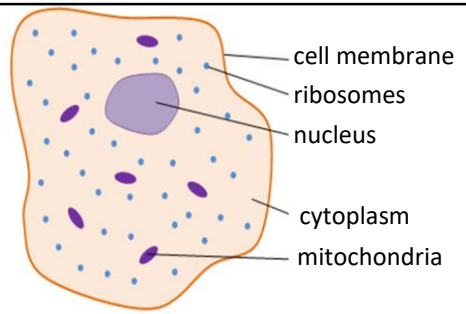
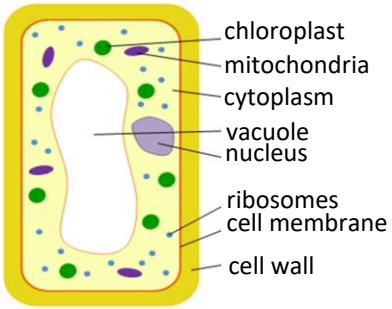
BIOLOGY PAPER 1: Cell Biology Part 1

Facts: Eukaryotic and prokaryotic cells	
1. Eukaryotic cell	Has a **nucleus that contains DNA, cytoplasm** and a **cell membrane**. Examples: **Animal** and **plant** cells.
2. Prokaryotic cell	Does **not have a nucleus**, **DNA** is **loose** in the cytoplasm and as rings of DNA called **plasmids**. Example: **Bacteria**.
3. Size	**Prokaryotic** cells are much **smaller** than **eukaryotic** cells.
Facts: Animal and plant cells	
4. Nucleus	Contains the **genetic material (DNA)** of a cell and **controls** the activities of a cell. **Animals and plants**.
5. Cell membrane	Controls the **movement** of **substances into** and **out of** the cell. **Animals and plants**.
6. Cytoplasm	Where **chemical reactions** such as **aerobic respiration** take place. **Animals and plants**.
7. Mitochondria	Where **aerobic respiration** that releases **energy** happens. **Animals and plants**.
8. Ribosomes	Synthesise (make) **proteins**. Smaller than mitochondria. **Animals and plants**.
9. Vacuole	Filled with **cell sap** to push the cell contents against the cell wall and keep the cell turgid. **Plants only**.
10. Chloroplast	Contains a chemical called **chlorophyll** which **absorbs light** for **photosynthesis**. **Plants only.**
11. Cell wall	Made of **cellulose**, provides **structure** and **support** for the cell. **Plants only.**
Facts: Cell differentiation	
12. Cell differentiation	When a cell **changes** to become a **specialised cell**.
13. In animals	Most types of animal cell **differentiate** (change) at an **early stage.**
14. In plants	Many types of plant cells retain the ability to **differentiate** (change) **throughout life.**
Facts: Cell specialisation	
15. Sperm cell (Animal)	Have a **flagellum** (tail) to **swim** to the egg and lots of **mitochondria** to produce **energy by respiration**.
16. Nerve cell (Animal)	Long, thin cells with branches that carry **electrical impulses all over the body**.
17. Muscle cell (Animal)	Contain lots of **mitochondria** to produce **energy by aerobic respiration** for **contraction.**
18. Root hair cell (Plant)	**Large surface area** to **absorb water** and **minerals**. Lots of **mitochondria** to carry out **active transport**.
Facts: Cell size calculations	
19. Equation	Image size = actual size x magnification
20. Units	Millimetre (mm) --> Micrometre (µm) x by 1000. E.g. 7mm = 7000µm Micrometre (µm) --> Millimetre (mm) ÷ by 1000. E.g. 1mm = 0.001µm





Facts: Microscopes (Light and electron)	
21. Magnification	How **many times bigger** an image is than the actual size.
22. Resolution	The amount of **detail** that can be seen.
23. Equation	Total magnification = magnification of eyepiece x magnification of objective Lens
24. Light	**Low magnification** and **low resolution**. Cheap and portable
25. Electron	**High magnification** and **high resolution. Expensive.**
Facts: Chromosomes	
26. Chromosomes	**Long thread-like** structures made from tightly coiled **DNA**.
27. Location	Chromosomes are found in the **nucleus** of a cell.
28. Gene	**Small section** of **DNA** which codes for a particular characteristic.
29. Body cells	Body cells have **23 pairs (46 single)** of chromosomes.
30. Gametes	Gametes (**egg** and **sperm** cells) have **23 single** chromosomes.
Facts: Mitosis and cell cycle	
31. Cell cycle	The 3 stages that a cell goes through as it is **growing** and **dividing**.
32. Stage 1	The cell **grows.** The **DNA replicates** to form **two** copies of each **chromosome.** The number of **sub-cellular** structures such as **ribosomes** and **mitochondria** also **increases**.
33. Stage 2	In **mitosis**, **one** set of **chromosomes** is pulled to each **end** of the cell and the **nucleus divides**.
34. Stage 3	The **cytoplasm** and **cell membranes** divide to form **two identical cells**.

