

# Science

Revision Resources

# AQA exam board

## Combined science

**6 papers- each 1hour 15 mins**

Paper 1 Biology (B1-B4)

Paper 1 Chemistry (C1-C5)

Paper 1 Physics (P1-P4)

Paper 2 Biology (B5-B7)

Paper 2 Chemistry (C6-C10)

Paper 2 Physics (P5-P7)

## Triple science

**6 papers- each 1hour 45 mins**

Paper 1 Biology (B1-B4)

Paper 1 Chemistry (C1-C5)

Paper 1 Physics (P1-P4)

Paper 2 Biology (B5-B7)

Paper 2 Chemistry (C6-C10)

Paper 2 Physics (P5-P8)

# Combined science



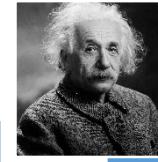
## Biology

- B1- Cell biology
- B2-Organisation
- B3- Infection & response
- B4-Bioenergetics
- B5- homeostasis
- B6- inheritance
- B7- Evolution



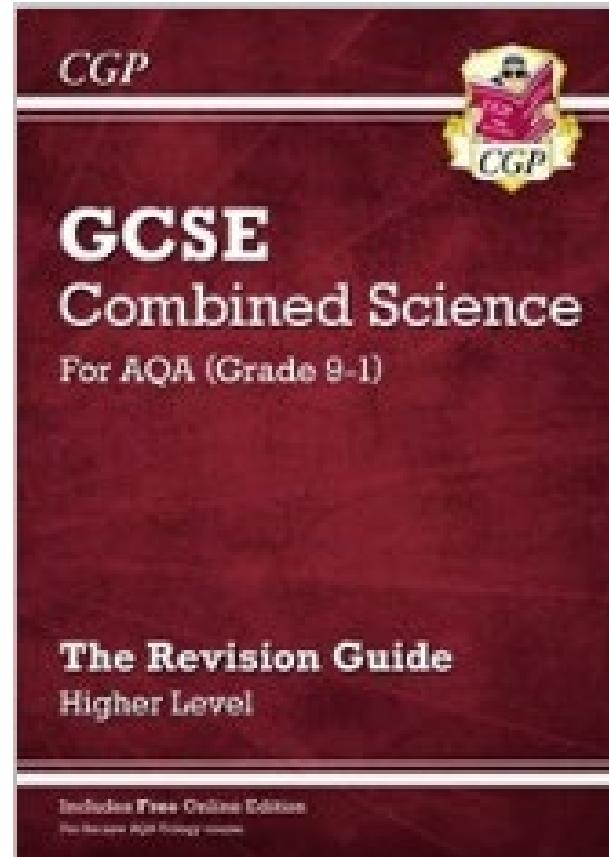
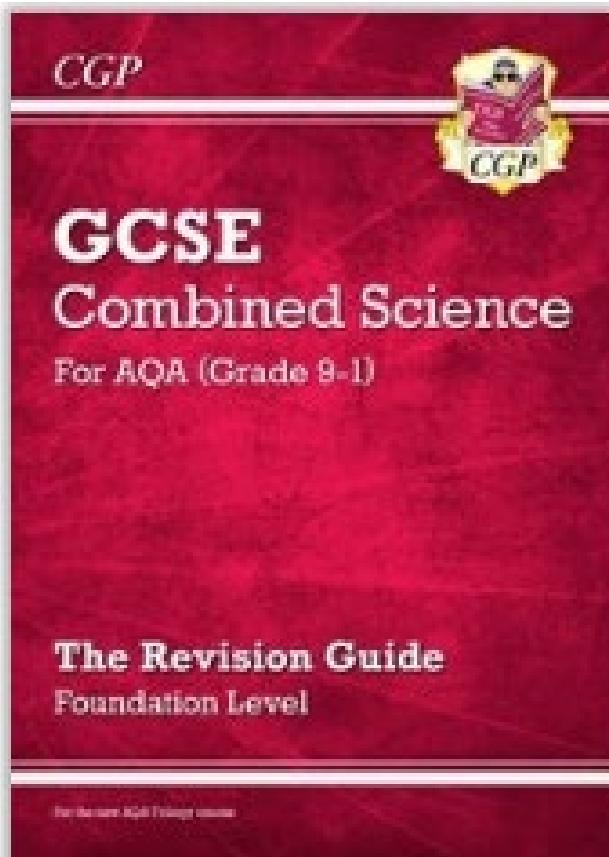
## Chemistry

