GCSE
SCIENCE

Marking and improving student outcomes in A02-focused questions

Support booklet and further information

Spring 2019

Contents

GCSE Science mark schemes

The 'Information to Examiners' section

The following information is present at the front of every GCSE Science mark scheme. It gives clear and explicit information to examiners on what the various parts of a mark scheme mean and how to apply them to ensure consistency of marking.

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material, it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

The points-based mark scheme: Prose questions

Below is an example points-based mark scheme. It is taken from the Summer 2018 GCSE Chemistry 2H Paper.

The 'Answers' column shows the correct answer(s).

- For longer prose questions, the individual marking points are shown.
- For calculations, this column will be set out in a series of steps showing the expected method.

The 'Extra information' column expands on what is required or indicates other credit-worthy alternative answers.

The final column lists the Assessment Objective(s) the question addresses and the area(s) of the specification that the question covers. Different marking points may cover different Assessment Objectives or specification references.

Brackets indicate information that does not need to be included to gain the mark.

'allow' is used to indicate alternative answers that are worthy of credit.

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.3	any one from: • (to reduce) health problems • (to reduce) global dimming	allow (to reduce) specified health problems eg breathing difficulties, asthma, lung cancer allow (to reduce) the effects of global dimming eg reduced light levels allow (to reduce) smog allow (to reduce) the formation of particulates ignore global warming do **not** accept to reduce soot	1	AO1 4.9.3.1 4.9.3.2

'ignore' indicates a statement that doesn't gain credit, but which doesn't cancel the marking point.

'do not accept' means a wrong answer, which cannot be credited.

The points-based mark scheme: Calculation questions

Below is an example points-based mark scheme for a calculation question. It is taken from the Summer 2018 GCSE Physics 1H Paper.

The same principles for brackets, allow, ignore, do not allow etc apply as for a prose question.

Question	Answers	Extra information	Mark	AO/Spec. Ref.
09.3		an answer of 0.12 (kg) **or** an answer that rounds to 0.12 (kg) scores **5** marks		AO2 4.2.4.2 4.1.1.3
	E = 2530 × 14	this mark may be awarded if P is incorrectly / not converted	1	
	E = 35 420 (J)	this answer only	1	
	35 420 = m × 4200 × 70	allow their calculated E = m × 4200 × 70	1	
	$m = \frac{35\,420}{4200 \times 70}$	allow $m = \frac{\text{their calculated E}}{4200 \times 70}$	1	
	m = 0.12 (kg)	allow an answer that is consistent with their calculated value of E	1	

The levels of response mark scheme

This example is taken from the Summer 2018 GCSE Biology 2H paper. It is for a 6-mark 'Design/plan' question (see generic levels descriptors, below).

Each command word has a generic set of levels descriptors.

The number of marks for each Assessment Objective are shown, along with the specification references.

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content • placing of quadrat • large number of quadrats used • how randomness achieved – eg table of random numbers **or** random number button on calculator **or** along transect • quadrats placed at coordinates **or** regular intervals along transect • in each of two areas of different light intensities **or** transect running through areas of different light intensity • for each quadrat count number of dandelions • for each quadrat measure light intensity • compare data from different light intensity to access **level 3** the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome		4.7.2.1

The indicative content shows the scientific points a student could use in their response. The list is not exhaustive, and students could use other ideas. Students do not need to include all of the indicative points to gain full marks.

GCSE Science generic level descriptors

The mark scheme uses generic level descriptors, which are linked to the specific command word.

This approach improves the consistency of levels-marked questions. There is specific indicative content for the examiner to consider.

1. Calculate/Determine: Use numbers/data to work out the correct answer.

2. Compare: Note/estimate/measure the similarity or dissimilarity between things.

4 or 6 marks.

Level 2: Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	3–4 or 4–6
Level 1: Relevant features are identified and differences noted.	1–2 or 1–3
No relevant content	0

3. Describe: Recall some facts, events or process in an accurate way.

4 or 6 marks.

Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4 or 4–6
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2 or 1–3
No relevant content	0

4. Design/Plan: Set out in a logical order how something can be done.

4 or 6 marks.

If 4 marks

Level 2: The plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4
Level 1: The plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2
No relevant content	0

If 6 marks

Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6
Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4
Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2
No relevant content	0

5. Evaluate: Make a judgement about the value of something, with respect to a particular purpose. The response is based on analysis – so identification of relevant features is necessary and the use of relevant criteria. Response might need to look critically, from a number of angles.

4 or 6 marks.

If 4 marks

Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4
Level 1: Relevant points are made. These are not logically linked.	1–2
No relevant content	0

If 6 marks

Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6
Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4
Level 1: Relevant points are made. They are not logically linked.	1–2
No relevant content	0

6. Explain: Clarify by stating reasons why or how something has happened. Gives causes or motivating factors of why something has happened.

4 or 6 marks.

If 4 marks

Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2
No relevant content	0

If 6 marks

Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6
Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3–4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2
No relevant content	0

Example student responses from 2018 papers

Example 1: 8464/B/1F Question 2.5

This question required students to accurately plot six data points from a table and draw a line of best fit. The plotting is low demand, as all the data points clearly fall on grid lines. The requirement to draw a line of best fit is standard demand (grades 4-5).

