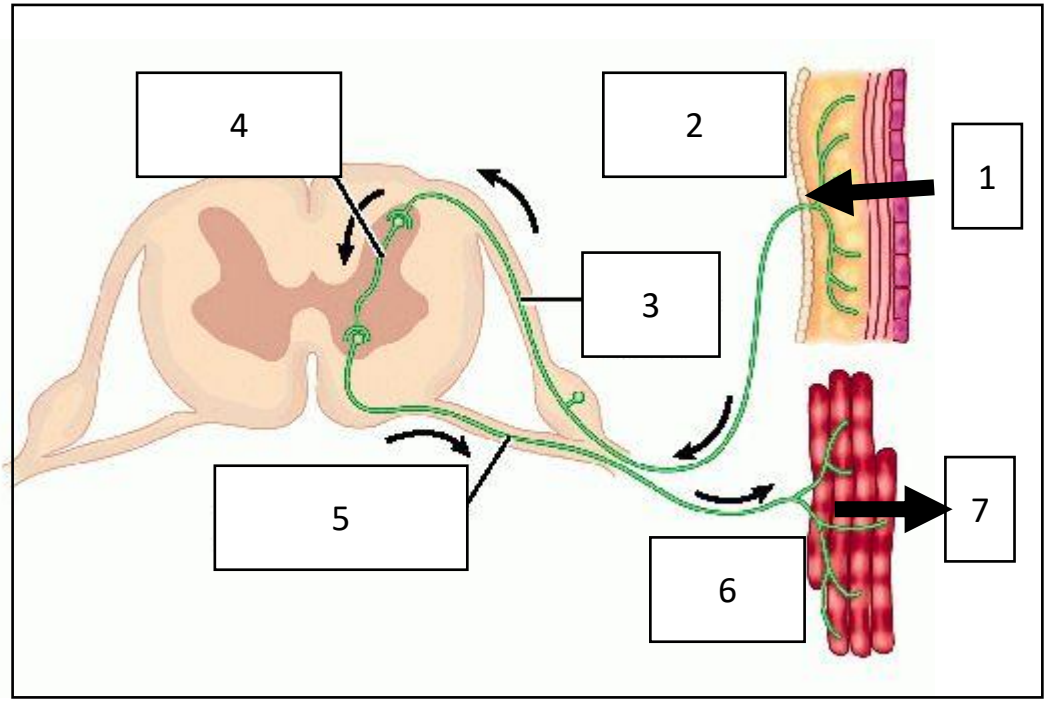

| | |
|---|---|
| Anaerobic | Without oxygen |
| Anaerobic respiration in muscle cells | glucose → lactic acid |
| Anaerobic respiration in yeast cells (fermentation) | glucose → ethanol + carbon dioxide |
| Lactic acid | A chemical that when built up in muscles causes fatigue |
| Oxygen debt HT ONLY | The amount of oxygen the body needs after exercise to remove the lactic acid |

| 4. Response to exercise | |
|---|---|
| Change | Reason |
| Heart pumps faster | Supply more oxygenated blood to the muscles |
| Breathing rate increases | |
| Deeper breaths | |

| 5. Metabolism | |
|---|---|
| Metabolism | The sum of all the reactions in a cell or the body |
| Includes: | • Conversion of glucose to starch, glycogen and cellulose<br>• Formation of lipids from glycerol and 3 fatty acids<br>• Use of glucose and nitrates to make proteins (PLANTS)<br>• Respiration<br>• Breakdown of protein to from urea. |

# Biology Topic 5: Homeostasis and response

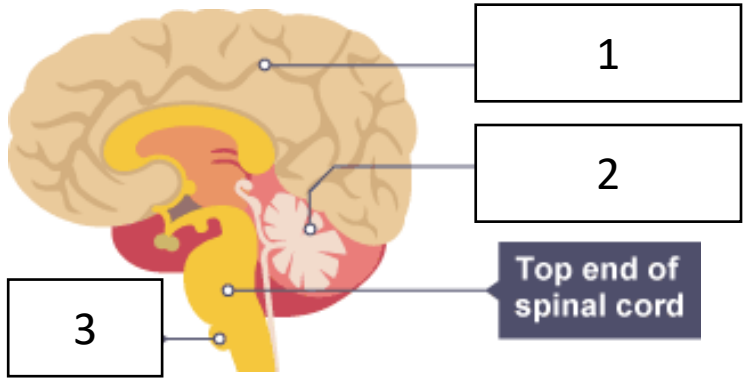
| 1. Keywords | |
|---|---|
| Homeostasis | The regulation of the internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes. |
| Optimum conditions | The perfect conditions for an organism to survive and grow.<br>E.g. blood glucose level, body temperature and water level. |
| Nervous response | Uses electrical signal in nerves to make fast changes |
| Chemical response | Uses hormones in the blood to make changes. |
| Reflex arc | A nervous response that is fast and automatic for protection. Does not involve the conscious brain. |
| CNS | (Central nervous system)<br>The brain and the spinal chord |
| Neurone | Nerve cell. Carries an electrical signal from one end to the other |




| 2. Nervous system: Reflex arc | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Section | Stimulus → | Receptor → | Sensory neurone → | Co-ordinator → | Motor neurone → | Effector → | Response |
| Definition | A change to the environment that triggers a nervous response | A cell which detects a specific stimulus | A neurones which carries electrical signal from receptor to CNS | The area that receives and processes the information | Neurone that connects the CNS to the effector | The organ that creates the correct response form the stimulus | The effect of the stimulus. Often designed to prevent injury |
| Example | Touching a flame | Pain receptor in skin | Sensory neurone | Brain<br>Relay neurone | Motor neurone | Muscle gland | Movement |

