GCSE Science

GCSE BIOLOGY, CHEMISTRY & PHYSICS

GCSE COMBINED SCIENCE

MRS R HOY SCIENCE CURRICULUM LEADER

AQA Triple Science

GCSE Biology- 2x 100 mark exam papers (105 mins)

GCSE Chemistry- 2x 100 mark exam papers (105 mins)

GCSE Physics- 2x 100 mark exam papers (105 mins)

Each subject is awarded a separate grade
Each subject can be sat at higher or foundation level

AQA (Triology) Combined Science

Biology- 2x 70 mark exam papers (75 mins)

Chemistry- 2x 70 mark exam papers (75 mins)

Physics- 2x 1 70 mark exam papers (75 mins)

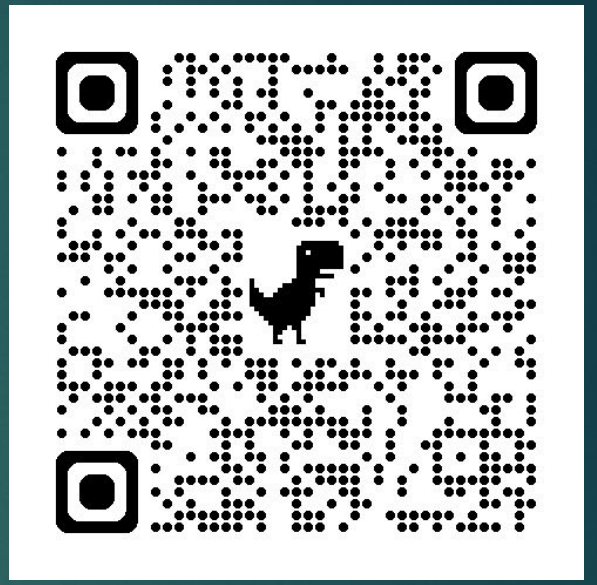
The subject is awarded two grade which are an average of all papers, e.g. 5,5 or 4,3
All 6 paper to be sat at higher or foundation level

Question types

- Multiple choice
- Structured
- Closed short answer
- Open response (maximum 6 marks)

Biology

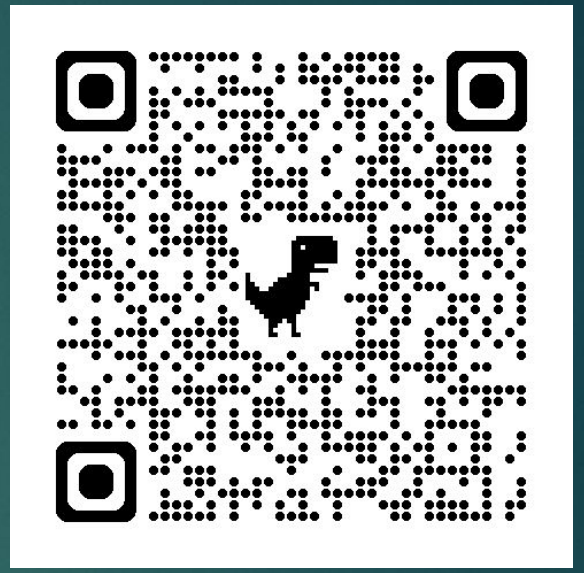
- 1. Cell biology
- 2. Organisation
- 3. Infection and response
- 4. Bioenergetics
- 5. Homeostasis and response
- 6. Inheritance, variation and evolution
- 7. Ecology
- 8. Key ideas



https://www.aqa.org.uk/subjects/biology/gcse/biology-8461/specification/specification-at-a-glance

Chemistry

- 1. Atomic structure and the periodic table
- 2. Bonding, structure, and the properties of matter
- 3. Quantitative chemistry
- 4. Chemical changes
- 5. Energy changes
- 6. The rate and extent of chemical change
- 7. Organic chemistry
- 8. Chemical analysis
- 9. Chemistry of the atmosphere
- 10. Using resources
- 11. Key ideas