BIOLOGY PAPER 1: Cell Biology Part 2

Facts: Stem cells in animals

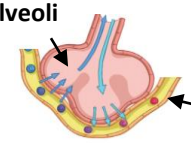
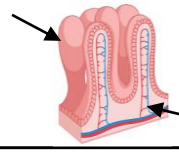
1. Stem cell	An **unspecialised** cell that can **differentiate** (change).
2. Sources of stem cells	Animal stem cells are found in **embryos** (developed from a fertilised egg) and **adult bone marrow.**
3. Uses	To treat conditions such as **paralysis** and **diabetes**.
4. + of embryo stem cells	**Easy** to **extract** and can they can **differentiate** into **any** type of cell.
5. - of embryo stem cells	**Ethical** issues (**unused** IVF **embryos**) and the body may **reject** them.
6. + of adult stem cells	The body **won't reject** them and there are **no ethical** issues.
7. - Disadvantages	They can **differentiate** into only a **few types** of cells and they are **difficult** to **extract**.

Facts: Stem cells in plants

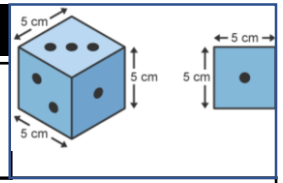
8. Meristem	**Tissue** in the **shoots and roots** of **plants** that contains cells that can **differentiate** into **any** type of plant cell **throughout the life** of the plant.
9. Uses	To **clone plants quickly** and **economically**, to **clone rare species** to protect **from extinction** and to produce **crop plants** with special features such as **disease resistance.**

Facts: Diffusion

10. Diffusion	The **net movement** of **particles** from a **high concentration** to a **low concentration**.
11. Concentration gradient	The **difference in the concentration** of a chemical across a membrane.
12. Specialised exchange surface	An area that is **adapted** to **maximise** that **rate of diffusion** in order to enable the survival of an organism. See the examples below:

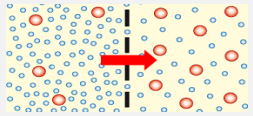
13. Alveoli (lungs), gas exchange	14. Villi (small intestine), absorption of nutrients
alveoli  O_2 moves into the blood CO_2 moves out of the blood **blood capillary**	**villi**  Glucose and amino acids move from the villi into the blood. **blood capillary**

15. Adaptations of exchange surfaces	**Lots of alveoli/villi** or a **folded membrane** to provide a **large surface area**. **Good blood supply** to **maintain** a steep **concentration gradient**. **Thin wall** (one-cell thick) so particles only have to diffuse a **short distance**.
16. Surface area and volume	**Surface area** = A cube has **six faces**. So the area of 1 face = 5 x 5 = 25cm^2 The area of a cube = 6 x 25 = 150cm^2
	Volume = space inside length x width x height 5 x 5 x 5 = 125cm^3



17. Single celled organisms	Have a **large surface area to volume ratio** so **do not need specialised exchange surfaces**.
18. Multicellular organism	Have a **small surface area to volume ratio** so **do need specialised exchange surfaces**.

Facts: Osmosis

19. Solution	A **mixture** that contains a **solute (sugar or salt)** that has **dissolved** in a **solvent (water).**
20. Sucrose	A type of sugar.
21. Dilute solution	A solution that contains a **high concentration of water molecules** and a **low concentration of solute** particles.
22. Concentrated solution	A solution that contains a **low concentration of water molecules** and a **high concentration of solute** particles.
23. Partially permeable membrane	A membrane that allows **small molecules** to **pass through**.
24. Osmosis  Dilute High H_2O Conc. Low H_2O	The **net movement** of **water molecules** from a **high water concentration** to a **low water concentration** across a **partially permeable membrane.** Or … The **net movement** of **water molecules** from a **dilute solution** to a **concentrated solution**.