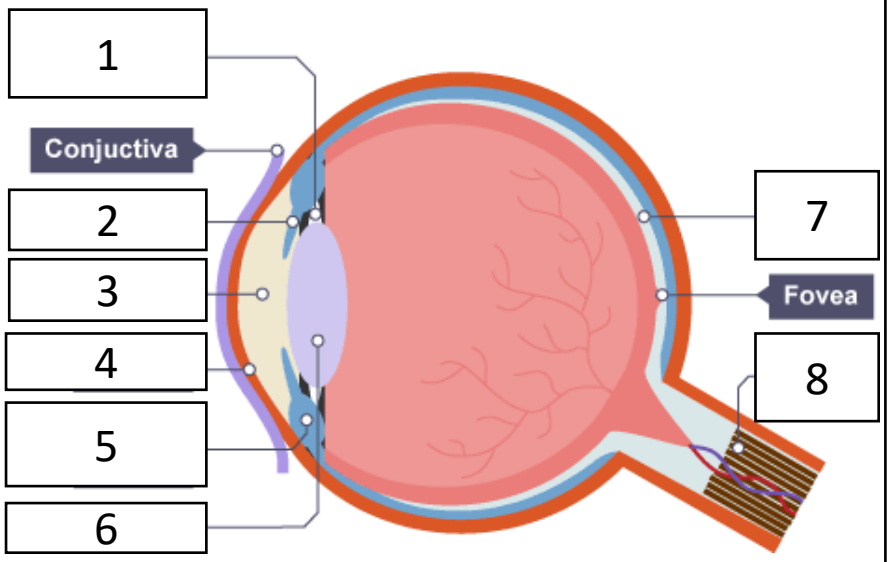
## 3. The brain (TRIPLE ONLY)

| No | Name | Function |
|---|---|---|
| 1 | Cerebral cortex | High level functions like language, memory and consciousness |
| 2 | Cerebellum | Balance and coordination of muscles in the body |
| 3 | Medulla | Controls life supporting functions like breathing and heart rate. Key for homeostasis |




## 4. The eye (TRIPLE ONLY)

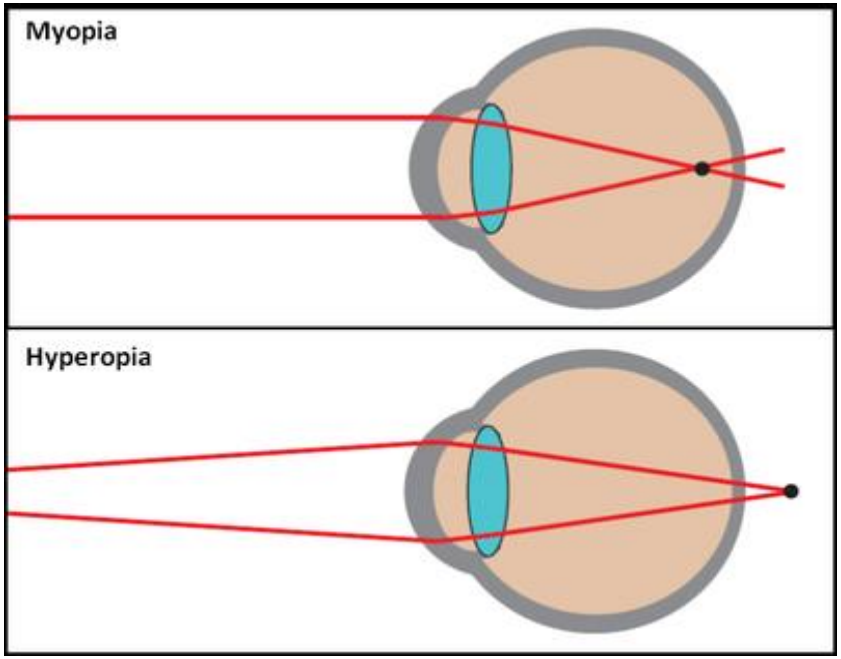
| No | Name | Function |
|---|---|---|
| | Sclera | White outer protective layer. |
| 1 | Suspensory ligaments | Connect ciliary muscles to lens |
| 2 | Iris | Controls the size of the pupil |
| 3 | Pupil | Hole in eye that lets light through. Wide in dark conditions small in light conditions |
| 4 | Cornea | Transparent protective layer |
| 5 | Ciliary muscles | Contract to change shape of lens to see near and far objects |
| 6 | Lens | Refracts light onto retina |
| 7 | Retina | Contain light sensitive rod and cone cells |
| 8 | Optic nerve | Send signals from retina to brain to make image |




## 5. Adjusting focus (TRIPLE ONLY)

| Object | Near | Distant |
|---|---|---|
| Ciliary muscles | Contract | Relax |
| Suspensory ligaments | Loosen | Tighten |
| Lens | Is thicker | Is thinner |

| 6. Vision problems (TRIPLE ONLY) | | |
|---|---|---|
| Name | Myopia | Hyperopia |
| Common name | Short-sighted | Long-sighted |
| Corrected by | • Glasses<br>• Contact lenses<br>• Laser eye surgery | |

