AQA
Questions matter

Exploring common misunderstandings in GCSE science

How to read and approach science questions and avoid common mistakes



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Help prepare your GCSE students with confidence

Every year, in GCSE science exams, students often misread, misunderstand or misinterpret questions and don't always do what the question is asking them to do.

This booklet has been designed by our curriculum experts for you to use with your students to explore and highlight some of these key misunderstandings in GCSE science assessments.

There are example workings, examiner commentaries, good exam technique and best practice approaches.

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Box-ticking

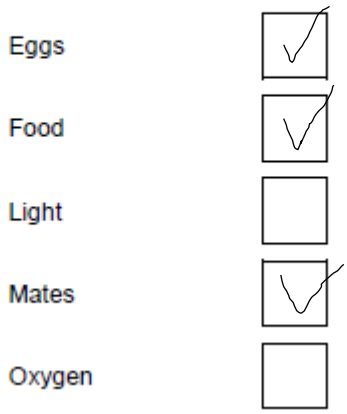
Students sometimes don't tick the correct number of boxes. The number of answers required is shown in the question.

Example

0 1 . 1 What will the birds be competing for when they arrive at their UK breeding grounds?

[2 marks]

Tick **two** boxes.



Top tip

Only tick as many boxes as the question asks for. If too many or not enough boxes are ticked, full marks can't be achieved.

If a student changes their mind, they can cross out the answer they want to change and mark the one wanted as their final answer.

Explanation

If a question asks for two answers and a student ticks three boxes, then one of the wrong answers will cancel out one of the correct answers. This means the student can only score 1 mark even if two of the three boxes were correct.

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Making connections

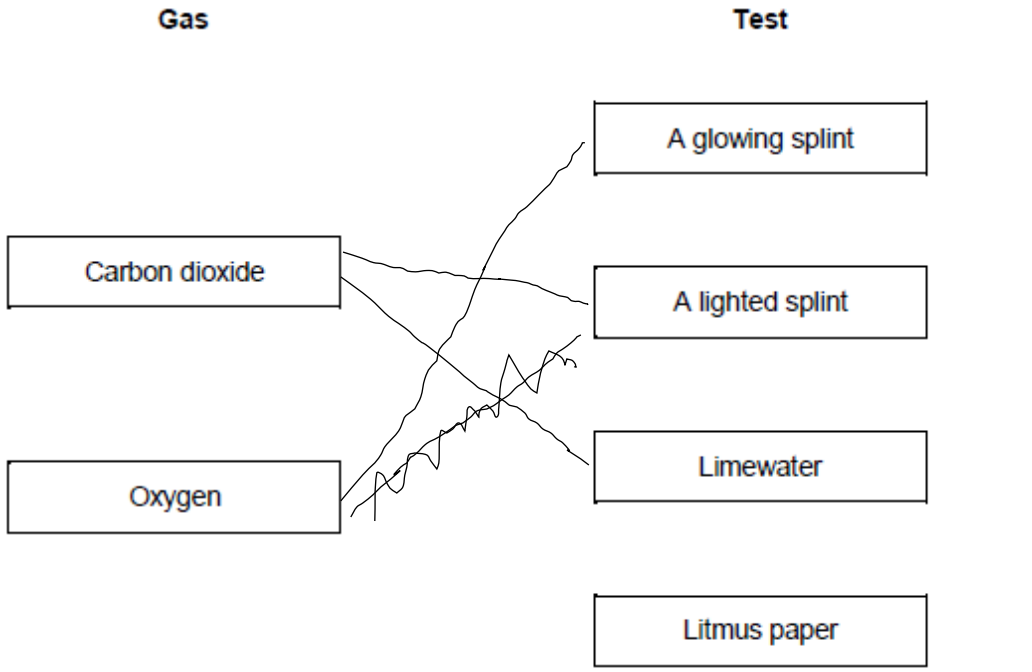
Students sometimes draw too many lines on linking boxes questions. The number of lines to be drawn from each box will be shown in the question.

Example

0 1 . 2 What is used to test for each of the gases?

Draw **one** line from each gas to the test for the gas.

[2 marks]



Top tip

Only draw one line per box. If too many lines are drawn, then it's not possible to achieve full marks.

If a student changes their mind, they can cross out the answer they want to change and mark the one wanted as their final answer.

Explanation

Only draw one line per box – any extra lines will cancel out any correct lines as the examiner won't know which answer the student wants to be marked.

In this example, the student correctly crossed out the incorrect response for oxygen, so one mark could be awarded. However, there are two lines from carbon dioxide, so they cannot score a second mark.

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Completing the sentence

Some students don’t use the words provided in sentence completion questions.

Example

0 6 . 2 Complete the sentences.

Choose answers from the box.

[2 marks]

controlled	dependent	scalar	valid	vector

Force has both magnitude and direction, so is a _____ quantity.

A quantity with magnitude only is a _____ quantity.

Top tip

Use only words from the box to complete the sentences and make sure to write the words in the blank spaces.

Explanation

Examiners can’t give marks for words that aren't shown in the box, or for circling the words rather than writing them on the answer line as it’s not clear which word the student wants to go where.

Here the student has circled the correct two answers, but has not indicated which one should go where. They won’t score any marks for this.

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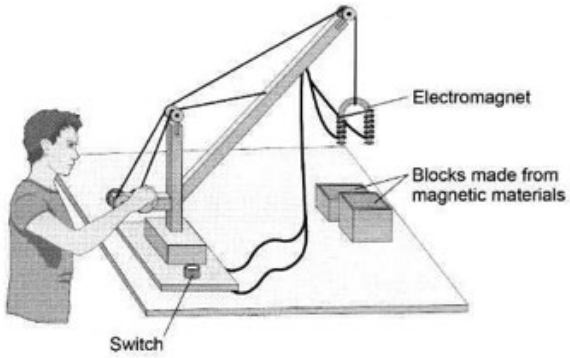
Repeating information

Students often repeat information from the question in their answer without adding any more information.

Example

0 8 . 3 **Figure 14** shows a toy crane.

Figure 14



The toy crane uses an electromagnet to pick up and move the blocks.

Explain how this electromagnet is able to pick up and move the blocks.