- C1-Atomic structure
- C2- Structure & bonding
- C3-Quantitative chemistry
- C4-Chemical change
- C5-Energy change
- C6- Rates of reaction
- C7-Organic chemistry
- C8-Chemical analysis
- C9-Chemistry of the atmosphere
- C10- Using resources



## Physics

- P1- Energy
- P2-Electricity
- P3-Atomic structure
- P4-Radiation
- P5-Forces
- P6-Waves
- P7-Magnetism



# Triple science



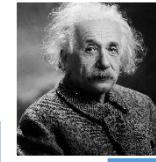
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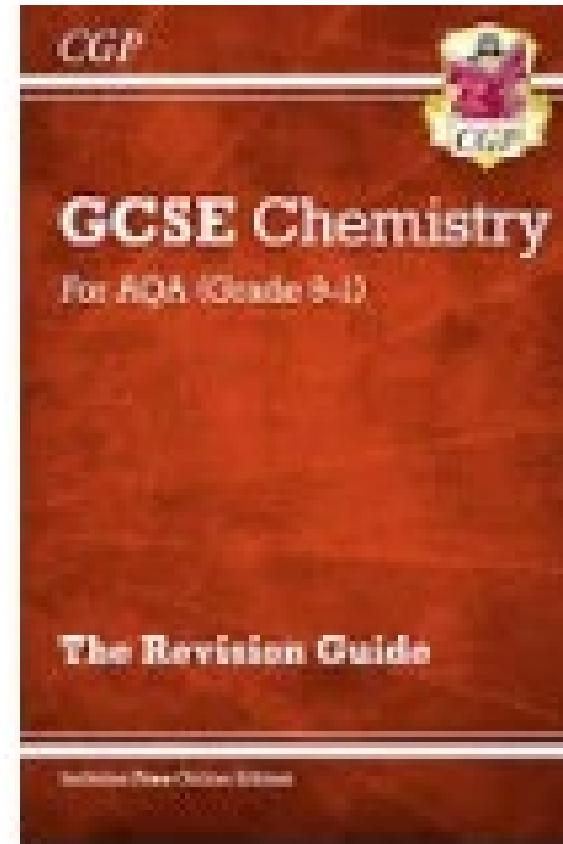
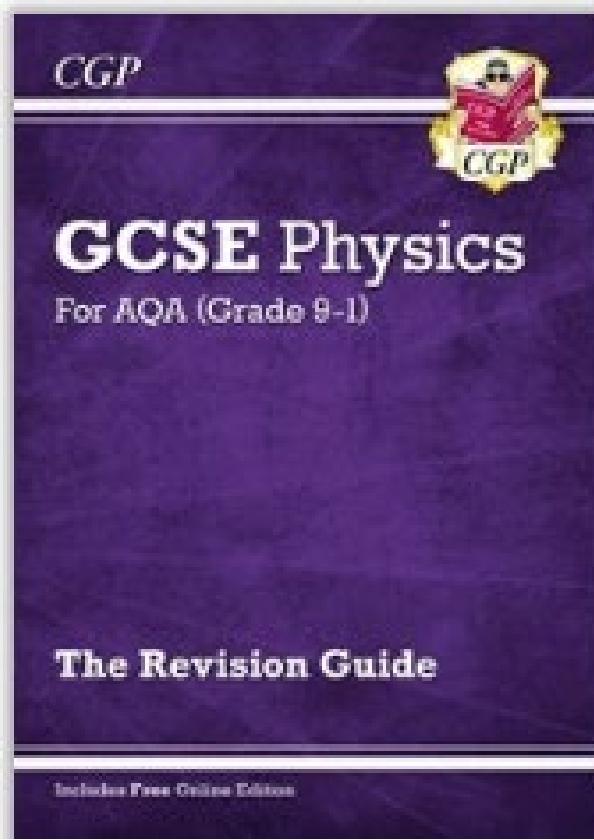
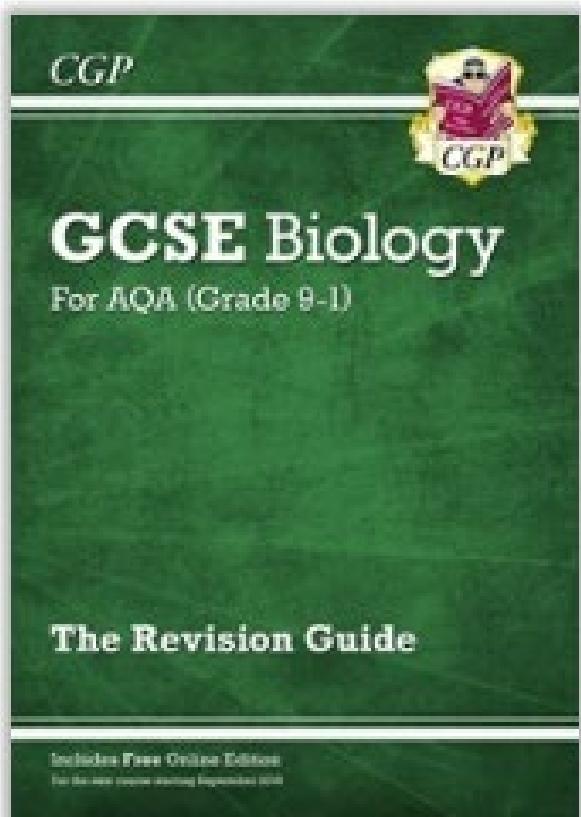
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## Physics