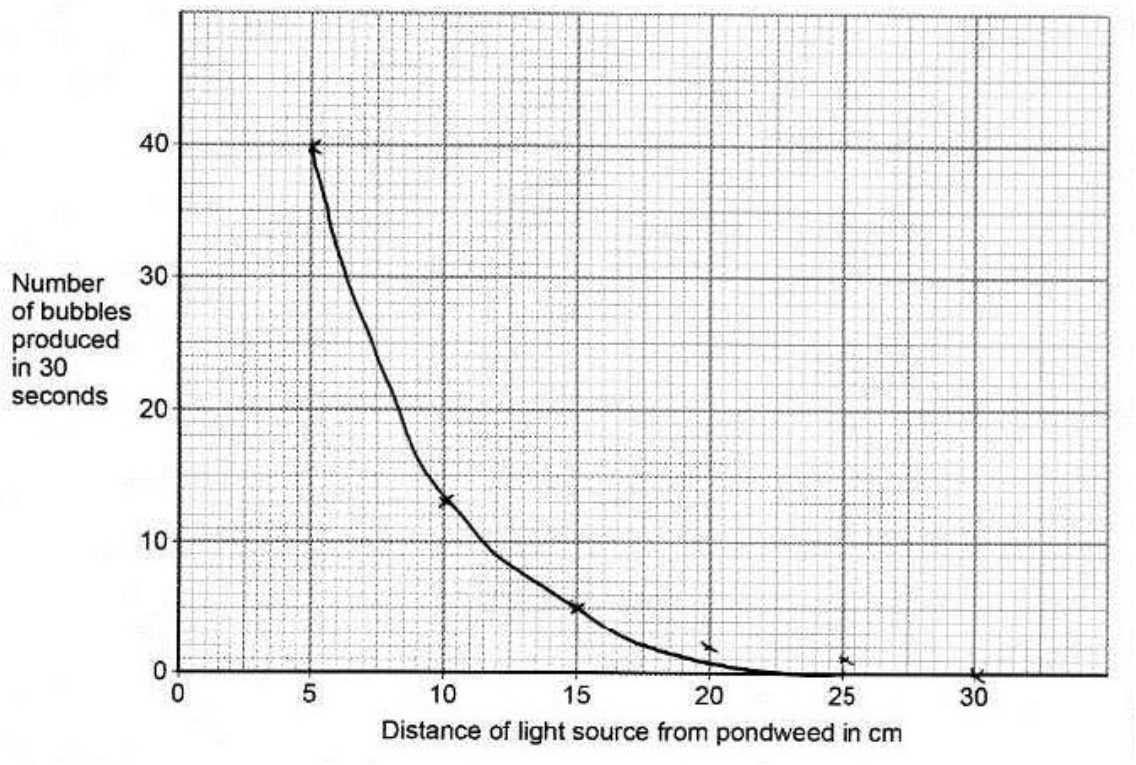
Distance of light source from pondweed in cm	Number of bubbles produced in 30 seconds
5	40
10	13
15	5
20	2
25	1
30	0

0 2 . 5 Plot the data from **Table 1** on **Figure 5**

Draw a line of best fit.

[3 marks]

Figure 5



Example 2: 8464/B/1F Question 2.5

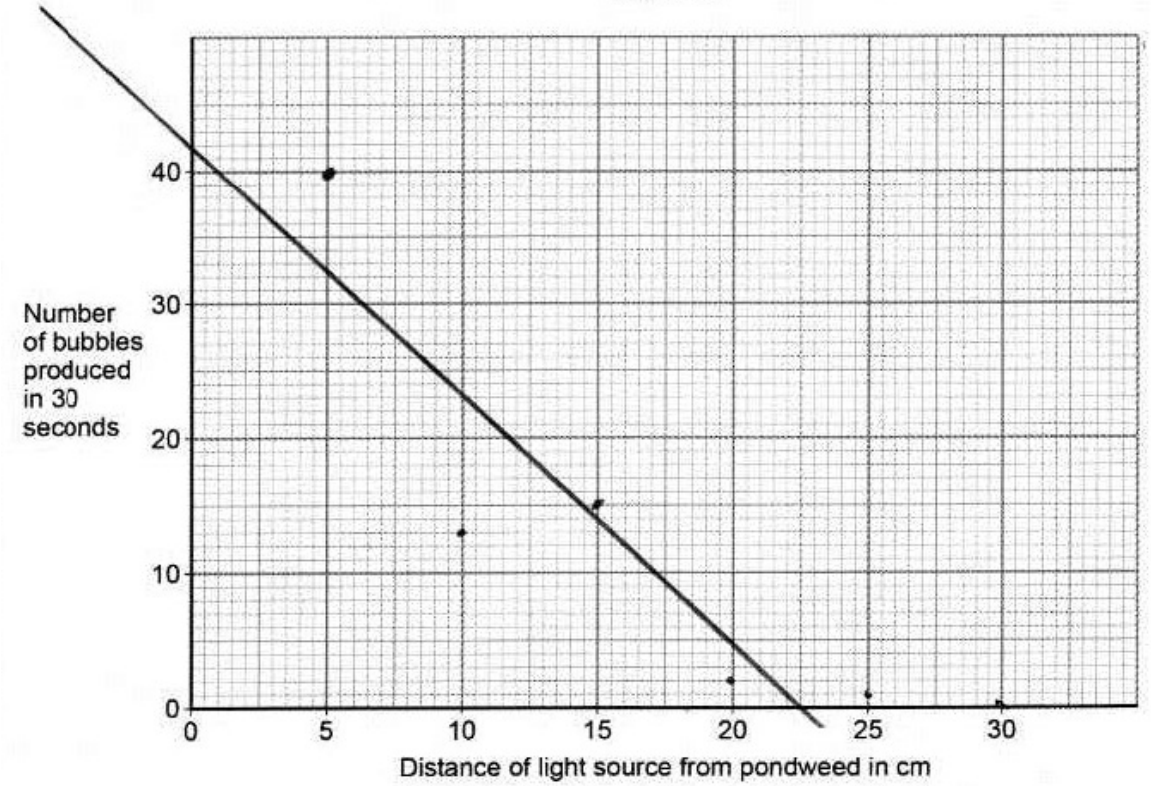
This is a second example response to this question.

