

GCSE Science



Skill Focus Sessions

How to help yourself to know all the work for the exams

Ensure to have
your Purple
Workbook with
you, along with a
piece of paper
and your hard
copy of your
textbook.

What do useful summary notes look like?

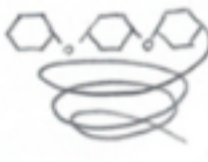
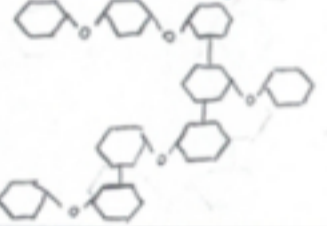


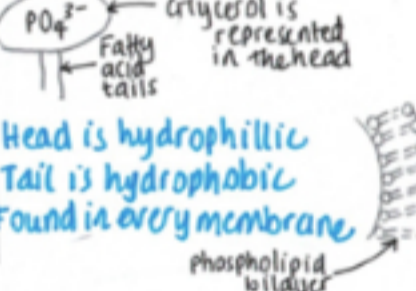
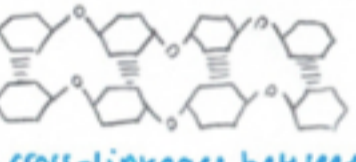





Photosynthesis

THE LIGHT DEPENDANT REACTION		LIGHT INDEPENDANT REACTION (CALVIN CYCLE)	
<p>PSII absorbs light energy</p> <p>Energy excites electrons in the CHLOROPHYLL to a higher energy level - PHOTOIONISATION</p> <p>High energy electrons leave the chlorophyll and go into the thylakoid membrane along a series of CARRIER PROTEINS called the ETC.</p> <p>Electrons are transferred from one carrier protein to the next in a series of REDOX REACTIONS until they reach PSI.</p> <p>During each transfer of electrons the redox reactions release energy</p> <p>Energy pumps H⁺ ions across the thylakoid membrane through the carrier proteins of the ETC</p> <p>H⁺ ions DIFFUSE back across the membrane through protein channels formed by ATP SYNTHASE process is called CHEMOSMOSIS</p>	<p>8 Movement of protons through ATP Synthase causes shape change that allows the enzyme to catalyse: ADP + Pi → ATP. ATP is made by PHOTOPHOSPHORYLATION.</p> <p>9 In the thylakoid H₂O is split in the presence of light (PHOTOLYSIS) Producing: - H⁺ - transferred to a COENZYME called NADP - Electrons - transferred to PSII to replace electrons lost in photoionisation. - Oxygen - diffuses out</p> <p>10 PSI also absorbs light causing photoionisation</p> <p>11 Electrons from here & H⁺ from photolysis are used to REDUCE NADP.</p> <p>12 ATP & reduced NADP move into the STROMA</p>	<p>1 CO₂ diffuses into the stroma and reacts with RuBP (CARBON FIXATION).</p> <p>2 Reaction is catalysed by the enzyme Rubisco.</p> <p>3 Produces an unstable 6 carbon molecule which splits to give 2 molecules of glycerate 3-phosphate</p> <p>4 Reduced NADP loses hydrogen (OXIDISED) and GP gains hydrogen (REDUCED) to form TP. (NADP is reformed).</p> <p>5 ATP is hydrolysed to ADP + Pi to release energy for this conversion.</p> <p>6 TP is used to regenerate RuBP using the phosphate group from the hydrolysis of ATP</p> <p>7 Some of the TP is used to make organic molecules like glucose</p>	<p>6 CALVIN CYCLES NEED TO OCCUR TO GENERATE ENOUGH TP TO PRODUCE 1 GLUCOSE MOLECULE & REGENERATE ALL 6 RUBP MOLECULES</p> <p>THESE ARE ENZYME CATALYSED REACTIONS SO ARE AFFECTED BY TEMPERATURE.</p> <p>8 Glucose can be joined to produce starch which is stored in the stroma.</p> <p><u>LIMITING FACTORS OF PHOTOSYNTHESIS:</u></p> <ul style="list-style-type: none"> LIGHT INTENSITY CO₂ CONCENTRATION TEMPERATURE Remember only certain wavelength of light will be absorbed. <p><u>AGRICULTURAL PRACTICES:</u></p> <p>In greenhouses:</p> <ul style="list-style-type: none"> Add CO₂ to the air by burning something. Light can pass through the glass & lamps can be used at night Glass houses trap heat Heaters & cooling systems for optimum temperature <p>In open fields:</p> <ul style="list-style-type: none"> Competing weeds are removed by spraying herbicides Crops sensitive to temperature are covered with fleece / polythene

Taking all aspects of a topic and putting them onto a single page will make you feel like there is a manageable workload.

What do useful summary notes look like?

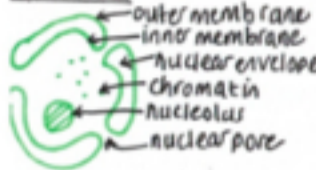
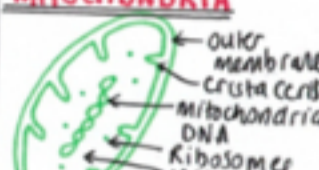
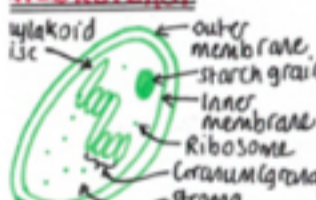

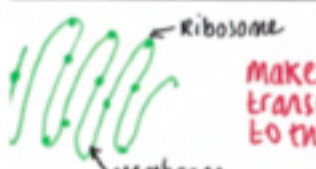





Biological Molecules

<p>STARCH Hydrolysed by amylase to form maltose & by maltase → α glucose Found in plant cells (cytoplasm & chloroplast). Made up of many glucose molecules so lots are available for respiration. Has a helical/coiled structure - compact & large amount stored in small area.</p> 	<p>PROTEINS PRIMARY STRUCTURE • Many amino acids join together forming peptide bonds → this structure determines shape & function • Solubility: If R group is polar → soluble in water If R group is non-polar → insoluble in water</p>	<p>LIPIDS/FATS/TRIGLYCERIDES • Slow conductor of heat so retain body heat. • Buoyancy - makes you float • Waterproof → waxy cuticle in plants, insects made of fat & oily secretion in mammals • Shock absorber - protection around delicate organs • Aren't polymers because are made of 2 components & fatty acids can only join 2 times.</p>	<p>IODINE TEST (STARCH) ① Add a few drops of iodine (yellow/orange) + Blue-black - Orange</p> <p>BENEDICT'S TEST (REDUCING SUGARS) ① Add benedict's reagent (blue) ② Heat + Red - Blue</p>
<p>GLYCOGEN Glycogen stored in animals is small because it is the main storage. Hydrolysed straight to alpha glucose. Branched structure increased surface area to be acted on by enzymes simultaneously to provide more glucose faster. Important as animals have a high metabolic/respiratory rate. Insoluble → osmotically inactive.</p> 	<p>SECONDARY STRUCTURE  Alpha helix  Beta pleated sheet • H of amino group has a +ve charge whilst O of carboxyl group has negative so readily forms weak hydrogen bonds. • Cause the chain to be twisted into a 3D shape.</p>	<p>PHOSPHOLIPIDS  • Head is hydrophilic • Tail is hydrophobic • Found in every membrane phospholipid bilayer</p>	<p>MODIFIED BENEDICT'S TEST (NON-REDUCING SUGARS) • Only sucrose ① Do original benedict's test to ensure result is negative. ② To a fresh sample add acid and heat to hydrolyse the glycosidic bond ③ Add alkali to neutralise acid ④ Add benedict's and heat + Red - Blue</p>
<p>CELLULOSE Many beta glucose molecules form long straight chains. Hydrogen bonds form cross-linkages between parallel chains → great number of hydrogen bonds provide strength. Chains are bundled together to form microfibrils. Microfibrils are bundled together to form macrofibrils. Macrofibrils are arranged in a criss-cross layout → holes allow substances in & out gives strength and rigidity to plant cell walls. Large and insoluble in water.</p> 	<p>TERTIARY STRUCTURE  Globular Tertiary Structure Soluble as R group is polar → enzymes  Fibrous Tertiary Structure Insoluble as R group is non-polar → keratin & collagen • Held in place by ionic, disulphide and hydrogen bonds • Faulty protein could be created if it folds in a different way and bonds form in different places. • Fibrous proteins have structural proteins - fibres provide flexibility & sheets provide strength. • Some globular proteins have informational role.</p>	<p>FOOD TESTS EMULSION TEST (FATS) ① Add alcohol so fat dissolves ② Add water because fat is insoluble ③ Shake + Cloudy white - clear</p> <p>BIURET TEST ① Few drops of copper sulphate ② Few drops of sodium hydroxide + Purple - Blue</p>	
	<p>QUATERNARY STRUCTURE  2 globular polypeptides Ribosome  4 globular polypeptides Haemoglobin  4 globular polypeptides Antibody</p>		

Could you summarise some of your work a bit more to alleviate some panic over the volume of content?

What do useful summary notes look like?

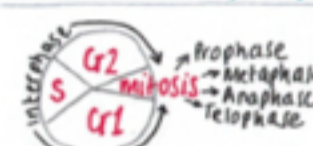



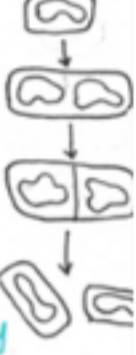







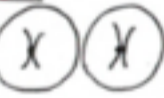
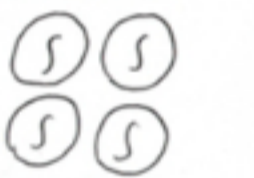

Cells

<p>NUCLEUS</p>  <p>outer membrane inner membrane nuclear envelope chromatin nucleolus nuclear pore</p> <p>contains DNA which codes for protein</p>	<p>MITOCHONDRIA</p>  <p>outer membrane cristae mitochondrial DNA ribosomes</p> <p>Carries out aerobic respiration to release energy</p>	<p>OPTICAL MICROSCOPE</p> <p>Light hits specimen & then the eye.</p>	<p>SCANNING ELECTRON</p> <p>Beam of electrons directed on the surface of the specimen and they scatter</p>	<p>TRANSMISSION ELECTRON</p> <p>Beam of electrons are transmitted through the specimen - denser parts absorb more electrons & appear darker</p>
<p>CHLOROPLAST</p>  <p>thylakoid outer membrane starch grain inner membrane ribosome stroma</p> <p>Carries out photosynthesis to produce glucose.</p>	<p>GOULGI APPARATUS & LYSOSOMES</p>  <p>vesicle lysosome enzymes</p> <p>The golgi body modifies & packages proteins, produces vesicles & lysosomes. Lysosomes contain hydrolytic enzymes</p>	<p>Low magnification due to long wavelength of light</p> <p>Can be alive or dead</p> <p>Whole organisms can be used</p> <p>Only some staining</p>	<p>High magnification/resolution due to short wavelength of e⁻</p> <p>Dead-sliced & in a vacuum</p> <p>Thin samples sliced</p> <p>Heavy metals/staining - can leave artefacts</p>	<p>High magnification/resolution due to short wavelength of e⁻</p> <p>Dead-sliced & in a vacuum</p> <p>Has to be very thin for electron beam to pass</p> <p>Heavy metals/staining - can leave artefacts.</p>
<p>ROUGH ENDOPLASMIC RETICULUM</p>  <p>ribosome membrane</p> <p>Makes proteins & transports them to the golgi body</p>	<p>SMOOTH ENDOPLASMIC RETICULUM</p>  <p>membrane</p> <p>Produces and transports fats around the cell</p>	<p>Cheap</p>	<p>3D images - expensive</p>	<p>2D images - expensive</p>
<p>LIPOSOMES</p>  <p>small subunit large subunit</p> <p>Carry out protein synthesis by joining amino acids together</p>	<p>VACUOLES</p>  <p>tonoplast cell sap</p> <p>keeps plant rigid and supports cells</p>	<p>DIFFERENTIAL CENTRIFUGATION</p>		
<p>BACTERIAL CELLS</p>  <p>slime capsule cell wall cell membrane flagellum plasmid cytoplasm circular DNA</p> <p>70s ribosome</p> <p>cell wall contains murein, a glycoprotein. Slime capsule protects it & keeps it hydrated.</p>	<p>VIRUSES</p>  <p>capsid (protein coat) attachment protein lipid envelope reverse transcriptase (enzyme)</p> <p>cellular Can't grow or multiply, but can only multiply inside living host cells</p>	<p>HOMOGENISATION</p>	<p>ULTRACENTRIFUGATION</p>	
<p>• Tissue must be prepared to prevent organelle damage by placing it in an ice cold, isotonic, buffer solution.</p> <p>• The isotonic solution prevents organelles from bursting as a result of osmotic gain/loss of water by moving water in & out of organelles equally.</p> <p>• Must be ice cold to prevent enzyme action so organelles aren't digested.</p> <p>• The buffer solution maintains pH so the enzymes aren't denatured.</p> <p>• These cells are then homogenised (grinded) by placing them in a homogeniser (blender).</p> <p>• This breaks the cell membranes (cell walls for plants) and releases organelles.</p> <p>• The resultant fluid (homogenate) is filtered to remove any complete cells, debris or membranes.</p>		<p>• Homogenate is placed in a tube and spun in a centrifuge at a low speed - heaviest organelle forms a pellet/sediment at the bottom.</p> <p>• The machine creates a centrifugal force and the rest of the organelles remain in the liquid above (supernatant).</p> <p>• The supernatant is placed in another tube and procedure is repeated, increasing the speed (centrifugal force) and time of centrifugation each time.</p> <p>Nucleus Chloroplast Mitochondria SER/RER/golgi Lysosomes Ribosomes</p> <p>Heaviest, low speed, less time</p> <p>Lightest, high speed, long time.</p>		