- P1- Energy
- P2-Electricity
- P3-Atomic structure
- P4-Radiation
- P5-Forces
- P6-Waves
- P7-Magnetism
- P8-Space physics



## 1 Topics are Covered in Different Papers

For AQA Trilogy GCSE Combined Science, you'll sit six exam papers.

You'll sit all the papers at the end of the course.

- ✓ You need to know the basic ideas of each of the sciences for both exams. So, for example, in Biology Paper 2 you could be asked about some of the basics from B1, B2, B3 or B4.



Paper	Time	No. of marks	Topics Assessed
Biology 1	1 hr 15 mins	70	B1, B2, B3 and B4
Biology 2	1 hr 15 mins	70	B5, B6 and B7
Chemistry 1	1 hr 15 mins	70	C1, C2, C3, C4 and C5
Chemistry 2	1 hr 15 mins	70	C6, C7, C8, C9 and C10
Physics 1	1 hr 15 mins	70	P1, P2, P3 and P4
Physics 2	1 hr 15 mins	70	P5, P6 and P7

## Designing Investigations

Dig out your lab coat and dust down your safety goggles... it's **investigation time**. Investigations include **lab experiments** and **studies** done in the **real world**.

### Investigations Produce Evidence to Support or Disprove a Hypothesis

- 1) Scientists **observe** things and come up with **hypotheses** to explain them (see p.1). You need to be able to do the same. For example:  
**Observation:** People have big feet and spots. **Hypothesis:** Having big feet causes spots.
- 2) To **find out** if your hypothesis is **right**, you need to do an **investigation** to gather **evidence**.
- 3) To do this, you need to use your hypothesis to make a **prediction** — something you think **will happen** that you can **test**. E.g. people who have bigger feet will have more spots.
- 4) Investigations are used to see if there are **patterns** or **relationships** between **two variables** (see below).