0 2 . 5 Plot the data from **Table 1** on **Figure 5**

Draw a line of best fit.

[3 marks]

Figure 5



02.5		(where a bar chart has been plotted) allow **1** mark for all bars plotted correctly if points are plotted as well as bars, ignore bars		AO2 4.4.1.2
	all points plotted correctly	allow ± ½ a square allow **1** mark for three points correctly plotted	2	
	smooth curve drawn through all points	ignore extensions of line / curve unless inconsistent with line / curve drawn	1	

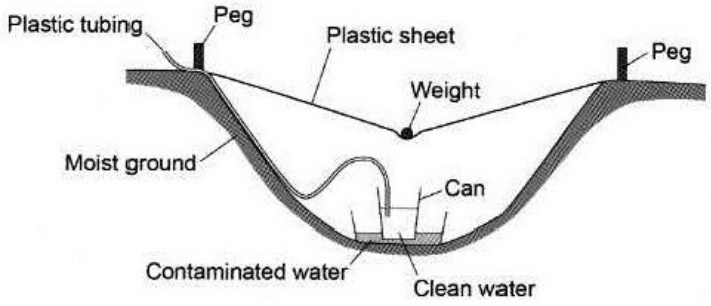
Example 3: 8465/2H Question 7.5

This is a high-demand question requiring students to link their knowledge and understanding of the water cycle to the context of a method of purifying water to create potable water.

0 7 . 5 There are a number of ways to provide clean and safe water for people.

Figure 7 shows a simple method for collecting clean water. This method is called solar distillation.

Figure 7



Explain the processes that occur in the method shown in **Figure 7** to provide clean drinking water.

[5 marks]

When the water evaporates in the can it later condenses on the plastic sheet leaving the disease in the can.

07.5	air / water under the sheet is warmed by the Sun		1	AO2 4.4.1.7
	(so) water evaporates (from the ground / contaminated water)		1	AO2 4.4.1.7
	(then water) condenses on (the underside of) the plastic sheet		1	AO2 4.4.1.7
	the weight causes a drip point in the centre of the plastic sheet		1	AO2 4.4.1.7
	(so clean) water drips into the can (continuously ready for drinking through the plastic tubing)		1	AO2 4.4.1.8

Example 4: 8464/P/1F Question 7.2

To answer this standard-demand question fully, students needed to use the bars that were already plotted to choose an appropriate scale for the *y*-axis, then to plot the data for the three other materials in the table. Prompts are given in the question to help students understand what they should do.

0 7 . 2 Another student did a similar experiment.

He determined the density of five common plastic materials.

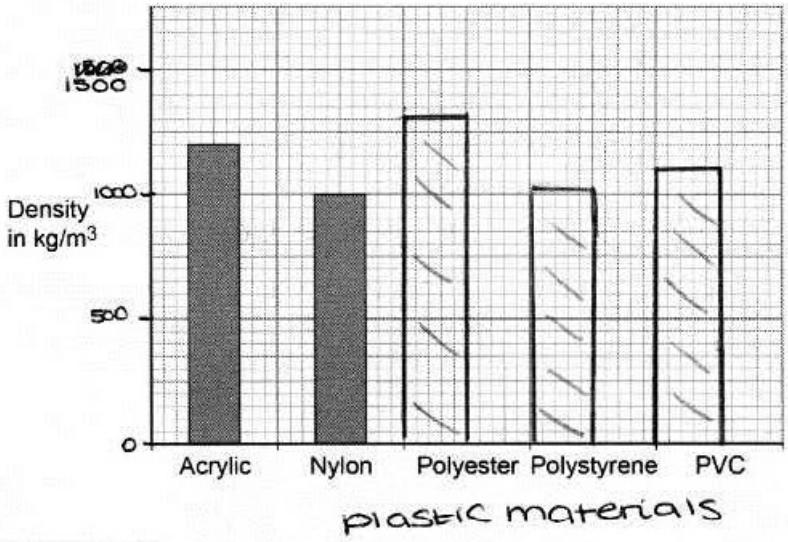
Table 3 shows the results.

Table 3

Plastic material	Density in kg/m^3
Acrylic	1200
Nylon	1000
Polyester	1380
Polystyrene	1040
PVC	1100

Figure 12 shows the results plotted in a bar chart.

Figure 12



Complete **Figure 12**

You should:

- Write the correct scale on the y-axis.
- Draw the bars for polyester, polystyrene and PVC.

[4 marks]

07.2	all *y*-axis values correct (minimum of 3) all bars drawn to the correct height	allow **1** mark for two correct values allow **1** mark for two correct bars allow ± ½ small square	2 2	AO2 6.3.1.1

Example 5: 8464/B/2F Question 5.4

Low-demand question covering knowledge and understanding of the use of Punnett squares.

0 5 . 4 Complete the Punnett square diagram in **Figure 8** for this man and woman.

[1 mark]

Figure 8

		Woman	
		b	b
Man	**B**	B b	B b
	b	b b	b b

05.4	(using bb for mother's gametes) correct combination in all four boxes, eg (b) (b) (B) Bb Bb (b) bb bb	allow any combination of mother's gametes as mark is for filling in boxes correctly	1	AO2 4.6.1.4

Example 6: 8461/2H Question 8.7

High-demand question covering knowledge and understanding of the use of Punnett squares.