Facts: Active Transport

25. Active transport	The movement of **particles** across a **membrane** from a **low concentration** to a **high concentration** (against a concentration gradient).
26. In plants	**Mineral ions** are absorbed from the soil (**low** concentration) into the plant **root hair cells** (**high** concentration).
27. In animals	**Sugar molecules** from the **gut** (**low** concentration) are absorbed into the **blood** (**high** concentration).
28. Energy	Active transport **requires** extra **energy** to move particles **up a concentration gradient.**
29. Mitochondria	Cell structures that **produce** the **energy** needed for active transport by the process of **respiration**.

BIOLOGY PAPER 1: Organisation Part 1

Facts: Principles of organisation

1. Cell	Basic building blocks of all living **organisms**.
2. Tissue	A **group of cells** with a **similar structure** and **function**.
3. Organ	Groups of **tissues** working together, to perform a **certain function**.
4. Organ system	Groups of **organs** working together to perform body functions.
5. Organism	An **individual** animal or plant.
6. Types of tissue	**Muscular tissue** for movement. **Glandular tissue** produces hormones and enzymes. **Epithelial** tissue provides a covering for organs.

Facts: Digestion

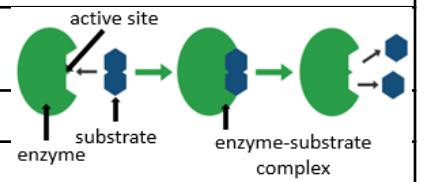
7. Digestion	The **breakdown** of **large** food **molecules into small** food **molecules** so that they can be **absorbed** into the **blood**.
8. Mechanical digestion	Breakdown of large food molecules into smaller molecules using **chewing** and **churning**.
9. Chemical digestion	Breakdown of large food molecules into smaller molecules using **enzymes**.
10. Bile	An **alkali produced** by the **liver** and **stored** in the **gall bladder.** Bile has two main functions: **1. To neutralise** the **hydrochloric acid** from the **stomach.** **2. To emulsify lipids** (break down fats into small droplets).

Facts: Digestive system

11. Digestive system	Several **organs** working together to **digest** and **absorb food**.
12. Mouth	**Teeth chew** food to start **mechanical digestion**. The **salivary glands** produce **enzymes** to start **chemical digestion**.
13. Oesophagus	A muscular tube which **moves food** to **the stomach** by **peristalsis**.
14. Stomach	**1. Muscular** tissue carries out **mechanical digestion** by **churning**. **2. Glandular** tissues produces **enzymes** for **chemical digestion**.
15. Small intestine	**1. Enzymes** breakdown large food molecules into small molecules. 2. Small molecules are then **absorbed** into the **blood**.
16. Pancreas	Produces digestive enzymes.
17. Rectum	Stores faeces.
18. Anus	Where faeces leaves the body.

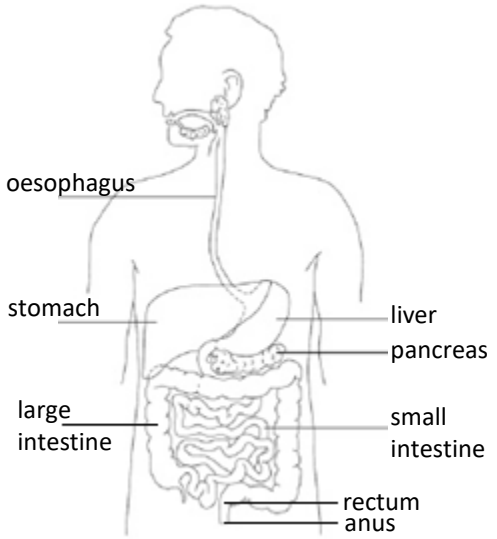
Facts: Enzymes

19. Proteins	Molecules made up of long chains of **amino acids.**
20. Uses	Proteins make **hormones, antibodies and enzymes.**
21. Enzyme	A **biological catalyst** which **speeds up** the rate of a **chemical reaction without being used up** or **changed**.
22. Substrate	The **molecule** that the **enzyme breaks down**.
23. Active site	Where the **substrate binds** to the enzyme.
24. Lock and key model	The active size has a **complementary** (opposite) shape to the substrate.



