



*'I will take responsibility for my learning, be intellectually curious and work independently at school and at home.'*



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# SCIENCE: BIOLOGY

EXAM BOARD: **AQA**

COURSE CODE: **8461**

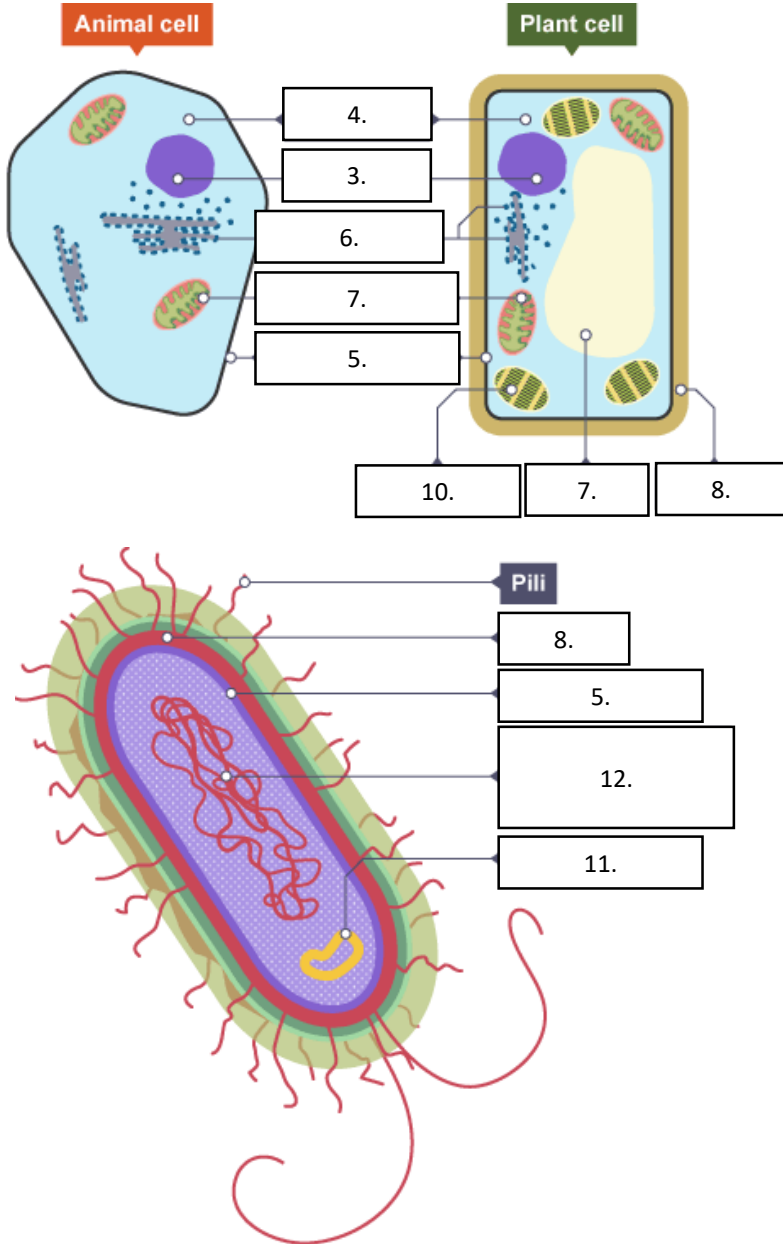
TOPIC NUMBER	TOPIC
1	CELL BIOLOGY
2	ORGANISATION
3	INFECTION AND RESPONSE
4	BIOENERGETICS
5	HOMEOSTASIS AND RESPONSE
6	INHERITANCE, VARIATION AND EVOLUTION
7	ECOLOGY

Name: .....

Tutor Group: .....

# Biology Topic 1: Cell Biology

## 1. Cell structure



### Keywords

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

## 2. Specialised cells

### Keywords

<b>Differentiation</b>	A stem cell turning into a specialised cell
<b>Stem cell</b>	A special type of cell which can turn into other specialised cells
<b>Adult stem cells</b>	Can only produce certain types of cell -found in bone marrow
<b>Embryonic stem cells</b>	Can produce all types of cells - controversial
<b>Meristems</b>	Where plant stem cells are found
<b>Sperm cells</b>	Take male DNA to the egg <ul style="list-style-type: none"> <li>• Tail to help it swim</li> <li>• Lots of mitochondria for energy</li> </ul>
<b>Nerve cells</b>	Carry electrical signals around the body <ul style="list-style-type: none"> <li>• Long to cover long distances</li> <li>• Branches to connect to other cells</li> </ul>
<b>Muscle Cells</b>	Muscle cells contract <ul style="list-style-type: none"> <li>• Long so have space to contract</li> <li>• Lots of mitochondria for energy</li> </ul>
<b>Root hair cells</b>	Root hair cells absorb water and minerals <ul style="list-style-type: none"> <li>• Long hairs</li> <li>• Big surface area for absorption</li> </ul>
<b>Phloem Cells</b>	Phloem cells transport sugars (plants) <ul style="list-style-type: none"> <li>• Long tube joined end to end</li> </ul>
<b>Xylem cells</b>	Xylem cells transport water (plants) <ul style="list-style-type: none"> <li>• Long tubes joined end to end</li> <li>• Hollow so water can flow through</li> </ul>


### 3. Comparing types of microscope

Type of microscope	Advantages	Disadvantages
Light microscope	<ol style="list-style-type: none"> <li>Cheaper</li> <li>Can see colours</li> <li>Can see live specimen</li> </ol>	<ol style="list-style-type: none"> <li>Lower magnification</li> </ol>
Electron microscope	<ol style="list-style-type: none"> <li>Expensive</li> <li>Higher magnification (x1000 more)</li> </ol>	<ol style="list-style-type: none"> <li>Can only see dead specimen</li> <li>No colour</li> </ol>

### 4. Calculating magnification

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

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



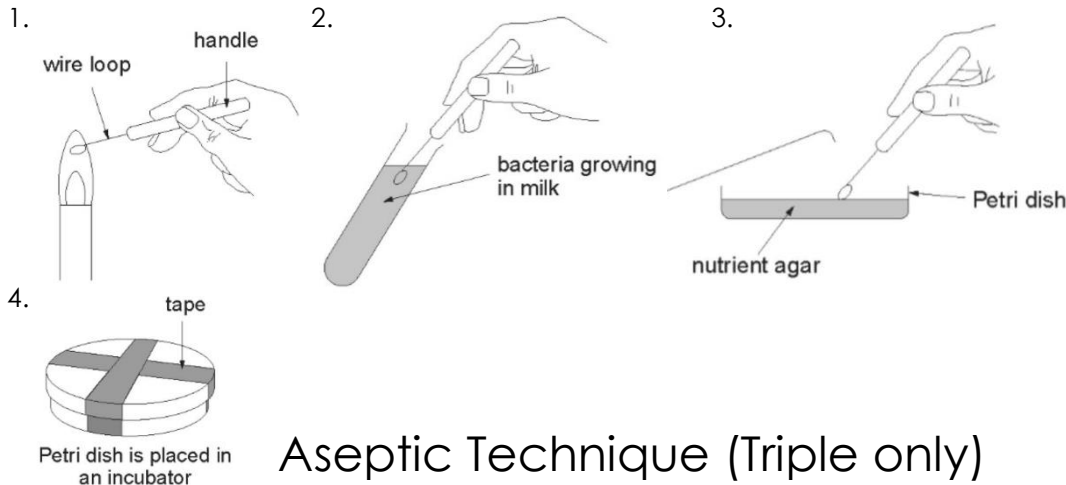
	(mm)	( $\mu\text{m}$ )	(nm)
2mm	2	2000 ( $2 \times 10^3$ )	2000000 ( $2 \times 10^6$ )
130 $\mu\text{m}$	0.13	130	130000 ( $1.3 \times 10^5$ )
0.032m	32	32000 ( $3.2 \times 10^4$ )	32000000 ( $3.2 \times 10^7$ )
7.25 $\mu\text{m}$	0.00725	7.25	7250 ( $7.25 \times 10^3$ )