0 8 . 7 Draw a Punnett square diagram to show a cross between animals **7** and **8**.

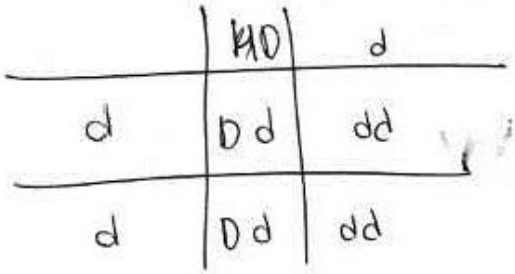
Identify which offspring produce low-fat milk and which offspring produce high-fat milk.

[4 marks]

Use the following symbols:

D = dominant allele for making low-fat milk

d = recessive allele for making high-fat milk



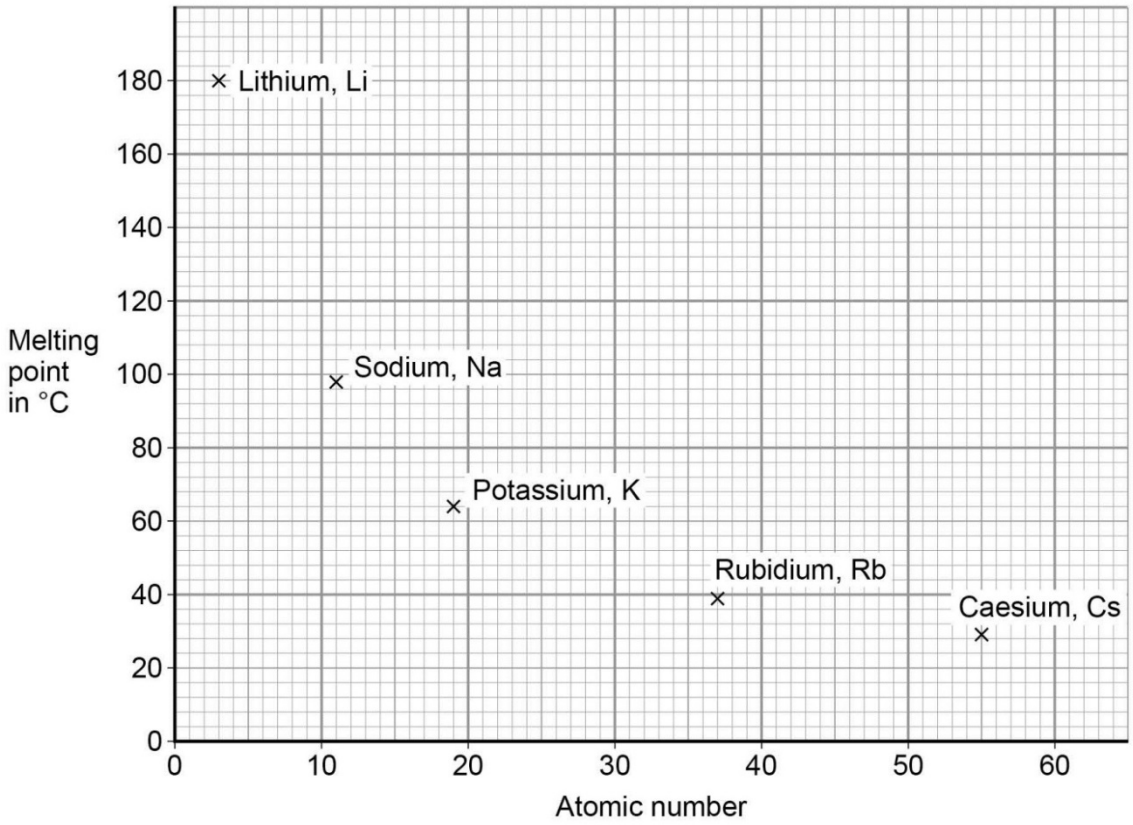
08.7		**max 3** marks if own symbols used with no key **max 3** marks if alternative diagram to Punnett square used		AO2 4.6.1.6
	male gametes correct: d (and d)		1	
	female gametes correct: D and d	allow **1** mark if gametes are correct but gender not identified	1	
	correct derivation of offspring genotypes from given gametes	allow 2 × 2 **or** 2 × 1 derivation	1	
	Dd identified as low-fat **and** dd identified as high-fat in offspring	if DD offspring are produced, must also identify as low-fat	1	

Example 7: 8465/3F Question 2.1

Low-demand question requiring students to interpret the data given in a graph.

Figure 1 shows the melting points of Group 1 metals plotted against their atomic number.

Figure 1



0 2 . 1 Describe the trend shown by the melting points of Group 1 metals as the atomic number increases.

[1 mark]

The graph has a negative correlation showing the higher the atomic number, the lower the melting point.