Include labelled diagrams in your work along with information.

What do useful summary notes look like?

Cell Division

<p>MITOSIS Cell division of all body cells to produce 2 genetically identical cells purpose: growth & repair</p> 	<p>Anaphase</p> <ul style="list-style-type: none"> Centromere divides and separates each pair of sister chromatids Spindles contract, pulling chromatids to opposite sides, centromere first The energy for this is provided by the mitochondria. 	<p>MEIOSIS Production of 4 haploid gametes which are genetically different.</p> <p>Importance of meiosis:</p> <ul style="list-style-type: none"> Produces haploid gametes Centromeres fuse during fertilisation so diploid number is restored. Ensures diploid no stays the same after each generation. Produces genetic variation in offspring which increases chance of species survival if the environment changes. 	<p>Metaphase</p> <ul style="list-style-type: none"> Centromeres attach to spindle fibres Homologous chromosomes move along spindles to the equator Different to mitosis as chromosomes move in pairs. 	<p>MEIOSIS II Metaphase II</p> <ul style="list-style-type: none"> Centromeres attach to spindles and chromosomes move to the middle 	<p>BINARY FISSION</p> <ol style="list-style-type: none"> The bacterial cell grows & becomes longer The circular DNA replicates to form genetically identical DNA. If plasmids are present, they also replicate Wall forms down the middle of the bacteria The cell splits to form 2 genetically identical cells 
<p>Interphase G1 - increased protein & organelle synthesis - transcription and translation occurs S Phase - DNA replication occurs G2 - more growth. Increased rate of respiration to provide energy for processes.</p> 	<p>Telophase</p> <ul style="list-style-type: none"> Nucleus reforms and DNA uncoils to become chromatin again. Cytokinesis to produce 2 daughter cells which are genetically identical. Spindles break down 	<p>Interphase</p> <ul style="list-style-type: none"> Starting cell is diploid DNA is in the form of chromatin. 	<p>Anaphase</p> <ul style="list-style-type: none"> Each chromosome moves along the spindles to opposite ends of the cell Movement of maternal and paternal chromosomes is random - independent segregation of homologous chromosomes. Different combinations of chromosomes are created in gamete cells - more variation 	<p>Anaphase II</p> <ul style="list-style-type: none"> Centromere splits and chromosomes migrate to opposite sides. 	<p>VIRAL REPLICATION</p> <ol style="list-style-type: none"> HIV virus antigens bind to specific receptor proteins on host cell membrane. Virus releases its RNA and reverse transcriptase Reverse transcriptase is used to make a strand of DNA along the viral RNA in a process called reverse transcription The viral DNA becomes double stranded. This involves the host's DNA nucleotides and DNA polymerase. The viral DNA becomes part of the host's DNA Viral DNA becomes activated causing transcription and translation Viral proteins are made (capsid, antigen, reverse transcriptase) New viral proteins are assembled and burst out of cell
<p>Prophase</p> <ul style="list-style-type: none"> Chromosomes condense so become shorter and thicker. Nucleus breaks down and chromosomes lie free in cytoplasm. 	<p>Calculating number of cells:</p> <p>2^n → number of cells of mitosis.</p>	<p>Prophase</p> <ul style="list-style-type: none"> DNA condenses into chromosomes Variation occurs at this stage because bivalents form and chromosomes get tangled up - can lead to crossover A section of DNA breaks off, swaps position and reattaches in crossover Parts of the paternal and maternal chromosomes have swapped - creates new combinations of alleles. 	<p>Telophase</p> <ul style="list-style-type: none"> Homologous chromosomes are separated, halving the chromosome number. 	<p>Telophase II</p>  <p>4 genetically different cells are produced</p>	
<p>Telophase</p> <ul style="list-style-type: none"> Spindle fibres form and centromeres attach to them Spindle fibres contract and chromosomes move along them to the centre of the cell 	<p>Mitotic index = $\frac{\text{number of dividing cells}}{\text{total no. of cells}}$</p>				

Carefully selected and sketched diagrams help so much with the meaning of the text.

You do NOT need to be an art student to add a useful diagram to your work.

What do useful summary notes look like?

PLANTS

FACTORS THAT AFFECT PHOTOSYNTHESIS:

- Light
- Temperature
- Carbon dioxide
- Water
- Oxygen
- Plant hormones

These things also limit photosynthesis (without one or more, photosynthesis slows down).

- Nutrients

- Genes (determine size + shape)

ELEMENTS PLANTS NEED TO SURVIVE:

DEFICIENCY CAUSES:

- Nitrogen: poor growth, pale leaves, weak stems, lower leaves dying
- Phosphorus: stunted growth, purple-tinged leaves
- Potassium: browning/yellowing around leaves, yellow lower leaves
- Sulphur: dead spots on leaves
- Calcium: green upper leaves, yellowing lower leaves
- Iron: dead spots on leaves
- Magnesium: green upper leaves, yellowing lower leaves

TRACE ELEMENTS: copper, boron, zinc, manganese, molybdenum

needed in very small amounts

!NO NUTRIENTS = DEAD PLANT!

TROPISMS = growth movements - generally caused by proteins.

- positive tropism = growth towards stimulus
- negative tropism = growth away from stimulus

PHOTOTROPISM: Light

GEOTROPISM: gravity

HYDROTROPISM: water

THALLOTOPIISM: touch

ETHICAL ARGUMENTS - always look at both sides of the argument, discuss them fairly, then sum up at the end.

A FEW IDEAS:

FOR:

- Quality of organisms
- Scientific research into our genes
- Parents who can't have children
- Prevention of dead pets/children/ extinct species (personality issues)
- Therapies (regrow damaged tissues/organs)

AGAINST:

- Religion - "man playing god"
- Moral - individuality destroyed
- Inhumane + dangerous
- Less genetic variation
- "Open future" elimination
- "predestination" introduced
- Could cause extinction
- Disease wiping out species
- Many attempts + many embryos needed to produce one clone - see Hayflick limit!

CLONING: creating a new organism that stores the exact same genetic code as another

- ↳ many plants form natural clones (e.g. dividing by mitosis)
- ↳ cloning uses embryos (potential people) → ethical issues!

CONTINUOUS + DISCONTINUOUS VARIABLES

- height
- hand span
- foot length
- variation amongst population.

GROWTH = a permanent increase in the size + mass of an organism.

↳ process: cell division + differentiation.

GENE THERAPY - how could we make it work?

deficient gene inserted into viral capsule

virus injected into patient

virus 'infects' cells with new gene - replaces the faulty gene so cell starts working properly

ABORTION

- LEGAL cut off for abortion in UK is at 24 weeks as some genetic defects can only be tested for at 20/22 weeks.
- At 26 weeks a foetus is viable and has a 50% chance of survival.
- At 30 weeks a foetus is capable of living outside the womb, but considered premature.
- Pregnancy generally lasts 40 weeks but can be as many as 42 weeks before labour gets induced.

HAYFLICK LIMIT

- A limit to the amount of times a cell can divide: generally ± 52 times.
- Stem cells + cancer cells have no Hayflick limit!

STEM CELLS: ETHICS!!

↳ a cell whose job has not yet been determined - not differentiated yet!

TYPES:

- **EARLY EMBRYONIC CELLS:** TOTIPOTENT (becomes "any" kind of cell).
- **BLASTOCYST EMBRYONIC STEM CELLS AND FOETAL STEM CELLS** are PLURIPOTENT (can become almost any kind of cell)
- **UMBILICAL CORD STEM CELLS AND ADULT STEM CELLS** are MULTIPOTENT.

stem cells that can differentiate into only a limited range of cells.

STERIODS: artificial hormones used for building muscle.

side effects: liver failure, foetal hair growth, deepening voice in women, impotence + breast development in men.

MITOSIS

- produces regular 46-chromosome cells.
- produces identical daughter cells
- diploid cells produced
- "growth" or asexual reproduction:

MEIOSIS

- produces gametes (sex cells)
- daughter cells are haploid with 23 single unpaired chromosomes - each unique

GENETHERAPY see remedy possibility

- Has potential to relieve (NOT CURE!) the symptoms of genetic illness.
- would not prevent disease being passed to offspring, unless applied to reproductive cells - but this presents ethical debate.
- If it is successful it could fix a problem at its genetic source.

CYSTIC FIBROSIS:

Disease where genetic defect prevents mucus being properly produced - becomes thick & sticky instead of fluid. Mucus forms in the lungs, digestive system + reproductive tract + needs to be removed daily. Sufferers rarely live beyond their 20s.

HAEMOPHILIA: 'The Royal Disease'

Bleeding disorder - blood takes a very long time to clot and the sufferer could bleed to death from the smallest injury - such as a bruise!

COLOUR BLINDNESS:

An inability to make colour distinctions. Most commonly red and green, but also extends to mustard + purple and others. Most common in males, as the defective gene is carried on the 'X' chromosome (No gene on the 'Y' chromosome to counteract it)

ARTIFICIAL SELECTION

Animals that are selected by humans to breed.

SELECTIVE BREEDING

- the breeding together of optimal organisms to produce an optimal version of specific traits or characteristics.
- Improves EXISTING characteristics.

DISADVANTAGES:

- can cause 'inbreeding' and defects if organisms are related.
- in crops if disease strikes the genetic similarity may mean death or extinction of those organisms.

An example of how artificial selection leads to selective breeding.

MITOSIS

Interphase (2N) → DNA replication

Prophase (2N) → Chromatids become visible

Metaphase (2N) → Chromosomes align

Anaphase (2N) → Cell division begins

Telophase (2N) → Cytokinesis completes

(2N → 2N)

MEIOSIS

Interphase (2N) → DNA replication

Prophase I (2N) → Homologous chromosomes pair

Metaphase I (2N) → Homologous chromosomes align

Anaphase I (2N) → Two chromosome sets to separate

Telophase I (2N) → Cell division

Prophase II (2N) → Homologous chromosomes pair

Metaphase II (2N) → Homologous chromosomes align

Anaphase II (2N) → Two chromosome sets to separate

Telophase II (2N) → Cytokinesis completes

(2N → 4N)

What do useful summary notes look like?

Taking a pulse:
Two fingers - neck, wrist - NOT thumb - it has its own pulse.

Fitness levels
determine how much a person's heart rate + breathing will increase during exercise.

lactose happens inside the cells.