Conversion factors:  $\times 1000$  (mm to  $\mu\text{m}$ ),  $\times 1000$  ( $\mu\text{m}$  to nm),  $\div 1000$  (mm to nm),  $\div 1000$  (nm to  $\mu\text{m}$ )

### 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



1. Sterilizing the wire loop.

2. Inoculating the loop with bacteria growing in milk.

3. Spreading the sample on nutrient agar in a Petri dish.

4. Sealing the Petri dish with tape and placing it in an incubator.

### Aseptic Technique (Triple only)

#### 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

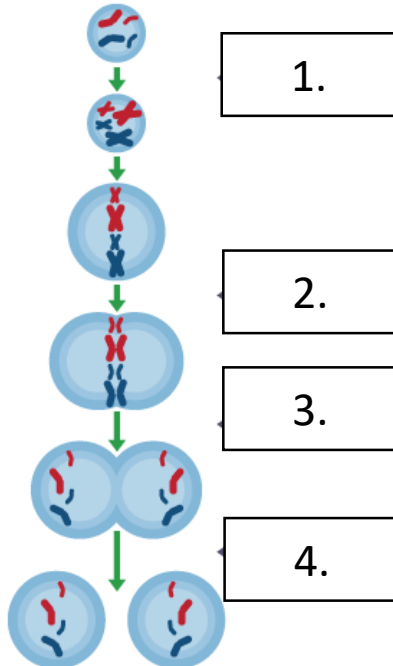
### Definition

### Examples

Diffusion	The passive movement of a substance from an areas of high concentration to an area of low concentration	<ul style="list-style-type: none"> <li>Oxygen and carbon dioxide in the lungs</li> <li>Perfume in a room</li> </ul>
Osmosis	The movement of <b>water</b> molecules across a partially permeable membrane from a less concentrated solution to a more concentrated solution.	<ul style="list-style-type: none"> <li>Water uptake in plants</li> <li>Water absorption in the intestine</li> </ul>
Active transport	Movement of a substance from a lower concentration to a higher concentration, against the concentration gradient. <b>Uses energy.</b>	<ul style="list-style-type: none"> <li>Mineral absorption by roots</li> <li>Glucose absorption by the intestine</li> </ul>
Surface area to volume ratio	The surface area divided by the volume expressed as a ratio	All high <ul style="list-style-type: none"> <li>Unicellular organisms</li> <li>Alveoli in the lungs</li> <li>Villi in the intestines</li> </ul>

## 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

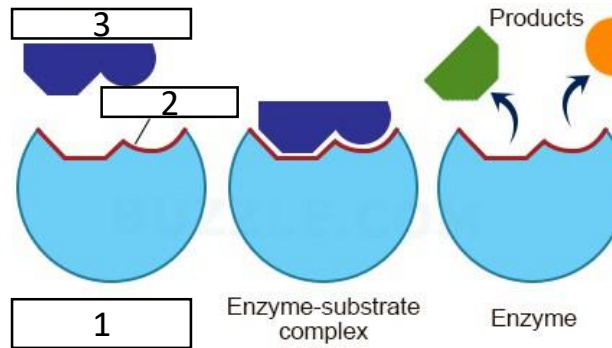
# Biology Topic 2: Organisation

## 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

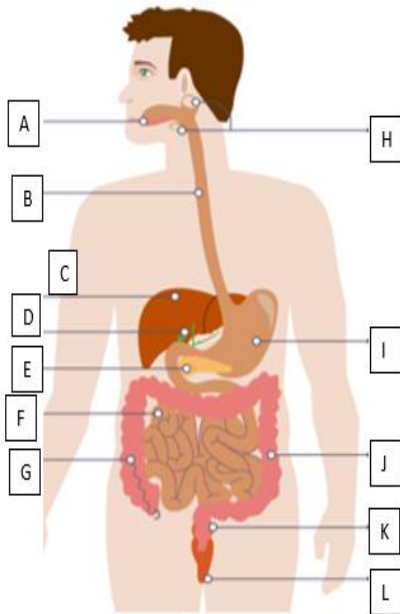
## 3. Enzymes

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:	<ul style="list-style-type: none"> <li>• Temperature</li> <li>• pH</li> </ul>

## 2. Digestive System



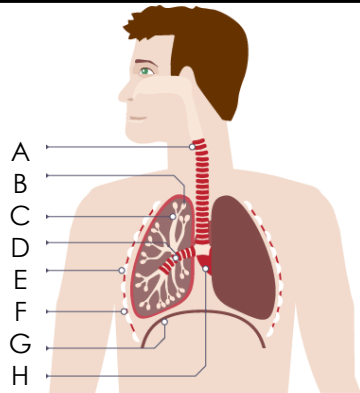
<b>A</b>	<b>Mouth:</b> mechanical breakdown/chew food	<b>G</b>	<b>Appendix:</b> useless organ which harbours bacteria (good and bad)
<b>B</b>	<b>Oesophagus</b> (gullet): push chewed food to stomach	<b>H</b>	<b>Salivary Glands:</b> produce saliva with amylase enzymes to breakdown starch
<b>C</b>	<b>Liver: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



### 3. Types of enzyme

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

### 4. Respiratory system



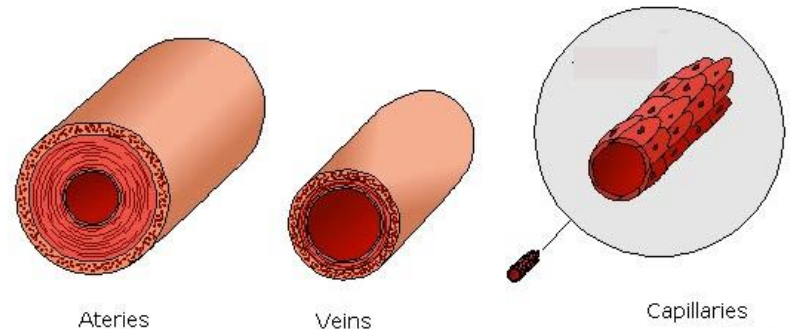
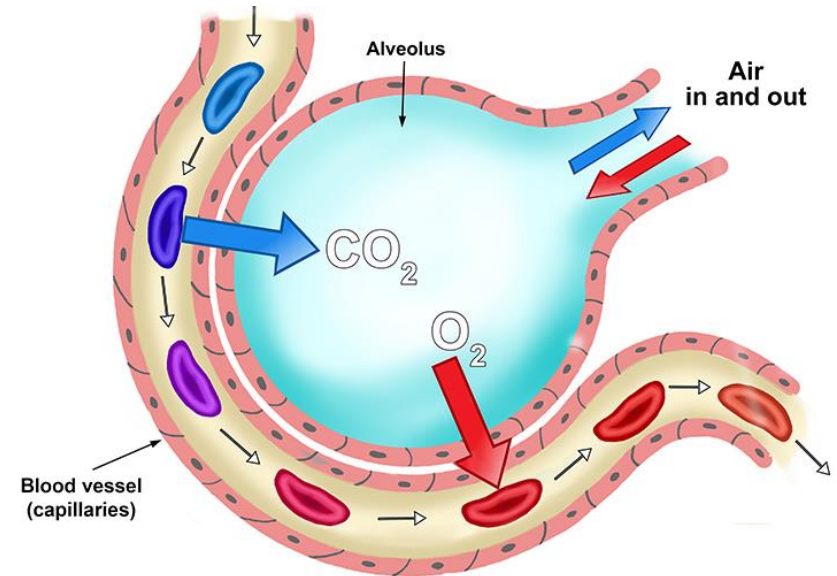
A	Trachea
B	Alveoli
C	Bronchiole
D	Right bronchus
E	Ribs
F	Intercostal muscles
G	Diaphragm
H	Heart