[6 marks]

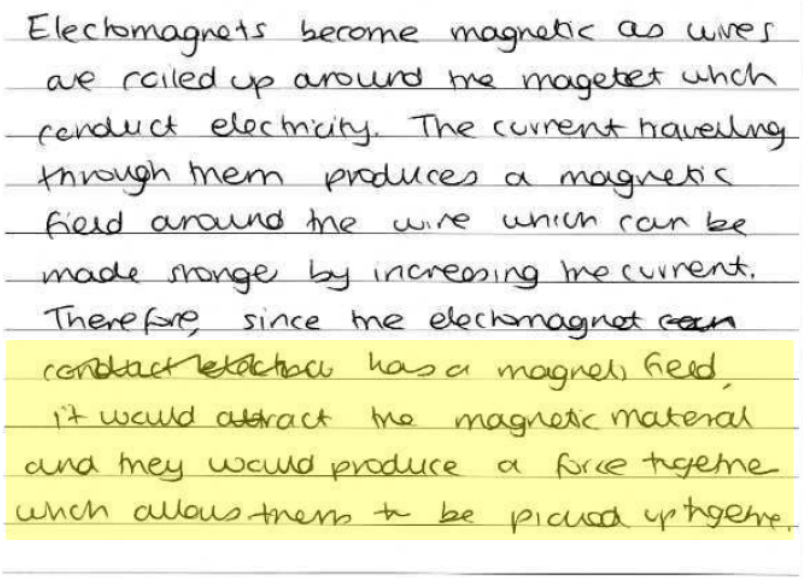
Because the blocks are made out of magnetic materials and the crane has a ~~huge~~ strong magnet on it.

The switch turns the magnetic force on then the blocks get picked up by the strong magnet and moved then for the crane to drop the blocks you have to press the switch.

The first four lines repeat the question stem so don't gain any marks.

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Example


Electromagnets become magnetic as wires are coiled up around the magetet which conduct electricity. The current traveling through them produces a magnetic field around the wire which can be made stronge by increasing the current. Therefore, since the electromagnet has a magnetic field, it would attract the magnetic material and they would produce a force togeher which allows them to be picked up togeher.

Explanation of why there is attraction between electromagnet and block.

Top tip

Information in the question is there to help so don't waste time repeating the question. Students should include their own knowledge when answering the question.

Explanation

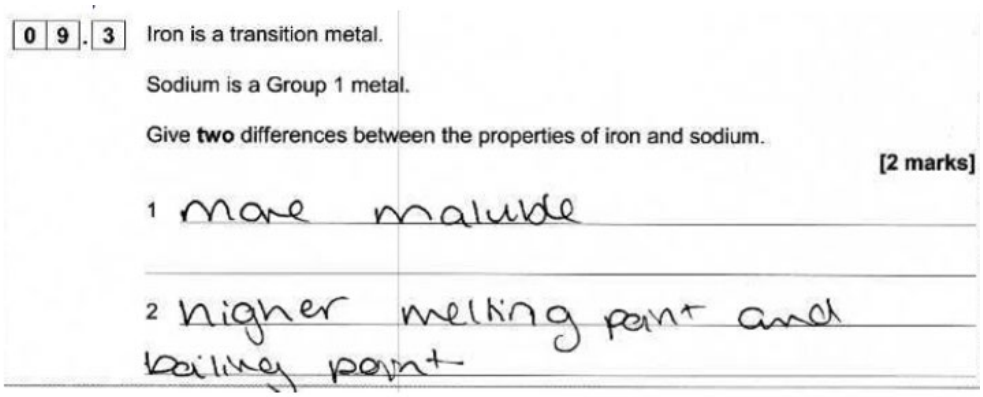
Repeating the question isn't credit-worthy. Diagrams and labels are included to trigger the student's memory. Answers should demonstrate their understanding of what's been asked, or the ability to link ideas together.

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Use of language and when spelling matters

Students often give answers that aren't clearly linked to the question or where the meaning isn't clear.

Example



0 9 . 3 Iron is a transition metal.

Sodium is a Group 1 metal.

Give **two** differences between the properties of iron and sodium.

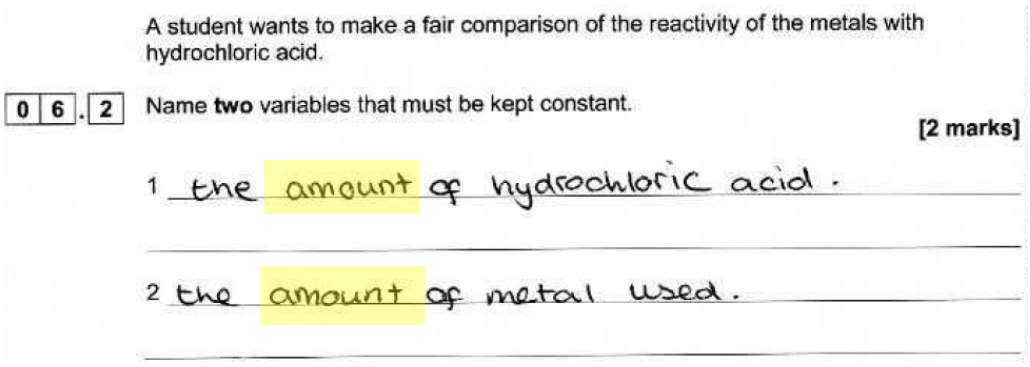
[2 marks]

1 more maluble

2 higher melting pont and boiling pont

It's not clear which metal is being referred to here, so no marks are gained.

Example



A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

0 6 . 2 Name **two** variables that must be kept constant.

[2 marks]

1 the amount of hydrochloric acid.

2 the amount of metal used.

'Amount' is not enough to be given the mark.

This example scores no marks.

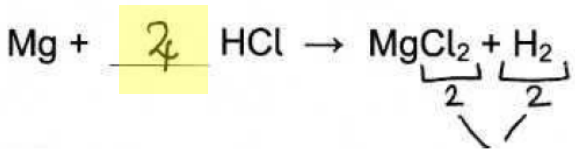
Examiners need 'concentration' of the acid and 'mass' of the metal.

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Example

0 3 . 1 Balance the equation for the reaction.