### To Make an Investigation a Fair Test You Have to Control the Variables

- 1) In a lab experiment you usually **change one thing** (a variable) and **measure** how it affects **another thing** (another variable).

**EXAMPLE:** you might change the **concentration** of a reactant and **measure** how it affects the **temperature change** of the reaction.



- 2) **Everything else** that could affect the results needs to **stay the same**. Then you know that the thing you're **changing** is the **only** thing that's affecting the results.

**EXAMPLE continued:** you need to keep the **volume** of the reactants the **same**. If you don't, you won't know if any change in the temperature is caused by the change in concentration, or the change in volume.

- 3) The variable that you **CHANGE** is called the **INDEPENDENT** variable.
- 4) The variable you **MEASURE** is called the **DEPENDENT** variable.
- 5) The variables that you **KEEP THE SAME** are called **CONTROL** variables.
- 6) Because you can't always control all the variables, you often need to use a **CONTROL EXPERIMENT**.
- 7) This is an experiment that's kept under the **same conditions** as the rest of the investigation, but doesn't have anything **done** to it. This is so that you can see what happens when you don't change **anything**.

**EXAMPLE continued:**  
Independent = concentration  
Dependent = temperature  
Control = volume of reactants, pH, etc.

### Evidence Needs to be Repeatable, Reproducible and Valid

- 1) **REPEATABLE** means that if the **same person** does the experiment again, they'll get **similar results**. To check your results are repeatable, **repeat** the readings **at least three times**. Then check the repeat results are all similar.
- 2) **REPRODUCIBLE** means that if **someone else** does the experiment, the results will still be **similar**. To make sure your results are reproducible, get **another person** to do the experiment too.
- 3) **VALID results** come from experiments that were designed to be a **fair test**. They're also repeatable and reproducible.

• If data is repeatable and reproducible, scientists are more likely to trust it.

### This is no high street survey — it's a designer investigation...

You need to be able to plan your own investigations. You should also be able to look at someone else's plan and decide whether anything needs to be changed to make it better. Those examiners are pretty demanding.

## Collecting Data

Ah ha — now it's time to get your hands sticky and **collect some data**.

### The Bigger the Sample Size the Better

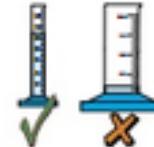
- 1) Sample size is **how many things you test** in an investigation, e.g. 500 people or 20 types of metal.
- 2) The **bigger** the sample size the **better** — to **reduce** the chance of any **wrong result**.
- 3) But scientists have to be **realistic** when choosing how big their sample should be. E.g. if you were studying how **Mistletoe** affects weight it'd be great to study everyone in the UK (a huge sample), but it'd take ages and cost loads.
- 4) When you choose a sample, you need to make sure you've got a **range** of different people.
- 5) For example, both **men** and **women** with a range of **different ages**.

### Your Data Should be Accurate and Precise

- 1) **ACCURATE results** are results that are **really close** to the **true answer**. The accuracy of your results usually depends on your method. You need to make sure you're measuring the right thing.
- 3) You also need to make sure you **don't miss** anything that should be included in the measurements. For example:  
**If you're measuring the volume of gas released by a reaction, make sure you collect all the gas.**
- 4) **PRECISE results** are ones where the data is **all really close** to the **mean** (average) of your repeated results.

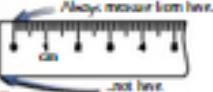
Repeat	Data set 1	Data set 2
1	12	8
2	14	17
3	13	14
Mean	13	14

Data set 1 is more precise than data set 2 — the results are all close to the mean (not spread out).