### 6. Blood vessels

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

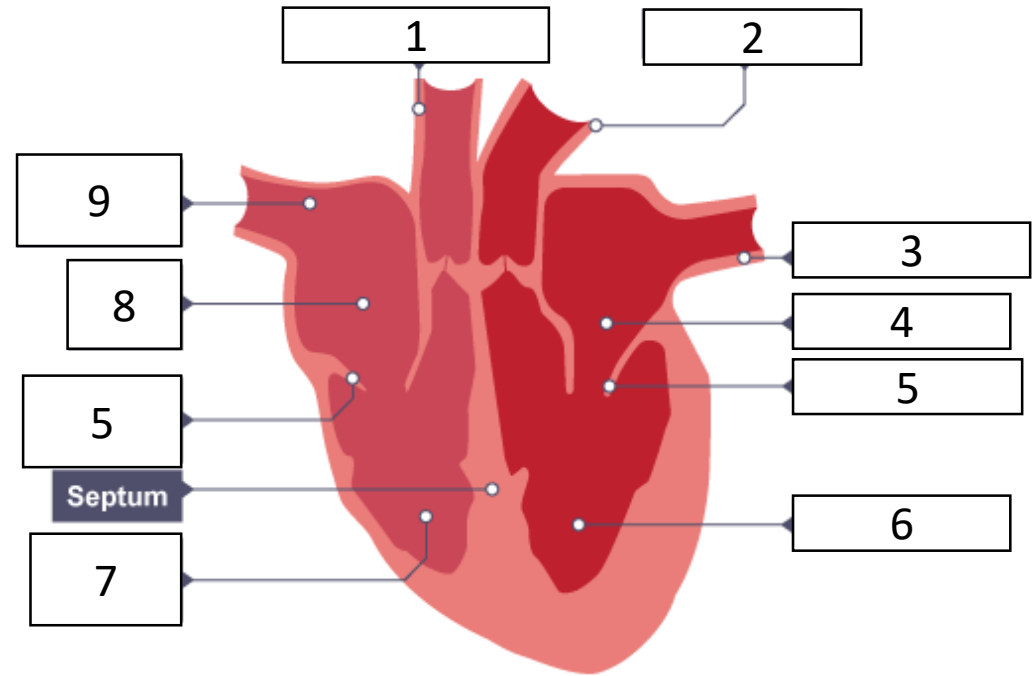
### 5. Adaptation to gas exchange: Alveoli

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 <sub>2</sub> and high CO <sub>2</sub>



## 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

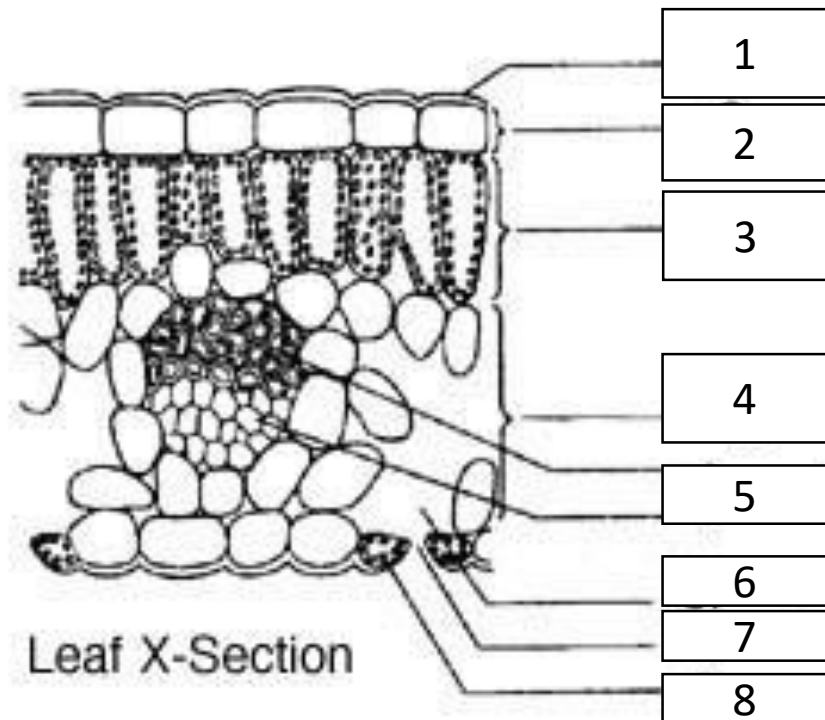
Coronary heart disease (CHD)	When fatty material builds up and stops the flow of blood to the heart muscle
Coronary arteries	The arteries that supply the heart muscle
Stent	A mesh tube used to keep the coronary arteries open
Statins	Drugs used to reduce blood cholesterol preventing (CHD)
Faulty valve	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 <sub>2</sub> 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 Skin rash	Droplet inhalation	Yes	vaccination
	HIV	Human	Reduced immune system	Unprotected sex	Yes	Antiviral drugs
	Tobacco mosaic virus (TMV)	Plants	Discolours leaves Stunts growth	Direct contact	No	Remove infected leaves and burn
Bacteria	Salmonella	Human	Fever Stomach cramps Vomiting 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 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

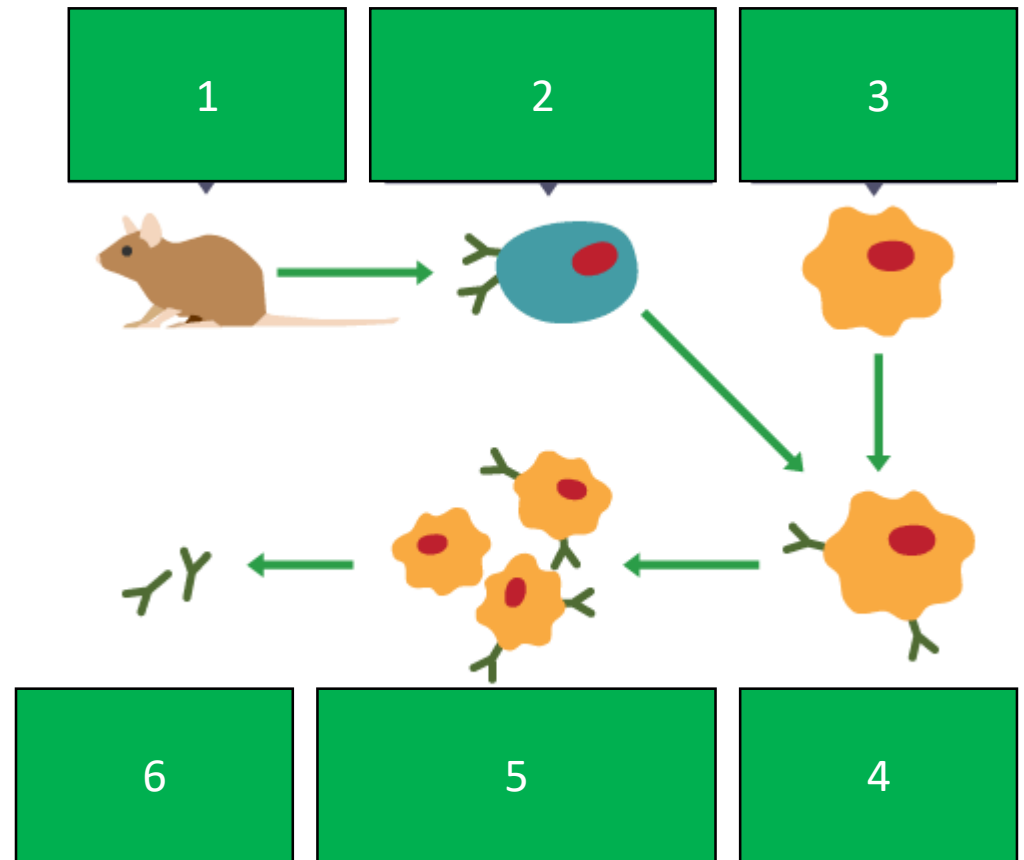
6. Drug development			
Drug/medicine		A chemical which alters the body. Often extracted from plants (eg aspirin) and microorganisms (eg penicillin)	
Toxicity		If it is toxic	
Efficacy		How well it works	
Dose		How much of a drug you need to take to make it work	
Placebo		A pill without the drug in it. 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 Measure levels of hormones or other chemicals in blood Locate specific molecules in cells 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:	<ul style="list-style-type: none"> <li>Stunted growth</li> <li>Spots on leaves</li> <li>Areas of decay</li> <li>Growths</li> <li>Malformed stems and leaves</li> <li>Discolouration</li> <li>Presence of pests</li> </ul>	Identified by:	<ul style="list-style-type: none"> <li>Reference to book or internet</li> <li>Taking to a lab</li> <li>Testing kits containing monoclonal antibodies</li> </ul>
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## 9. Plant disease (TRIPLE ONLY)