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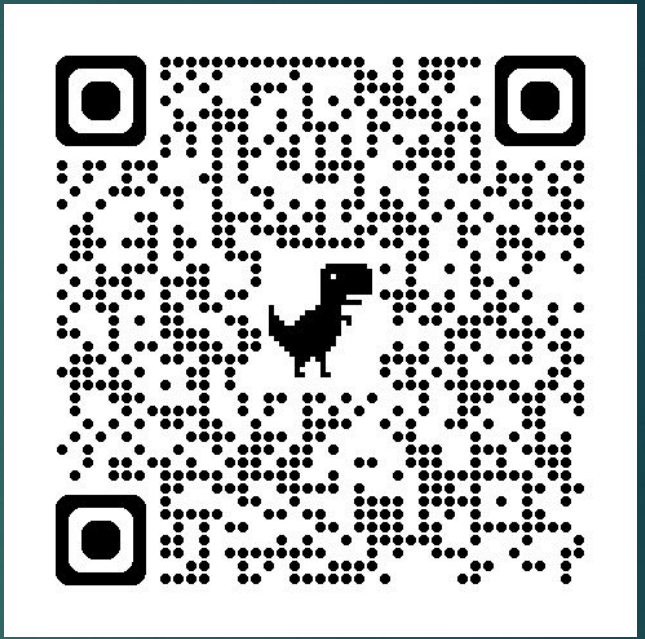
Physics

- 1. Energy
- 2. Electricity
- 3. Particle model of matter
- 4. Atomic structure
- 5. Forces
- 6. Waves
- 7. Magnetism and electromagnetism
- 8. Space physics (physics only)



https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/specification-at-a-glance

Combined Science

- 1. Cell biology
- 2. Organisation
- 3. Infection and response
- 4. Bioenergetics
- 5. Homeostasis and response
- 6. Inheritance, variation and evolution
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- 8. Atomic structure and the periodic table
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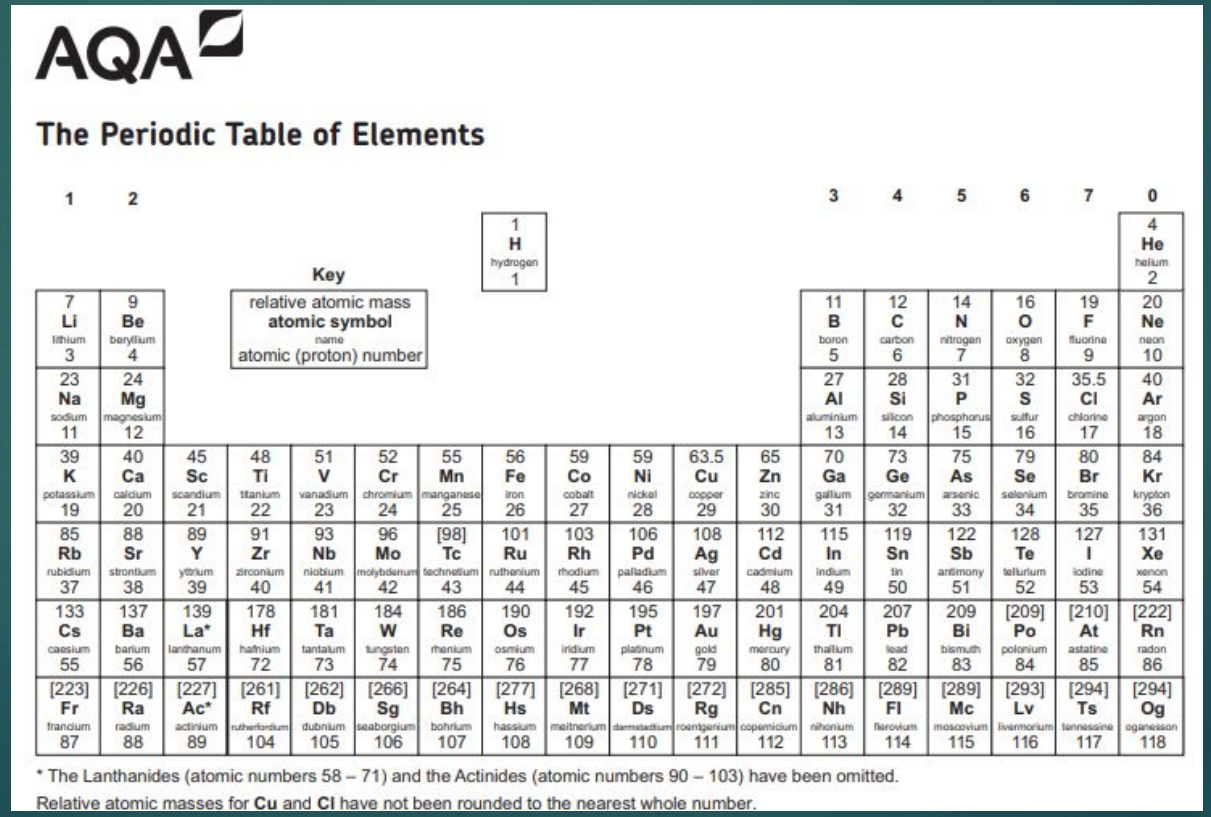
- 13. The rate and extent of chemical change
- 14. Organic chemistry
- 15. Chemical analysis
- 16. Chemistry of the atmosphere
- 17. Using resources
- 18. Energy
- 19. Electricity
- 20. Particle model of matter
- 21. Atomic structure
- 22. Forces
- 23. Waves
- 24. Magnetism and electromagnetism