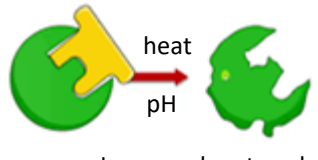
Facts: Digestive enzymes

25. Carbohydrase	Breaks down **carbohydrates** into **simple sugars**. Produced in the **small intestine, pancreas** and **salivary glands.**
26. Amylase	Breaks down **starch** into **glucose**. Produced in the **small intestine, pancreas** and **salivary glands**.
27. Protease	Breaks down **proteins** into **amino acids**. Produced in the **small intestine, pancreas** and **stomach**
28. Lipase	Breaks down **lipids** into **fatty acids** and **glycerol**. Produced in the **small intestine** and **pancreas.**



Facts: Enzyme activity

29. Optimum conditions	The **best** working **conditions** for the enzyme, were **enzyme activity** is at its **fastest rate**.
30. Enzyme activity	The activity of an enzyme is affected by two conditions; **temperature** and **pH**.
31. Optimum temperature	Enzymes in the human body have an optimum temperature of **37^{0}C** (**body temperature)**.
32. Optimum pH	Protease, **pH 2** as it found in the **stomach** (**hydrochloric acid** is present in the stomach). Amylase **pH 7**. **Bile neutralises** hydrochloric acid to provide this optimum pH.
33. Denature	The active site **changes shape** and the **substrate no longer fits**.



BIOLOGY PAPER 1: Organisation Part 2

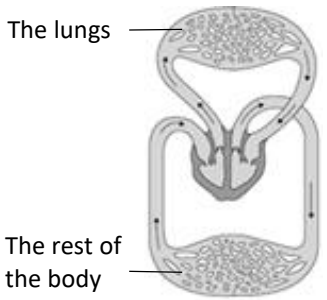
Facts: Respiratory system

1. Structure	**Organ system** made up of the: **trachea**, **bronchi**, **lungs** and **alveoli.**
2. Breathing	The mechanical action of taking air in and out of the lungs (inhaling and exhaling).
3. Respiration	A **chemical reaction** that takes place in our cells, to provide **energy.**
4. Gaseous exchange	Happens through the process of diffusion, gases move from an area of high concentration to an area of low concentration.
5. Alveoli	**Where gas exchange occurs in the lungs**. **Oxygen** diffuses from the **alveoli** into the **blood** and **carbon dioxide** diffuses from the **blood** into the **alveoli**.
6. Alveoli adaptations	**1. Lots of alveoli** to provide a **large surface area**. **2. Good blood supply** to **maintain** a steep **concentration gradient**. **3. Thin wall** so particles only have to diffuse a **short distance**.

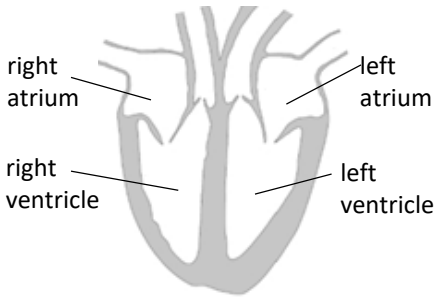
Facts: Circulatory system

7. Structure	**Organ system** made up of the: **heart**, **blood vessels** and **blood**.
8. Double system	Blood passes through the heart twice on each journey around the body.
9. The Heart	The right side of the heart pumps blood to the lungs and the left side of the heart pumps blood around the body.
10. Atria	The **top two chambers** of the heart. The right atrium and the left atrium.
11. Ventricles	The **bottom two chambers** of the heart. The right ventricle and the left ventricle.
12. Resting heart rate	Controlled by a **group of cells** in the **right atrium**.
13. Blood vessels	**Transport blood** around the body. There are 3 main types; **arteries**, **veins** and **capillaries**

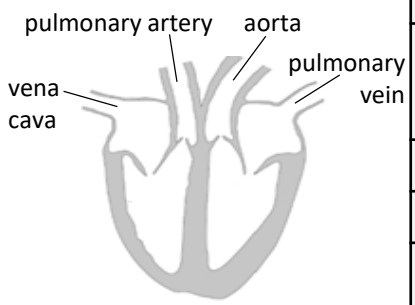
14. Double circulatory system



15. Chambers of the Heart



16. Blood vessels of the Heart



Facts: Blood vessels

17. Arteries	Carry **blood** under **high pressure away from the heart**. They have **thick walls** with **lots of muscle tissue** and **elastic fibres** to allow them to **stretch** and **spring back**.
18. Vein	Carry **blood** under **low pressure back into the heart**. They have **thin walls** with **little muscle tissue and elastic fibres**. They have **valves** to keep blood flowing in the **right direction**.
19. Capillaries	Carry blood through organs and body tissues **directly to cells.** They are one cell thick which allows **rapid diffusion** of materials between the blood and body to take place.