AEROBIC RESPIRATION
glucose + oxygen → carbon dioxide + water + energy
↳ releases 37 aerobic!

more energy needed ∴ more respiration needed.
- more O₂ must be absorbed by lungs
- more CO₂ must be removed by blood
- more glucose + O₂ must be delivered to muscles by blood.
- more CO₂ must be removed from your muscles by your blood.

INSIDE LIVING CELLS

MAKING PROTEINS
- instructions from the code must be carried from the DNA in the nucleus to the ribosomes.
- amino acids must be brought to the ribosomes to be built up into a protein

TRANSCRIPTION - the process of copying the DNA code into RNA.
- in the nucleus, the double helix unwinds, base pairs expose
- mRNA forms next to DNA
- Bases match up according to base pairing.
- When poly peptide is completely formed, it breaks away from DNA and it leaves through the nuclear pore.
- the DNA molecule then "zips up" again.

DNA (deoxyribonucleic acid)
ALWAYS in a double helix
Four TYPES: adenine, guanine, cytosine, thymine (small in DNA)

Pairing: C-G; T-A

There are 20 types of amino acids - every 3 bases code for one. These 3 bases together are called a 'triplet'.

CTA CGA
amino acid attaches here

ANAEROBIC RESPIRATION
means "no" oxygen
Glucose → lactic acid (+ some energy)
oxygen cannot move quickly enough to the muscles, so the muscles react with only the glucose.

DISADVANTAGES OF ANAEROBIC RESPIRATION
- produces less energy than aerobic respiration
- lactic acid build up in bloodstream causes muscle cramp.

REMOVAL OF LACTIC ACID:
After exercise - lactic acid breaks down into CO₂ + H₂O using O₂
During exercise an oxygen debt is created. This must be repaid.
the difference between the amount of O₂ that would have been needed the first time to respire aerobically and how much O₂ was actually there.

INSULIN
pancreatic hormone
controls blood glucose level
Human insulin can be artificially produced by bacteria by inserting human DNA into bacterial cells, then they are cultivated + multiplied.
Engines + human growth hormone are also made in this way.

Yeast
used for fermentation
yeast uses sugar as food to ferment

Micro-organisms
yeast
bacteria
Foods made by micro-organisms:
'Quorn' (mould); bread, wine, beer (yeast); cheese, yoghurt (bacteria); soy sauce (uses mould, bacterium yeast to produce it)

THERMOMETERS
Old vs New
Mercury vs Digital
- takes a while.
- difficult to determine exact measurement.
- more dangerous if broken.
- instant.
- easier to see.
- more reliable.

DNA coding strand sequence: ATC : CTA : GAC : GAT
mRNA sequence: UAG : GAC : CUA : CUA
notice: no "T" in RNA!

Diagram: A diagram showing a cross-section of a body with arrows indicating the flow of substances. 'from body' points to 'LUNG', 'back to lung' points to 'Body Cell', and 'pancreatic hormone' points to 'INSULIN'. A note says 'controls blood glucose level'.

Diagram: A diagram of a DNA double helix with the bases A, T, C, G labeled. A note says 'notice the number of bonds!'.

Diagram: A diagram of a DNA double helix with a note 'amino acid attaches here' pointing to a specific location on the structure.

What do useful summary notes look like?

Which are best?

Non-rechargeable	Rechargeable
<ul style="list-style-type: none"> cheap to buy can only be used once expensive to use in the long term as more are needed (high cost / performance ratio) output stays constant until almost flat disposed of many because creating a lot of chemical pollution 	<ul style="list-style-type: none"> often expensive to buy can be used many times cheap in the long term as they can be reused (low cost / performance ratio) output stays constant until almost flat dispose of fewer batteries creates less chemical pollution

LOOK UP MAGLEV TRAIN!

Use in medicine	What it does
transcutaneous electrical nerve stimulation (TENS)	uses electrical signals to help reduce pain, often used during childbirth
conduction testing	electrical signals are sent along nerves to test how well they are working
electronic muscle stimulation (EMS)	electrical signals are used to stimulate and move the muscles of paralysed people in physiotherapy - this is exactly the same idea as Galvani's frog's legs
pacemaker	implanted in the chest to provide a regular pulse of electricity to regulate the heartbeat

Power = Current x Voltage, $P = IV$
(W) (A) (V)

Efficiency = $\frac{\text{Useful Output}}{\text{Total Input}} \times 100\%$

SANKEY DIAGRAM

Appliance	Power rating (kW)	Time used in a day (h)	Total units (kWh)	Cost (p)
cooker	2.5	1		
kettle	1.0	2		
fridge	0.1	24		

brushes

How long will a 10 Ah battery last?

Current (A)	Time (h)
10	1
5	
1	
0.1	

FILL THIS TABLE

* Battery Capacity *

Capacity = Current supplied x Time supplied
(Ah) (A) (h)

Current (I)

- Only flows in complete circuit
- Ampers (A) or mA
- 1 mA = $1 \times 10^{-3} A = 0.001 A$
- Ammeter - connected in series

DYNAMO: EG Bicycle Light

Dynamo has wheel that touches the bike tyre. As bicycle moves the wheel turns a magnet inside a coil. This induces enough electricity to run bicycle lights. The faster the bicycle moves the greater the current induced.

→ Gives brighter lights

* Play-back Time *

⇒ Cost of energy-saving measure

Amount of money saved each year

* Total Cost = Power (kW) x Time (h) x Cost (p/kWh)

Fill in table - Say that Cost is 6p/kWh

ENERGY RESOURCES

There are different ways that the UK could generate electricity.

Renewable	Non-Renewable
Solar, Wind, Hydroelectric, Tidal	Fossil Fuels, Nuclear, Natural Gas, Coal, Oil

Voltage (V)

- Also called Potential Difference

- V across a component needed to make a current flow through it - measured in Volts

- Cells or Batteries often provide this.

- Voltmeter - connected in parallel.

ELECTRICITY

Inducing Current

① What will happen if you move a magnet into a coil of wire?

② Current is induced in the coil - only when magnet is moving.

③ Current produced when magnet is moved into a coil of wire in a circuit.

④ Direction of the induced current is reversed when magnet moved out of coil.

⑤ Can also be reversed if the other pole of the magnet is moved into the coil.

⑥ No current is induced when magnet is still, even if it's inside the coil.

* 4 WAYS TO INCREASE CURRENT

[A] Move Magnet faster [B] Use stronger magnet

[C] Increase turns in coils [D] Increase area of coil.

Filament Bulb

- contains a thin coil of wire. This heats up when an electric current passes through it and produces light as a result.

Resistance of lamp ↑ as T of its filament ↑.

V Current flowing through a lamp is NOT directly proportional to V across it.

Resistance (R)

- Measured in Ohms

Resistance in Series: $R_{total} = R_1 + R_2 + R_3$

Resistance in Parallel: $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

⊗ Bulb ⊗ Thermistor ⊗ LDR ⊗ Buzzer

Direct Current vs Alternating Current

(DC)

- Current always flowing in one direction.
- Sources ⇒ Solar Cells or Photovoltaic Cells + Batteries

(AC)

- Current constantly changing direction.
- Sources ⇒ Mains Electricity
- Eg 50Hz - changes direction 50x per second

Generators

- these induce a current by spinning a coil of wire inside a magnet field.

- spinning a magnet inside a coil of wire - small renewable power generators = alternative to NATIONAL GRID

GREEN+YELLOW Earth wire Neutral wire BLUE Live wire

Case grip

air insulation

⇒ When current gets too high the wire inside gets hot and melts.

What do useful summary notes look like?

POLLUTION INDICATORS (eg. lichen, pond life)
"living indicator" - an organism whose life or death tells the observer something about the organism's environment.

EUTROPHICATION:
Fertilisers wash into the water system, cause algal growth, algae die, bacteria decompose the algae, use up all the oxygen, small fish die due to lack of O₂, larger fish die due to lack of O₂ and food.

NITROGEN-FIXING BACTERIA: live in leguminous plant roots. convert nitrogen to nitrates. Symbiotic relationship - bacteria give plants nitrates, plant supplies bacteria with nutrients.

NITRIFYING BACTERIA: convert ammonia to nitrates.

DENITRIFYING BACTERIA: break down nitrates + release atmospheric nitrogen.

COPPING: Cutting trees + shrubs to ground level to encourage rapid regrowth.

REPLACEMENT PLANTING: Replacing a tree or shrub by planting another of the same species.

REFORESTATION: Replanting trees to increase the number of trees.

BIODIVERSITY: The variation of life forms within a given ecosystem.

EXTREME ENVIRONMENTS
- The Antarctic - Emperor penguins
- High Altitudes - snow leopards
- Deep sea - volcanic vents with bacteria
- Extreme Deserts - velvet scia mambis, prickly pear cactus, desert shrew.

CONSERVATION MANAGEMENT
Helpful intervention in nature + looking after the environment.
SUCCESSION: The gradual change of a habitat to become something else.

LEGUMES: peas, beans, clovers
DECOMPOSERS: break down dead organisms into ammonia which contains nitrogen.

WHY DO SPECIES BECOME EXTINCT?
- humans encroaching on their environment
- cutting down trees
- killing prey
- food drying out
- pollution
- unnatural predators

HOW COULD THEY BE PROTECTED?

EXTREMOPHILES
- **HYPERTHERMOPHILE:** temps between 80 - 122°C
- **PSYCHROPHILE/CRYOPHILE:** temps of 15°C or lower (polar frost)
- **PIEZOPHILE:** high hydrostatic pressure
- **POLYEXTREMOPHILE:** extremophile under more than one category.

KEYWORDS: LEARN WHAT THEY MEAN!
Population, community, habitat, environment, adaptation, food chain, food web, predator-prey relationship, competition (between organisms for food, space, water, mates), Inter- and Intra-competition

INDUSTRIAL ACCIDENTS - Chernobyl!
DON'T FORGET Lemniscate George!

INTERDEPENDENCE & ENERGY FLOW
MRS GREEN!
100% → 10% → 1% → 0.1%
rabbit → plant → fox

ANABIOSIS:
 $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

PLANT CELL: cell wall, nucleus, vacuole, cytoplasm, chloroplast (containing chlorophyll), cell membrane.

ANIMAL CELL: nucleus, cytoplasm, cell membrane.

nucleus: controls what the cell does. contains genetic info.
cytoplasm: chemical reactions take place here - it's like jelly.
cell membrane: keeps the cell shape. It is partially permeable.
chloroplast: contains chlorophyll, green pigment, traps sunlight for photosynthesis.
vacuole: helps keep plant cells shape, controls cell sap.
cell wall: made of tough cellulose which strengthens the cell.

ACTIVE TRANSPORT: transport that needs energy to move molecules across barriers.
OSMOSIS: the natural movement of water down a concentration gradient.
DIFFUSION: the movement of molecules down a concentration gradient.

INTENSIVE FARMING: food gets produced on a smaller area of land; farmers use fertilizers, pesticides, water and fuels to minimise their harmful effects. This kind of farming keeps costs down but does little for crop rotation or nutrient recycling.

ORGANIC FARMING: uses manure instead of fertilisers, natural predators to control pests (biological control) crops get rotated, but this is a more expensive way of farming. It also does not cut down on the disturbed food chains - most organic crops for UK are imported.

FISH FARMS

BENEFITS
1. Protection of fish species.
2. Reduces hunger.
3. Less boats = less CO₂.

IMPACTS
1. Diseases - wiping out populations.
2. Farmed fish breeds with wild fish, compromise genetic integrity.
3. Waste from farm changes nutrients in seabed below.

GREEN HOUSES

ADVANTAGES
1. Control growing environment.
2. Filter out insects.
3. Protect plants from bugs.
4. You always know what toxins are in your fruit/veg.

DISADVANTAGES
1. Takes up space.
2. Diseases spread quickly.
3. Expensive initial purchase.
4. Watery (O₂ need to be controlled).