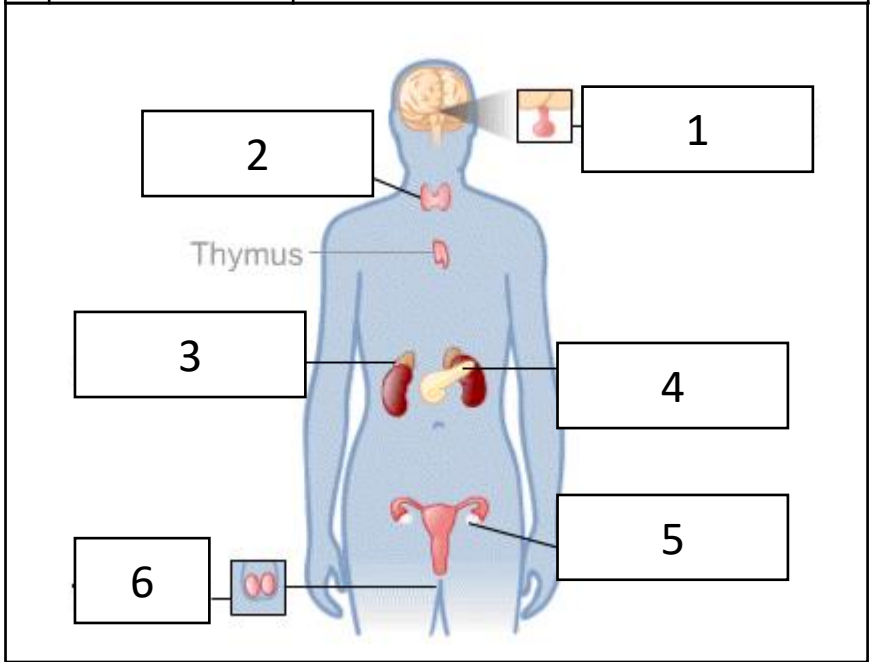



| 7. Control of body temperature (TRIPLE ONLY) | |
|---|---|
| Thermoregulatory centre | Part of the brain that receives signals about temperature of the blood and skin |
| 37°C | Optimum internal body temperature |
| Vasodilation | The widening of blood vessels near the surface of the skin |
| Vasoconstriction | The narrowing of blood vessels near the surface of the skin |
| Sweat | Liquid released from pores on skin to cool the body as it evaporates |
| Shivering | Involuntary muscle contractions to generate heat |

| How the body responds to changes in temperature | |
|---|---|
| Too hot | Too cold |
| 1. **Vasodilation** bring blood near the surface<br>2. **Sweating** increases<br>3. Heat is lost through evaporation and radiation<br>4. Body temp drops | 1. **Vasoconstriction** take blood away from surface<br>2. **Sweating** stops<br>3. Muscles contractions **(shivering)** generate heat<br>4. Body temp increases |

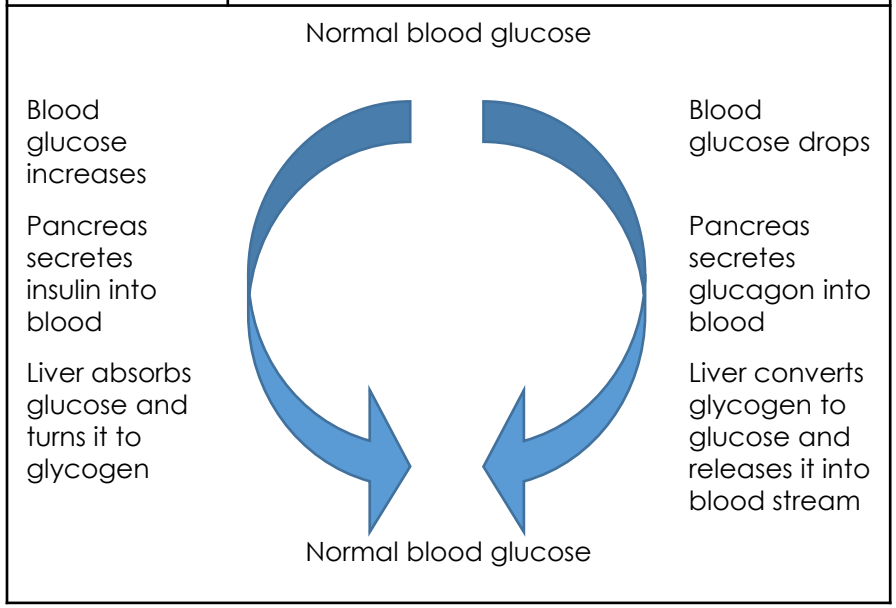
| 8. Hormonal control: Endocrine system | |
|---|---|
| Endocrine system | A chemical response where glands secrete hormones into the blood which make changes around the body |
| Glands | Special tissues designed to produce specific chemical (hormones) |
| Secrete | Release |

| 9. Major glands on the body | | |
|---|---|---|
| 1 | Pituitary gland | The 'master gland' makes hormones which affect other glands causing them to secrete hormones |
| 2 | Thyroid gland | Controls metabolism |
| 3 | Adrenal gland | Makes adrenalin |
| 4 | Pancreas | Controls blood sugar levels |
| 5 | Ovary | Produces female sex hormones |
| 6 | Testes | Produce male sex hormone |




| 10. Control of blood glucose levels | |
|---|---|
| Type 1 diabetes | When the pancreas is damaged from infection and cannot make insulin. Needs injections to treat |
| Type 2 diabetes | When poor diet and obesity cause body cells to not respond to insulin anymore. Treated with diet and exercise |
| Insulin | Hormone made in pancreas that reduces glucose levels in the blood |
| glycogen | The long term store of sugar in the body. Made in the liver |

| 11. Control of blood glucose continued (HT ONLY) | |
|---|---|
| Glucagon | A hormone which reduces blood glucose concentration by turning it into glycogen |