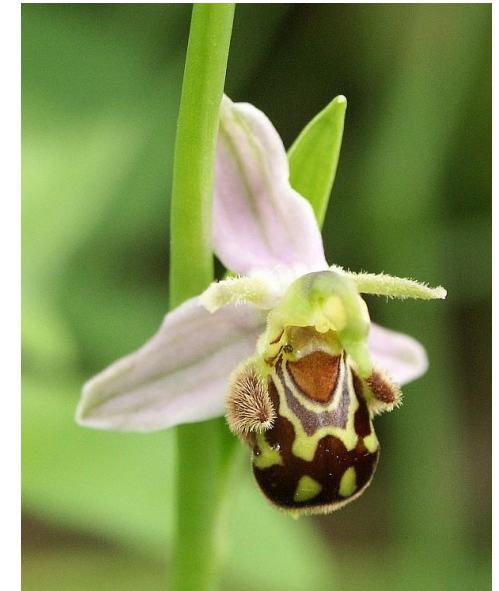
Type	Disease	How it damages plants
Pest	Aphid	A insect which injects toxins into plants as they eat them
Fungal	Black spot	Damages leaves
Virus	Tobacco mosaic virus	Damages leaves

## 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)

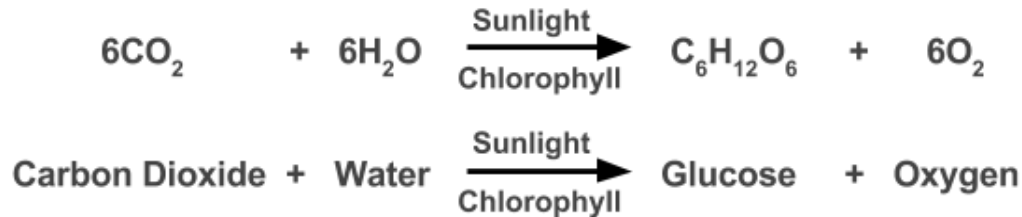
Type	Examples
Physical	<ul style="list-style-type: none"><li>Cellulose cell wall</li><li>Waxy cuticle on leaves</li><li>Layers of dead cells (bark on trees)</li></ul>
Chemical	<ul style="list-style-type: none"><li>Antibacterial chemicals</li><li>Poisons to stop animals</li></ul>
Mechanical	<ul style="list-style-type: none"><li>Thorns and hairs stop animals</li><li>Leaves which droop or curl when touched</li><li>Mimicry to trick animals</li></ul>



[Bee orchid](#) flower resembles a female bee closely enough to attract males in search of a mate

# Biology Topic 4: Bioenergetics

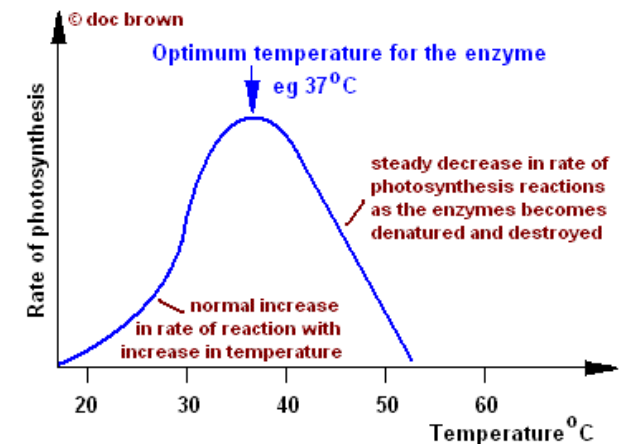
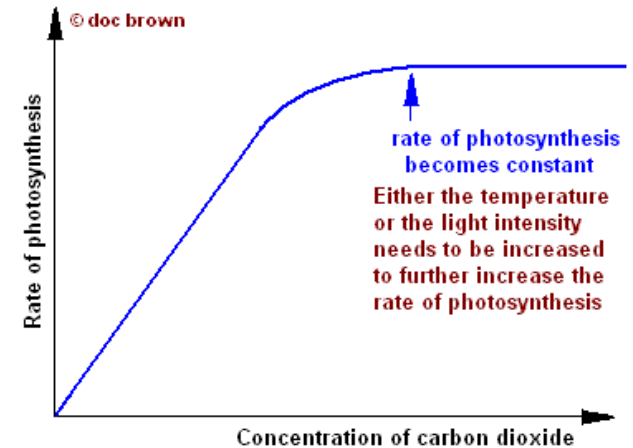
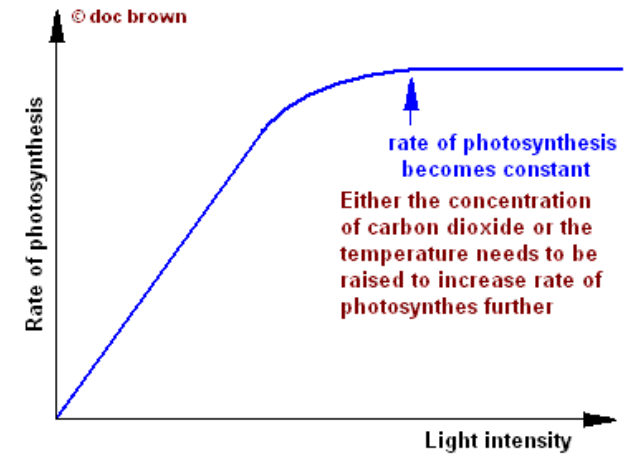
## 1. Photosynthesis



Photosynthesis	An endothermic reaction where sunlight is absorbed and used to convert carbon dioxide and water into glucose and oxygen
Uses of glucose	<ul style="list-style-type: none"> <li>• Respiration</li> <li>• Converted into starch</li> <li>• Produce fat or oil</li> <li>• Produce cellulose cell walls</li> <li>• Produce amino acids</li> </ul>

## 2. Rate of photosynthesis

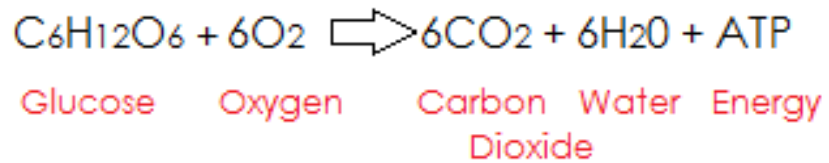
Factor	Affect on photosynthesis	Reason
Light	Increases	More energy for the reaction
Carbon dioxide	Increases	More reactants (provided there is no limiting reactant)
Amount of chlorophyll	Increases	More energy for the reaction
Temperature	Increases then decreases	Initially more energy but then enzyme 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: <ul style="list-style-type: none"><li>• Chemical reactions</li><li>• Movement</li><li>• Warmth</li></ul>
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	