### Your Equipment has to be Right for the Job

- 1) The **measuring equipment** you use has to be able to **accurately measure** the chemicals you're using. E.g. if you need to measure out 11 cm<sup>3</sup> of a liquid, use a **measuring cylinder** that can measure to 1 cm<sup>3</sup> — not 5 or 10 cm<sup>3</sup>.
- 2) You also need to **set up the equipment properly**. For example, make sure your **mass balance** is **set to zero** before you start weighing things.



### You Need to Look out for Errors and Anomalous Results

- 1) The results of your experiment will always **vary a bit** because of **RANDOM ERRORS** — for example, mistakes you might make while **measuring**.
- 2) You can **reduce** the effect of random errors by taking **repeat readings** and finding the **mean**. This will make your results **more precise**.
- 3) If a measurement is wrong by the **same amount every time**, it's called a **SYSTEMATIC ERROR**. For example:  
**If you measure from the very end of your ruler instead of from the 0 cm mark every time, all your measurements would be a bit small.**
- 4) If you know you've made a systematic error, you might be able to **correct it**. For example, by adding a bit on to all your measurements.
- 5) Sometimes you get a result that **doesn't fit in** with the rest. This is called an **ANOMALOUS RESULT**.
- 6) You should try to **work out what happened**. If you do (e.g. you find out you measured something wrong) you can **ignore** it when presenting your results (see next page).

### The bigger the better — what's true for cakes is true for samples...

Make sure you take lots of care when collecting data — there's plenty to watch out for, as you can see.

## Units

Graphs and maths skills are all very well, but the numbers don't mean much if you can't get the **units** right.

### S.I. Units Are Used All Round the World

- All scientists use the same **units** to measure their data.
- These are **standard units**, called S.I. units.
- Here are some S.I. units you might use:

Quantity	S.I. base unit
mass	kilogram, kg
length	metre, m
time	second, s
temperature	kelvin, K

### Different Units Help you to Write Large and Small Quantities

- Quantities come in a huge **range** of sizes.
- To make the size of numbers easier to handle, larger or smaller units are used.
- Larger and smaller units are written as the **S.I. base unit** with a **little word** in **front** (a prefix). Here are some **examples of prefixes** and what they mean:

prefix	mega (M)	kilo (k)	deci (d)	centi (c)	milli (m)	micro (μ)
1000 times larger than the base unit	1 000 000 times larger	1000 times larger	10 times smaller	100 times smaller	1000 times smaller	1 000 000 times smaller

E.g. 1 kilometre is 1000 metres. E.g. there are 1000 millimetres in 1 metre.

Kilogram is an exception. It's an S.I. unit with the prefix already on it.

### You Need to be Able to Convert Between Units

You need to know how to **convert** (change) one unit into another. Here are some useful conventions:

**DIVIDE** to go from a **smaller unit** to a **bigger unit**.

Mass can have units of kg and g.

Energy can have units of J and kJ.

Length can have lots of units, including m, mm, and μm.

**MULTIPLY** to go from a **bigger unit** to a **smaller unit**.

#### EXAMPLE

A car has travelled 0.015 kilometres. How many metres has it travelled?  
1 km = 1000 m. So to convert from km (a bigger unit) to m (a smaller unit) you need to **multiply** by 1000.

Always make sure the values you put into an equation or formula have the right units.

$$0.015 \text{ km} \times 1000 = 15 \text{ m}$$

### You Can Rearrange Equations

- Equations show **relationships** between **variables**. For example, speed =  $\frac{\text{distance}}{\text{time}}$ .
- The **subject** of an equation is the variable **by itself** on one side of the equals sign. So **speed** is the **subject** in the equation above.
- To **change the subject** of an equation do the same thing to **both sides** of the equation until you've got the **subject you want**. E.g. you can make **distance** the subject of the equation above:

- Multiply both sides by time:  $\text{speed} = \frac{\text{distance}}{\text{time}} \rightarrow \text{speed} \times \text{time} = \frac{\text{distance} \times \text{time}}{\text{time}}$
- Time is now on the top and the bottom of the fraction, so it cancels out:  $\text{speed} \times \text{time} = \frac{\text{distance} \times \text{time}}{\text{time}} = \text{distance}$
- This leaves **distance** by itself. So it's the **subject**:  $\text{speed} \times \text{time} = \text{distance}$

### I wasn't sure I liked units, but now I'm converted...

If you're moving from a smaller unit to a larger unit (e.g. g to kg) the number should get smaller, and vice versa.