AIR POLLUTION - ACID RAIN → burning coal (CO₂) → our engines (NO₂)
- sulphur dioxide (SO₂) comes from cars, factories + general burning of fossil fuels.
- possibilities on how acid rain is formed:
 $H_2O + SO_2 \rightarrow H_2SO_3$ OR $2SO_2 + O_2 \rightarrow 2SO_3 + H_2O$
 $2H_2SO_3 + O_2 \rightarrow 2H_2SO_4$ OR $2SO_3 + H_2O \rightarrow H_2SO_4$
(H₂SO₃ = sulphurous acid, H₂SO₄ = sulphuric acid, SO₂ = sulphur dioxide).

GLOBAL WARMING → the rise in Earth's atmospheric temperature.
Theory A - Human activity causes global warming.
Theory B - Global warming is natural.

GREENHOUSE GASES: CO₂ traps heat without it, Earth would be 30°C colder.

GREENHOUSE EFFECT: sun's rays get trapped under CO₂ blanket. Fossil fuels increase this effect.

WATER POLLUTANTS: raw sewage has the same effect as excess nitrates in water.

LEAD: naturally occurring in air, water, soil, food. An excess intake is linked to low IQ + slow development. Soft water reacts with lead water pipes, hard water does not.

THE RHINE: sources of Rhine pollution - industries, households + agriculture.

THE GREAT STINK: 1858, London. sewage flowing into Thames, Joseph Bazalgette fixed problem by re-routing sewage lines. Today Thames is one of the cleanest metropolitan rivers.

NITROGEN CYCLE
Atmospheric nitrogen 78%
nitrogen in animal proteins
nitrogen in plant proteins
nitrogen in decaying matter + waste
bacteria "fix" nitrogen for use by plants

THE CARBON CYCLE
sunlight
photosynthesis
Decaying organisms
Organic carbon
Animal respiration
Dead organisms + waste products
Fossils + fossil fuels
Ocean uptake
root respiration
respiration
Auto + factory emissions
CO₂ cycle



What do useful summary notes look like?

THE EARTH'S INNER STRUCTURE

A thin solid **CRUST** 10-15km thick that floats on the more dense mantle.

Core - made up of molten nickel and iron, outer part liquid, inner part solid.

The **mantle** has the properties of a solid but can also flow like a thick liquid.

GARHQUAKE WAVES

P-waves: longitudinal. Moves building from side to side, can pass through solids + liquids. Goes faster through dense material.

S-waves: transverse. Moves building up + down, can pass through only solids. Slower than p-waves, goes faster through dense material.

REMEMBER: Shadow zones

epicentre
focus
swave
psave

SETI: search for extraterrestrial intelligence - A NASA sponsored organisation.

RED SHIFT
stars moving away, frequency of the waves that reach us has decreased.

BLUE SHIFT
stars move towards us, frequency of the waves increase.

The shift in 'Calcium K' lines tells us which direction stars are moving.

Attenuation in waves

THE ORDER OF THE PLANETS

SUN → MERCURY → VENUS → EARTH → MARS → ASTEROID BELT → JUPITER → SATURN → URANUS → NEPTUNE → PLUTO (CHARON)

Body	what it is made of	Size	Type of orbit
COMET	large lumps of ice + dust	Several km's across	elliptical around the sun, but different to shape of planets
ASTEROID	large lumps of rock	10's - 100's of km's across	circular, around the sun.

SOUND WAVES

quiet, low pitched sound

loud, low pitched sound

quiet, high pitched sound

loud, high pitched sound

ELECTROMAGNETIC SPECTRUM WAVES

- Radiowaves**: used in communication + astronomy
- Infrared**: used in remote controls, grills, night vision (all objects above absolute 0 emit infrared radiation) Dangers: skin burns
- Light**: needed for sight. Dangers: blindness, cataracts!
- Ultraviolet**: used in sunbeds, fluorescent lamps + security markings. Dangers: High doses can kill cells, lower doses can cause cells to become cancerous.
- Microwaves**: used in satellite communication, mobile phone networks, cooking, RADAR. Dangers: Internal tissue heating.
- X-rays**: used to create shadow pictures of items inside the human body. Dangers: High doses can kill cells, low doses can cause cells to become cancerous.
- Gamma rays**: used to kill harmful bacteria on food and for sterilising surgical equipment. Also used to kill cancer cells. Dangers: High doses can kill cells, lower doses can cause cells to become cancerous.
- Ultra sound/ultrasonic**: High frequency >20000Hz (greater than human hearing range.) Used in medicine: Does not harm fetus in womb (unlike X-rays would) waves reflect off to produce an image (different tissues cause different amounts of reflection). GEL used as it is the same density as skin - less reflection.

GRAVITY

GRAVITY is the field that results in a force of attraction between any two masses. All masses have gravitational field, the bigger the mass, the larger the field strength. THERE IS NO GRAVITY IN INTERGALACTIC SPACE.

Speed = distance covered by the wave time taken to travel

measured in Newtons → kg

Weight = mass × 10

Free-falling: acceleration (m/s²) = Force (N) / mass (kg)

GRAVITY on earth = 10N/kg
on the moon = 1.7N/kg

1 light year = 9.5 × 10¹⁵ km (distance measurement) overcoming space conditions exercise + hydration

STAGES IN THE LIFE OF AN AVERAGE STAR

Nebula → protostar → star → red giant → white dwarf → Neutron star

THE LIFE CYCLE OF A MASSIVE STAR

Nebula → protostar → massive star → super → supernova → Black hole (A gravitational field that not only lights, but has a mass of 100 million suns.)

WAVES & SPACE

TRANSVERSE
- light
- water
- S-waves
- ultrasound

LONGITUDINAL
- sound
- P-waves
- wavesound

ANALOGUE VS DIGITAL
- old
- constant varying signal (continuous)
- signal just amplified
- often interrupted

- new
- more simple on & off signal (discrete)
- signal interpreted by computer
- reduced interference and increased quality

TRANSVERSE WAVE
particle movement ⊥ wave length

LONGITUDINAL WAVE
when the displacement is parallel to the direction of the wave.

HOW THE UNIVERSE BEGAN THEORIES

BIG BANG THEORY - states that an enormous amount of concentrated energy and matter appeared suddenly. Nothing existed before this moment. The universe started off small and has expanded ever since.

THE OSCILLATING THEORY - suggests that the creation of this universe (a big bang) followed the death of the last universe (a big crunch). The cycle repeats itself, with a series of universes, one after the other.

STEADY-STATE THEORY - says that the appearance of the universe has never changed + never will. It assumes that the universe is expanding but does not accept that the matter in the universe occupies an ever-increasing volume. As the universe expands, a supply of hydrogen + helium atoms fills in the spaces.

ELECTROMAGNETIC SPECTRUM

Radiowaves, Sub-mm, Infrared, Visible Light (ROYGBIV), Ultra violet, X Rays, Gamma Rays

Long wavelengths
Low energies
Low frequency
Least penetrating

Short wavelengths
High energies
High frequency
Most penetrating

RELIABILITY: increases when your data agrees with any secondary data. If repeated measurements are taken: data can be said to be reliable.

VALIDITY: when data is collected, interpreted correctly + relates directly to the original hypothesis - question is hard to be valid. Valid data is reliable.

Reflection

ANGLE OF INCIDENCE = ANGLE OF REFLECTION

Incident ray, Normal, Reflected ray

MIRROR

Refraction of Light

As the light wave enters the glass it slows down and bends towards the normal.

As the light wave exits the glass it speeds up and bends away from the normal.

Notice that the wavelength of the light decreases inside the glass (but as its speed is reduced - but the frequency remains the same)

Refraction of Sound

As the sound wave enters the glass it slows down and bends towards the normal.

As the sound wave exits the glass it speeds up and bends away from the normal.

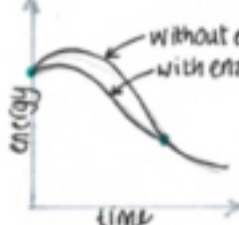
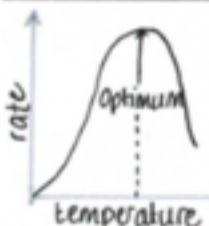

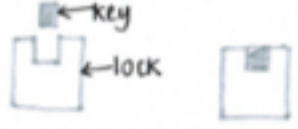
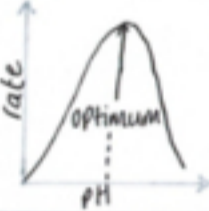


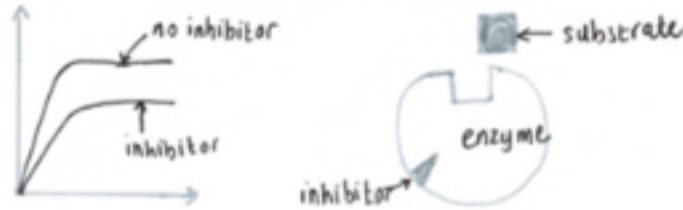

Notice that the wavelength of the sound increases inside the glass (but as its speed is increased - but the frequency remains the same)

Attenuation in waves

Attenuation in waves →

What do useful summary notes look like?

Enzymes

 <p>• start and endpoint still the same</p> <p>Active site is determined by tertiary structure. Enzymes bind to a complementary substrate forming an ES complex.</p>	<p>TEMPERATURE</p>  <ul style="list-style-type: none"> As temperature increases, more kinetic energy so molecules collide more often so rate increases. As temperature increases beyond optimum, enzyme denatures molecules in enzyme vibrate too much → breaks hydrogen and ionic bonds Tertiary structure changes, active site shape changes, not complementary so can't form an ES complex. 	<p>COMPETITIVE INHIBITORS</p> <ul style="list-style-type: none"> Competes for active site as it has a similar shape to substrate Inhibition can be overcome by adding more substrate → higher chance substrate will bind, increasing rate 
<p>LOCK & KEY HYPOTHESIS</p>  <p>Active site shape is complementary before and after substrate binds.</p>	<p>pH</p>  <ul style="list-style-type: none"> significant pH change causes hydrogen and ionic bonds to break → enzyme is denatured and ES complex can't form. 	<p>NON-COMPETITIVE INHIBITORS</p> <ul style="list-style-type: none"> Different shape to substrate - binds to enzyme, but not on active site Denatures enzyme by breaking hydrogen and ionic bonds, changing specific tertiary structure so no longer complementary Adding more substrate doesn't decrease the inhibition as the substrate and inhibitor aren't competing for the same site → permanently denatured.
<p>INDUCED FIT HYPOTHESIS</p> <p>Better as it explains why enzymes are so specific → they interact with substrates. Active site is not complementary to substrate. As substrate fits in, active site shape changes and becomes complementary. As it changes, enzyme puts a strain on the substrate, distorting particular bonds and lowering the activation energy. Substrate has to be right shape to fit active site and make it change shape.</p> 	<p>SUBSTRATE CONCENTRATION</p>  <ul style="list-style-type: none"> The higher the substrate conc, the higher the rate Rate increases up to a 'saturation point' → enzymes become limiting factor. 	
<p>ENZYME CONCENTRATION</p>  <ul style="list-style-type: none"> Directly proportional to rate → adding more = more ES complexes. If substrate concentration is limited, increasing enzyme concentration would have no further effect 		

Start by picking one of the headings, and then pull together all notes and paragraphs. Make a one-page summary.

If you need to use these as a crutch, do. BUT – TRY.