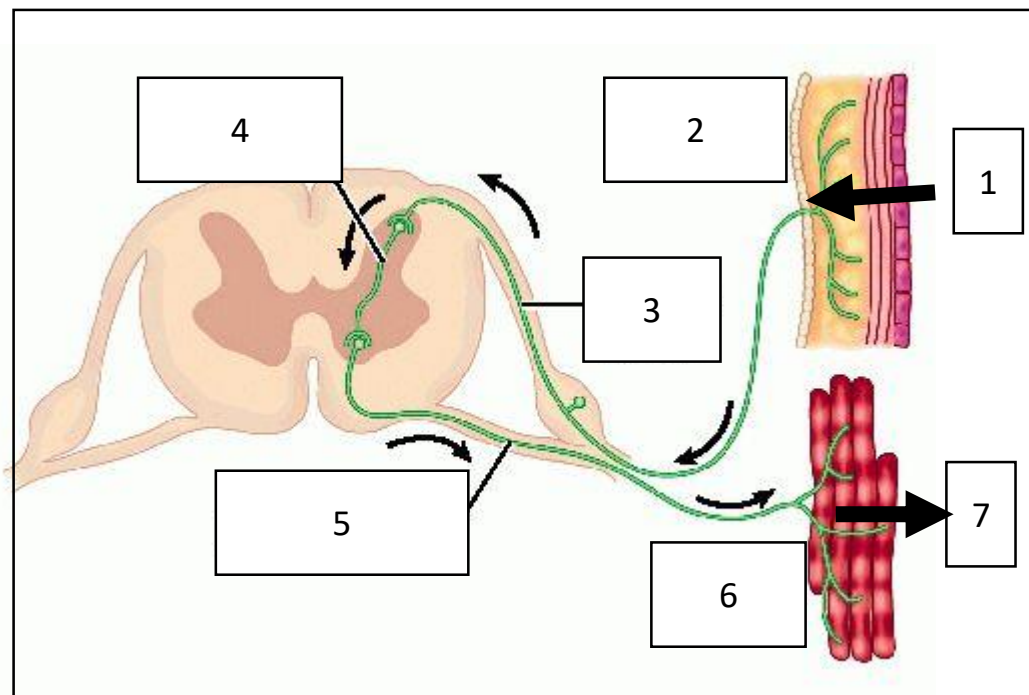
### 5. Metabolism

Metabolism	The sum of all the reactions in a cell or the body
Includes:	<ul style="list-style-type: none"><li>• Conversion of glucose to starch, glycogen and cellulose</li><li>• Formation of lipids from glycerol and 3 fatty acids</li><li>• Use of glucose and nitrates to make proteins (PLANTS)</li><li>• Respiration</li><li>• Breakdown of protein to form urea.</li></ul>

# 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. 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) The brain and the spinal chord
Neurone	Nerve cell. Carries an electrical signal from one end to the other

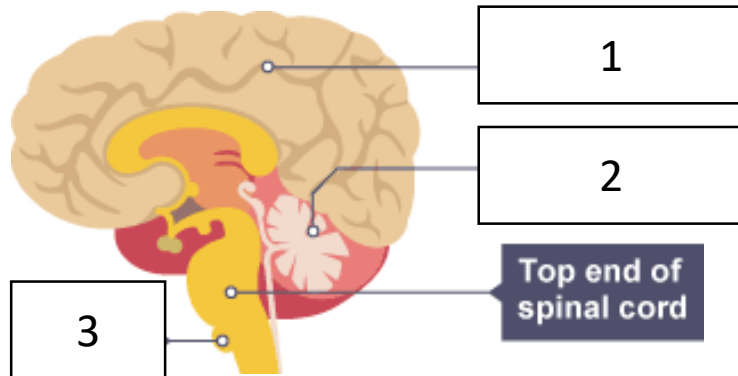


## 2. Nervous system: Reflex arc

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 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

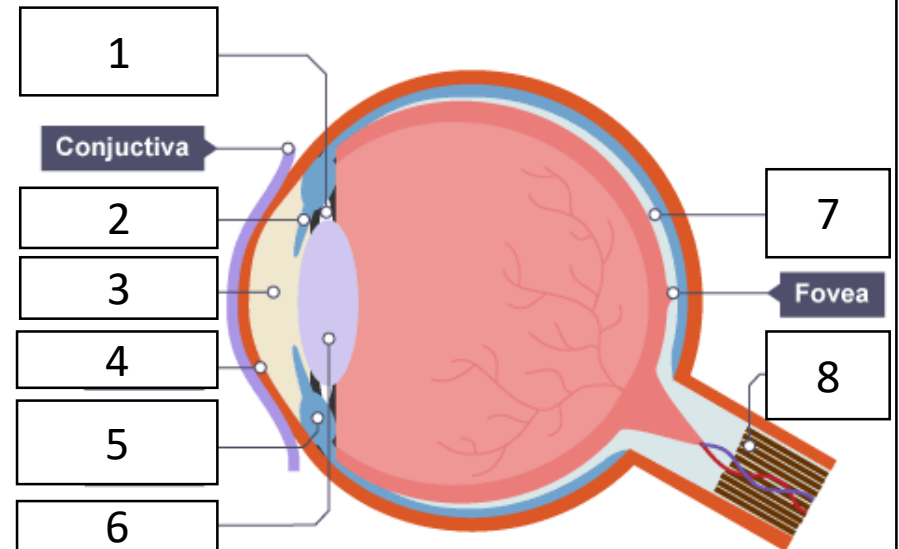


### 5. Adjusting focus (TRIPLE ONLY)

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

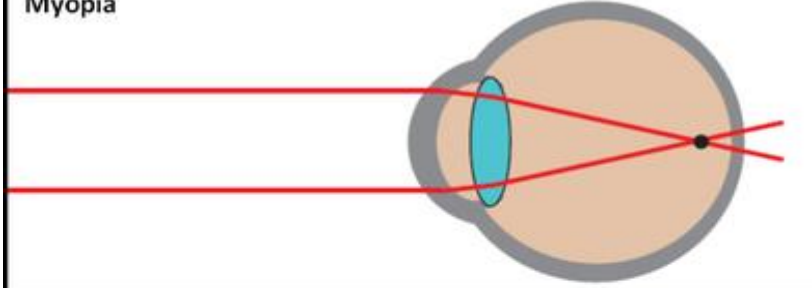
### 4. The eye (TRIPLE ONLY)

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

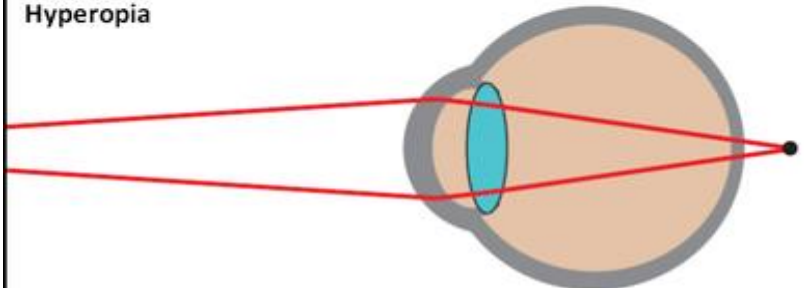


6. Vision problems (TRIPLE ONLY)		
Name	Myopia	Hyperopia
Common name	Short-sighted	Long-sighted
Corrected by	<ul style="list-style-type: none"><li>• Glasses</li><li>• Contact lenses</li><li>• Laser eye surgery</li></ul>	