02.1	melting points decrease (as the atomic number increases)	allow negative correlation	1	AO2 4.5.1.4

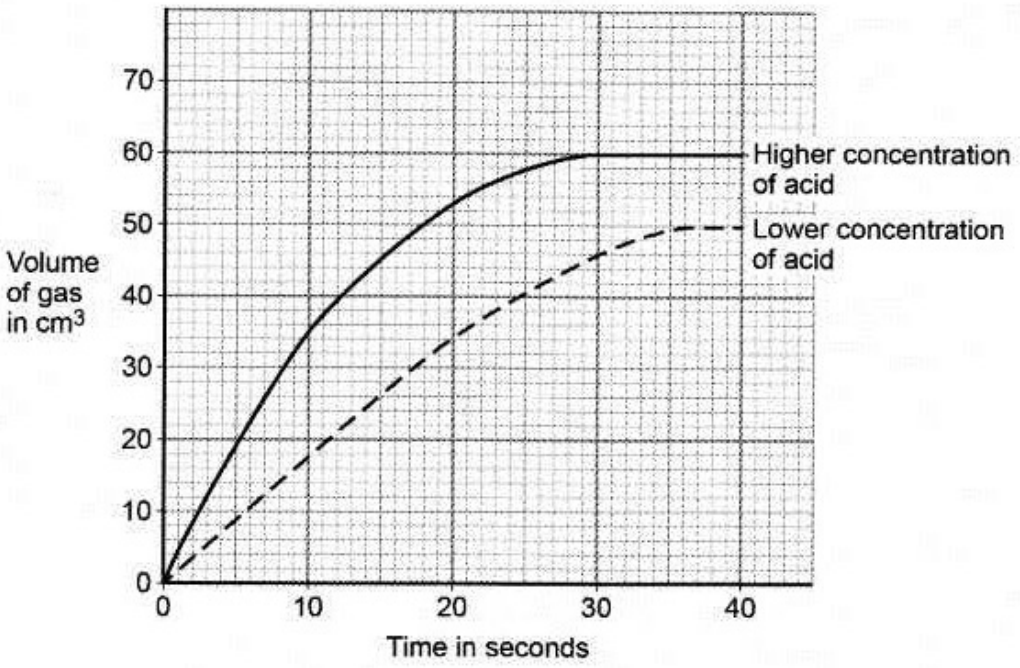
Example 8: 8464/C/2H Question 5.9

High-demand question requiring students to interpret the data given in a graph.

0 5 . 9 The student repeated the investigation with small marble chips using hydrochloric acid with a lower concentration.

Figure 7 shows the volume of gas produced during the first 40 seconds.

Figure 7



Explain why the results for the lower concentration of acid are different from the results for the higher concentration of acid.

[3 marks]

The results are different, as when there is a higher amount of concentration, this increases the rate of reaction, due to the collison theory, where more frequent collisons will take place when the concentration is increased or higher therefore increasing the rate of reaction.

05.9	(sloping part is less steep because) reaction is slower	allow converse for more concentrated acid	1	AO2 5.6.1.2 5.6.1.3 10.2.11
	due to less frequent collisions	do **not** accept reference to speed of particles or energy of collisions ignore fewer collisions	1	
	fewer acid particles (in same volume)	ignore weaker acid	1	
	or (sloping part is less steep because) reaction is slower (1) there are fewer acid particles (in same volume) (1) (graph levels off lower) so less gas is produced (1)			

Example 9: 8464/B/1H Question 4.2

To gain full marks on this high-demand question students needed to choose an appropriate scale for the data presented, plot five data points accurately (including use of a negative scale) and draw an appropriate line of best fit.

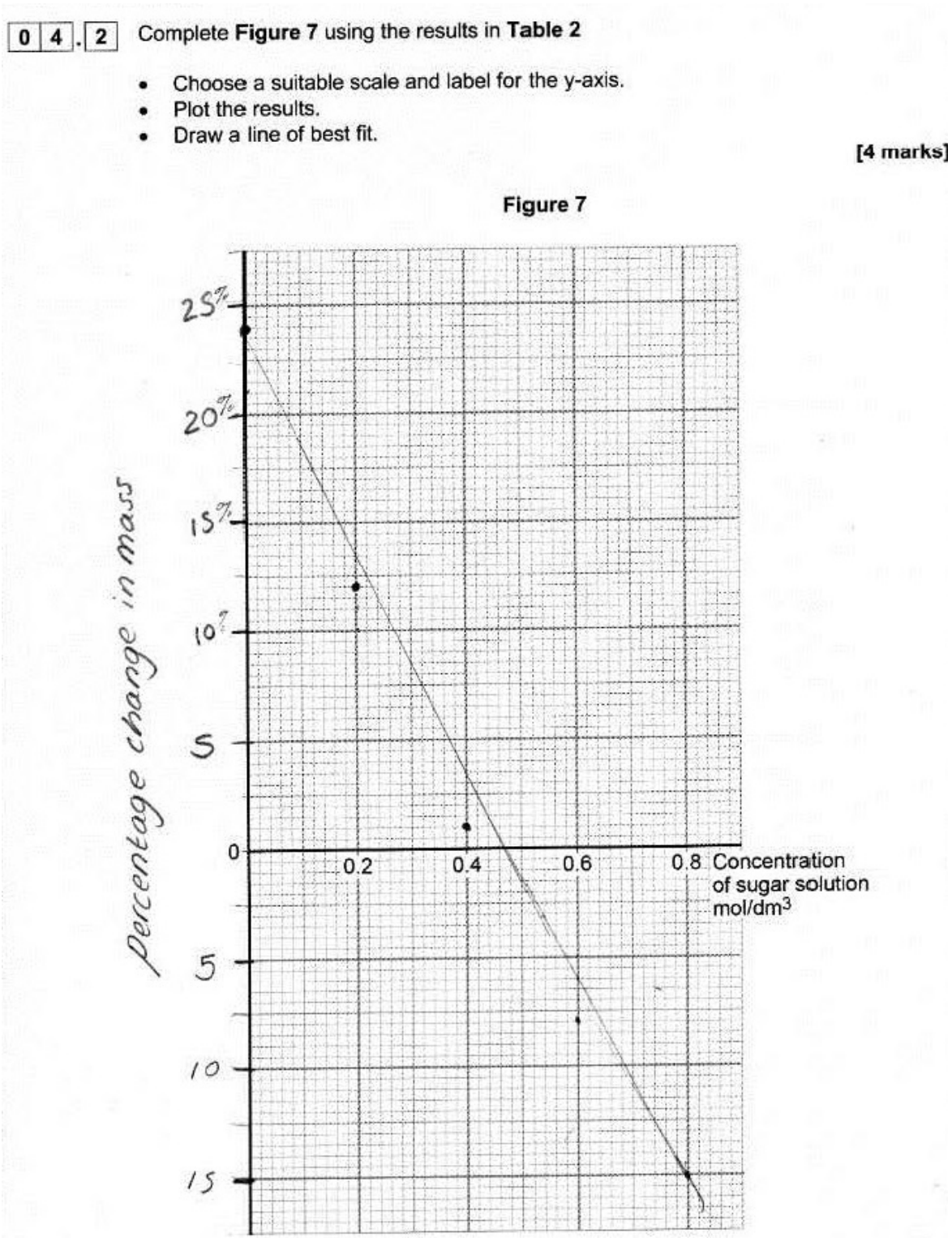
The data table is repeated in the mark scheme, so is not included here.