[1 mark]



It's not clear if this is 2 or 4, so no marks can be given.

Top tip

Read the answer back to check the answer has been clearly linked to the question. Check scientific words have been spelt correctly.

Explanation

Examiners do their best to read the answers, but it's helpful if writing is clear. Phonetic spelling is generally accepted, but some words need to be spelt correctly, for example, words such as glycogen and glucagon are often mixed up. Using vague words such as amount rather than concentration, mass or volume is a common mistake.

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Contradictory answers

Students sometimes give both a right and wrong answer to a question, or contradict themselves.

Example

The student becomes negatively charged because of the friction between his socks and the carpet.

Explain why the friction causes the student to become charged.

[2 marks]

the friction repels protons and attracts electrons causing the student to become negatively charged.

Correct reference to electrons being transferred, but this is cancelled out by 'repels protons' as this is incorrect science.

Example

0 5 . 3 Insulin cannot be taken as a tablet. This is because insulin is a type of protein.

What would happen to the insulin in the tablet if it reached the stomach?

[1 mark]

It would be ~~or~~ broken down into protease

If the student hadn't written 'into protease' they could have scored the mark as this part is incorrect science.

Top tips

Read through the answer carefully to look for contradictions.

Even if a correct statement has been given, this can be cancelled out by a wrong statement.

Explanation

Students should resist the temptation to keep writing to fill the space as they may end up contradicting themselves or include wrong statements that affect the overall quality of the answer.

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Misreading the question

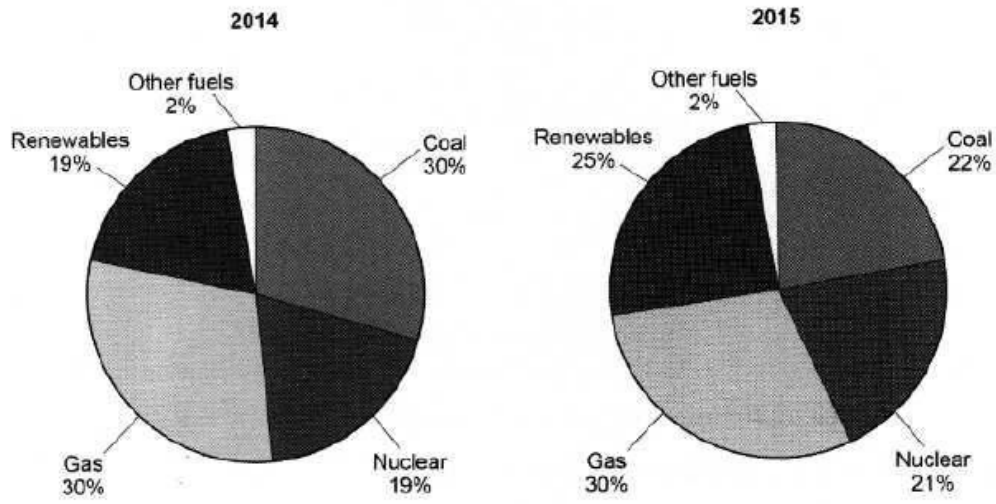
Students answer what they would like the question to be about rather than the actual question stated.

Example

0 1 . 5 **Figure 2** shows the electricity generated by different energy resources in the UK.

The total amount of electricity generated was the same in 2014 and in 2015

Figure 2



There are changes in the amounts of different energy resources used between 2014 and 2015

Explain the environmental impacts of the changes.

[4 marks]

In both alot of the energy resources were either used to much such as Coal as that is at 30% but in 2015 Coal has reduced by 8% as it is now at 22%. Gas has stayed the same in 2014 and 2015.

Differences between the charts are described but no link has been made to the environmental impacts so the answer can't get full marks.

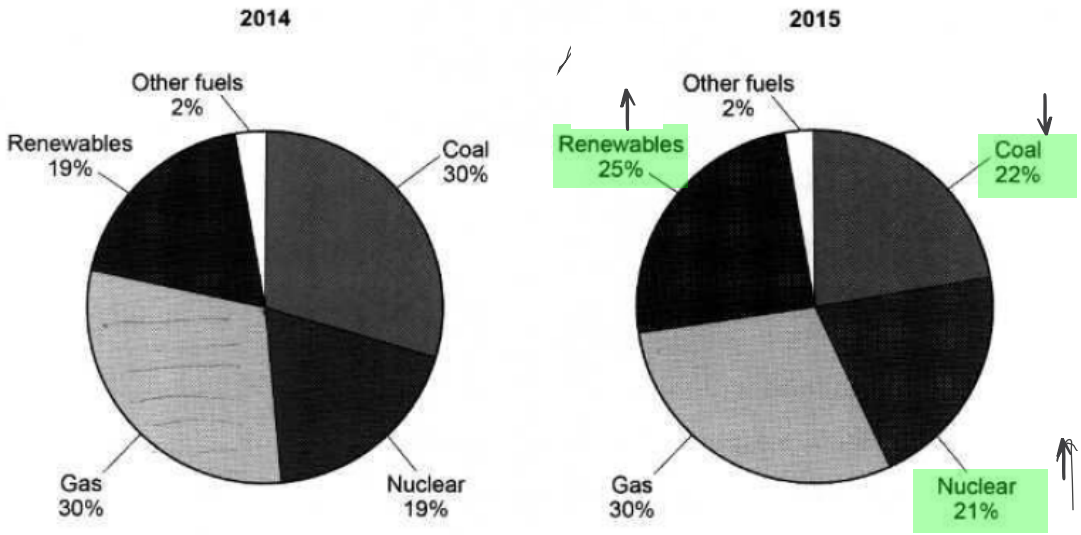
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Example

0 1 . 5 **Figure 2** shows the electricity generated by different energy resources in the UK.

The total amount of electricity generated was the same in 2014 and in 2015

Figure 2



There are changes in the amounts of different energy resources used between 2014 and 2015

Explain the environmental impacts of the changes.

[4 marks]

The change from 30% coal to 22% coal will reduce the amount of CO_2 and other gases that will contribute to global warming. The change from 19% renewable to 25% renewable will be a positive impact as it won't contribute to global warming.