**Myopia**



**Hyperopia**



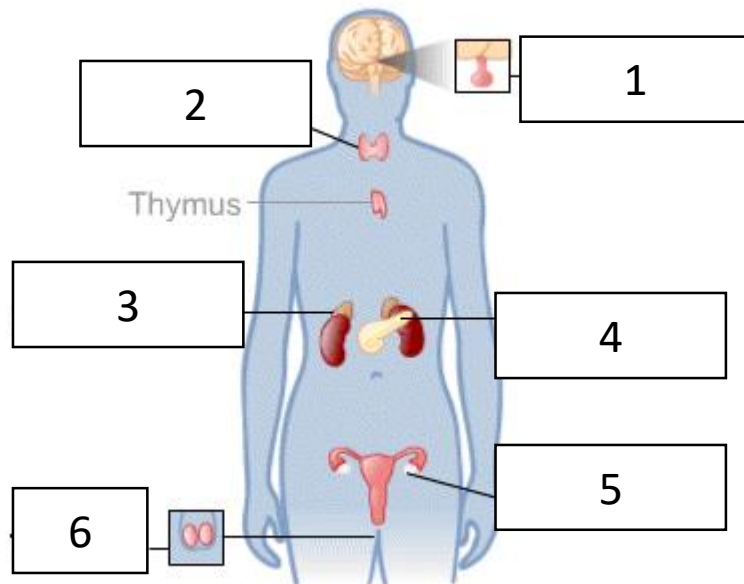
7. Control of body temperature (TRIPLE ONLY)	
Thermoregulatory centre	Part of the brain that receives signals about temperature of the blood and skin
37°C	Optimum internal body temperature
Vasodilation	The widening of blood vessels near the surface of the skin
Vasoconstriction	The narrowing of blood 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
<ol style="list-style-type: none"> <li><b>Vasodilation</b> bring blood near the surface</li> <li><b>Sweating</b> increases</li> <li>Heat is lost through evaporation and radiation</li> <li>Body temp drops</li> </ol>	<ol style="list-style-type: none"> <li><b>Vasoconstriction</b> take blood away from surface</li> <li><b>Sweating</b> stops</li> <li>Muscles contractions (<b>shivering</b>) generate heat</li> <li>Body temp increases</li> </ol>

## 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

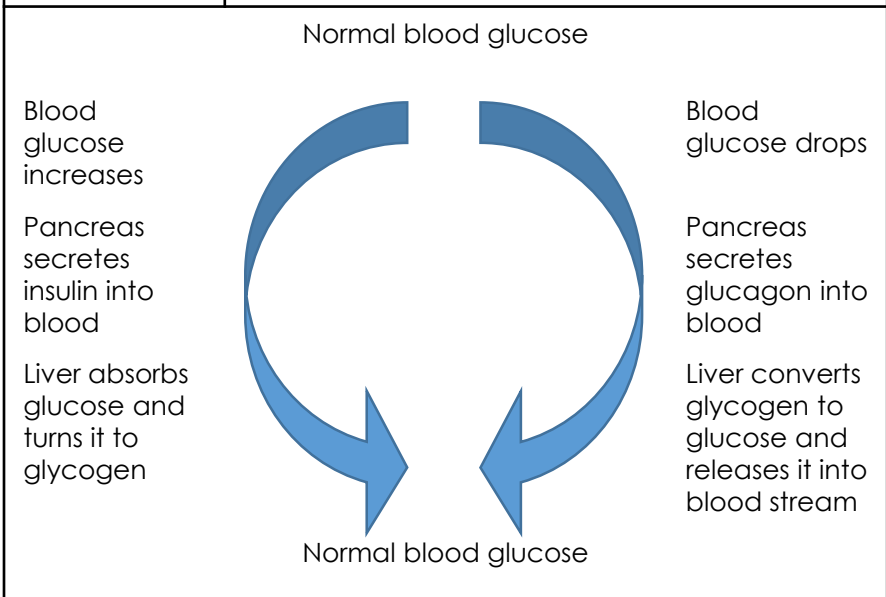


## 10. Control of blood glucose levels

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
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## 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: <ul style="list-style-type: none"> <li>• All of the glucose</li> <li>• Some of the mineral ions</li> <li>• Some of the water</li> </ul>
Dialysis	A way of manually filtering the blood when the kidneys are no longer functioning. Whilst waiting for a transplant

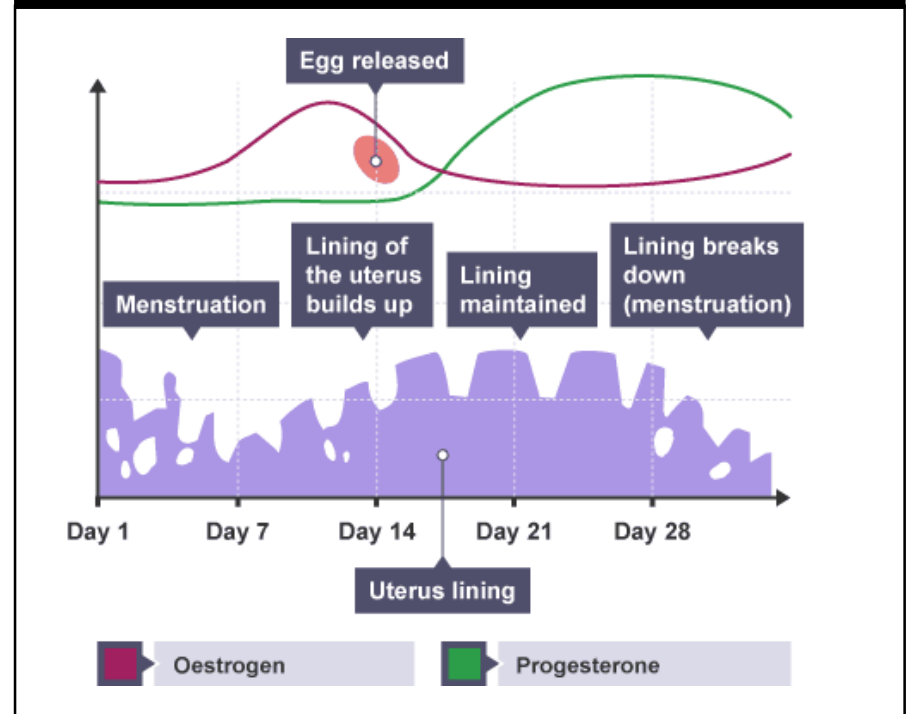
## 13. Hormones and the kidneys (TRIPLE HT ONLY)

ADH (anti-diuretic hormone)	A hormone made in the pituitary gland which increase the reabsorption of water by kidney tubules
How ADH works:	
<ol style="list-style-type: none"> <li>1. Blood is too concentrated</li> <li>2. Pituitary gland releases ADH into blood.</li> <li>3. ADH increase permeability of kidney tubules</li> <li>4. More water is reabsorbed</li> <li>5. Blood dilutes to normal levels. Urine is yellow.</li> </ol>	

## 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:	
<ol style="list-style-type: none"> <li>1. FSH and LH stimulate production of many eggs</li> <li>2. Eggs are harvested and fertilised by fathers sperm in a lab</li> <li>3. Fertilised eggs grow in lab</li> <li>4. A few embryos are implanted into mother womb</li> </ol>	
Possible consequences of IVF	Physical and emotional fatigue Low success rate 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 from 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	<ol style="list-style-type: none"> <li>1. Shaded side contains more auxin</li> <li>2. So grows faster</li> <li>3. Plant leans towards light</li> </ol>
Gravitropism	<ol style="list-style-type: none"> <li>1. Bottom of shoot has more auxin</li> <li>2. So grows slower</li> <li>3. Roots bends downwards</li> </ol>