https://www.aqa.org.uk/subjects/science/gcse/science-8464/specification/specification-at-a-glance

Periodic tables are provided in chemistry exams but no equation sheets



AQA

The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4		Key: relative atomic mass / atomic symbol / name / atomic (proton) number									11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

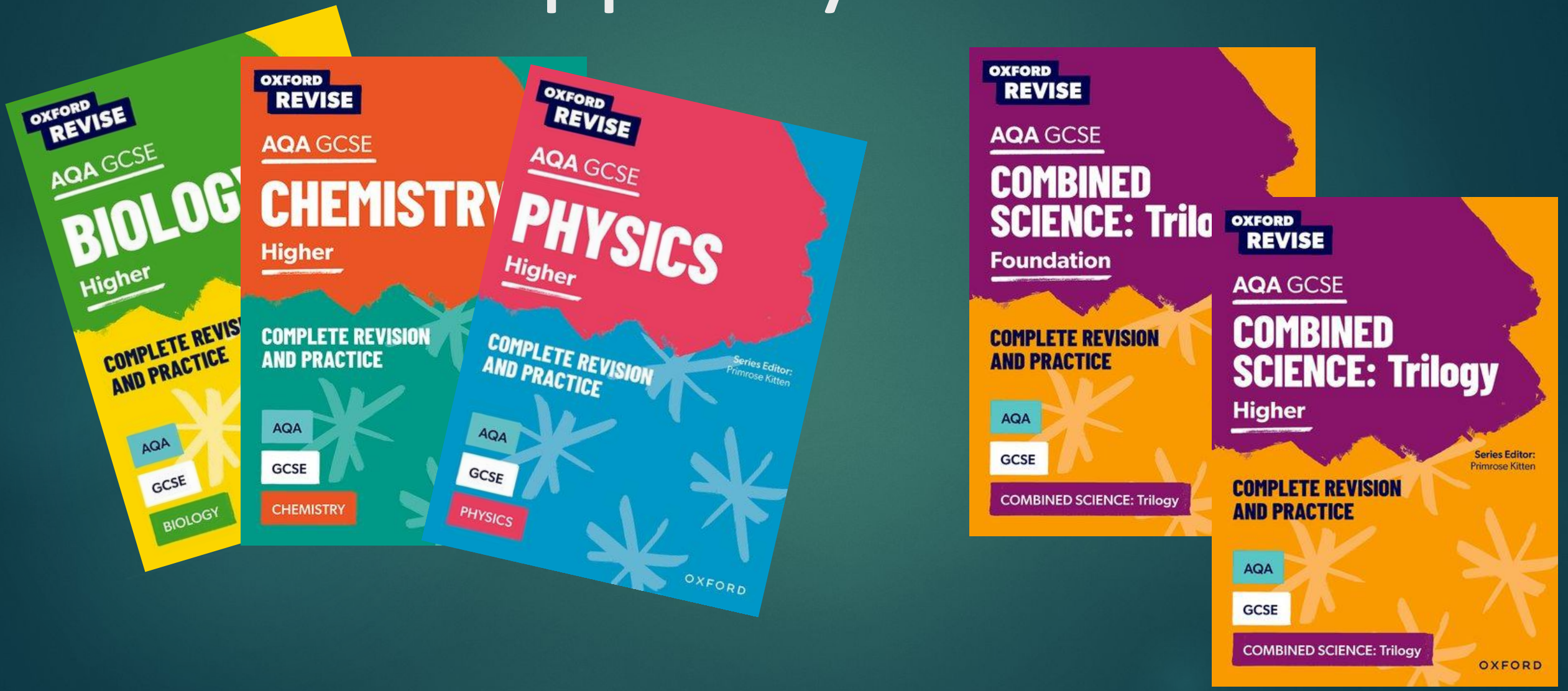
Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Full Physics equation sheets have been provided for the last few exam series, it is likely this will continue in summer 2025.