AQA due by
end of June:

Bio paper 1:

10 summaries = 9 Chapt + 1 prac

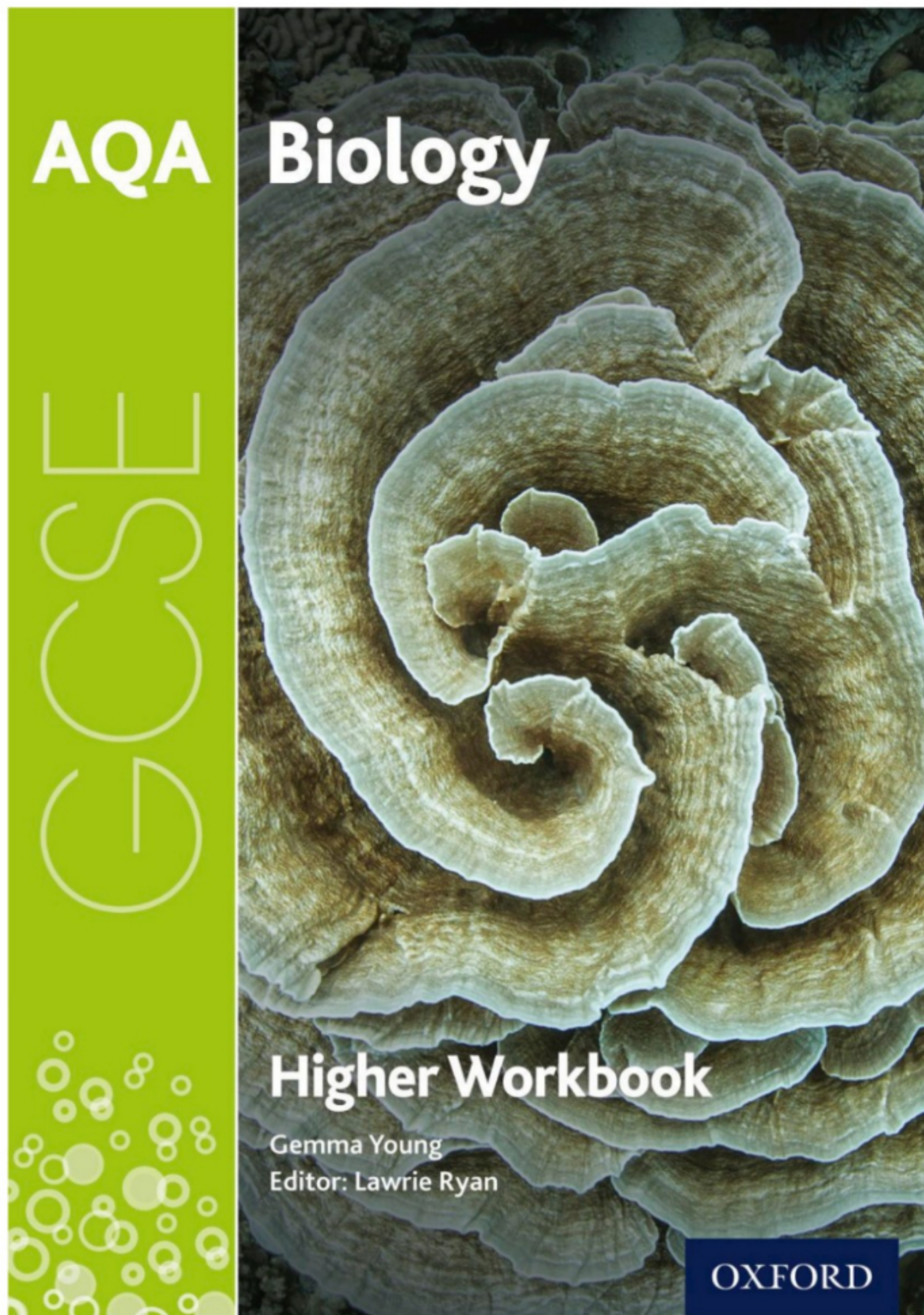
Chem paper 1:

8 summaries = 7 content + 1 prac

Phys paper 1:

8 summaries: 7 content, 1 prac

+ do the other summaries
of stuff we have covered
to ease the work load in
yr 11.



10 summaries = 9 Chapt + 1 prac

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1 Cells and organisation

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can't do yet.

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10 Summaries.

This book has been written for the AQA GCSE Biology and AQA GCSE Combined Science: Trilogy courses, making them completely co-teachable. Biology only lessons are easily identifiable by a black-bordered design, and are also formatted in italics in the below

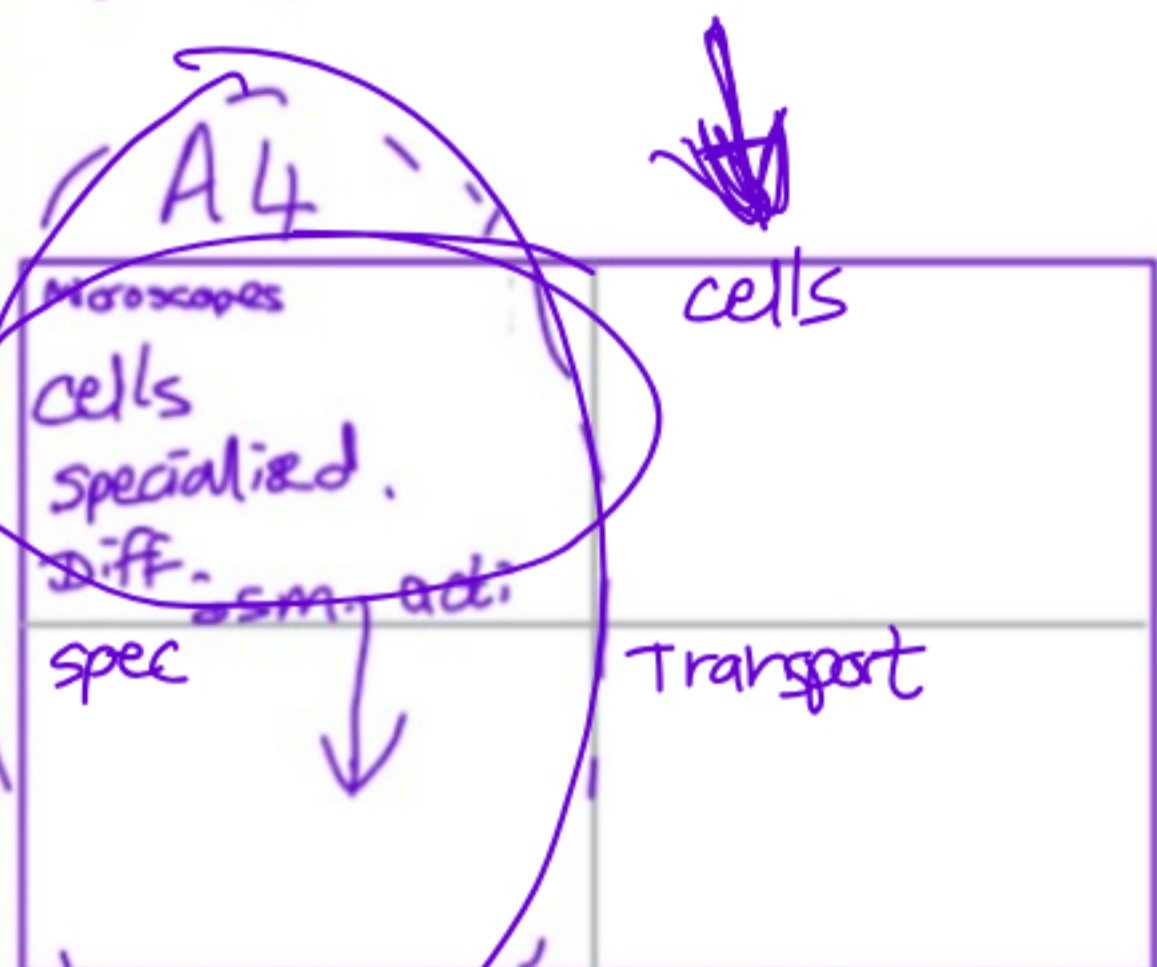
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AQA

Chemistry

GOSE

Higher Workbook

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OXFORD

8 summaries = 7 content + 1 prac

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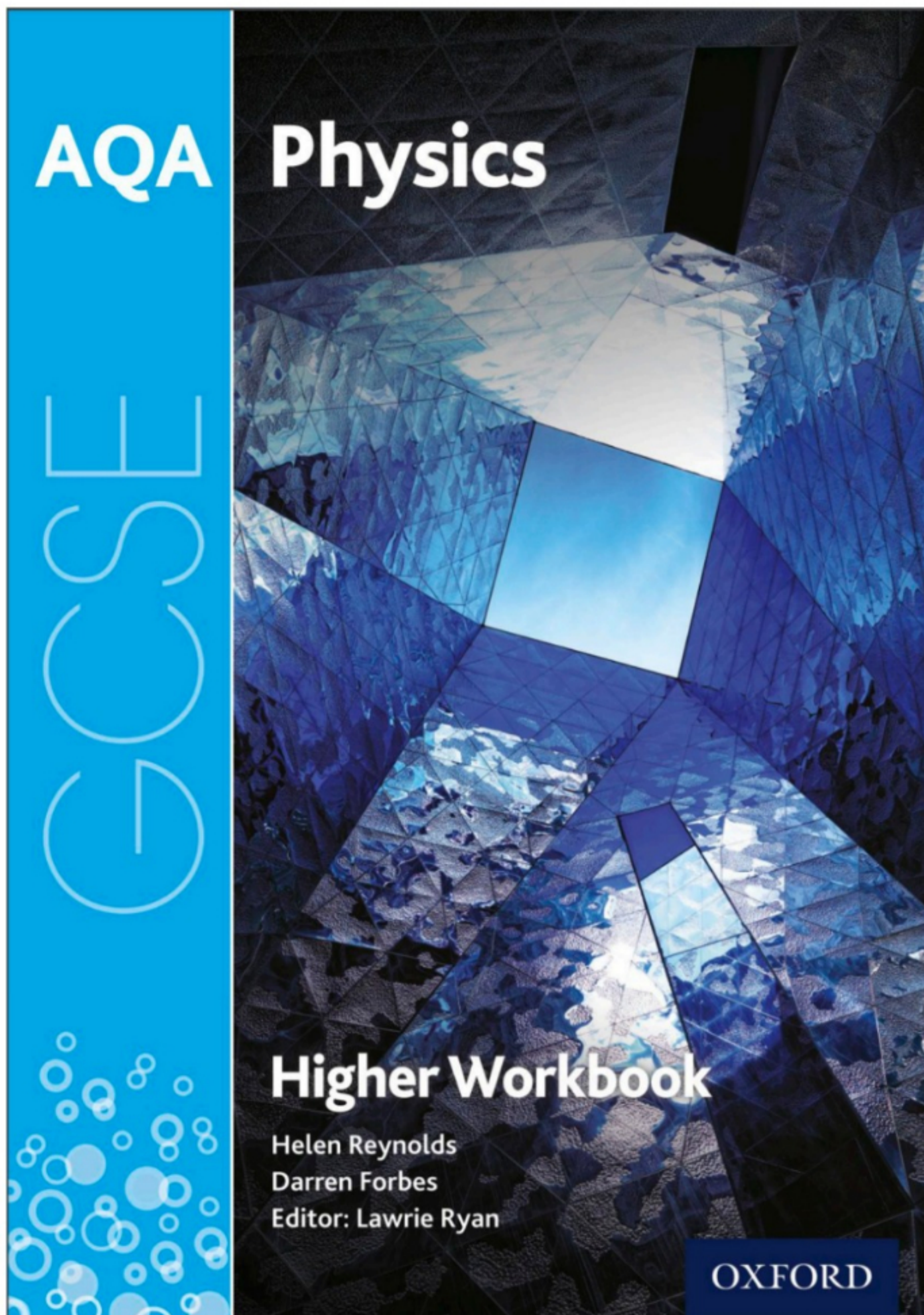
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Due by end of June:

OCR

Bio paper 1: 4 summaries

3x content, 1x prac

Chem Paper 1: 4 summaries

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Phys Paper 1: 5 summaries

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+ do the other summaries
of stuff we have covered
to ease the workload in
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you will need to master all of the ideas and concepts on these pages.
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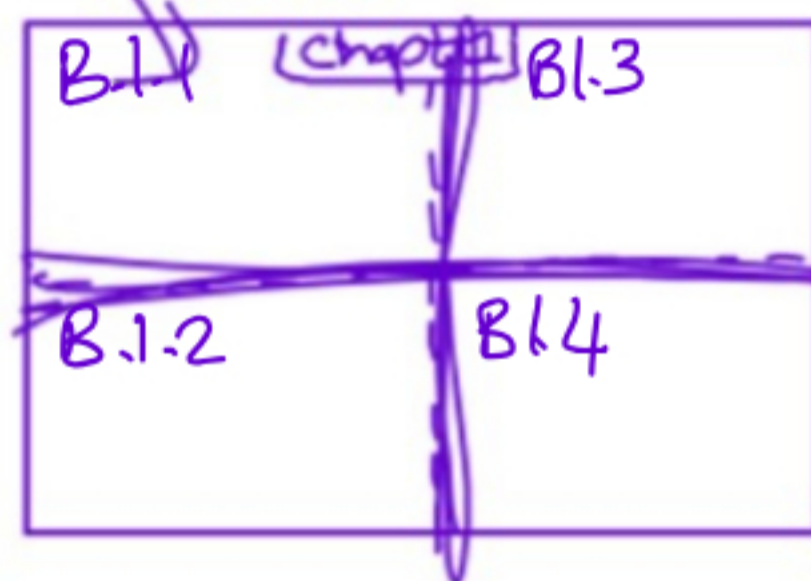
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Microscopes & cells.