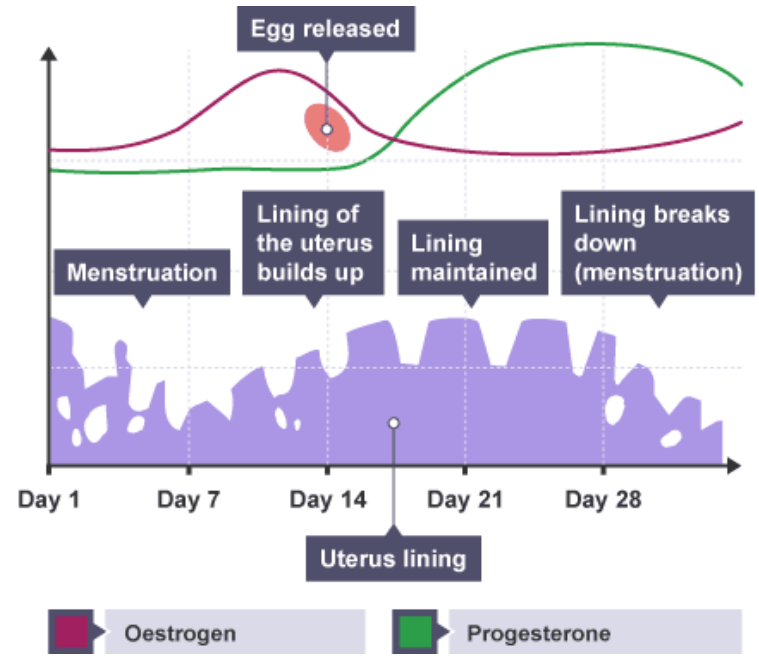


| 12. Controlling water and nitrogen levels (TRIPLE ONLY) | |
|---|---|
| Urea | The waste product made by the breakdown of amino acids in the liver. |
| Urine | The urea, excess water and ions not needed by the body. Made by the kidneys |
| Kidneys | The organ responsible for filtration and selective reabsorption |
| Selective reabsorption | When the kidneys reabsorb:<br>• All of the glucose<br>• Some of the mineral ions<br>• Some of the water |
| Dialysis | A way of manually filtering the blood when the kidneys are no longer functioning. Whilst waiting for a transplant |

| 13. Hormones and the kidneys (TRIPLE HT ONLY) | |
|---|---|
| ADH (anti-diuretic hormone) | A hormone made in the pituitary gland which increase the reabsorption of water by kidney tubules |
| How ADH works: | |
| 1. Blood is too concentrated<br>2. Pituitary gland releases ADH into blood.<br>3. ADH increase permeability of kidney tubules<br>4. More water is reabsorbed<br>5. Blood dilutes to normal levels. Urine is yellow. | |

| 14. Reproductive hormones | | |
|---|---|---|
| Hormone | Made in | Function |
| Testosterone | Testes | Creates male sexual changes at puberty including sperm production |
| Oestrogen | Ovary | Creates female sexual changes at puberty including ovulation |
| Follicle stimulating hormone (FSH) | Pituitary gland | Causes egg to mature in ovary |
| Luteinising hormone (LH) | Pituitary gland | Causes egg to be released by ovary |
| Progesterone | Ovary | Maintains lining of womb |

## 15. Menstrual cycle (HT ONLY)



| 16. Contraception | |
|---|---|
| Type | How it works |
| Oral (the pill) | Stops FSH so no egg released |
| Injection/implant | Release progesterone which prevents egg maturation for months or years |
| Barrier (condoms) | Prevent sperm and egg meeting |
| Intrauterine (the coil) | Prevents embryo implanting |
| Spermicides | Kill sperm |
| Abstinence | Not having sex |
| Surgical (vasectomy/hysterectomy) | Surgically sterilising the adult permanently |

| 17. Hormones in fertility (HT ONLY) | |
|---|---|
| Fertility drugs | Drugs which stimulate the production and release of eggs. Eg FSH and LH |
| IVF (in vitro fertilisation) | The process of creating an embryo in the lab when couples struggle to conceive a baby |
| Stages of IVF: | |
| 1. FSH and LH stimulate production of many eggs<br>2. Eggs are harvested and fertilised by fathers sperm in a lab<br>3. Fertilised eggs grow in lab<br>4. A few embryos are implanted into mother womb | |
| Possible consequences of IVF | Physical and emotional fatigue<br>Low success rate<br>Risk of multiple births simultaneously |

| 18. Negative feedback (HT ONLY) | |
|---|---|
| Negative feedback | A system where the product reduces the stimulus to return the change to normal levels |
| Adrenalin | Fight or flight hormone. Increases heart rate and boosts blood supply of oxygen and glucose |
| Thyroxine | Controls metabolic rate and affects growth and development. Controlled by negative feedback. |

| 19. Plant hormones (TRIPLE ONLY) | |
|---|---|
| Phototropism | The shoot of a plant growing towards light. The root growing away form light |
| Gravitropism (geotropism) | The shoot of a plant growing up and the roots growing down |
| Auxin | Group of plant hormones which make cells in shoots grow more and cells in roots grow less. Used as rooting powder and weedkiller. |
| How tropisms work | |
| Phototropism | 1. Shaded side contains more auxin<br>2. So grows faster<br>3. Plant leans towards light |
| Gravitropism | 1. Bottom of shoot has more auxin<br>2. So grows slower<br>3. Roots bends downwards |

| 20. Other plant hormones (TRIPLE HT ONLY) | |
|---|---|
| Gibberellins | Start seed germination. Used to promote fruit development and flowering |
| Ethene | Cell division and ripening fruit |

# Biology Topic 6: Inheritance, variation and evolution

| 1.Keywords | |
|---|---|
| Mitosis | A type of cell division which create two identical daughter cells |
| Meiosis | A type of cell division the create 4 unique gametes |
| Gametes | Sex cells eg sperm + egg and pollen + ovum |
| Sexual reproduction | Reproduction involving the fusion of gametes. Make unique offspring that resemble both parents |
| Asexual reproduction | Reproduction involving only one parent. No gametes fuse. Offspring are identical to parent |
| DNA | Deoxyribose nucleic acid. Polymer made of 2 strands forming a double helix. Contains the instructions for an organism. |
| Chromosomes | Long strands of DNA found in the nucleus. Humans have 23 pairs |
| Gene | A section of DNA which codes for a protein |
| Genome | All the genes of an organism |

| 2. Meiosis |
|---|
| **1. DNA replication:** chromosome number doubles |
| **2. Cell divides:** two cells now |
| **3. Those cells divide:** four gametes now with half the number of chromosomes |

| 3. Advantages of reproduction (TRIPLE ONLY) | |
|---|---|
| Advantages sexual | Advantages asexual |
| Causes variation | Only need 1 parent |
| If environment changes natural selection can occur | Energy and time efficient (fast) |
| Humans can selectively breed organisms for beneficial characteristics | Lots of offspring can be produced when conditions are good |
| Organisms that can use both | • Malaria<br>• Fungi<br>• Plants |