0 4 . 2 Complete **Figure 7** using the results in **Table 2**

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

Figure 7



04.2	suitable scale **and** label for y-axis	allow 5 or 6 per 2 cm do **not** accept 5 per 1 cm	1	AO2 4.1.3.2
	all points plotted correctly	allow ± ½ a square allow **1** mark for 4 correct points	2	
	line of best fit		1	

conc. …	percentage (%) change…
0.0	+ 24
0.2	+ 12
0.4	+ 1
0.6	- 8
0.8	- 15

Example 10: 8464/C/1F Question 2.3

Low-demand question assessing students' ability to apply their knowledge and understanding of word equations in the context of a displacement reaction involving Group 7 elements.

0 2 . 3 Chlorine reacts with potassium bromide solution.

Complete the word equation.

[2 marks]

chlorine + potassium bromide → Potassium chloride + hydrogen and bromine

02.3	bromine potassium chloride	allow correct chemical formulae either order	1 1	AO2 5.1.1.1 5.1.2.6

Example 11: 8464/C/1F Question 2.2

To answer this low-demand question, students need to apply their knowledge of how dot-and-cross diagrams are used to represent molecules, the electronic structure of Group 7 elements and covalent bonding.

0 2 . 2 A fluorine atom has 7 electrons in the outer shell.

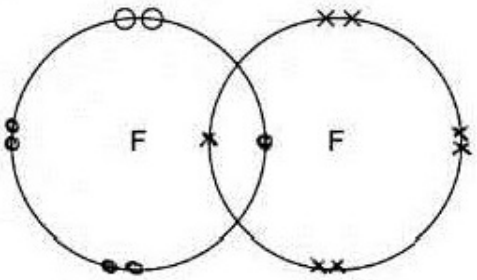
Figure 8 shows part of a dot and cross diagram to represent a molecule of fluorine (F_2).

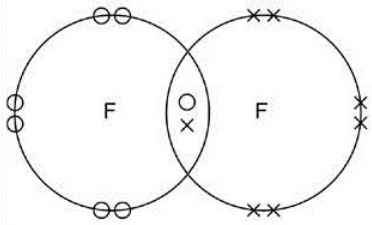
Complete the dot and cross diagram.

You should show only the electrons in the outer shells.

[2 marks]

Figure 8



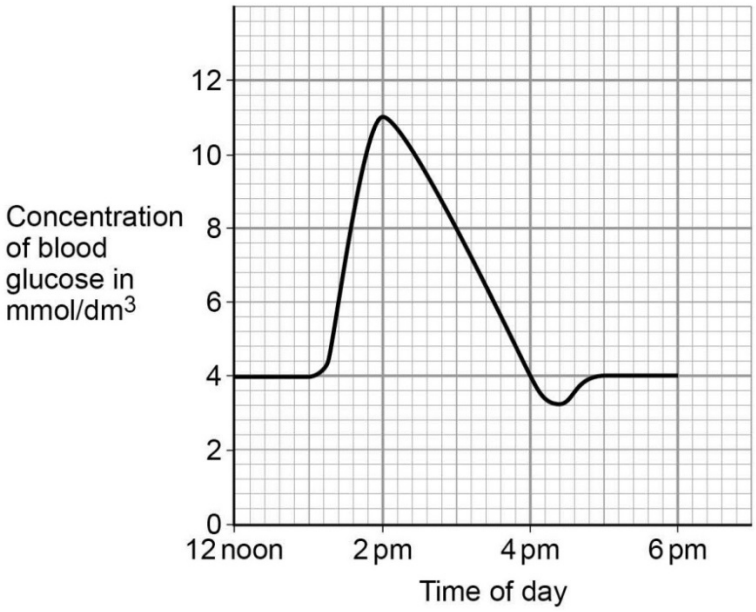
02.2		one shared pair anywhere in overlap between two circles **or** on intersection 6 other electrons on each atom allow dots **or** crosses **or** mixture for all marks ignore any inner shell electrons	1 1	AO2 5.1.2.6 5.2.1.4

Example 12: 8465/1F Question 5.2

Low-demand question requiring students to do a calculation with data they have taken from a graph.

Figure 5 shows the change in glucose concentration in the blood of a person with Type 1 diabetes.

Figure 5



0 5 . 2 Calculate the increase in blood glucose concentration between 1 pm and 2 pm.