B.1.1



You can use this book if you are studying Combined Science:
 ● you will need to master all of the ideas and concepts on these pages.

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now to can

You can use this book if you are studying Combined Science

- you will need to master all of the ideas and concepts on these pages
- you will need to master some of the ideas and concepts on these pages.

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can do by summer

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do
now

Microscopes

Robert Hooke invented in 1665

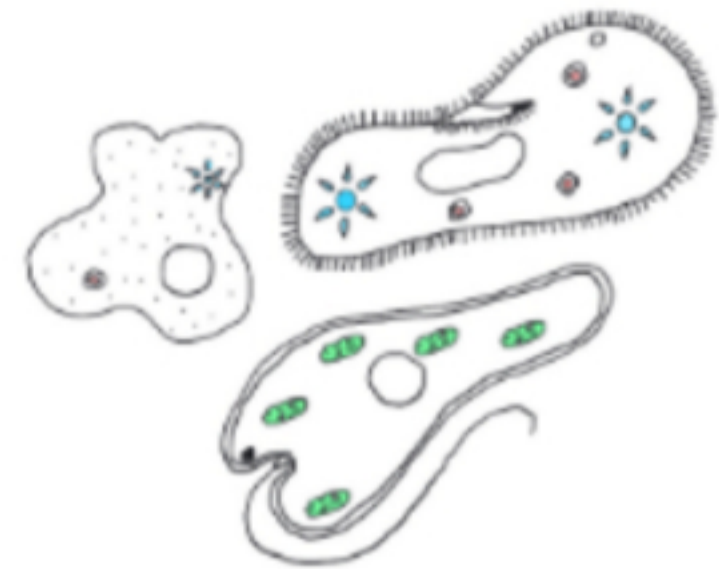
AM Image size = actual x magnification

Total magnification = objective x eyepiece

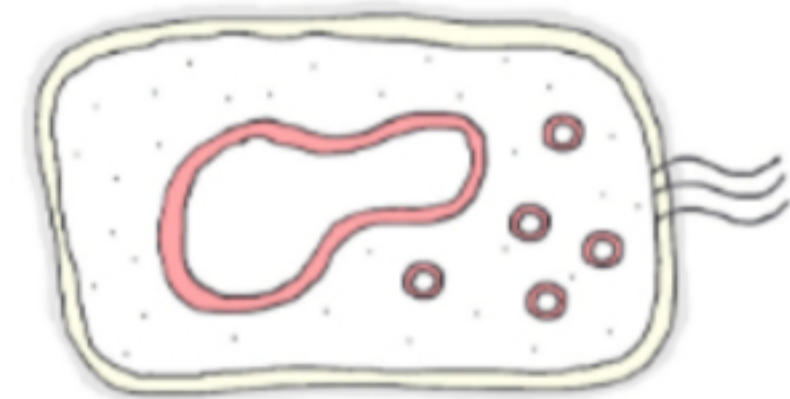
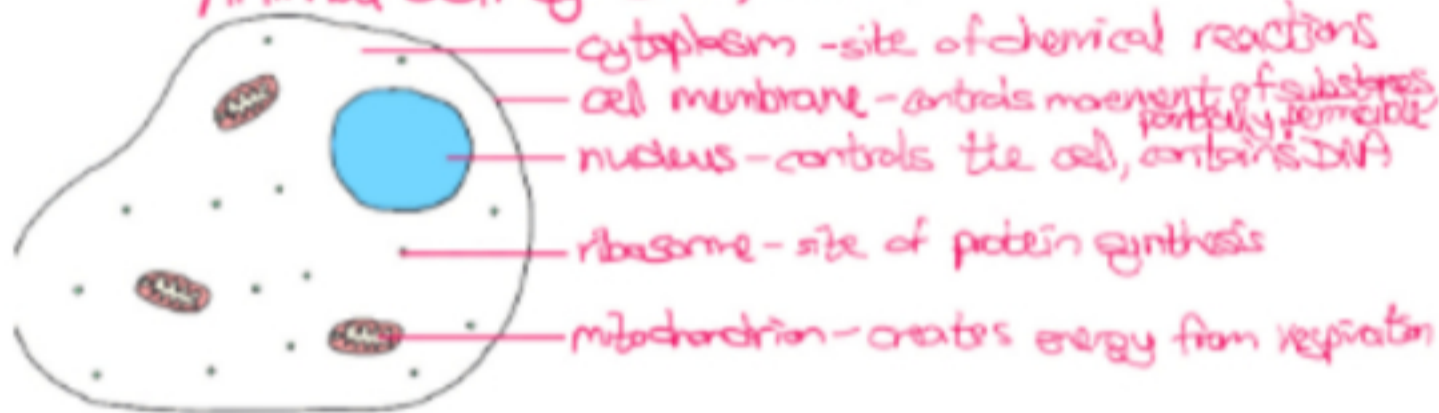
Resolution: smallest distance between two points that can still be seen as two points

electron microscope invented 1930s. up to 2000000x magnification
0.000002mm resolution

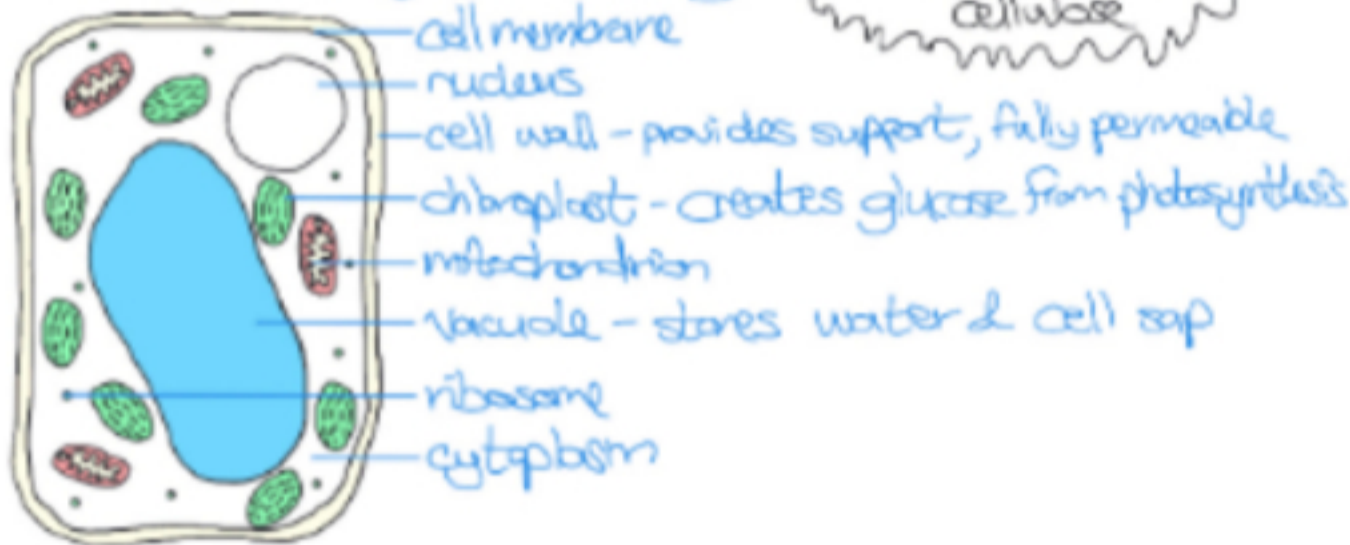
Stain: used to see specimen better; eg iodine, methylene blue



Animal cell eg: cheek, ovum



Plant cell eg: daffodil, daisy



Cell wall made of cellulose

Fungal cell eg: Yeast, mushroom



ionic bonding

- ionic bonding is bonding between a metal and non-metal
- electrons are transferred from metal to non-metal to create ions
- electrostatic forces - hold the ions together

properties:

- > high melting / boiling points
- > many are soluble in water
- > conduct electricity when liquid or in solution but not when solid

dot and cross diagrams

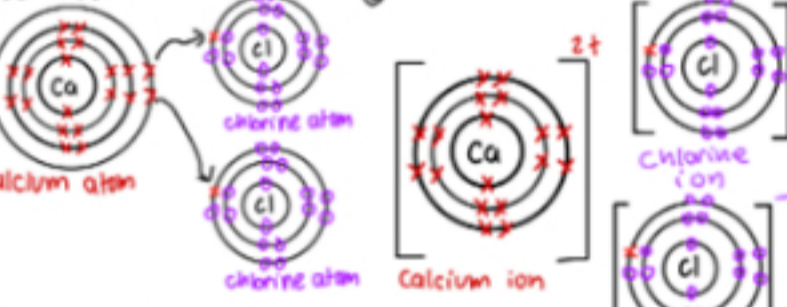
Sodium chloride



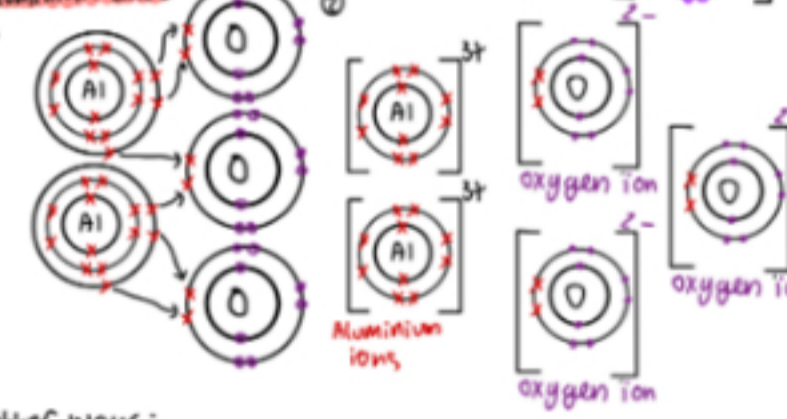
magnesium oxide



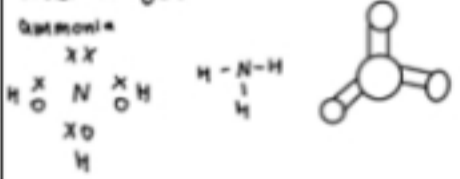
calcium chloride - CaCl2



aluminium oxide



other ways:



C3 structure and bonding covalent bonding

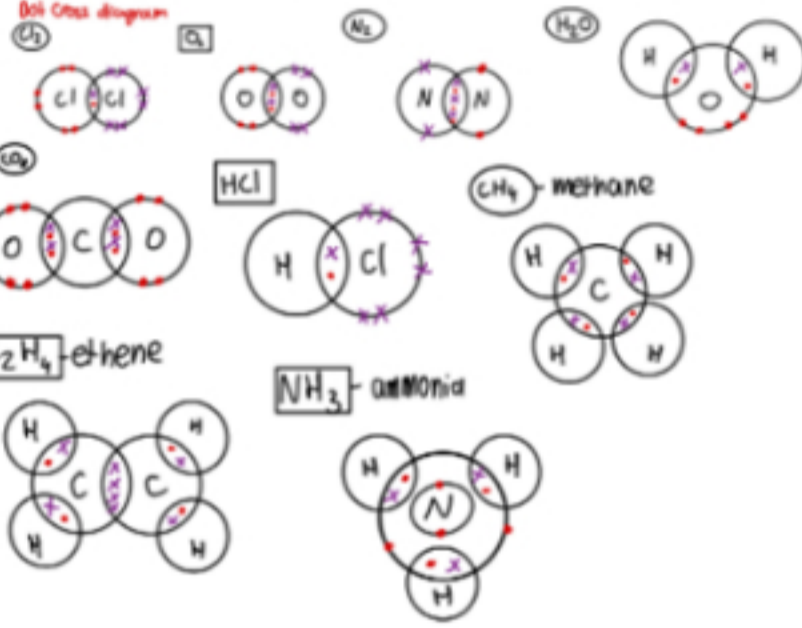
- covalent bonding is bonding between non-metals
- electrons are shared in pairs between atoms
- (intermolecular forces hold together the atoms)