Differences between the charts are linked to global warming so full marks are achieved.

Top tip

Read the question carefully and underline or highlight key parts of the question and make sure the response answers the question being asked.

Explanation

Students should have a good understanding of command words. Annotating the information in the question – as shown in green in the above example – can help keep the answer focused.

Often a question will be based on something a student might have done in class. Students tend to write down what they remember about that task rather than using what they learnt from it to answer the question in front of them. Reading the question carefully will help identify what precisely the question is asking about that common task.

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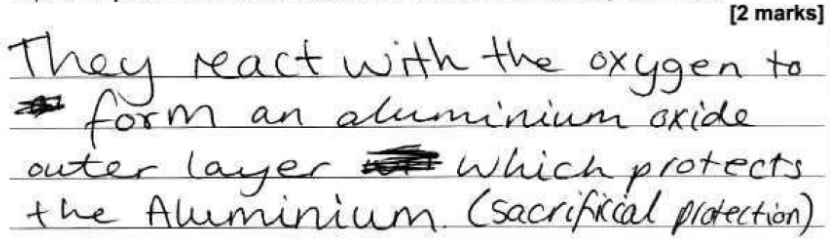
'Explain' questions

Some students don't understand what the command word 'explain' means and what they need to do to answer these questions.

Example

0 4 . 3 Explain why aluminium window frames do **not** corrode after they are made.

[2 marks]



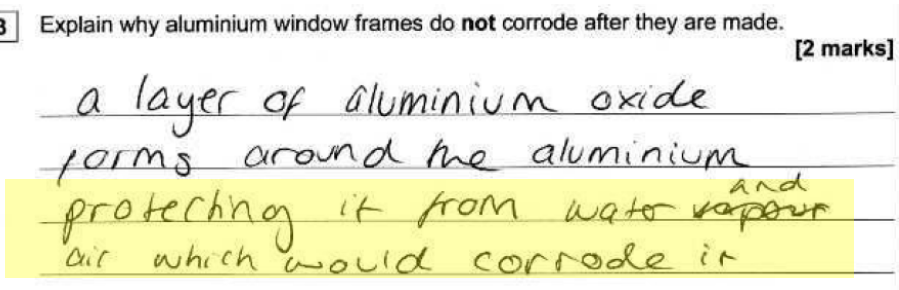
Answer states 'aluminium is protected', but doesn't explain why.

Total 1 mark.

Example

0 4 . 3 Explain why aluminium window frames do **not** corrode after they are made.

[2 marks]



This is a correct answer as it states 'aluminium oxide forms' and says why this protects the aluminium.

Top tips

Don't just write a description, the answer needs to include a reason why something is happening.

Use words like 'so' and 'because' to link the answer.

Look at how many marks the question is worth.

Try to give as many facts, statements or points as there are marks.

Explanation

The answer shouldn't just be a simple list of reasons or points. Points in the answer must be linked coherently and logically, using words such as 'so', 'therefore', 'because', 'due to', 'since', 'this means' or 'meaning that'.

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'Evaluate' questions

Students often don't include judgements when answering compare and evaluate questions.

Example

1 0 . 5 **Table 7** shows data about different ways to power electric cars.

Table 7

	Hydrogen fuel cell	Rechargeable lithium-ion battery
Time taken to refuel or recharge in minutes	5	30
Distance travelled before refuelling or recharging in miles	Up to 415	Up to 240
Distance travelled per unit of energy in km	22	66
Cost of refuelling or recharging in £	50	3
Minimum cost of car in £	60 000	18 000

Evaluate the use of hydrogen fuel cells compared with rechargeable lithium-ion batteries to power electric cars.

Use **Table 7** and your own knowledge.

[6 marks]

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Hydrogen fuel cells take less time to recharge/refuel but has a lower distance per in km per unit of energy, so although it refuels faster it can not travel as far unlike a lithium ion battery that can travel 66 km per unit of energy, But you can travel only 240 miles before refueling. Hydrogen fuel cells are a lot more expensive to buy and run, costing 60,000 to buy and £50 per refuel. But from my own knowledge water is the only product of hydrogen fuel cells so it cause no harm to the enviroment unlike lithium ion batterys that release pollutants.

The student gives some strongly linked reasons and includes their own knowledge, but they didn't include a judgement.

Full marks unable to be awarded.

Example

I would choose an electric car as it is cheaper to run and purchase as well as been better for the environment.

A judgement like this would help improve the answer in the example above.

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Top tips

Comparative statements must be made, not just consist of a description.

For evaluate questions, remember to include a simple judgement or opinion, for example, 'I think X is better than Y'. It's okay to sit on the fence and not decide which one is correct.

Explanation

To score high marks in evaluate questions, students need to include a judgement linked to their answer.

Strongly linked judgements could be written in terms of:

'**I think** cell/battery X is **better because** …'

or

'advantages of cell/battery x are…but disadvantages are… **so x is better**' etc.



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Questions in unfamiliar contexts

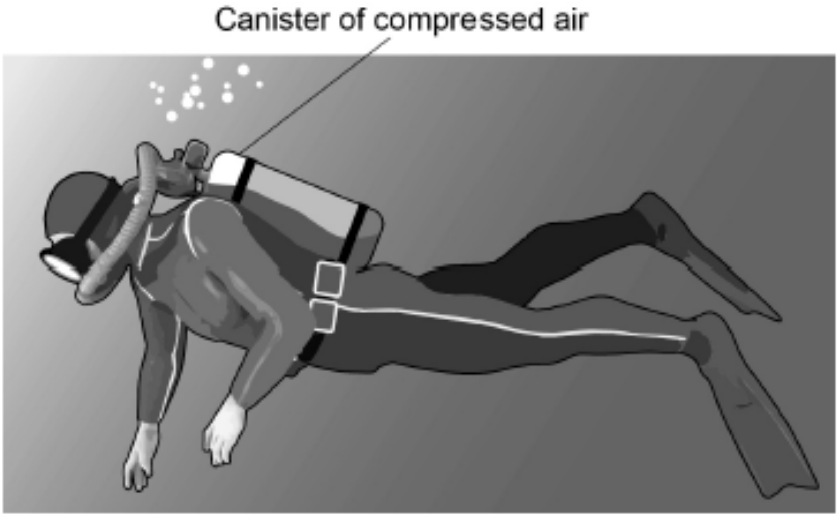
Some students struggle to identify science when it's in an unfamiliar context.