Please complete this online survey

Proposed changes to the assessment of mathematics, physics and combined science GCSEs in 2025, 2026 and 2027 - Page 1 of 8 - Ofqual Citizen Space - Citizen Space

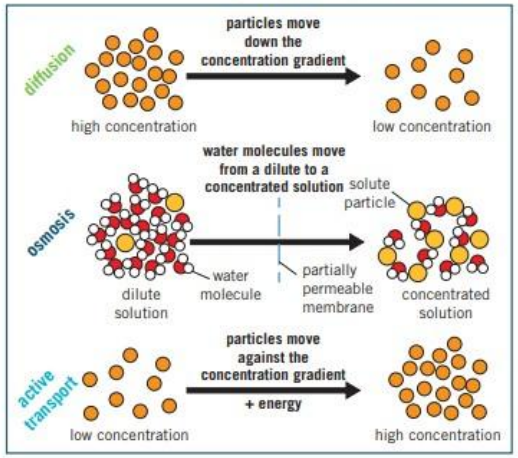
How to support your child



B2 Cell transport

Comparing diffusion, osmosis, and active transport

	Diffusion	Osmosis	Active transport
Definition	The spreading out of particles, resulting in a net movement from an area of higher **concentration** to an area of lower concentration.	The diffusion of water from a **dilute** solution to a concentrated solution through a **partially permeable membrane**.	The movement of particles from a more dilute solution to a more concentrated solution using energy from respiration.
Movement of particles	Particles move down the concentration **gradient** – from an area of *high* concentration to an area of *low* concentration.	Water moves from an area of *lower* solute concentration to an area of *higher* solute concentration.	Particles move against the concentration gradient – from an area of *low* concentration to an area of *high* concentration.
Energy required?	no – **passive process**	no – passive process	yes – using energy released during respiration
Examples	**Humans** • Nutrients in the small intestine diffuse into the blood in the **capillaries** through the **villi**. • Oxygen diffuses from the air in the **alveoli** into the blood in the capillaries. Carbon dioxide diffuses from the blood in the capillaries into the air in the alveoli. • **Urea** diffuses from cells into the blood for excretion by the kidneys. **Fish** • Oxygen from water passing over the gills diffuses into the blood in the **gill filaments**. • Carbon dioxide diffuses from the blood in the gill filaments into the water. **Plants** • Carbon dioxide used for photosynthesis diffuses into leaves through the **stomata**. • Oxygen produced during photosynthesis diffuses out of the leaves through the stomata.	**Plants** Water moves by osmosis from a dilute solution in the soil to a concentrated solution in the **root hair cell**.	**Humans** Active transport allows sugar molecules to be absorbed from the small intestine when the sugar concentration is higher in the blood than in the small intestine. **Plants** Active transport is used to absorb mineral ions into the root hair cells from more dilute solutions in the soil.



Factors that affect the rate of diffusion

① **Difference in concentration**
The steeper the concentration gradient, the faster the rate of diffusion.

② **Temperature**
The higher the temperature, the faster the rate of diffusion.

③ **Surface area of the membrane**
The larger the membrane surface area, the faster the rate of diffusion.

Adaptations for exchanging substances

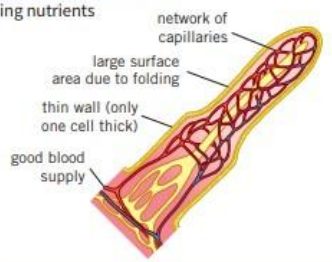
Single-celled organisms have a large surface area-to-volume ratio. This allows enough molecules to be transported across their cell membranes to meet their needs.