Simple molecular covalent molecules

- Structure: small, distinct groups of atoms
- properties:
 - low melting/boiling points
 - a few are soluble in water
 - most do not conduct electricity

giant covalent molecules

- Structure: billions of atoms held together in a lattice structure
- properties:
 - high melting/boiling points
 - insoluble in water
 - most do not conduct electricity
 - except in carbon as graphite



DIAMOND	GRAPHITE	SILICON DIOXIDE
<ul style="list-style-type: none"> - each carbon is bonded to 4 other carbons - lattice - very hard - strong covalent bonds between each of the atoms - doesn't conduct electricity - high melting/boiling points - very hard uses: jewellery, sports equipment, cutting tools in dentistry 	<ul style="list-style-type: none"> - each carbon joined to 3 other C's - delocalised electron - conducts electricity - soft - excellent conductor of electricity uses: writing implements (pencil), electrical wiring, dry lubricant for machine parts synthetic - superior wear material graphite - 1st atom thick 	<ul style="list-style-type: none"> - giant covalent - silicate minerals - white crystalline solid - water insoluble - brittle uses: glass, insulating materials, very hard, high mp, insoluble in water, doesn't conduct electricity

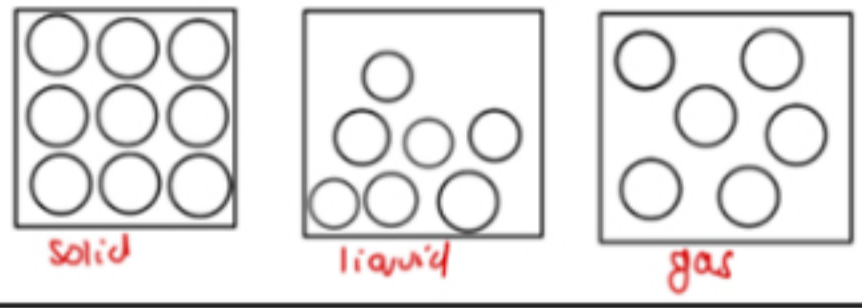
Carbon nanotubes

- each carbon to 3 other carbons
- delocalised electron
- high tensile strength
- high electrical conductivity
- high thermal conductivity
- uses:
 - catalysts
 - reinforcing materials
 - semi-conductors
 - single molecule transistors

buckminster fullerene

- C60 → 60 carbon molecules
- hollow center
- 6-C 7-C } same shape
- 5-C
- shaped into spheres or tube
- each carbon is bonded to 3 other C's
- a delocalised electron
- weak intermolecular forces between molecules
- used: catalysts

States of matter



metallic bonding

properties of

metals

- high mp/bp
- malleable in water
- conduct electricity
- conduct heat
- good shapers
- shiny
- high density
- malleable

non-metals

- low mp/bp
- some soluble in water
- do not conduct electricity
- poor shapers
- do not conduct heat
- brittle
- low density
- brittle

Electrostatic attraction between positive metal ions holds the giant structure and a 'sea' of negatively charged electrons. Metallic bonding is in metals. Metal atoms become positively charged when electrons are delocalised. Held together because of electrostatic attraction. Free electrons move throughout the structure. Properties: high mp/bp, malleable in water, conduct electricity when solid or liquid.



alloys

- brass: copper + zinc
- bronze: copper + tin
- steel: iron + carbon
- solder: lead + tin
- titanium: titanium
- duralumin: aluminium + copper
- sterling silver: 92.5% silver + the rest of copper
- stainless steel: steel mixed with chromium + nickel
- gunmetal: 88% copper, 8% tin + rest aluminium
- pewter: 93% tin + 7% copper
- Invar: iron + nickel
- Inconel: nickel + chromium + titanium

nanoparticles

Nanoparticles are particles that are between 1nm and 100nm in size. Nanoparticles of a substance consist of a few hundred particles only and often have very different properties to the bulk material of the same substance. **nanoscience is the study of nanoparticles.**

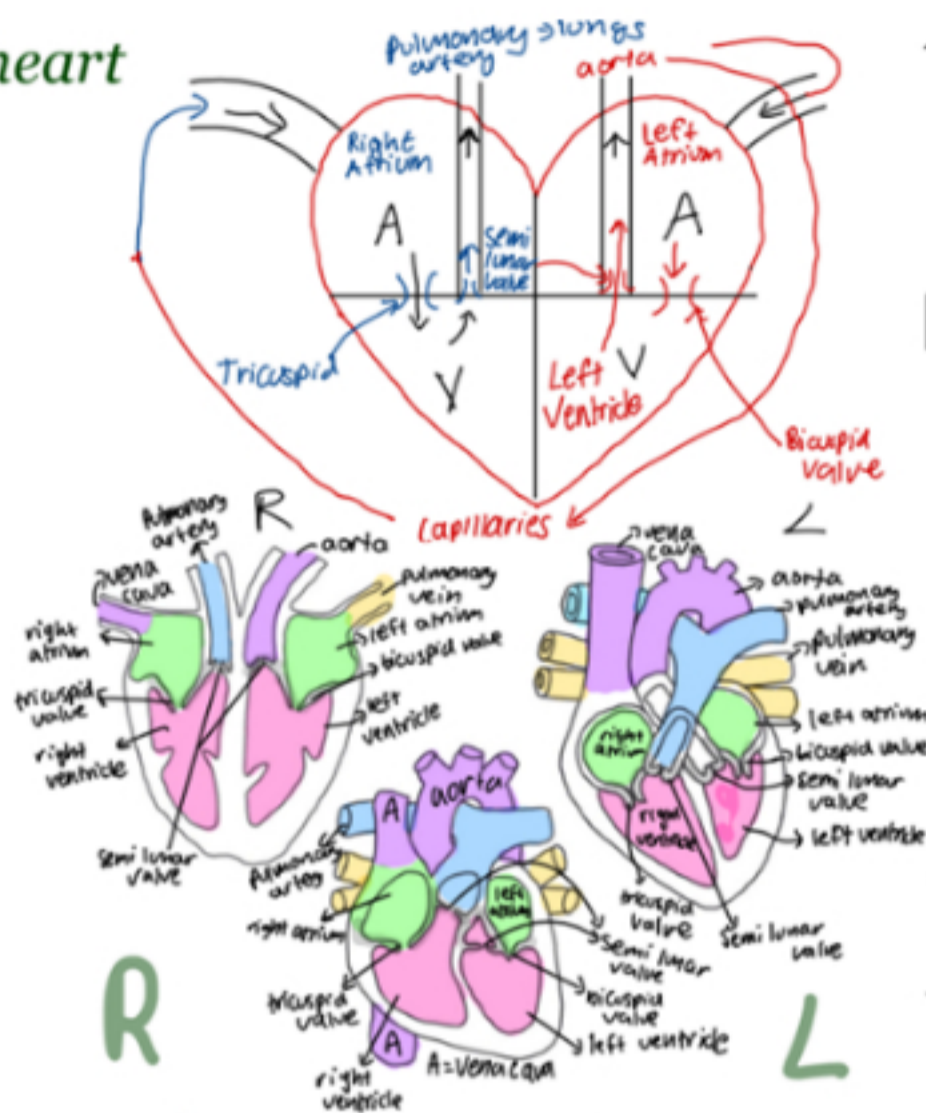
Risks of Using Nanoparticles

Scientists are concerned about the use of nanoparticles. As nanoparticles behave differently to their bulk material, there could be a concern that nanoparticles may not be safe to use. The risks are difficult to determine as modern nanoparticles have not been in large-scale use for very long. The nanoparticles we use today are all embedded in other materials, like stained glass and sunscreens. These do not get into the air and cannot be absorbed through the skin. This means that we cannot breathe them in accidentally.

Uses of Nanoparticles

- Sunscreens:** Nanoparticles of zinc oxide or titanium dioxide are used in sunscreens as they appear to be colourless and absorb harmful UV light. These sunscreens give better protection than normal sunscreens. *Wants to use: protection, colourless.*
- Drug Delivery:** Gold nanoparticles can be used to deliver drugs to specific cells in the body, reducing the volume of drugs required and so reducing the side effects of the drugs. *Wants to use: drug effects, volume, nanoparticles.*
- Deodorants:** Silver nanoparticles are contained in some deodorants as they kill the bacteria that create unpleasant odours. *Wants to use: bacteria, deodorants, odours.*
- Fuel cells:** Fuel cells enclose a reaction between hydrogen and oxygen. Platinum is used to catalyse this reaction. Using platinum nanoparticles means that less platinum is required because of the large surface area of platinum nanoparticles. *Wants to use: platinum, surface, catalyst, oxygen.*
- Cosmetics:** Nanoparticles are being used in foundation to diffuse light. Moisturisers can kill bacteria. Nanoparticles can be used in face creams to deliver vitamins to the skin. *Wants to use: foundation, bacteria, vitamins, foundations.*
- Synthetic skin:** Carbon nanotubes are being used to create stronger synthetic skin to cover wounds and potentially, in future, they could sense pain and heat. *Wants to use: skin, nanotubes, skin, wounds.*
- Clothing:** Some clothes contain silver nanoparticles that kill bacteria. Some clothes are treated with titanium dioxide nanoparticles making them self-cleaning. *Wants to use: bacteria, titanium, self-cleaning.*
- Electronics:** Printing circuit boards with nanoparticles allow smaller circuits to be created. *Wants to use: circuit boards.*

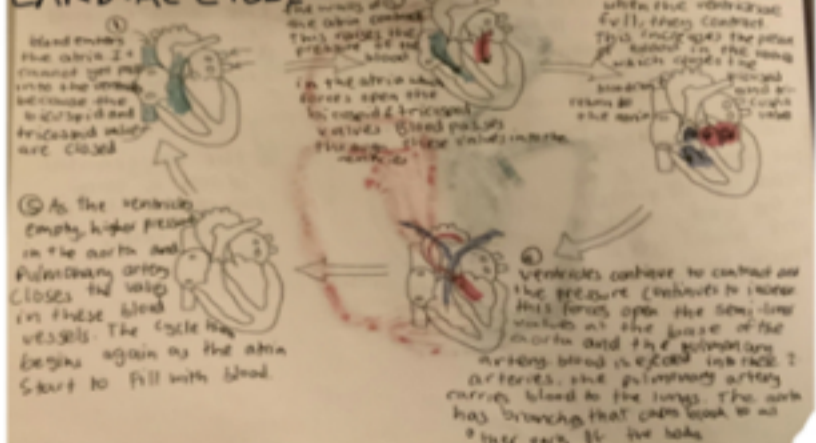
heart



DOUBLE CIRCULATION



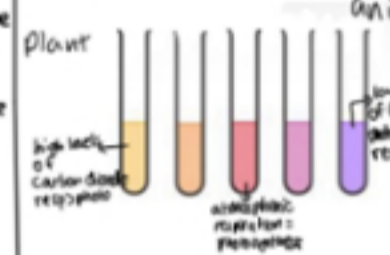
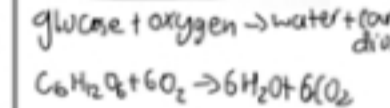
CARDIAC CYCLE



SB8 exchange and transport in animals
cellular respiration

a series of chemical reactions that release energy from glucose.