Example

0 3 **Figure 5** shows a diver.

The diver is using a canister of compressed air so that he can breathe underwater.

Figure 5



0 3 . 2 The temperature of the air inside the canister increases.

What happens to the movement of the air particles?

[1 mark]

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Example

0 8 . 5 Astatine (At) is below iodine in Group 7.

Predict:

- the formula of an astatine molecule
- the state of astatine at room temperature.

[2 marks]

Formula of astatine molecule _____

State at room temperature _____

Example

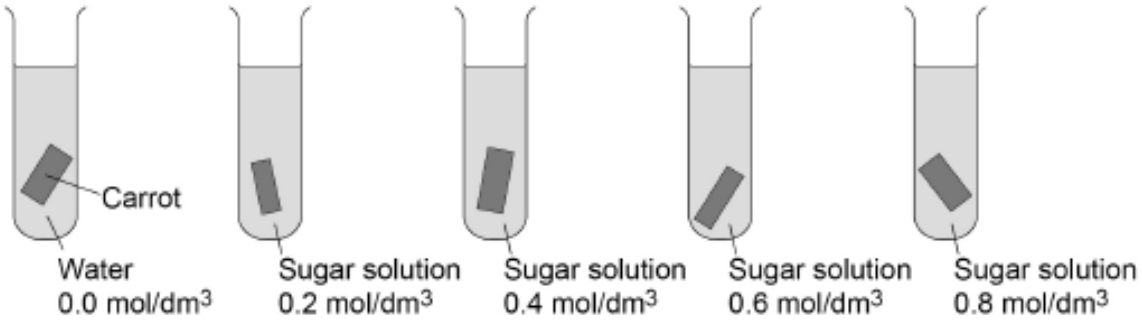
0 4 A student investigated the effect of different concentrations of sugar solution on pieces of carrot.

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm^3 of water or one of the sugar solutions as shown in **Figure 6**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 6 shows how the investigation was set up.

Figure 6



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Example

- Bluebells can reproduce sexually by producing seeds.
- Bluebells can also reproduce asexually by making new bulbs.

Top tips

Read the question to work out what it's asking.

Underline or highlight scientific words to help identify which topic the question is about, as shown in the examples.

Sometimes practicals might not be identical to the ones carried out in class. Different equipment or different names of chemicals might be used, but the science behind the practical is the same.

Think about what knowledge will help answer the question.

Explanation

Students should be aware that questions are likely to assess application of knowledge in an unfamiliar context. Modelling the process of how to identify the science in a question can support the students accessing these questions.

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Extended response questions

Students need to show clear, coherent reasoning to produce a logically structured answer.

Example

1 1 A student carried out an investigation to determine the spring constant of a spring.

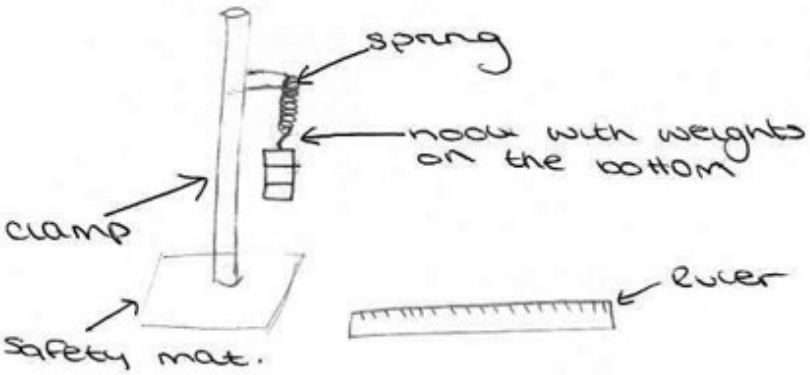
Table 4 gives the data obtained by the student.

1 1 . 1 Describe a method the student could have used to obtain the data given in **Table 4**.

Your answer should include any cause of inaccuracy in the data.

Your answer may include a labelled diagram.

[6 marks]



- Get a clamp, a ruler (in cm), a spring, a hook, weights of 2N each
- Attach the spring to the clamp and add the hook (with one weight of 2N) to the bottom
- using the ruler, measure the extension of the spring and record the results
- Remove the hook from the spring and increase the weight by 2N, then attach the hook again to the spring
- Measure the extension again, record the results.
- keep repeating this until you have reached a force of 10N and have recorded all of the results.

Table 4

Force in N	Extension in cm
0	0.0
2	3.5
4	8.0
6	12.5
8	16.0
10	20.0

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Example

0 6 . 4 **Table 4** gives some information about disposable cups.

Table 4

	Coated paper cups	Poly(styrene) cups
Source of raw materials	Wood	Crude oil
Energy to make 1 cup in arbitrary units	550	200
Biodegradable	Yes	No
Recyclable	No	Yes

Compare the advantages and disadvantages of using coated paper and poly(styrene) to make disposable cups.

Use **Table 4** and your knowledge and understanding of life cycle assessments (LCAs).

[4 marks]

Coated	Poly(styrene)
+ It is made out of wood, which is renewable, so doesn't run out	+ It is made out of crude oil, which is non-renewable, so does eventually run out
- It takes 350 more energy units to make, so would cost more to produce	+ Takes 350 less energy units to make, so would cost less to produce
+ It's biodegradable meaning, it won't be churned on a landfill and won't harm the earth	- It's not biodegradable, so it will pollute the earth and stay on the landfill

Top tips

It's always worth having a go at answering these questions as even a few relevant comments or bullet points could gain marks.

Bullet points, labelled diagrams and tables can all be used to help structure the answer.

Explanation

Extended response questions can be answered by:

- writing in paragraphs
- using bullet points to be precise, concise and relevant
- using labelled diagrams especially if it's planning an experiment or writing the method
- using tables with headings for compare and evaluate questions. Statements, explanations and numerical data need to be clearly linked across the table so like is being compared with like. There needs to be an explanation to what the table is showing.