| 4. DNA structure (TRIPLE ONLY) | |
|---|---|
| Nucleotide | The monomer of DNA. Consists of a sugar, phosphate and a base |
| Base | One of 4 different chemicals that make the triplet code.<br>A G T C |
| Triplet code | 3 bases in a row give a code for a specific amino acid |

| 5. Protein synthesis and gene expression (HT TRIPLE ONLY) | |
|---|---|
| Pairing of nucleotide bases | A → T T→A<br>G → C C→G |
| Transcription | When the DNA is read and converted into messenger RNA (mRNA) |
| Translation | When the mRNA is read by ribosomes and use to build the amino acid sequence |
| Transfer RNA (tRNA) | Carries the correct amino acid to the ribosome for the mRNA triplet code |
| Coding DNA | DNA which codes for a protein, a gene |
| Non-coding DNA | DNA which does not code for a protein. Can be involved in turning on or off genes. |
| Mutation | A change to the DNA sequence. Most are harmless but some can stop proteins working correctly |

| 6. Genetic inheritance | |
|---|---|
| Allele | Different forms of the same gene. eg hair colour |
| Dominant | When only one copy of the allele is needed to show in the offspring |
| Recessive | When the allele only shows when there are two copies |
| Homozygous | Two copies of the same allele |
| Heterozygous | Two different alleles |
| Genotype | The set of genes in our DNA |
| Phenotype | The outward appearance a set of genes displays |

| 7. Inherited disorders | |
|---|---|
| Inherited disorders | Disorders that are caused by inheriting faulty genes from parents |
| Polydactyly | A dominant inherited disorder which causes extra fingers or toes to form |
| Cystic fibrosis | A recessive inherited disorder which causes sticky mucus to block air ways |

| 8. Sex determination | |
|---|---|
| No of chromosomes in a human | 23 pairs (22 normal, 1 pair of sex) |
| Male | XY (50% chance) |
| Female | XX (50% chance) |
| Sperm | Can hold Y or X chromosome so determine gender of embryo |

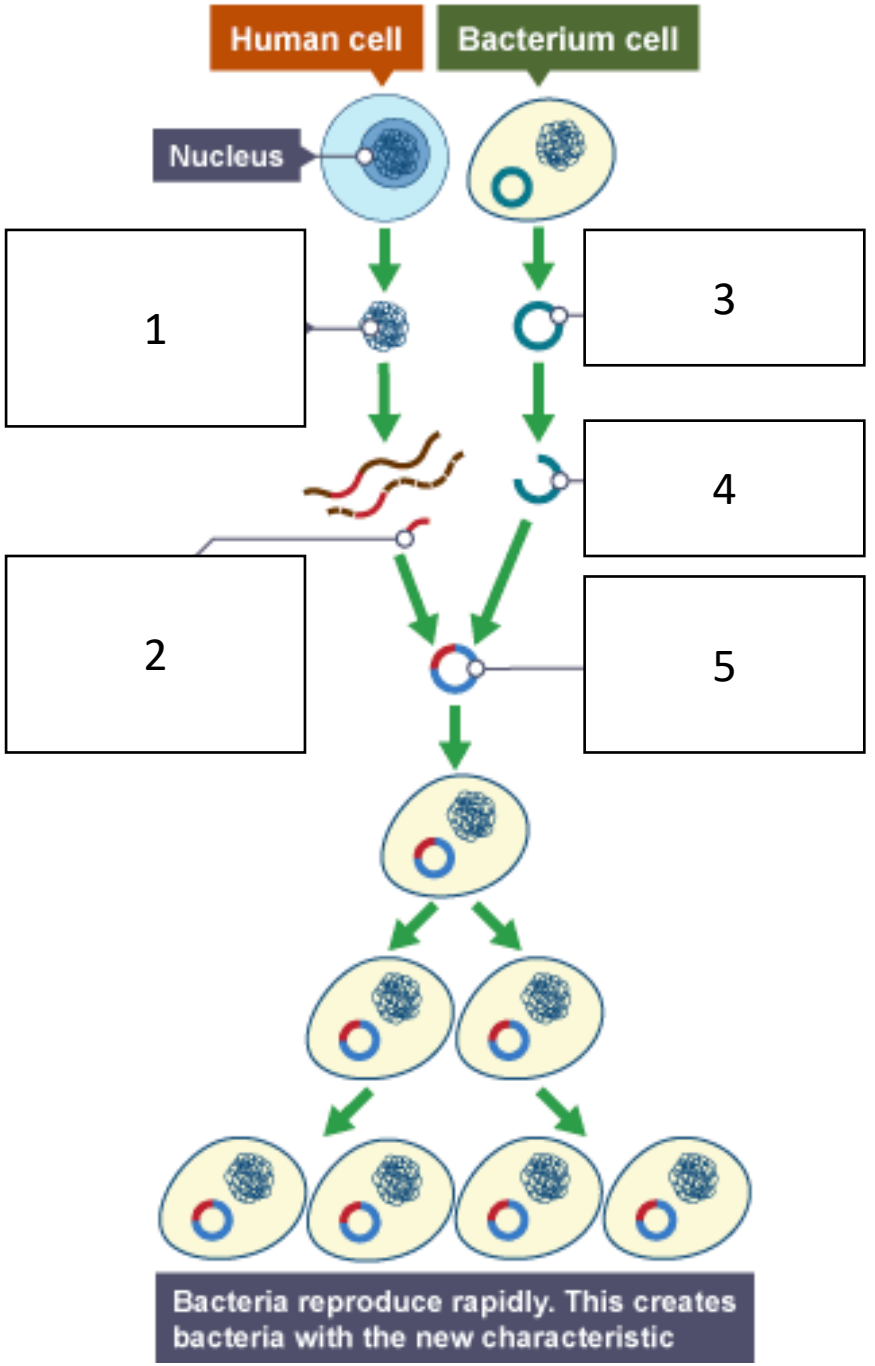
| 9. Variation | |
|---|---|
| Variation | Changes within a population. Caused by mutation |
| Genetic variation | Changes due to inheriting different alleles of genes |
| Environmental variation | Changes due to the effect the environment has |

| 10. Evolution | |
|---|---|
| Evolution | The change in the inherited characteristics of a population due to natural selection. May result in a new species |
| Natural selection | The process where the organism best adapted to the environment survives and passes on their characteristics |
| Species | A group of organisms with similar features which can breed to make fertile offspring |
| Stages of evolution | |
| 1. Population shows variation due to their genes | |
| 2. Environment changes | |
| 3. Some individuals are best adapted and live longer | |
| 4. These can breed and produce more offspring | |
| 5. Over a long period of time the offspring dominate the population | |

