Exmouth Community College
Academy Trust

Cells and microscopy L26-32

largest ↑ smallest

cell	The smallest structural and functional unit of an organism.
nucleus	A structure that contains genetic material and controls the activities of the cell.
chromosome	A thread like structure of coiled DNA found in the nucleus of eukaryotic cells.
DNA	A polymer made up of two strands forming a double helix.
gene	A section of DNA that codes for a specific protein or characteristic.

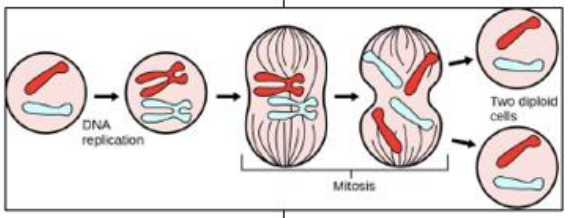
AQA Cell Biology 2

Cell division

Cells divide in a series of stages. The genetic material is doubled and then divided into two identical cells.

MITOSIS AND THE CELL CYCLE

Stage 1	*Growth*	Increase the number of sub-cellular structures e.g. ribosomes and mitochondria.
Stage 2	*DNA Synthesis*	DNA replicates to form two copies of each chromosome.
Stage 3	*Mitosis*	One set of chromosomes is pulled to each end of the cell and the nucleus divides. Then the cytoplasm and cell membranes divide to form two cells that are identical to the parent cell.



Mitosis occurs during growth, repair, replacement of cells. Asexual reproduction occurs by mitosis in both plants & simple animals.

STEM CELLS

Undifferentiated cell of an organism

Divides to form more cells of the same type, and can differentiate to form many other cell types.

Human Embryonic stem cells	*Can be cloned and made to differentiate into most cell types*	Therapeutic cloning uses same genes so the body does not reject the tissue. Can be a risk of infection
Adult bone marrow stem cells	*Can form many types of human cells e.g. blood cells*	Tissue is matched to avoid rejection, risk of infection. Only a few types of cells can be formed.
Meristems (plants)	*Can differentiate into any plant cell type throughout the life of the pant.*	Used to produce clones quickly and economically, e.g. rare species, crop plants with pest /disease resisitance

Treatment with stem cells may be able to help conditions such as diabetes and paralysis. Some people object to the use of stem cells on ethical or religious grounds

Transport in cells

Diffusion <u>No</u> energy required	*Movement of particles in a solution or gas from a higher to a lower concentration*	E.g. O_2 and CO_2 in gas exchange, urea in kidneys. Factors that affect the rate are concentration, temperature and surface area.
Osmosis <u>No</u> energy required	*Movement of water from a dilute solution to a more concentrated solution*	E.g. Plants absorb water from the soil by osmosis through their root hair cells. Plants use water for several vital processes including photosynthesis and transporting minerals.
Active transport <u>ENERGY</u> required	*Movement of particles from a dilute solution to a more concentrated solution*	E.g. movement of mineral ions into roots of plants and the movement of glucose into the small intestines.

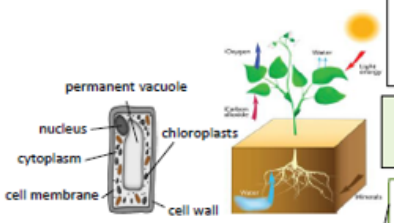
ADAPTATIONS FOR DIFFUSSION

The greater the difference in concentrations the faster the rate of diffusion.

Small intestines	*Villi – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Lungs	*Alveoli– increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Gills in fish	*Gill filaments and lamella – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Roots	*Root hair cells - increase surface area.*
Leaves	*Large surface area, thin leaves for short diffusion path, stomata on the lower surface to let O_2 and CO_2 in and out.*

Year 10 – Biology / Cells and Microscopy – HT2

Plants L60-68



Respiration, stored as insoluble starch, fats or oils for storage, cellulose for cell walls, combine with nitrates from the soil to form amino acids for protein synthesis