Multicellular organisms have a small surface area-to-volume ratio. This means they need specialised organ systems and cells to allow enough molecules to be transported into and out of their cells.

Exchange surfaces work most efficiently when they have a large surface area, a thin membrane, and a good blood supply.

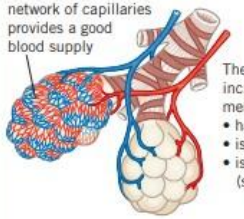
Villi in the small intestine

for absorbing nutrients



Alveoli in the lungs

for gas exchange

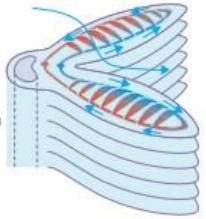


The rate of diffusion is increased because the membrane of the alveoli
- has a large surface area
- is moist
- is only one cell thick (short diffusion pathway).

Fish gills

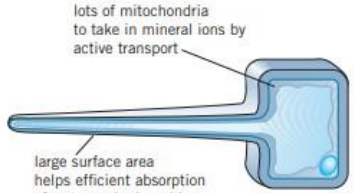
for gas exchange

Fish gills are made up of stacks of thin filaments with
- a large surface area to increase diffusion
- a network of capillaries (good blood supply).



Root hair cells

for uptake of water and minerals



Key terms

Make sure you can write a definition for these key terms.

active transport *alveoli* *capillaries* *concentration* *diffusion* *dilute* *gill filament* *gradient* *osmosis* *partially permeable membrane* *passive process* *root hair cell* *stomata* *urea* *villi*

Retrieval

Learn the answers to the questions below, then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

B2 questions	Answers
1 What is diffusion?	net movement of particles from an area of high concentration to an area of low concentration along a concentration gradient – this is a passive process (does not require energy from respiration)
2 Name three factors that affect the rate of diffusion.	concentration gradient, temperature, membrane surface area
3 How are villi adapted for exchanging substances?	• long and thin – increases surface area • one-cell-thick membrane – short diffusion distance • good blood supply – maintains a steep concentration gradient
4 How are the lungs adapted for efficient gas exchange?	• alveoli – large surface area • moist membranes – increases rate of diffusion • one-cell-thick membranes – short diffusion distance • good blood supply – maintains a steep concentration gradient
5 How are fish gills adapted for efficient gas exchange?	• large surface area for gases to diffuse across • thin layer of cells – short diffusion distance • good blood supply – maintains a steep concentration gradient
6 What is osmosis?	diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane
7 Give one example of osmosis in a plant.	water moves from the soil into the root hair cell
8 What is active transport?	movement of particles against a concentration gradient – from a dilute solution to a more concentrated solution – using energy from respiration
9 Why is active transport needed in plant roots?	concentration of mineral ions in the soil is lower than inside the root hair cells – the mineral ions must move against the concentration gradient to enter the root hair cells
10 What is the purpose of active transport in the small intestine?	sugars can be absorbed into the blood when the concentration of sugar in the small intestine is lower than the concentration of sugar in the blood

Now go back and use the questions below to check your knowledge from previous chapters.

Previous questions	Answers
1 Give two adaptations of a root hair cell.	long projection, lots of mitochondria
2 What is the function of a red blood cell?	carries oxygen around the body
3 What type of cell are bacteria?	prokaryotic
4 What is the function of ribosomes?	enable production of proteins (protein synthesis)
5 Give two adaptations of a nerve cell.	branched endings, myelin sheath insulates the axon
6 What is the function of a sperm cell?	fertilises an ovum (egg)
7 Give two adaptations of a sperm cell.	tail, contains lots of mitochondria
8 How are electron microscopes different to light microscopes?	electron microscopes use beams of electrons instead of light, cannot be used to view living samples, are much more expensive, and have a much higher magnification and resolution

Required practical skills

Practise answering questions on the required practicals using the example below. You need to be able to apply your skills and knowledge to other practicals too.

Osmosis in cells

Different concentrations of sugar and salt solutions both affect the movement of water by osmosis, causing cells to lose or gain water, and changing the mass of a tissue sample.

For this practical you need to be able to accurately measure length, mass, and volume to measure osmosis in cells.

You will need to be comfortable applying this knowledge to a range of samples, not just to the typical example of potato tissue, as osmosis happens in all cells.