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Physics equation recall

Some students recall physics equations incorrectly. Sometimes students write the terms in the order they are given in the question.

Example

0 1 . 6 Write down the equation that links acceleration (a), mass (*m*) and resultant force (*F*).

[1 mark]

acceleration = force × mass

Incorrect rearrangement so no marks given

Top tips

Questions give terms in alphabetical order.

Answers can use words or symbols. If using symbols, make sure the ones shown in the question are used.

An equation triangle can be used to help, but the full equation must be given in the answer. Just giving an equation triangle will not achieve any marks.

Explanation

Equation recall questions since 2020 look like the example above, including the symbols that students should use if they wish to give the equation using symbols.

Terms/symbols shown in the question are given in alphabetical order. This might not be in the correct order for the equation. Students, therefore, need to know the correct structure of the equation

Sometimes, students try to rearrange the equations to match the order of the terms in the question. They don't need to do this.

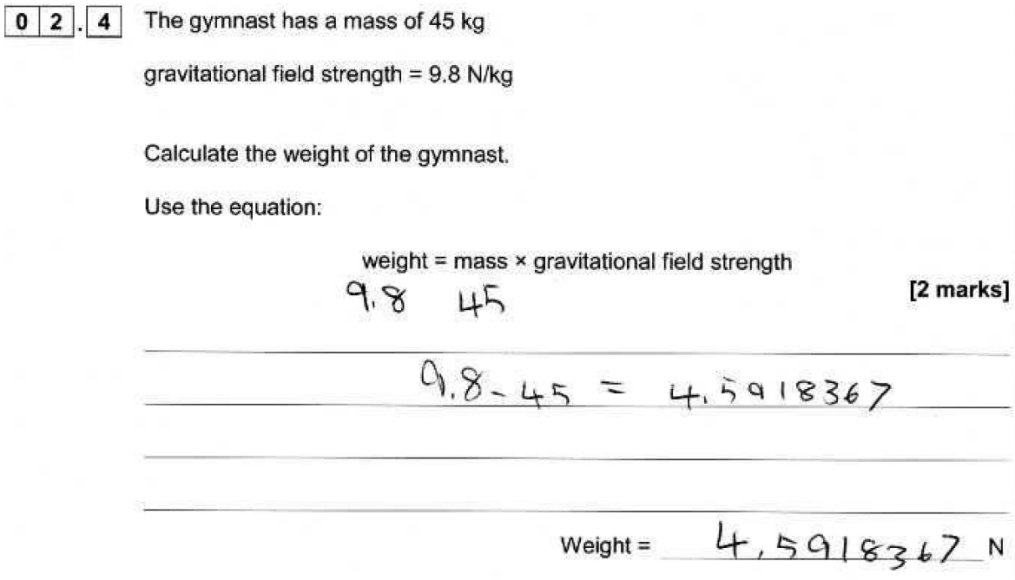
In this question, students could score the mark for writing F=ma or force = mass x acceleration or any correct rearrangement of either of these.

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Not using the equation or numbers given

Students should use the equation or numbers provided to assist them in answering the question.

Example



0 2 . 4 The gymnast has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the weight of the gymnast.

Use the equation:

weight = mass × gravitational field strength

9.8 45 [2 marks]

9.8 - 45 = 4.5918367

Weight = 4.5918367 N

The correct numbers have been used, but not the equation given. The student has written

9.8 – 45

The student has then used their calculator incorrectly for their final answer, so scores no marks.

Top tips

Read the question carefully.

Use the equation as it has been given.

Use the numbers given in the question.

Check the answer makes sense.

Explanation

Students should be careful to avoid rearranging for low demand calculation questions. Mostly these are low tariff questions.

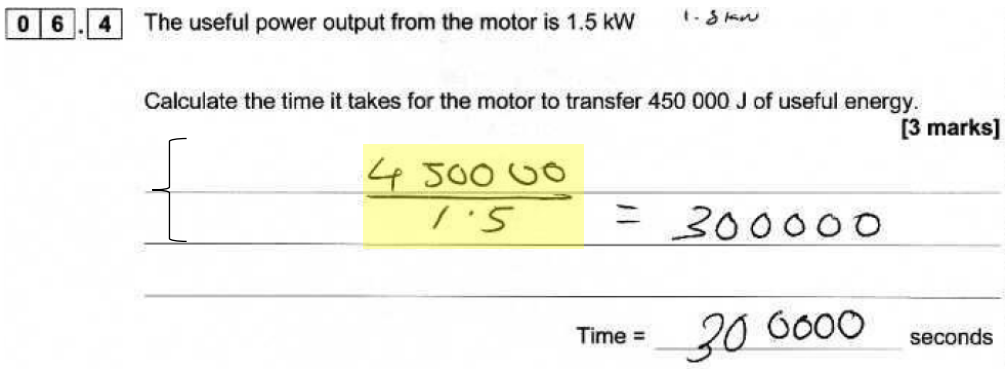
Checking the final answer can help identify mistakes.

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Common calculation mistakes

Students often make mistakes in calculation questions, such as not converting units correctly, misreading units or missing out steps.

Example: Unit conversion



0 6 . 4 The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.

[3 marks]