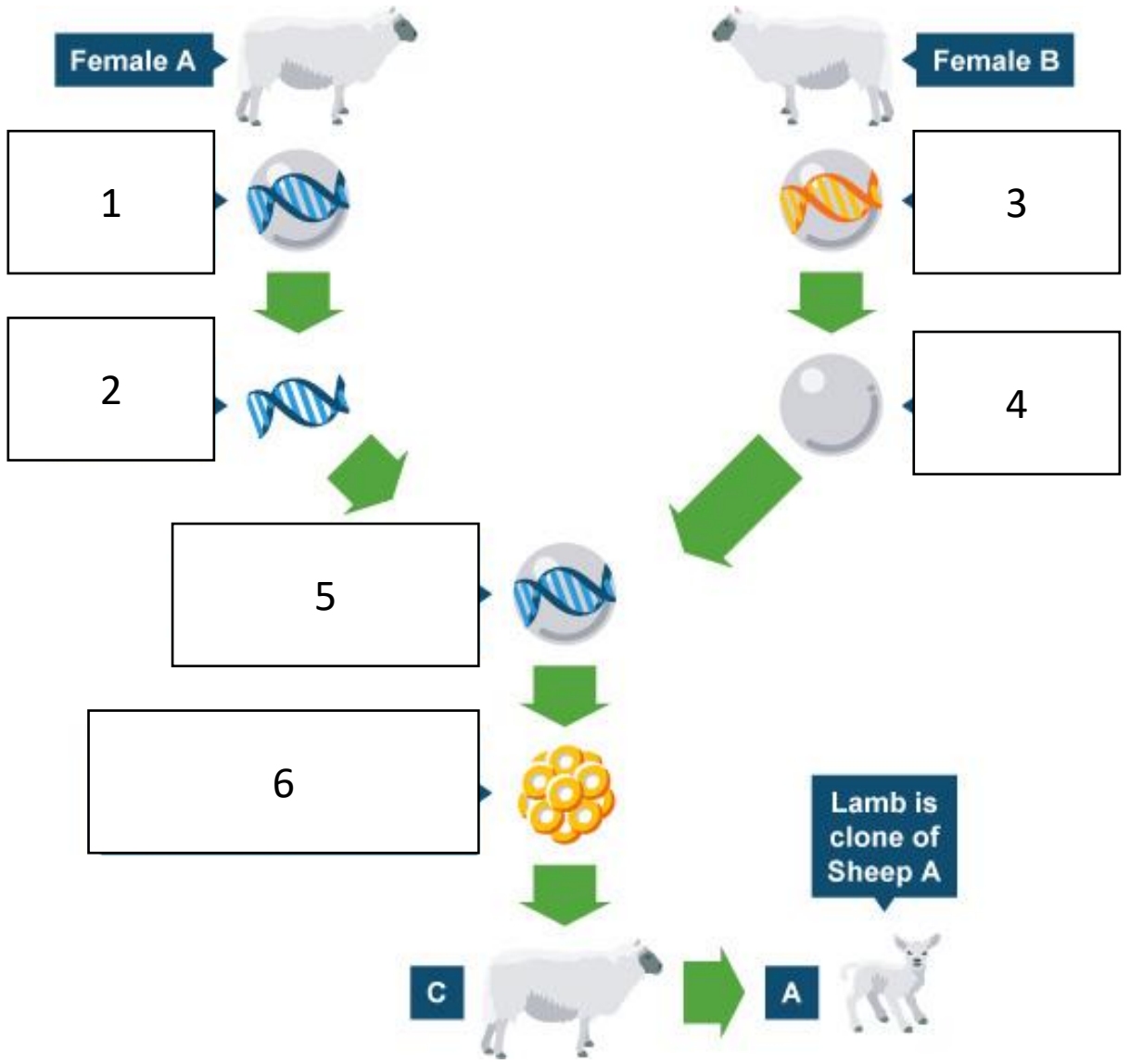
| 11. Selective breeding | |
|---|---|
| Selective breeding | The ancient practice of artificially selecting animals and plants to breed together to create certain characteristics |
| Inbreeding | The consequence of too much selective breeding. Can lead to disease or defects |
| Outcomes of selective breeding | • Disease resistance in crops<br>• Increased meat and milk production<br>• Domestication of pets<br>• Large unusual flowers |

| 12. Genetic engineering | |
|---|---|
| Genetic engineering | The process of changing the genome by adding a desirable gene from another organism |
| GM crops | Genetically modified crops that are resistant to disease or grow bigger crops. Controversial to some |

| 13. Process of genetic engineering (HT ONLY) | |
|---|---|
| 1 | DNA containing desired gene removed from cell |
| 2 | Enzyme cuts out gene |
| 3 | Plasmid taken from bacteria |
| 4 | Plasmid cut by same enzyme |
| 5 | Plasmid and human gene joined by an enzyme |