Worked example

A sample of carrot was placed into a 0.75 mol/dm³ sugar solution for 30 minutes. The mass of the carrot was recorded before and after this.

Initial mass = 6.02 g

Final mass = 3.91 g

1 Determine the percentage change in mass of the sample.

Change in mass = $3.91 - 6.02 = -2.11\ g$

Percentage change in mass = $\left(\frac{-2.11}{6.02}\right) \times 100 = -35\%$

(a minus sign is used because the sample has lost mass)

2 Explain why this experiment should be repeated, and give one other variable that should be controlled.

The experiment should be repeated to give a more reliable result, and to allow calculation of a mean loss in mass for the sample. The dimensions of the carrot samples need to be controlled between repeats.

Practice

1 Give one reason why it is important to dry the samples of carrot cores before they are weighed.

2 When repeating this experiment using different concentrations of sugar solution, a student found that one sample did not change mass. Suggest what this tells you about the concentration of the solution. Assume no error in the experiment.

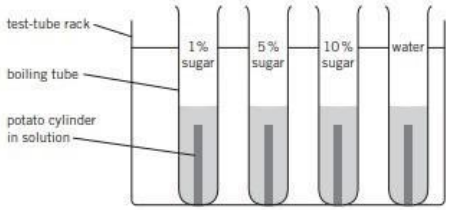
3 Two students set up this experiment. Student A said that each sample of carrot must have the same starting mass. Student B argued that each sample must have the same length and width. Explain which student is correct.

Exam-style questions

01 A group of students investigated how the mass of a potato sample changed over time, when placed into sugar solutions of varying concentrations.

They set up their equipment as shown in **Figure 1**.

Figure 1



01.1 Identify the independent variable in their investigation. **[1 mark]**

Tick **one** box.

- mass of potato sample ☐
- concentration of sugar solution ☐
- time potato placed in sugar solution ☐

01.2 Use **Figure 1** to identify **two** variables that the students controlled. **[2 marks]**

Tick **two** boxes.

- mass of potato sample at start ☐
- volume of sugar solution ☐
- change in mass of potato sample ☐
- light intensity ☐

01.3 The students' results are shown in **Table 1**.

Table 1

Solution	0% sugar solution	1% sugar solution	5% sugar solution	10% sugar solution
Starting mass in g	3.1	3.3	3.1	3.4
Final mass in g	3.4	3.5	2.9	2.7
Change in mass in g	+0.3	+0.2	−0.2	_____

Complete the results table by calculating the change in mass for the 10% sugar solution. **[1 mark]**

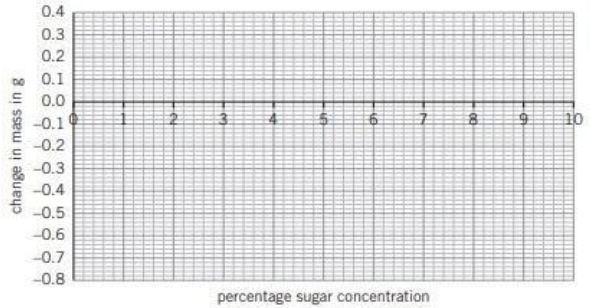
Change in mass = _____ g

Exam Tip

If you're not sure how to calculate the change in mass, use the 1% or 5% as practice calculations where you've already been given the answer.

01.4 Plot the students' results of sugar concentration against change in mass on **Figure 2**. Draw a line of best fit. **[2 marks]**

Figure 2



Exam Tip

Always plot points on graphs using crosses, dots are not clear enough and can get hidden under lines of best fit, and dots within circles are not specific enough.

01.5 Use the graph to determine the concentration of sugar present in the potato. **[1 mark]**

_____

02 Many substances move into and out of cells by diffusion.

02.1 Choose the appropriate bold words to complete this description of diffusion. **[4 marks]**

Diffusion is the **spreading out / clumping together** of particles in a gas or **solid / liquid**.

Particles move from an area of **low / high** concentration to an area of **low / high** concentration.