[1 mark]

11 − 4

Increase in blood glucose = 7 mmol/dm^3

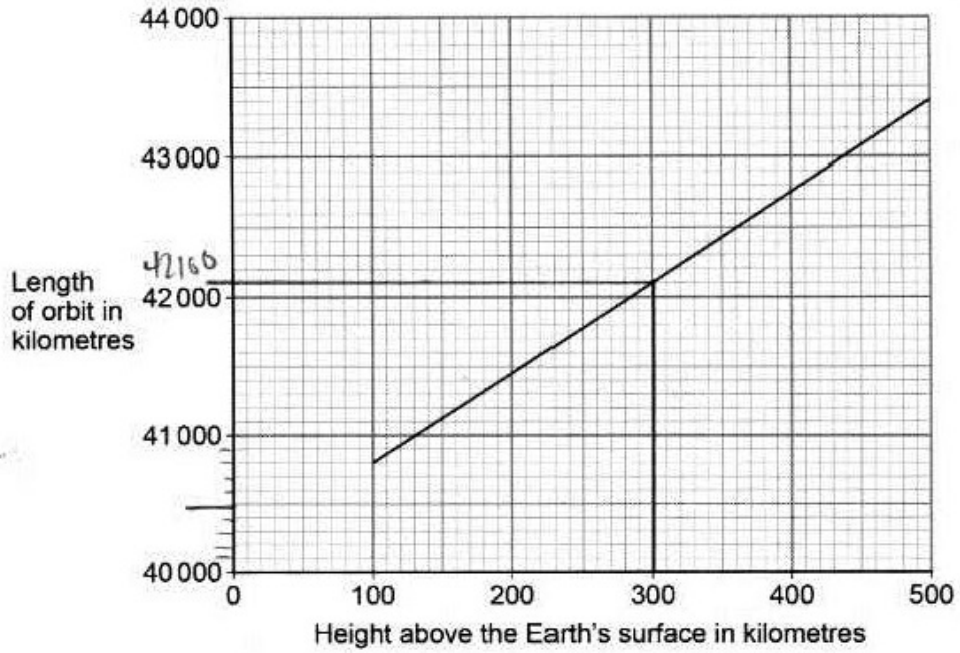
05.2	7 (mmol/dm^3)	allow 6.75 to 7.25 (mmol/dm^3)	1	AO2 4.3.1.5

Example 13: 8463/2H Question 8.2

High-demand question, in which students need to carry out a calculation with data they have obtained from a graph.

0 8 . 2 **Figure 15** shows how the length of a satellite orbit depends on the height of the satellite above the Earth's surface.

Figure 15



A satellite orbits 300 km above the Earth's surface at a speed of 7.73 km/s.

Calculate how many complete orbits of the Earth the satellite will make in 24 hours.

[5 marks]

7·73 km/s

463·8 = ↓ minute × 60

87 828 hour × 60

667 872 = 24 hour × 24

42100 km = 300 km

$\frac{667872}{42100} = 15.86 = 16$

Number of complete orbits = 16

08.2		an answer of 15 scores **5** marks		AO2 4.8.1.3 4.5.6.1.2
	length of orbit taken from graph = 42 100 (km)		1	
	42 100 = 7.73 × time **or** time = $\frac{42\,100}{7.73}$	allow their distance = 7.73 × time	1	
	time (1 orbit) = 5446(s)	allow a value consistent with their distance	1	
	number of orbits = $(\frac{24 \times 3600}{5446})$ = 15.86	allow $(\frac{24}{1.51}) = 15.86$ allow a value consistent with their distance	1	
	number of orbits = 15	allow a value consistent with their distance an answer of 16 scores **4** marks	1	
	or length of orbit taken from graph = 42 100 (km) (1) $7.73 = \frac{\text{distance}}{24 \times 3600}$ (1) distance = 667 872 (km) (1)			
	number of orbits = $(\frac{667\,872}{42\,100})$ = 15.86 (1)	allow a value consistent with their two distances		
	number of orbits = 15 (1)	allow a value consistent with their two distances up to full marks can be awarded for a method calculating velocity in km/h and time in hours		

Commentaries and marks awarded

Example 1

The student has correctly plotted all the points from the table of data, although the crosses could have been clearer.

They have attempted to draw a curved line of best fit, but it has not been drawn through all the points and is quite rough. As such, the mark for lobf cannot be awarded.

Total: 2 marks

Example 2

The student has plotted five of the six points correctly, within the tolerance allowed, so gains 1 mark for the plotting.

The line of best fit is incorrect, so the mark for this cannot be awarded.

Total: 1 mark

Example 3

Although the student has not clearly indicated how the process works with the equipment shown, there is a basic understanding of the principles involved. They have recognised that the water will evaporate and condense on the plastic sheet, so gain marking points 2 and 3. There is nothing else of any merit in this answer.

Total: 2 marks

Example 4

The student has chosen an appropriate scale for the *y*-axis, and has correctly given four values, so gains the marks for this skill.

The three bars are not tidily drawn – the one for PVC actually overlaps the label for Polystyrene. They do **just** correspond to at least part of the label on the *x*-axis so the positioning is considered adequate to gain a mark. The bars for Polystyrene and PVC are at the correct heights, but that for Polyester is drawn at 1300 kg/m^3, which is outside the tolerance, so only 1 mark can be awarded for the bars.

Total: 3 marks

Example 5

The student has chosen bb for the mother's gametes (although any combination would have been accepted here) and given the correct combination in all four boxes, so gains the mark.

Total: 1 mark

Example 6

The student has not indicated which are the male and which the female gametes, but has drawn the gametes correctly, so gains the 'allow' mark here.

They have correctly derived the offspring genotypes, so gain the mark for this.