| 14. Cloning (TRIPLE ONLY) | |
|---|---|
| Tissue cloning | Using groups of cells from a plant to grow a identical new plants |
| Cuttings | Old fashioned simple method of growing a new plant from part of an old plant |
| Embryo transplant | Splitting apart unspecialised animal cells from an embryo and transplanting them into host mother |
| Adult cell cloning | |
| 1 | Body cell taken from Sheep A |
| 2 | DNA removed |
| 3 | Egg taken from Sheep B |
| 4 | Nucleus removed |
| 5 | DNA and cell fused with electric shock |
| 6 | Cell develops into embryo and implanted into surrogate (c) |



| 15. Theory of evolution (TRIPLE ONLY) | |
|---|---|
| Charles Darwin | Proposed the theory of evolution in his book 'on the origins of species' |
| Darwin's theory took a long time to be accepted because: | • It challenged the idea that God made all creatures<br>• There was not enough evidence at the time<br>• Mechanism of inheritance was not understood for another 50 years. |
| Jean-Baptiste Lamarck | Had a different theory about inherited characteristics. He believed they were acquired through the life of the parents. He was wrong |
| Alfred Russell Wallace | Independently came up with the idea of evolution and natural selection at the same time as Darwin. Worked on the idea of speciation |
| Speciation | Formation of a new species as a result of evolution |

| 16. Understanding genetics (TRIPLE ONLY) | |
|---|---|
| Mid 19th century | Gregor Mendel a monk who carried out breeding experiments on plants. Discovered the inheritance of characteristics as 'units' |
| Late 19th century | Chromosomes observed |
| Early 20th century | Chromosomes linked to inheritance. Genes discovered. |
| Mid 20th century | Structure of DNA discovered and the way genes code for proteins. |
| Today | Antibiotic resistance provides real time evidence of evolution in action |

| 17. Fossils | |
|---|---|
| Fossil | Remains of a plant or animal that were alive millions of years ago. Found in rocks. Normally only the hard parts |
| Fossil formation | • Parts of organisms that have not decayed because one or more of the conditions needed for decay are absent<br>• Parts of the organism are replaced by minerals as they decay<br>• Preserved traces of organisms, such as footprints |
| What they tell us | Early life was simple<br>As the fossils get newer the life becomes more complex |
| Why do we not have a fossil for every living thing | • Early life forms were soft bodied so not fossils formed<br>• Geological activity destroyed fossils |

| 18. Extinction | |
|---|---|
| Extinction | When an entire species has died |
| Causes of extinction | 1. Disease<br>2. New predators<br>3. Famine<br>4. Natural disaster (meteor, volcano) |

| 19. Resistant bacteria | |
|---|---|
| MRSA | A type of bacteria that has evolved to be resistant to antibiotics |
| How to prevent antibiotic resistance | 1. Not prescribing antibiotic for viral and non-threatening infections<br>2. Completing the course of antibiotic given<br>3. Restricting the use of agricultural antibiotics |

| **20. Classification of organisms** | |
|---|---|
| Carl Linnaeus | Invented the groups we classify organisms into<br>1. Kingdom<br>2. Phylum<br>3. Class<br>4. Order<br>5. Family<br>6. Genus<br>7. Species |
| Binomial name | The official name of all organism consisting of genus and species |
| 3 domain system | |
| Archaea | Primitive bacteria normally found in extreme environments |
| Bacteria | True bacteria |
| Eukaryotes | Plants, animals, fungi and protists |

# Mnemonic Device

| | |
|---|---|
| Kingdom | • King |
| Phylum | • Phillip |
| Class | • Came |
| Order | • Over |
| Family | • For |
| Genus | • Good |
| species | • Soup |

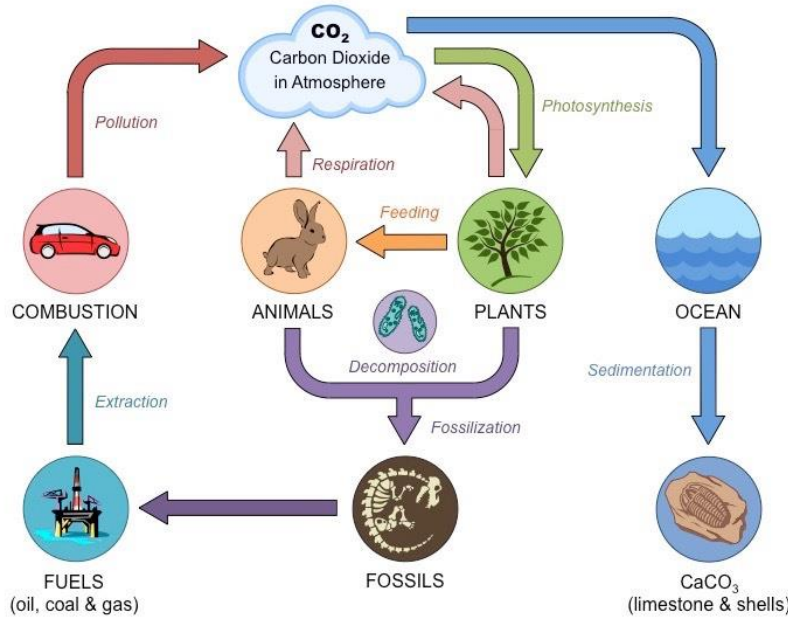
# Biology Topic 7: Ecology

| 1. Keywords | |
|---|---|
| Ecosystem | The interaction of a community of living organisms with their environment |
| Biotic | Living factors |
| Abiotic | Non-living factors |
| Interdependence | Different species rely on each other for survival within an ecosystem |
| Adaptations | Features that help an organism survive in a particular habitat |
| Habitat | Natural environment of a particular organism |
| Competition | The process by which organisms try to gain raw materials over each other.<br>Plants compete for space, light water and mineral ions<br>Animals compete for shelter, food, water and mates |
| Biodiversity | The variety of all the living organisms within the earth or ecosystem. A good thing |