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	<ul style="list-style-type: none"> <li>• Malaria</li> <li>• Fungi</li> <li>• Plants</li> </ul>

## 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. 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 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

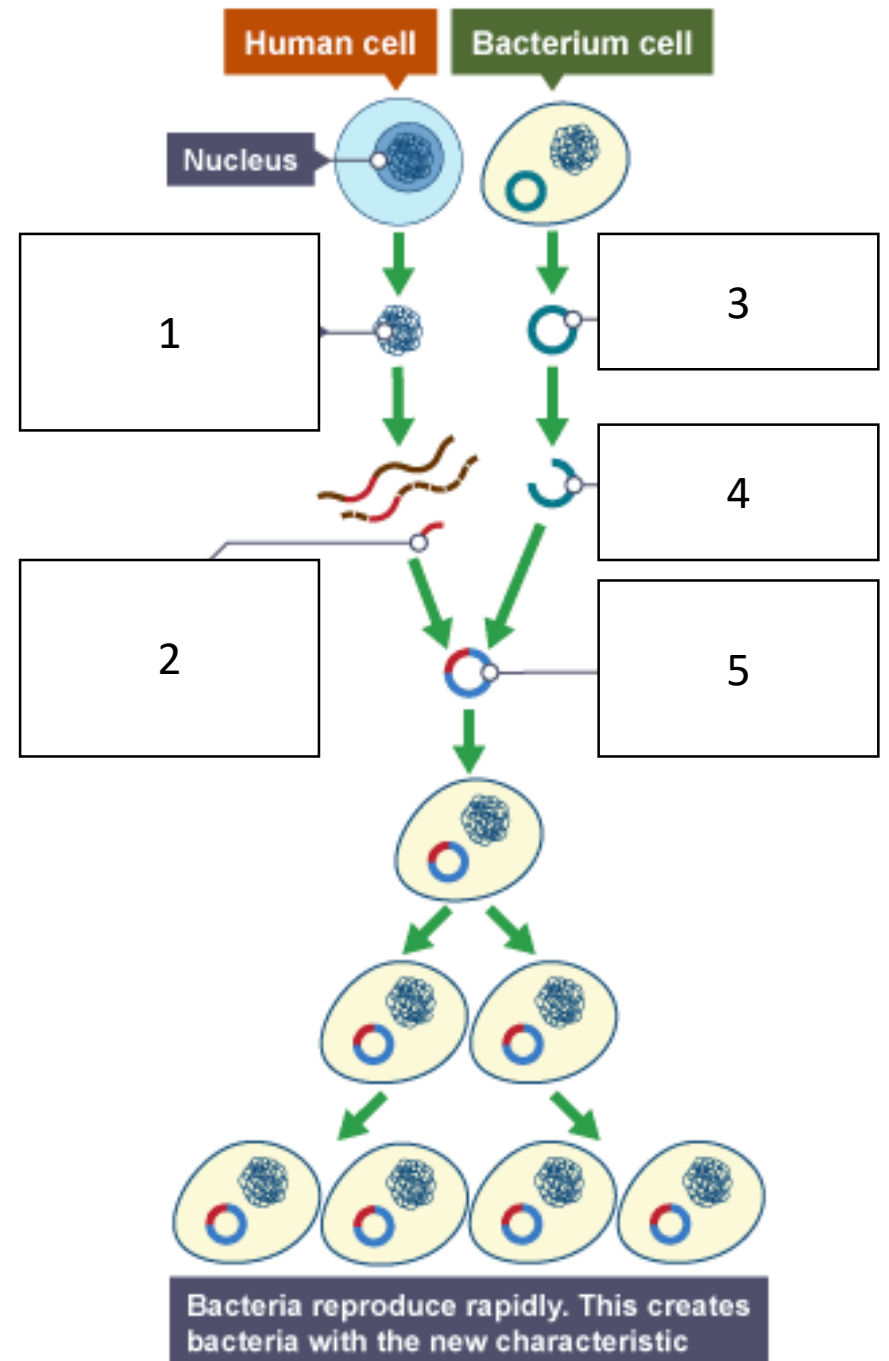
Selective breeding	The ancient practice of artificially selecting animals and plants to breed together to create certain characteristics
Inbreeding	The consequence of too much selective breeding. Can lead to disease or defects
Outcomes of selective breeding	<ul style="list-style-type: none"> <li>• Disease resistance in crops</li> <li>• Increased meat and milk production</li> <li>• Domestication of pets</li> <li>• Large unusual flowers</li> </ul>

### 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

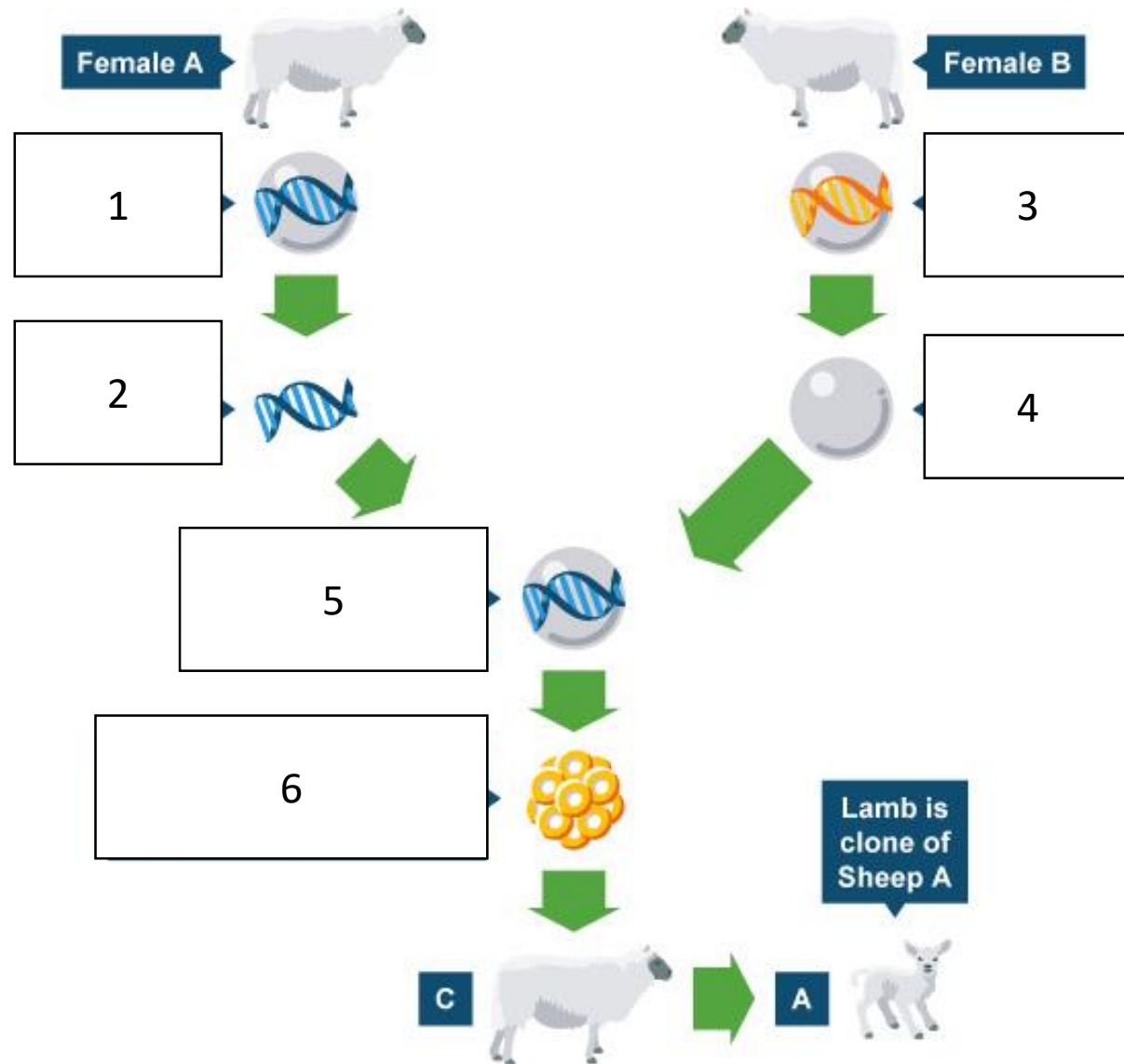
### 13. Process of genetic engineering (HT ONLY)