Practice Papers

Triple Science

https://www.aqa.org.uk/subjects/biology/gcse/biology-8461/assessment-resources

https://www.aqa.org.uk/subjects/chemistry/gcse/chemistry-8462/assessment-resources

https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/assessment-resources

Combined Science

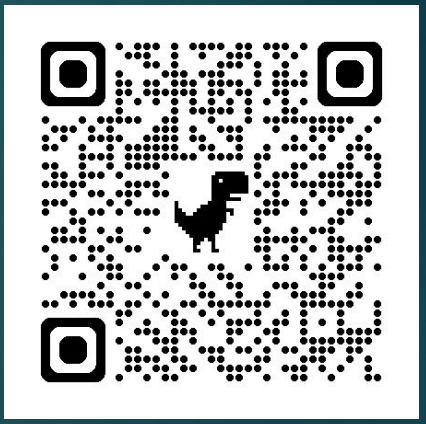
https://www.aqa.org.uk/subjects/science/gcse/science-8465/assessment-resources

Practical Videos

https://www.youtube.com/playlist?list=PLAd0MSIZBSsF3vV_uxzbcNHuDrQ6Hc-UI

Revision techniques that work:

- Don’t just read the revision guide
- Make notes
- Make mind maps
- Talk about your revision- say it out loud
- Complete quizzes and online tests (e.g. SENECA)
- Get someone to test you



BBC Bitesize

- Biology https://www.bbc.co.uk/bitesize/examspecs/zpgcbk7
- Chemistry https://www.bbc.co.uk/bitesize/examspecs/z8xtmnb
- Physics https://www.bbc.co.uk/bitesize/subjects/zpm6fg8

- Combined Science https://www.bbc.co.uk/bitesize/examspecs/z8r997h

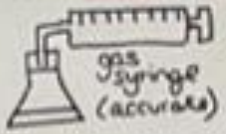
Rates of Reaction

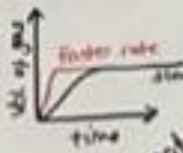
Rate of a reaction is the speed at which reactants are turned into products.
Iron rusting is slow
Explosions are fast

For a reaction to occur particles need to collide with enough energy to react = activation energy

Measuring Rates:

The rate of reaction can be shown by
- the volume of gas being made





- loss of mass
- colour change

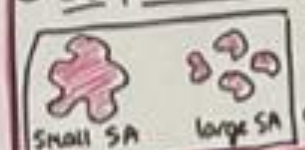
Rate = change ÷ time

rate is affected by:

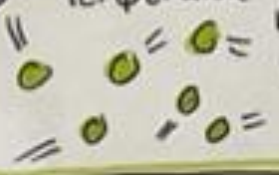
4 Factors !!

① Concentration
the higher the conc. the more particles there are so there are more collisons and a higher rate

② Surface Area
- higher surface area means more collisions and a faster rate



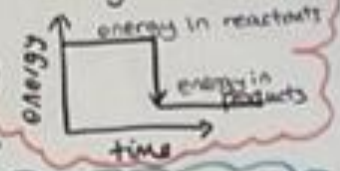
③ Temperature
- at higher temps particles have more energy, there are more collisions so the rate of reaction is higher.



④ Pressure
the higher the pressure the closer the particles so collisions are more frequent + rate is faster

Exothermic - releases energy so temp. increases
eg combustion

energy stored in chemical bonds is transferred to the surroundings

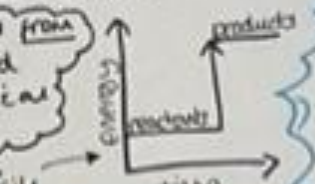


investigating exothermic reactions

reaction carried out in polystyrene cup as it is an insulator

Endothermic - takes in energy so temp. decreases

energy transferred from surroundings and stored in chemical bonds



This is a reaction profile

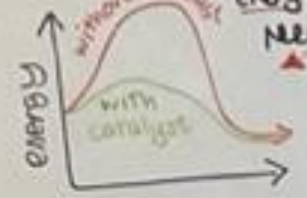
Calc. rate from a tangent (H)

= change in mass or volume / change in time

Catalysts

- speed up chemical reactions
- are NOT permanently changed in the reaction
- used in industry to make products more quickly and at low temp or pressure (which saves money)
- don't alter the products (yield)
- reduce the amount of activation energy needed

eg. enzymes
catalytic converters
iron in the Haber process



Top Tips:

- Learn key words and their meanings
- Calculations (showing working out)
- Underline key words in questions

- Get started with revision NOW!