Facts: Blood

20. Blood	Blood is a **tissue** containing **plasma**, **red blood cells**, **white blood cells** and **platelets**.
21. Plasma	**Transports carbon dioxide**, food molecules, urea and hormones.
22. Red blood cells	**Carry oxygen.** They have a **large surface area, no nucleus** and lots of **haemoglobin** so they can carry as much oxygen as possible.
23. White blood cells	Change shape to **engulf** and **destroy pathogen,** produce **antibodies** and **antitoxins.**
24. Platelets	Help the **blood** to **clot.**

Facts: Non-communicable diseases – Coronary Heart disease and Cancer

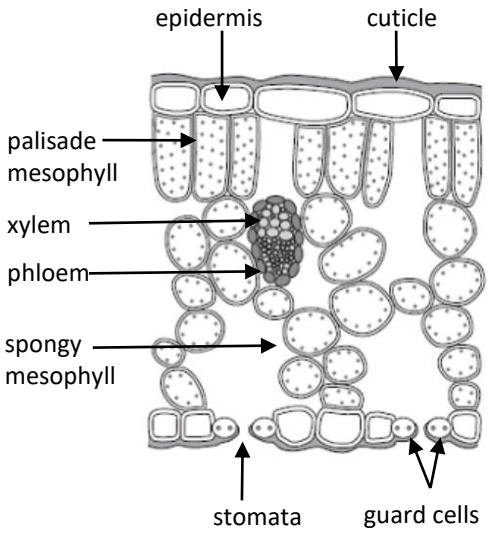
25. Non communicable	A disease that is **not caused** by a **pathogen** (bacteria or virus) and **cannot be transferred** (spread) between people or other organisms.
26. Coronary heart disease	Caused by the **build up of fatty deposits** in the coronary arteries. This **narrows arteries**, **reducing blood flow** and therefore the amount of oxygen reaching heart muscle. This can then cause **heart attacks** and **heart failure.**
27. Stents	A **metal mesh** used to **open** and **widen blocked arteries** to **increase** the **flow of blood** containing **oxygen and glucose**. **1. Benefits:** A life-long fix to the artery, no more medication. **2. Risks:** An operation, meaning a risk of developing an infection and/or blood clots.
28. Statins	**Drugs** that help **lower cholesterol** in the blood. **1.Benefits:** No operation, reduce the risk of CHD and strokes. **2.Risks**: Must be taken regularly to be effective, side-effects.
29. Cancer	**Uncontrollable cell growth** and **division** causing a **tumour**.
30. Benign tumour	Grows quickly but **does not invade other parts of the body**, can **easily be removed**.
31. Malignant tumour	Grows quickly and **invades other tissues, spreading** to other parts of the body to form **secondary tumours**.

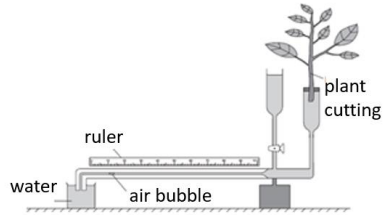
BIOLOGY PAPER 1: Organisation Part 3

Facts: Plant organisation	
1. Cells	The main cells in a plant are the **palisade cells**, **guard cells and root hair cells.**
2. Tissue	The main tissues in a plant are the **xylem**, **phloem** and **meristem.**
3. Meristem	**Tissue** in the **shoots and roots** of **plants** containing cells that can **differentiate** into **any type of plant cell throughout the life of the plant**.
4. Organ	The main organs of a plant are the **roots**, **stem**, **leaves** and **flowers.**
5. Organ system	The **roots**, **stem** and **leaves** make up the transport system of a plant. Moving substances such as **glucose** and **water** up and down the plant.