## Drawing Conclusions

Congratulations — you've made it to the **final step** of an investigation — **drawing conclusions**.

### You Can Only Conclude What the Data Shows and NO MORE

- To come to a conclusion, look at your data and say what pattern you see.

**EXAMPLE:** The table on the right shows the height of pea plant seedlings grown for three weeks with different fertilisers.

Fertiliser	Mean growth / cm
A	13.5
B	10.5
No fertiliser	5.5

**CONCLUSION:** Pea plant seedlings grow taller over a **three week** period with fertiliser B than with fertiliser A.

- It's important that the conclusion **matches** the data it's based on — it shouldn't go any further.

**EXAMPLE continued:** You can't conclude that **any other type of plant** grows taller with fertiliser B than with fertiliser A — the results could be totally different.

- You also need to be able to **use your results** to **justify** your conclusion (i.e. back it up).

**EXAMPLE continued:** The pea plants grow 6 cm more on average with fertiliser B than with fertiliser A.

- When writing a conclusion you need to say whether or not the data **supports** the original **hypothesis**:

**EXAMPLE continued:** The hypothesis might have been that adding different types of fertiliser would affect the growth of pea plants by different amounts. If so, the data supports the hypothesis.

### Correlation DOES NOT Mean Cause

- If two things are **correlated**, there's a **relationship** between them — see page 7.
- But a correlation **doesn't always** mean that a change in one variable is **causing** the change in the other.
- There are **three possible reasons** for a correlation:

#### ① CHANCE

The results happened by chance. Other scientists **wouldn't** get a correlation if they carried out the same investigation.



#### ② LINKED BY A 3rd VARIABLE

There's another factor involved.

E.g. there's a correlation between water temperature and shark attacks. They're linked by a **third variable** — the number of people swimming (more people swim when the water's hotter, which means you get more shark attacks).

#### ③ CAUSE

Sometimes a change in one variable does **cause** a change in the other. You can only conclude this when you've **controlled** all the variables that could be affecting the result.

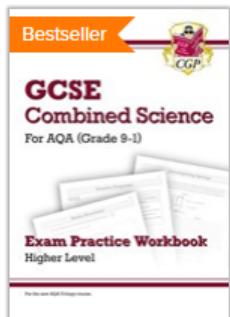
### I conclude that this page is a bit dull...

In the exam you could be given a conclusion and asked whether some data supports it — so make sure you understand how far conclusions can go. And remember, correlation does not mean cause.