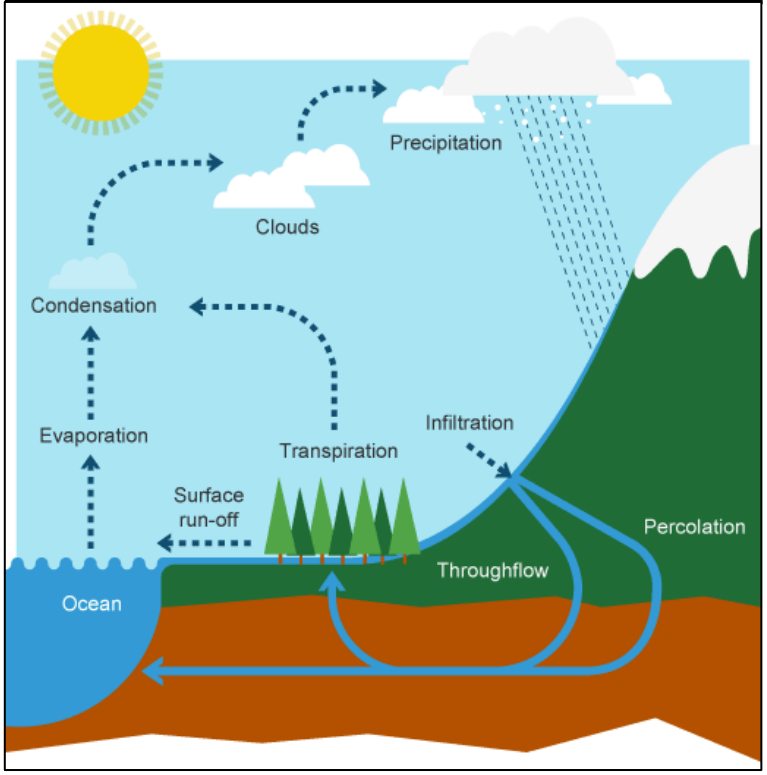
| 2. Biotic and abiotic factors | |
|---|---|
| Biotic factors | Abiotic factors |
| • availability of food<br>• new predators arriving<br>• new pathogens<br>• one species outcompeting another so the numbers are no longer sufficient to breed. | • light intensity<br>• Temperature<br>• moisture levels<br>• soil pH and mineral content<br>• wind intensity and direction<br>• carbon dioxide levels for plants<br>• oxygen levels for aquatic animals |

| 3. Levels of organisation | |
|---|---|
| Producer | An organism that makes its own food by photosynthesis. They are the starting point of all food chains |
| Consumer | Organism that eats something |
| Predator | Consumer that hunts |
| Prey | Consumer that is hunted |
| Transect | Sampling method which samples at regular spaces along a strip to measure the variation of a species |
| Quadrat | Sampling technique where a metal square is placed randomly in an area to determine an estimate of the population of a species |
| Mean | Average. Add up the values and divide by the number of results used |
| Mode | The most common value |
| Median | The value that is half the range of results |

## 4. The carbon cycle



## 5. The water cycle




## 6. Decomposition (TRIPLE ONLY)

| | |
|---|---|
| Decomposers | Microorganisms which respire on dead matter breaking it down to be recycled |
| Decomposition (decay) | The breaking down of dead matter so nutrients can be recycled |
| Compost | A natural fertiliser made from decomposed plants |

## 7. Factors that affect the rate of decomposition (TRIPLE ONLY)

| Factor | Value | Reason |
|---|---|---|
| Temperature | 35-40°C | Too cold, rates slow. Too hot enzymes denature |
| Oxygen | As much as possible | Decomposers work faster when they respire aerobically. If they respire anaerobically they produce biogas, which can be useful |
| Water | As much as possible | Decomposers need water to help digest their food |

## 8. Waste management

| Pollution type | Examples |
|---|---|
| Water | Sewage |
| | Fertilisers |
| | Toxic chemicals |
| Air | Smoke |
| | Acidic gases ($SO_2$) |
| Land | Landfill |
| | Toxic chemicals |

## 9. Impact of pollution

| | |
|---|---|
| Destruction of peat bogs | Reduction in biodiversity<br>Burning the peat releases carbon dioxide |
| Deforestation to make room for agriculture and biofuels | Reduction in biodiversity<br>Reduces ability to absorb carbon dioxide |
| Global warming | Extreme weather<br>Famine |

| 10. Maintaining biodiversity |
|---|
| 1. breeding programmes for endangered species<br>2. protection and regeneration of rare habitats<br>3. reintroduction of field margins and hedgerows in agricultural areas<br>4. reduction of deforestation and carbon dioxide emissions by some governments<br>5. recycling resources rather than dumping waste in landfill. |

| 11. Trophic levels (TRIPLE ONLY) | | |
|---|---|---|
| 1 | producers | Plants and algae |
| 2 | Primary consumers | Herbivores |
| 3 | Secondary consumers | Carnivores/ Predators |
| 4 | Tertiary consumers | Top carnivore/ apex predator |
| Energy loss between trophic levels | | Only 10% of biomass makes it up each trophic level. It is wasted by<br>• Respiration of glucose<br>• Wasted being produced and excreted |

| 12. Food security (TRIPLE ONLY) | |
|---|---|
| Food security | Having enough food for your population |
| Biological factors which affect food security: | • Increased birth rate<br>• Changing diet habits<br>• New pests and pathogens<br>• Drought<br>• Rising costs<br>• War |

| 13. Food production (TRIPLE ONLY) | |
|---|---|
| Factory farming | Increasing food production by restricting the movement of animals and heating their cages |
| Sustainable fishing | Using fish quotas to prevent over fishing and the extinction of fish stocks |
| Fusarium | A fungus that makes mycoprotein and vegetarian protein source. |
| GM bacteria | Produce human insulin for medical use. |

# Notes page

# Y11 GCSE Exam Dates

Y11 Mock(s):

Y11 PPE(s):

Final GCSE(s):

Success Programme Sessions:

Revision Guide (if applicable):

Notes