Facts: Root hair cells	
6. Root hair cells	Absorb **water** and **mineral ions** from the soil.
7. Water	Absorbed by **osmosis** (high water concentration to a low water concentration).
8. Absorbing water adaptations	Root hair cells have a **large surface area** and a **thin cell wall** making **osmosis faster**.
9. Mineral ions	Absorbed by **active transport** (low concentration to a high concentration).
10. Absorbing mineral ions adaptations	Root hair cells have **many mitochondria** that produce **energy** by **respiration.** This energy is needed because active transport moves ions **against** the **concentration gradient** from a **low to high concentration.**

Facts: The leaf	
11. Leaf	Where **photosynthesis** occurs; glucose + carbon dioxide → glucose + oxygen
12. Epidermis and cuticle	**Covers** the outer surfaces of the plant. **Coated in a waxy cuticle** to **prevent water loss**. The upper epidermis is **transparent** to allow light to pass through it.
13. Palisade mesophyll	Made up of palisade cells. Most **photosynthesis** occurs here. Cells are **tightly packed** and contain **many chloroplasts** to absorb light.
14. Spongy mesophyll	Cells are **loosely packed** and contain air spaces, which increases the rate of diffusion of gases to and from the cells.
15. Xylem tissue	Transports **water** and **minerals up** the plant.
16. Phloem tissue	Transports **sugar** (glucose, sucrose) **up** and **down** the plant.
17. Stomata	**Tiny holes** in the underside of the leaf, which allows **carbon dioxide to diffuse into** the leaf for photosynthesis and **oxygen to diffuse out**.
18. Guard cells	**Control** the opening and closing of the **stomata**.



Facts: Xylem tissue	
19. Xylem	Transports **water** and **minerals up** the plant.
20. Structure	**Hollow**, **dead** tubes **strengthened** with **lignin.**
21. Transpiration stream	The **movement of water** from the roots, through the xylem and out of the leaves.
22. Transpiration	The **loss of water** from the **leaves.**
23. Rate of transpiration	**How fast water is lost** into the atmosphere through the **stomata**.
24. A Potometer	Measures the rate of transpiration.
25. Equipment diagram	As **water** is **lost** from the leaves. The **plant absorbs** the **water** from the beaker causing the **air bubble** to **move toward the plant**. The **further** the air **bubble moves** the **faster the rate.** 
26. Factors affecting transpiration	**Increasing** transpiration → **windy**, **high light intensity** (sunny), **high temperature.** **Decreasing** transpiration → **humid** (lots of water in the atmosphere).

Facts: Phloem tissue	
27. Phloem	Transports **sugar** (glucose, sucrose) **up** and **down** the plant.
28. Structure	Columns of **elongated living cells** with small pores in the end walls to allow cell sap to flow through.
29. Translocation	The **movement of sugar** (glucose, sucrose) **up** and **down** the plant.
30. Importance	Sugar needs to be able to reach **all** the **cells** of a **plant** so that **respiration** can take place.

BIOLOGY PAPER 1: Infection and response

Facts: Communicable disease	
1. Communicable disease	A disease **passed** on from person to person **caused** by a **pathogen**.
2. Pathogen	A **microorganism** that causes infectious **disease**.
3. The four pathogens	1. Bacteria 2. Virus 3. Fungus 4. Protist
4. Bacteria	**Prokaryotic** cells (no nucleus) that **reproduce rapidly** in the body and produce poisons (**toxins**) that damage tissues and **make us feel ill**.
5. Virus	Smaller than bacteria. They live and **reproduce in cells.** The **cell** then **bursts** and this **cell damage makes us ill.**
6. Fungus	**Eukaryotic cells (**have a **nucleus)**. **Yeast** is a fungus
7. Protist	Usually a single-celled eukaryotic organism.
8. Vector	An **organism** that can **spread a disease** (usually insects or rats).
9. Salmonella (bacteria)	Causes fever, vomiting, diarrhoea. Spread by eating **contaminated food**. Prevented by **cooking food properly** and **vaccinating poultry** (chickens).
10. Gonorrhoea (bacteria)	Causes pain when urinating and thick yellow/green discharge. Spread by **sexual contact**. Prevented by using **condoms**. Treated by **antibiotics**.
11. Measles (virus)	Causes fever and red skin rash. Spread through sneeze or cough droplets. Prevented by **vaccination**, **MMR** (measles, mumps and rubella).
12. HIV (virus)	Causes a flu-like illness and long term **damage to the immune system**. Spread by sexual contact and sharing needles. Prevented by using **condoms.**
13, Tobacco Mosaic Virus	Causes **leaves** to become **discolored**. Spread by contact between plants or farmers. Treated by removing infected plants and, washing hands and tools.
14. Rose black spot (fungus)	Causes **black/purple spots on leaves**. Spread by **air**, **water** and **direct contact** by gardeners. Treated by **removing** infected leaves and fungicides.
15. Malaria (protist)	Causes episodes of fever. Spread by **mosquitos** (vector). Prevented by **removing breeding sites**, sleep under **nets** and use **insect repellent**.