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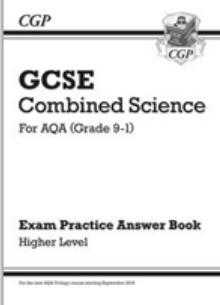
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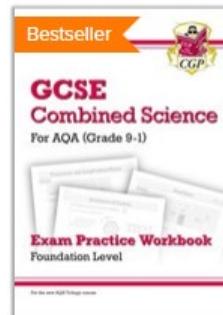
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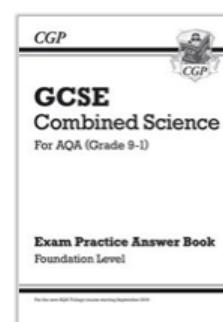
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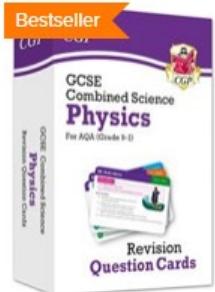
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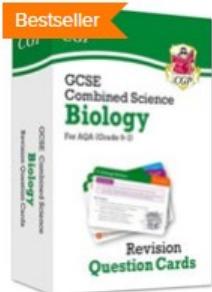
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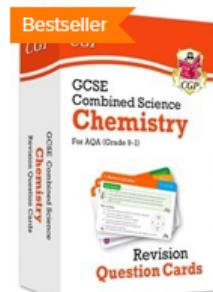
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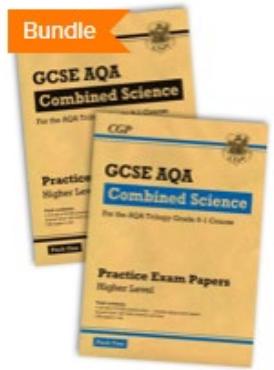
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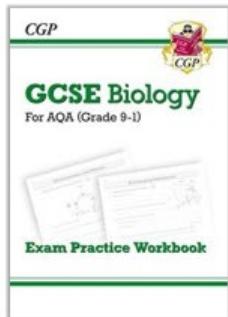
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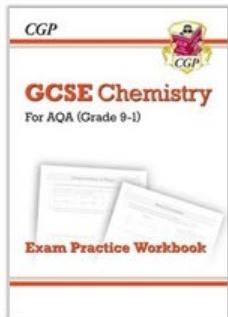
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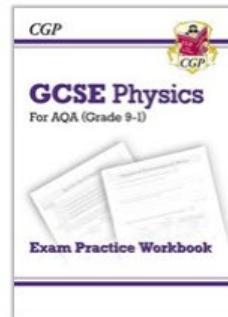
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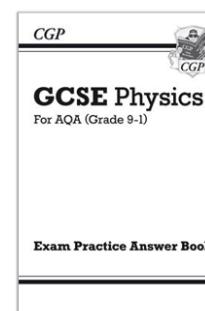
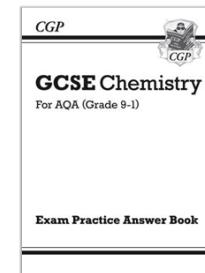
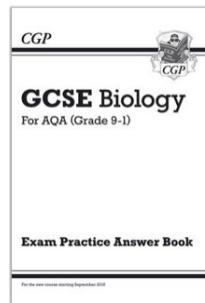
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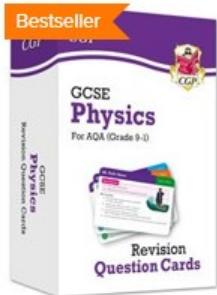
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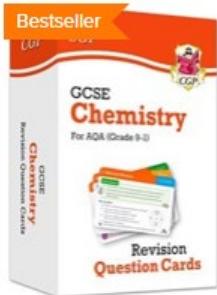
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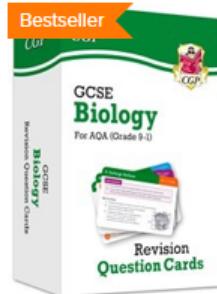
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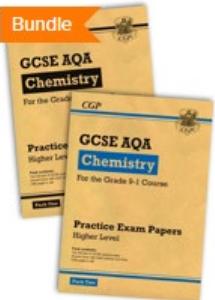
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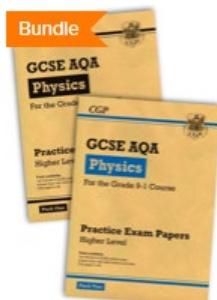
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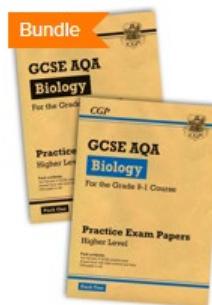
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  - GCSE bitesize
  - Seneca learning
- 
- Flash cards
  - CCP question books 8-9 targeted
  - Exam practice questions

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