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:	<ul style="list-style-type: none"> <li>It challenged the idea that God made all creatures</li> <li>There was not enough evidence at the time</li> <li>Mechanism of inheritance was not understood for another 50 years.</li> </ul>
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 19 <sup>th</sup> century	Gregor Mendel a monk who carried out breeding experiments on plants. Discovered the inheritance of characteristics as 'units'
Late 19 <sup>th</sup> century	Chromosomes observed
Early 20 <sup>th</sup> century	Chromosomes linked to inheritance. Genes discovered.
Mid 20 <sup>th</sup> 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	<ul style="list-style-type: none"> <li>Parts of organisms that have not decayed because one or more of the conditions needed for decay are absent</li> <li>Parts of the organism are replaced by minerals as they decay</li> <li>Preserved traces of organisms, such as footprints</li> </ul>
What they tell us	Early life was simple As the fossils get newer the life becomes more complex
Why do we not have a fossil for every living thing	<ul style="list-style-type: none"> <li>Early life forms were soft bodied so not fossils formed</li> <li>Geological activity destroyed fossils</li> </ul>

## 18. Extinction

Extinction	When an entire species has died
Causes of extinction	<ol style="list-style-type: none"> <li>Disease</li> <li>New predators</li> <li>Famine</li> <li>Natural disaster (meteor, volcano)</li> </ol>

## 19. Resistant bacteria

MRSA	A type of bacteria that has evolved to be resistant to antibiotics
How to prevent antibiotic resistance	<ol style="list-style-type: none"> <li>Not prescribing antibiotic for viral and non-threatening infections</li> <li>Completing the course of antibiotic given</li> <li>Restricting the use of agricultural antibiotics</li> </ol>



## 20. Classification of organisms

Carl Linnaeus	Invented the groups we classify organisms into 1. Kingdom 2. Phylum 3. Class 4. Order 5. Family 6. Genus 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. Plants compete for space, light water and mineral ions Animals compete for shelter, food, water and mates
Biodiversity	The variety of all the living organisms within the earth or ecosystem. A good thing

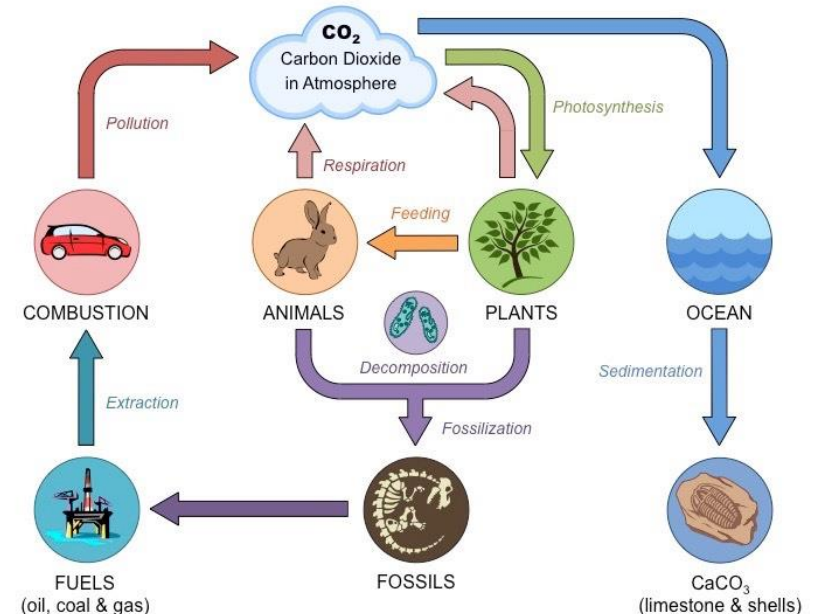
## 2. Biotic and abiotic factors

Biotic factors	Abiotic factors
<ul style="list-style-type: none"> <li>availability of food</li> <li>new predators arriving</li> <li>new pathogens</li> <li>one species outcompeting another so the numbers are no longer sufficient to breed.</li> </ul>	<ul style="list-style-type: none"> <li>light intensity</li> <li>Temperature</li> <li>moisture levels</li> <li>soil pH and mineral content</li> <li>wind intensity and direction</li> <li>carbon dioxide levels for plants</li> <li>oxygen levels for aquatic animals</li> </ul>

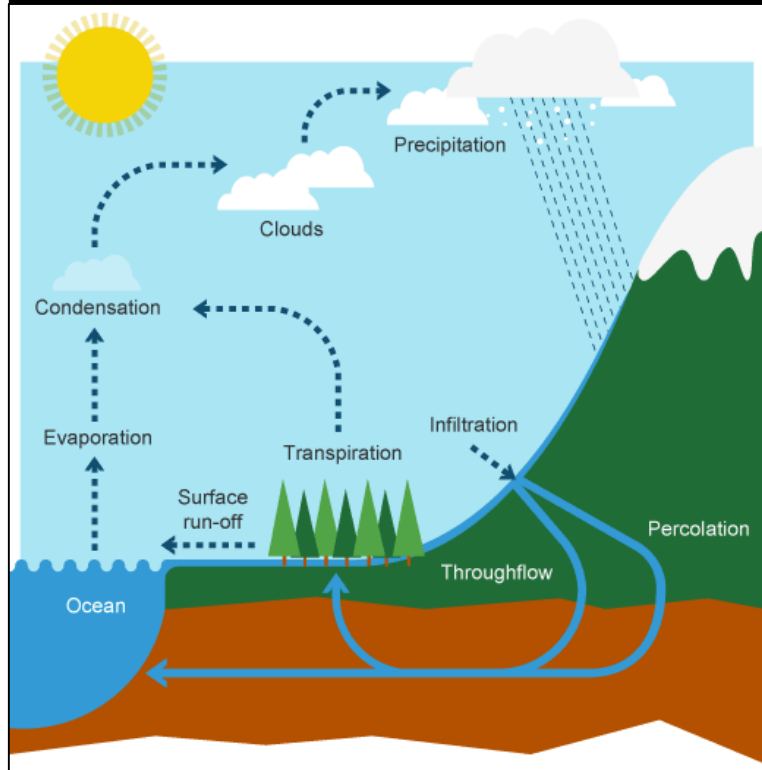
## 3. Levels of organisation

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 <sub>2</sub> )
Land	Landfill
	Toxic chemicals

## 9. Impact of pollution

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

## 10. Maintaining biodiversity

1. breeding programmes for endangered species
2. protection and regeneration of rare habitats
3. reintroduction of field margins and hedgerows in agricultural areas
4. reduction of deforestation and carbon dioxide emissions by some governments
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 <ul style="list-style-type: none"><li>• Respiration of glucose</li><li>• Wasted being produced and excreted</li></ul>

## 12. Food security (TRIPLE ONLY)

Food security	Having enough food for your population
Biological factors which affect food security:	<ul style="list-style-type: none"><li>• Increased birth rate</li><li>• Changing diet habits</li><li>• New pests and pathogens</li><li>• Drought</li><li>• Rising costs</li><li>• War</li></ul>

## 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.

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## Y11 GCSE Exam Dates

Y11 Mock(s):

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Y11 PPE(s):

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Final GCSE(s):

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Success Programme Sessions:

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Revision Guide (if applicable):

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