Facts: Human defence system	
16. Non-specific system	The first line of the body's defence. **Stops** the **pathogens entering** the body.
17. Eyes and mouth	**Enzymes** in tears and saliva **kill the pathogen** or make it inactive.
18. Skin	Acts as a **physical barrier**. **Platelets clot** the skin if cut.
19. Nose and trachea	**Mucus traps** the pathogens. Then **the tiny hairs on the cilia** cells **move** mucus and trapped pathogens out of the airways.
20. Stomach	**Chemical barrier**, **hydrochloric acid** kills bacteria.
21. Immune system	When a pathogen enters the body **white blood cells** (WBCs) will **destroy** the pathogens in **3** ways: 1. Phagocytosis 2. Antibody production 3. Antitoxin production.
22. Phagocytosis	White blood cells **surround and engulf pathogens**, releasing **chemicals** to **digest them**.
23. Antibodies	White blood cells produce antibodies which **attach to the antigens** on the surface of a pathogen. So other white blood cells can easily find and destroy the pathogen.
24. Antitoxins	White blood cells can produce antitoxins, which **neutralise the toxins** produced by bacteria.

Facts: Vaccination	
25. Vaccine (vaccination)	A small amount of **dead/inactive pathogen injected** into the body.
26. Immunisation	Making someone **immune** to a **disease** (don't get it), the **result of a having a vaccine**.
27. Vaccines advantages	Less **chance** of getting an infectious disease, they can eradicate (get rid of) a disease and money is saved on treating the disease.
28. Vaccine disadvantages	Vaccines are expensive, they do not always work and they can cause side effects.

Facts: Discovery and development of drugs	
29. Traditional drugs	Extracted from plants and microorganisms. E.g. Aspirin extracted from **willow (tree)**.
30. Antibiotics	**ONLY kill bacteria. Do not kill viruses** as they **live inside cells.**
31. Painkillers	**Treat symptoms** of disease e.g. **fever**. **Do not kill** pathogens.
32. Antibiotic resistance	When a bacterium **cannot be killed** by an antibiotic. E.g. **MRSA** bacteria.
33. Drug trial	A thorough testing procedure to check that new drugs are safe and effective. Made up of two parts, **preclinical and clinical testing**.
34 Preclinical testing	Drug testing carried out on cells, tissues, and animals **before** it is tested on human volunteers. To test for **efficacy** (does the drug work) and **toxicity** (is the drug safe).
35. Clinical testing	Drug testing carried out on humans, healthy volunteers first then on volunteers who suffer from the illness. To test for **side effects** and to work out the **optimal** (best) **dosage**
36. Placebo (fake drug)	A substance that is like the drug being tested but it **does not actually do anything**.
37. Double blind trial	One group of patients is given the new drug and the other is given a placebo. **Neither the patient nor the doctor knows** who has taken the new drug or placebo. Removes **bias**

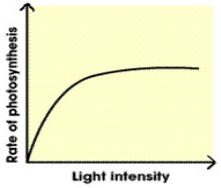
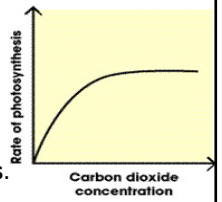
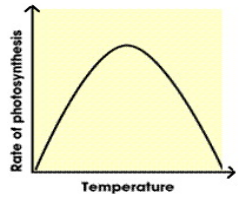
BIOLOGY PAPER 1: Bioenergetics