Plants use the glucose produced in photosynthesis in a variety of ways

Photosynthetic reaction

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

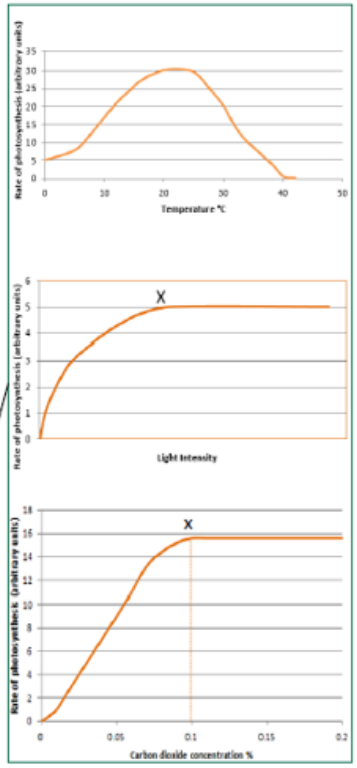
Photosynthesis	*Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)*	Carbon dioxide + Water $\xrightarrow{\text{light}}$ Oxygen + Glucose
		$CO_2 + H_2O \xrightarrow{\text{light}} O_2 + C_6H_{12}O_6$

The rate of photosynthesis is affected by temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll

Factors affecting the rate of photosynthesis	Factor	How the rate is affected	Limiting factors (why the rate stops going up)
	Temperature	*As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.*	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
	Light intensity	*Light intensity increases as the distance between the plant and the light sources increases As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.*	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
	Carbon dioxide concentration	*Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).*	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll
	Amount of chlorophyll	*Chlorophyll is a photosynthetic pigment that absorbs light and allows the reaction between water and carbon dioxide to occur (photosynthesis)*	Another factor could limit the rate of photosynthesis. This could be light intensity, temperature or the carbon dioxide concentration

AQA GCSE BIOENERGETICS part 1

Rate of photosynthesis



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

Control conditions in greenhouses to reduce limiting factors can improve crop yields		
	Heating	Used to provide optimum temperatures for maximum plant growth.
	Artificial lighting	Enhances the natural sunlight especially overnight and on cloudy days.
	Extra carbon dioxide	Gas can be pumped into the air inside the greenhouse.

Growers must balance the economics of additional costs of controlling the conditions to maximise photosynthesis with making a profit.

Rate of photosynthesis HT Only

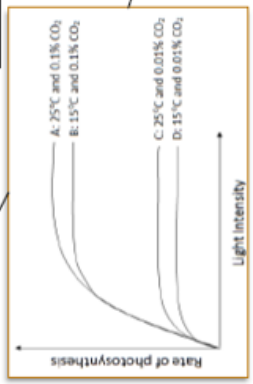
Graph lines C and D: If temperature is increased by 10°C then a slight increase in rate of photosynthesis occurs.

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

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

Explain graphs of two or three factors and decide which is the limiting factor

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



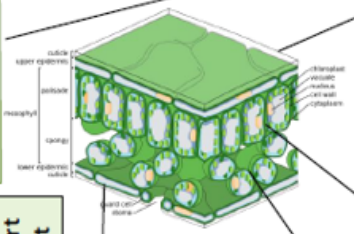
Year 10 – Biology / Plants – HT2

AQA GCSE ORGANISATION part 3

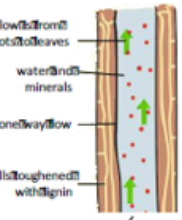
Plant tissues

Plant organ systems

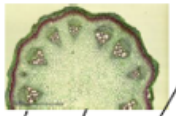
The roots, stem and leaves form a plant organ system for transport of substances around the plant



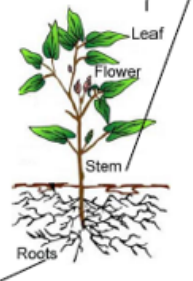
Epidermal tissues	*Waxy cuticle (top layer of the leaf)*	Reduces water loss from the leaf
	Guard cells and stomata	Guard cells open and close the stomata to control water loss and allow for gas exchange (oxygen and carbon dioxide).
Palisade mesophyll	*Palisade cells*	Cells near the top surface of the leaf that are packed with chloroplasts that contain chlorophyll. Both adaptations maximize photosynthesis.
Spongy mesophyll	*Air spaces in the leaf between cells*	Increased surface area for gas exchange so that carbon dioxide can diffuse into photosynthesising cells.
xylem	*Hollow tubes strengthened by lignin adapted for the transportation of water in the transportation stream*	Allows transport of water and mineral ions from the roots to the stem and the leaves.
phloem	*Cell sap moves from one phloem cell to the next through pores in the end walls*	Transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage (translocation).
Meristem tissue	*New cells (roots and shoot tips) are made here including root hair cells*	Root hair cells have an increased surface area for the uptake of water by osmosis, and mineral ions by active transport.