AEROBIC RESPIRATION



ANAEROBIC

building up an oxygen debt
glucose → lactic acid $C_6H_{12}O_6 \rightarrow C_3H_7CO_2$
paying back the oxygen debt by breaking down the lactic acid
lactic acid + oxygen → carbon dioxide + water
 $C_3H_7CO_2 + 3O_2 \rightarrow 3CO_2 + 3H_2O$
AN aerobic Respiration in Yeast
glucose → ethanol + carbon dioxide
 $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

SA:VOL calcs
 $1 \times 1 \times 6 = 6 \text{ cm}^2$ | $1 \times 1 \times 1 = 1 \text{ cm}^3$ SA:VOL 6:1
EXPRESSIONS
alveoli: containing a thin layer of fluid which make gas exchange easier
alveoli are one cell thick to allow faster diffusion
alveoli are rounded and numerous for a large SA

efficient transport and exchange

Single-celled organisms have relative large SA:V. Larger multicellular organisms have smaller SA:V. so, they have evolved exchange surfaces in plants and animals is increased by having:

- A large surface area:
 - the flattened shape of structures such as leaves
 - the alveoli in the respiratory system
 - the villi in the digestive system
- A short distance required for diffusion:
 - the membrane of cells
 - the flattened shape of structures such as leaves
 - the walls of blood capillaries are 1 cell thick

diffusion

A concentration is the amount of a substance in a certain volume.

concentration = $\frac{\text{mass of solute (mg)}}{\text{volume of solution (dm}^3\text{)}}$ $C = \frac{m}{V}$

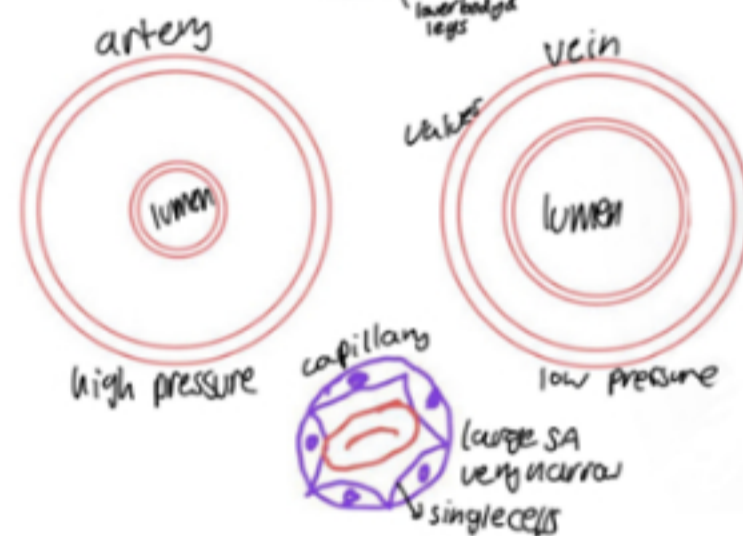


the difference between two concentrations forms a concentration gradient. The bigger the difference, the steeper the concentration gradient and the faster the rate of diffusion $O \rightarrow CO_2$

Fick's law shows the relationship the variables that affect diffusion:

rate of diffusion $\propto \frac{\text{surface area} \times \text{conc. diff.}}{\text{thickness of membrane}}$

the circulatory system

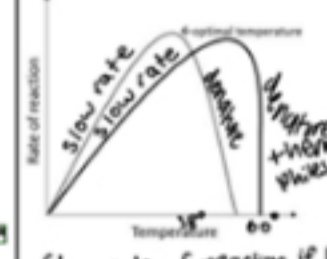


Arteries	Veins
No valves	has semi lunar valves prevent back flow
thick elastic tissue	thin elastic tissue layer
Carry blood away from the heart	Carry blood towards the heart
small lumen to increase pressure	large lumen to be able to carry blood but in larger volumes, low pressure
thick muscle wall and connective tissue layer	thin muscle wall layer

In the circulatory system, blood flows away from the heart into arteries. These divide into narrow capillaries, which form fine networks running through tissues. Blood returns to the heart in veins

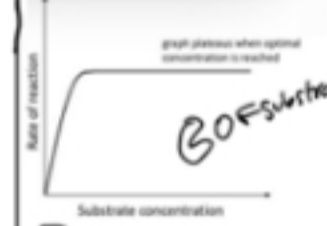
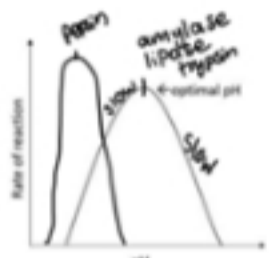


SB1 key concepts in biology enzymes



the enzymes start work slowly until they reach the optimal temp which is 38 and they denature

Slow rate of reaction if line touches axis enzyme is denatured enzymes is denatured when temperature is too high or it is too low or high.



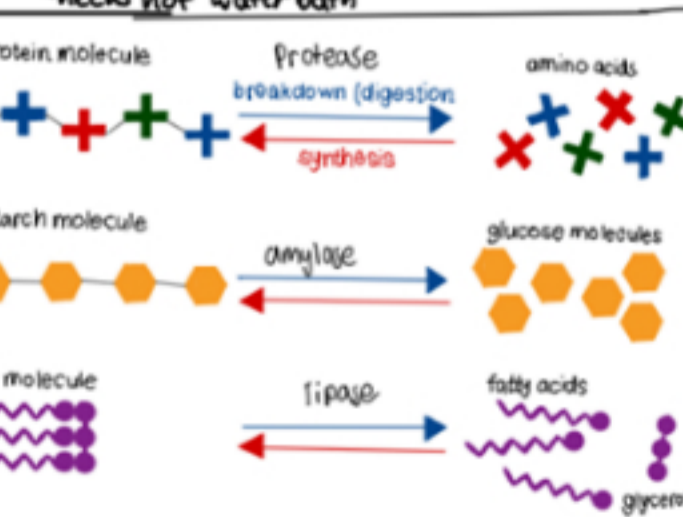
as temperature increases, the optimal temperature takes much less time for the reaction to finish. At a lower temperature it takes longer.

- 1) active site is specific to substrate
- 2) enzyme substrate complex
- 3) enzyme catalyses reaction and releases product

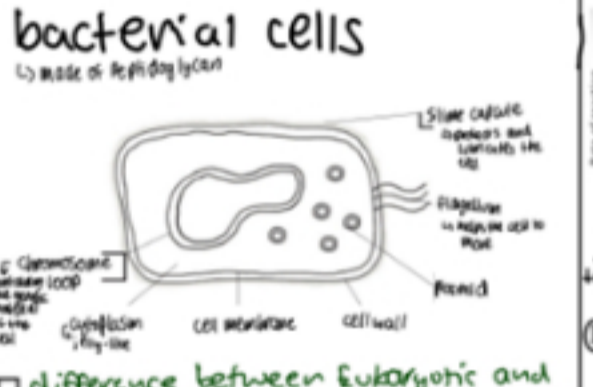
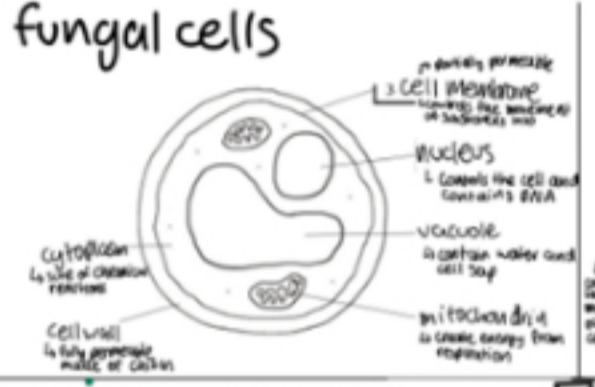
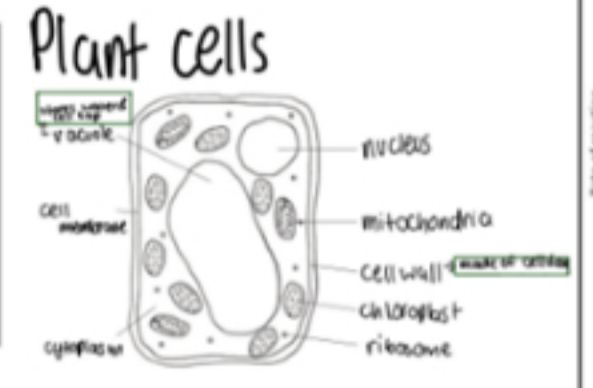
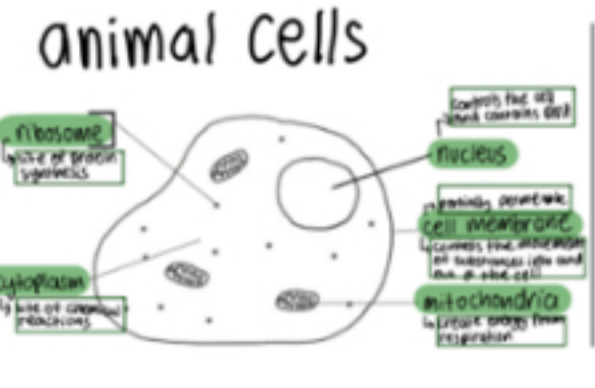
enzymes
lipase e.g. lipids
carbohydrase e.g. amylose maltose
protease e.g. protein tryptin

food tests

- test for starch-iodine
positive: blue-black
negative: red-brown
- test for proteins
positive: lilac
negative: blue
- test for lipids
positive: cloudy emulsion
negative: No cloudy emulsion
- test for sugars-solutions
positive: green (a little)
orange (some)
brick red (a lot)
- needs hot water bath



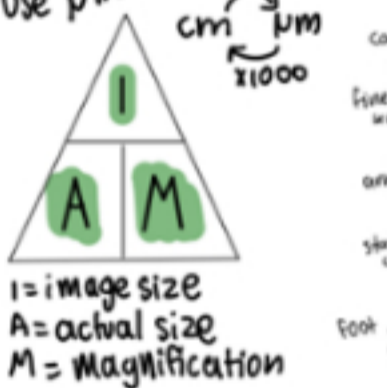
cells



difference between Eukaryotic and Prokaryotic cells

prokaryotes are always unicellular while eukaryotes are often multicellular. eukaryotes are larger than prokaryotes. the DNA in eukaryotes is stored within the nucleus but prokaryotes lack a nucleus so it is stored in the cytoplasm

microscopes

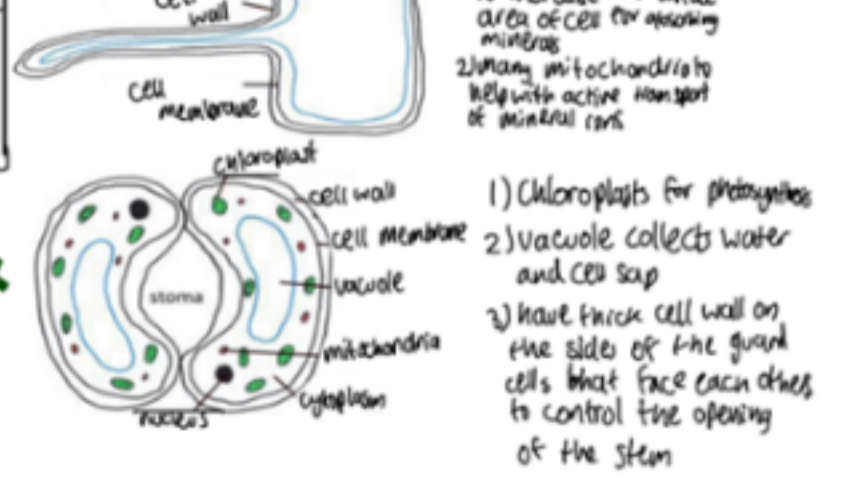


electron & light microscopes

light microscopes are used to study living cells and for regular use when relatively low magnification and resolution. Electron microscopes provide higher magnifications and higher resolution images in great detail and clarity

total = eyepiece \times objective lens mag

specialised cells



transporting substances

diffusion is the net movement of particles from an area of high conc. to an area of low conc. with a conc. gradient. e.g. oxygen

osmosis is the net movement of water particles from an area of high conc. to an area of low conc. with a conc. gradient across a partially permeable membrane. it is basically the diffusion of water across a membrane

active transport is the movement of particles from an area of low conc. to an area of high conc. up a conc. gradient across a partially permeable membrane using energy e.g. sugar