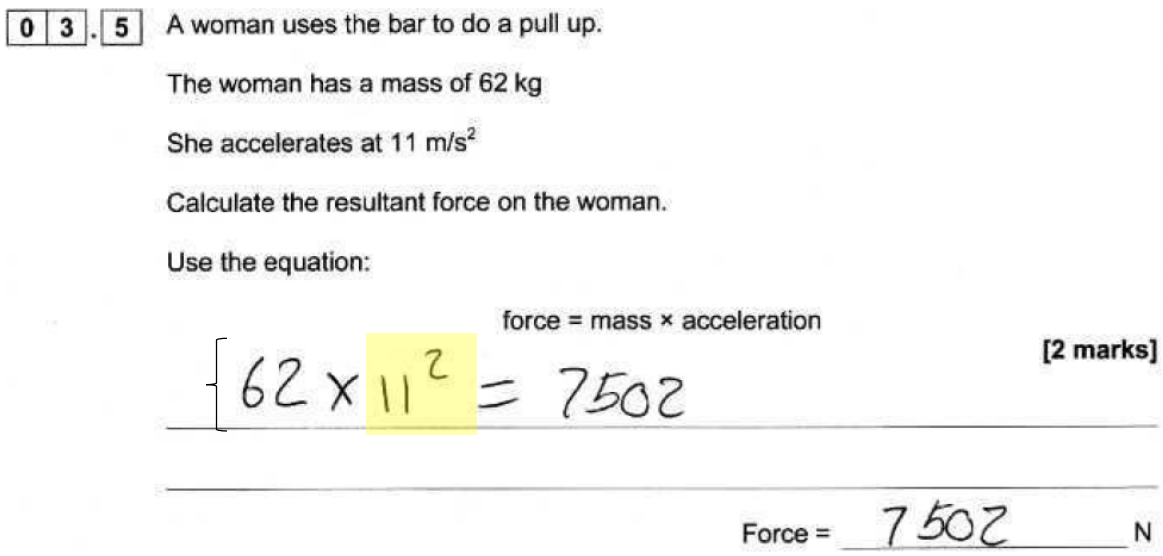
$\frac{450\,000}{1.5} = 300000$

Time = 300 000 seconds

Correct substitution but hasn't converted kW.

Total 2 marks.

Example: Misunderstanding units



0 3 . 5 A woman uses the bar to do a pull up.

The woman has a mass of 62 kg

She accelerates at 11 m/s^2

Calculate the resultant force on the woman.

Use the equation:

force = mass × acceleration

[2 marks]

$62 \times 11^2 = 7502$

Force = 7502 N

The student misunderstood that m/s^2 is the unit that acceleration is measured in so has squared 11 which is incorrect.

They have substituted 112 and calculated f = ma2 which is incorrect.

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Example: Showing working out and the equation triangle

Table 1

	No beta blockers taken		Taking beta blockers	
	At rest	During exercise	At rest	During exercise
Heart rate in beats per minute	68	150	52	88
Stroke volume in cm^3	80	120	X	98
Cardiac output in cm^3 per minute	5440	18 000	2800	8624

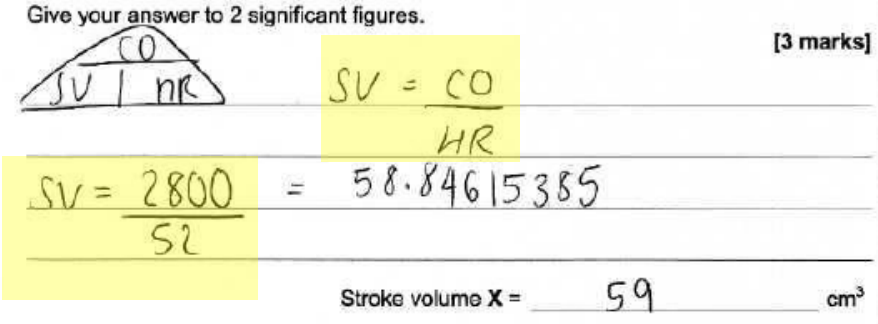
0 1 . 4 Calculate stroke volume **X** in **Table 1**.

Use the equation:

cardiac output = stroke volume × heart rate

Give your answer to 2 significant figures.

[3 marks]



No marks can be given for the equation triangle, but the correct rearrangement is shown.

The final answer is wrong, but it's correctly rounded to 2 significant figures so 2 marks are given.

Without the working out, the answer of 59 would have scored no marks.

Top tips

Show working as marks may be available for correct working even if a mistake has been made.

Learn how to convert between common units such as kilograms and grams.

Learn the common prefixes: tera, giga, mega, kilo, centi, milli, micro and nano.

Understand the difference between m/s and m/s^2.

Look out for unit conversions and answering to a certain number of significant figures.

Explanation

Students should be encouraged to show their working because they may still get compensatory marks for correct working even if the final answer is wrong.

Students often miss out on marks for simple mistakes like not converting units correctly and squaring the answer if the units are m/s^2.

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Rounding numbers

Students should avoid rounding answers unless asked to.

Example

A teacher used a Geiger-Muller tube and counter to measure the number of counts in 60 seconds for a radioactive rock.

The counter recorded 819 counts in 60 seconds. The background radiation count rate was 0.30 counts per second.

Calculate the count rate for the rock.

[3 marks]

819 ÷ 60 = 13.65

13.65 x 0.3

Count rate = 4.0 per second

Correct working has been shown, but the student has made a mistake rounding their final answer (it should be 4.1 to 2 sig figs) so can only score a maximum of 2 marks.

Top tips

Questions that need students to use significant figures will state, for example, give your answer to 2 significant figures.

The answer should only be rounded if the questions states to do so. Don't round numbers part way through a calculation, and only round the final answer.

Explanation

At GCSE, this is all that is required.

Students should be careful not to confuse significant figures and decimal places.

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Graphs

Students sometimes make mistakes when drawing graphs.

Example

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm^3	Rate of photosynthesis in cm^3/hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X
200	1.2	3.6
250	1.2	3.6