Facts: Photosynthesis reaction

1. Photosynthesis	An **endothermic** reaction that takes place in a **leaf** and produces food (**glucose**) for the plant.
2. Endothermic	A chemical reaction that **takes in energy**. Photosynthesis takes in **light energy** from the **Sun**.
3. Reactants	Substances that react together during photosynthesis: **carbon dioxide** and **water**.
4. Products	Substances that are produced by photosynthesis: **glucose** and **oxygen**.
5. Palisade cells	The cells in the leaf **where photosynthesis takes place**.
6. Chloroplasts	Cell structures that contain **chlorophyll** for photosynthesis.
7. Chlorophyll	A **green** pigment that absorbs **light energy** for photosynthesis.
8. Equation	$\text{carbon dioxide } (6CO_2) + \text{water } (6H_2O) \xrightarrow{\text{(light energy + chlorophyll)}} \text{glucose } (C_6H_{12}O_6) + \text{oxygen } (6O_2)$
9. Uses of glucose	Produces energy during **respiration**, stored as insoluble **starch**, makes fat and oils for energy storage, makes **cellulose** for **cell walls** and converted into amino acids to build proteins.

Facts: Rate of photosynthesis

10. Rate	How quickly photosynthesis takes place (how quickly glucose and oxygen are produced).
11. Limiting factor	A factor that can **slow down** the **rate** of photosynthesis e.g. **light, CO_2 and temperature**.
12. Enzymes	**Biological catalysts** that **speed up photosynthesis**. They are **denatured** by high temperatures

13. Light limiting factor graph	14. CO_2 limiting factor graph	15. Temp limiting factor graph
A – as light increases rate increases. **Light** is the **limiting factor**. **B** – as light increases rate stays the same. **CO_2** or **temp** are now the **limiting factors**. 	**A** – as CO_2 increases rate increases. **CO_2** is the **limiting factor**. **B** – as CO_2 increases rate stays the same. **Light** or **temp** are now the **limiting factors**. 	**A** – as temp increases rate increases. **Temp** is the **limiting factor**. **B** – as temp increases rate decreases **temp** is still the **limiting factor**. 

Facts: Aerobic respiration in animal and plant cells

16. Respiration	An **exothermic** reaction that **produces energy** and takes place in **all cell**s.
17. Exothermic	A **chemical reaction** that **gives out energy**.
18. Uses of energy	For movement, to keep warm and to build up larger molecules from smaller ones.
19. Aerobic respiration	Respiration that occurs in the **presence of oxygen**. **Lots of energy** is produced due to the **complete breakdown** of **glucose**.
20. Reactants	Substances that react together during respiration: **glucose** and **oxygen**.
21. Products	Substances that are produced by respiration: **carbon dioxide** and **water**
22. Mitochondria	The cell structures **where respiration occurs**.
23. Equation	glucose ($C_6H_{12}O_6$) + oxygen ($6O_2$) → carbon dioxide ($6CO_2$) + water ($6H_2O$) + **(energy)**

Facts: Anaerobic respiration in animal, plant and yeast (fungal) cells

24. Anaerobic respiration	Respiration **without oxygen**. Much **less energy** is produced due to the **incomplete breakdown of glucose**.
25. Equations	**In animal muscle cells**: glucose → lactic acid **In plant and yeast (fungal) cells**: glucose → ethanol + carbon dioxide
26. Lactic acid	Produced during **anaerobic respiration** in **animal cells**. Causes **muscle fatigue**.
27. Fermentation	This is what **anaerobic respiration** is called in **yeast cells**. Fermentation has **economic importance** in the **manufacture of bread and alcohol**.
28. Ethanol	A **product** of **anaerobic respiration (fermentation) in yeast**. Ethanol provides the **alcohol** in alcoholic drinks.
29. Carbon dioxide	A **product** of **anaerobic respiration (fermentation) in yeast**. Carbon dioxide provides the **bubbles** in alcoholic **drinks** and also makes **bread rise**.

Fact: Response to exercise

30. Rate	The rate of respiration **increases** to meet the **increase** in demand for **energy**.
31. Heart rate	Heart rate **increases** providing cells with **more blood** containing **more glucose** and **oxygen**.
32. Breathing rate and volume	Breathing rate and volume **increases.** This **increases** the amount of **oxygen entering** the blood stream and **removes carbon dioxide**.
33. Glycogen stores	Glycogen stores are **broken down** to provide **extra glucose** for **respiration**.
34. Oxygen debt	The volume of **extra oxygen** the body needs after exercise to **breakdown** the **lactic acid** into carbon dioxide and water. Lactic acid + oxygen → carbon dioxide + water

Facts: Metabolism

35. Metabolism	The **sum of all the chemical reactions** that occur in our cells including the building up of new molecules. E.g. glucose to starch and amino acids to proteins.