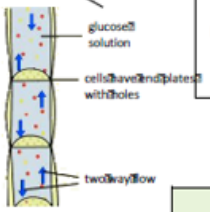


xylem

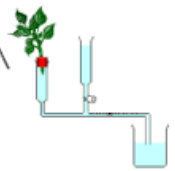


phloem

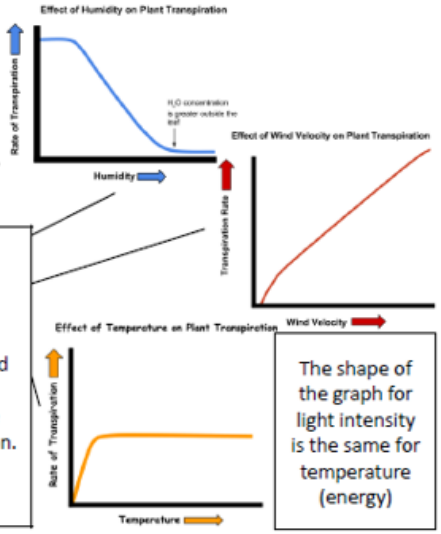


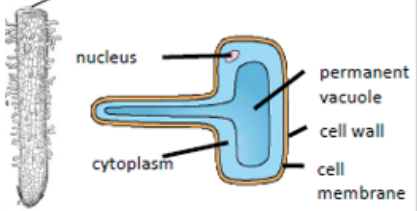


A potometer is used to measure the amount of water lost over time (rate of transpiration)



Transpiration





Transpiration	*The rate at which water is lost from the leaves of a plant. The transpiration stream is the column of water moving through the roots, stem and leaves*	Temperature, humidity, air movement and light intensity affect the rate of transpiration.

The shape of the graph for light intensity is the same for temperature (energy)

Respiration L67-71

Year 10 – Biology / Respiration – HT2

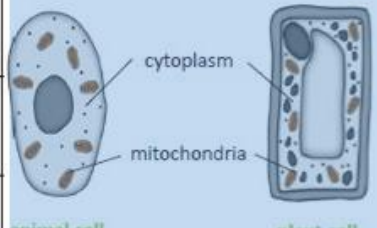
Respiration

OCR 1.3 Respiration

Respiration is an exothermic reaction. It occurs continuously, to supply cells with ATP

Blue = Recap

Cellular respiration is an exothermic reaction which is continuously occurring in all living cells



Electron micrograph of a mitochondrion

Response to exercise

During long periods of vigorous activity muscles become fatigued and stop contracting efficiently

During exercise the human body reacts to increased demand for energy	*Heart rate increases*	Top pump oxygenated blood faster to the muscle tissues and cells.
	Breathing rate and breath volume increase	This increases the amount of oxygen entering the blood stream.

An organism will receive all the energy it needs for living processes as a result of the energy transferred from respiration	*For movement*		To enable muscles to contract in animals.
	For keeping warm		To keep a steady body temperature in a cold environment.
	For chemical reactions		To build larger molecules from smaller one.

Metabolism

Metabolism is the sum of all the reactions in a cell or the body

Metabolism	*The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism.*	Conversion of glucose to starch, glycogen and cellulose.
		The formation of lipid molecules from a molecule of glycerol and three molecules of fatty acid.
		The use of glucose and nitrate ions to form amino acids which in turn are used to synthesise proteins.
		Respiration
		Breakdown of excess proteins to form urea for excretion.

Nutrient	Enzyme	Product(s)
Carbohydrate	Carbohydrases	Simple sugars
Protein	Proteases	Amino acids
Fats	Lipases	Fatty acid & glycerol

Anaerobic respiration in plant and yeast cells

The end products are ethanol and carbon dioxide. Anaerobic respiration in yeast cells is called fermentation

glucose ⟶ ethanol + carbon dioxide

This process is economically important in the manufacture of alcoholic drinks and bread.

Anaerobic respiration

Respiration when oxygen is in short supply. Occurs during intensive exercise

During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs.

Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.

glucose ⟶ lactic acid

Anaerobic respiration releases a much smaller amount of energy per glucose molecule than aerobic respiration.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt.

Aerobic respiration

Respiration with oxygen. Occurs inside the mitochondria continuously

Glucose is oxidised by oxygen to transfer the energy the organism needs to perform it's functions.

$6O_2 + C_6H_{12}O_6 \longrightarrow 6CO_2 + 6H_2O$

glucose + oxygen ⟶ carbon dioxide + water

Aerobic respiration releases a large amount of energy from each glucose molecule