Table 9 shows the student's results

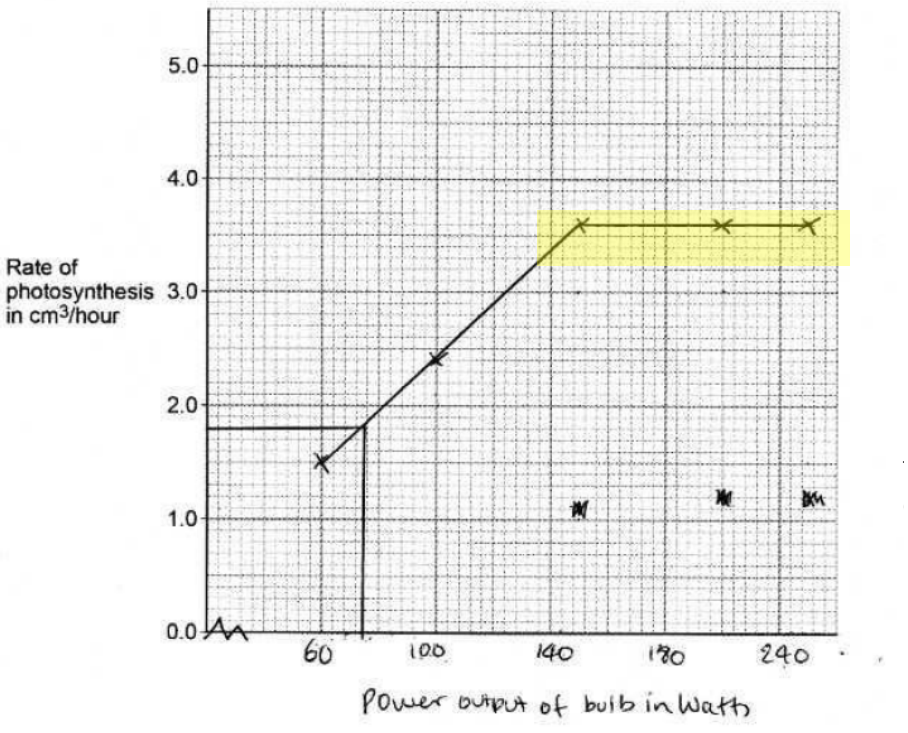
0 9 . 5 Complete **Figure 15**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale
- plot the data from **Table 9** and your answer to Question **09.4**
- draw a line of best fit.

Figure 15



One point is plotted incorrectly.

The line should be a curve.

Uneven scale and no scale after 240 – we don't know what the scale will be above 240.

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Example

0 8 . 2 **Table 5** shows the student's results for hydrochloric acid at 30 °C

Table 5

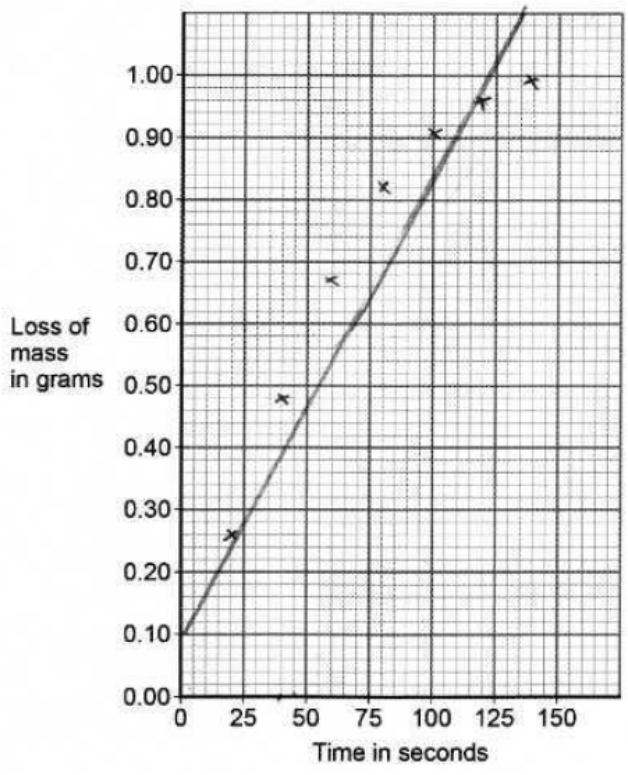
Time in seconds	Loss of mass in grams
0	0.00
20	0.26
40	0.48
60	0.67
80	0.82
100	0.91
120	0.96
140	0.99

Plot the data from **Table 5** on **Figure 6**.

Draw a line of best fit.

[3 marks]

Figure 6



The line of best fit should be a curve.

Point (0,0.00) has not been plotted.

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Top tips

Use at least half of the graph paper to draw the graph.

Look at the question carefully – tick the bullet points as they are completed.

Make sure to plot (0,0) if it's included in the data.

A normal pencil, eg HB, can be used to draw a graph as mistakes can be rubbed out.

Look at the pattern of the data to decide if it should be a curve or straight line of best fit.

Explanation

Students should be encouraged to use as much of the graph paper as possible so the scale is appropriate and the examiner can clearly see the points they have plotted.

Dots or crosses can be used when plotting points but dots may be hidden by any line of best fit they draw.

Lines of best fit need to be smooth not jagged and can be curved or straight depending on the data and all data asked for needs to be plotted.

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Related resources

Command words

The command words guide explains the words and phrases used in exams that tell students how they should answer a question.

bit.ly/comwords

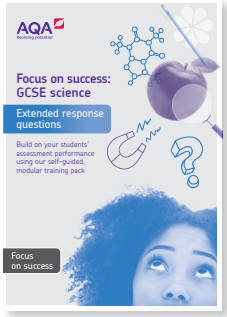
Subject specific vocabulary

The subject specific vocabulary guide provides definitions of key terms used in our GCSE science specifications.

bit.ly/sub-vocab

Focus on success packs

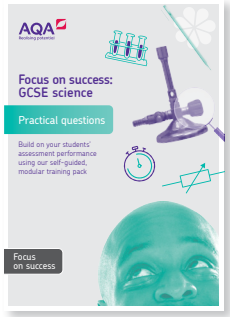
Build on your students' assessment performance using our self-guided, modular training packs, available to download from your subject's Plan page.



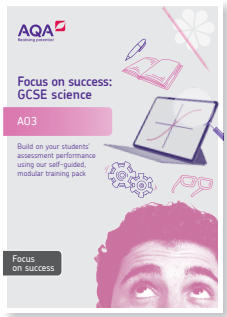
Extended response questions



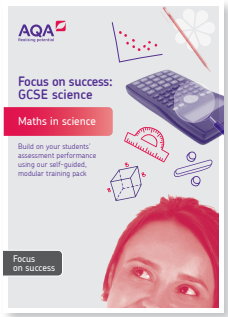
Assessment Objective 2



Practical questions



Assessment Objective 3



Maths in science



Disciplinary language

Inside Exams

- Hungry examiners and GCSE memes podcast episode
  In this episode of Inside Exams, discover how the difference between a potato and a carrot caused a Twitter storm which had students and examiners going bananas.

  bit.ly/IEepisode3

- Question the question blog post
  Dan Rogan, Chair of Examiners, puts together some top tips to tackle questions that at first glance might not be all they seem.

  bit.ly/IEepisode3blog

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Questions matter

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June 2023 Version 2.0

G02478_13a