They have not identified which offspring will produce which type of milk, so do not gain the last marking point.

Total: 2 marks

Example 7

The student has stated that there is a negative correlation (which is the 'allow' mark here) and what they have gone on to state does not contradict this, so gains the mark.

Total: 1 mark

Example 8

The student has stated their response in terms of more concentrated acid, which is an allowed approach. They have stated that increasing the concentration increases the rate of reaction, which is sufficient for marking point 1.

They have also stated that at higher concentration there are more frequent collisions, which gains marking point 2 and is consistent with their first point.

They have not gone any further in their explanation, so do not gain the final marking point.

Total: 2 marks

Example 9

The student has chosen an appropriate scale for the *y*-axis and it is clearly labelled.

All five data points have been accurately plotted.

The line of best fit looks as if it has been drawn in two stages (perhaps the student did not have a long enough ruler), has a downward 'tail' at the right hand end and is actually a double line in the middle. It is of insufficient quality to gain the mark.

Total: 3 marks

Example 10

The student has correctly given potassium chloride as one of the products, so gains a mark. However, they have given two further products and although one is correct (bromine), one is incorrect (hydrogen). In this case, 'list principle' applies, and so the student cannot gain the second mark.

Total: 1 mark

Example 11

Although the student's diagram does not match the 'ideal' diagram in the mark scheme, the pair of electrons they have drawn between the two atoms has been taken as just sufficient for the mark. Six other atoms are shown on each atom, so the student gains both marks here.

Total: 2 marks

Example 12

The student has correctly read the numbers from the graph and calculated the difference.

Total: 1 mark

Example 13

The student has set out their answer so it is clear that they have completed all the stages required for this calculation correctly. They have used the graph to ascertain the length of an orbit at 300 km, have calculated the distance travelled by the satellite in one day and have completed the calculation to ascertain the number of orbits this distance equates to.

However, the student has rounded this number up to the nearest whole number. In this case rounding in this way gives the wrong answer to the question as the satellite will not have **completed** 16 orbits. This means they do not gain the final marking point.

Total: 4 marks

Levels of demand

Compare the features that differentiate the levels of demand of the following examples.

Example 5 and Example 6

In the lower-demand question students are given a framework to help them focus their answer, whereas at higher demand they need to make their own choices.

Example 7 and Example 8

The data in Example 7 is quite simple: melting point plotted against atomic number. Students simply have to describe what they see. In Example 8, there is more information for students to process; they need to link their knowledge of particle theory to concentration of acid and come up with an explanation of what the data is showing.

Example 12 and Example 13

The data in Example 12 is simple and straightforward, on a clear and simple scale. Students need to read two numbers from this graph and carry out a straightforward subtraction calculation.

Example 13 is clearly at a much higher level of demand: the scale used for the graph is still relatively straightforward (although the numbers are large) but there is more information outside of the graph that students need to be able to process in order to come up with an answer.

Example 9

How could this question be adapted to assess the same skills at a lower level of demand?
Examples:

- give the scale on the graph
- use a simpler scale (one small square per percentage point instead of two)
- use only positive numbers for the plotting (students can struggle with plotting negative numbers).

Example 10

How could this question be adapted to assess the same skill at a higher level of demand?
Examples:

- ask students to write a symbol equation
- give the products and reactants and ask students to balance the equation
- give the reactants and ask students to complete the balanced equation.

Example 14: 8464/B 2F and 2H

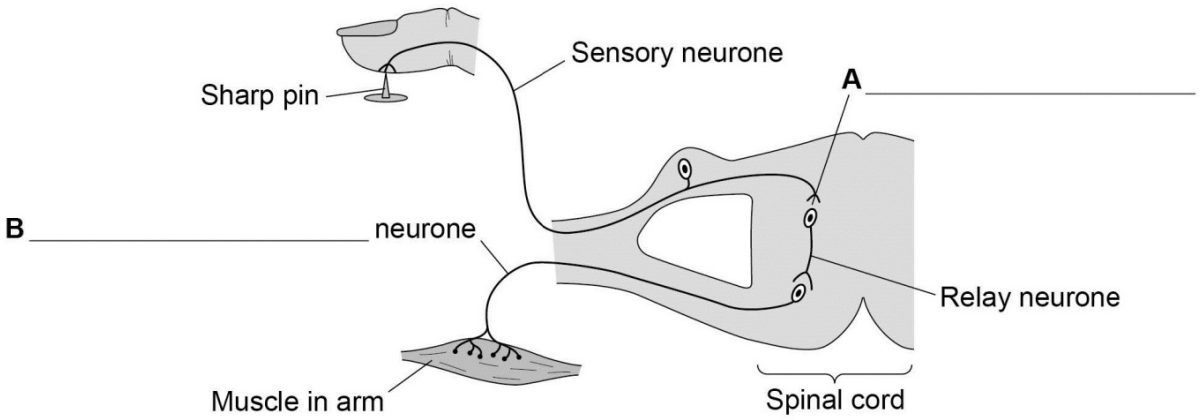
Comparing Foundation 3.3 and Higher 4.1

The questions cover the same Assessment Objective (AO1) and the same area of content (4.5.2). They use the same diagram, but in the Foundation paper there is more labelling, which acts as a prompt for low demand (grades 1-3). The task is more demanding on the Higher paper (grades 4-7), as students are not writing directly on the diagram and there are no prompts to help them.

Foundation question

0 3 . 3 **Figure 3** shows the nerve pathway when a person touches a sharp pin.

Figure 3



Name structures **A** and **B** on **Figure 3**

[2 marks]

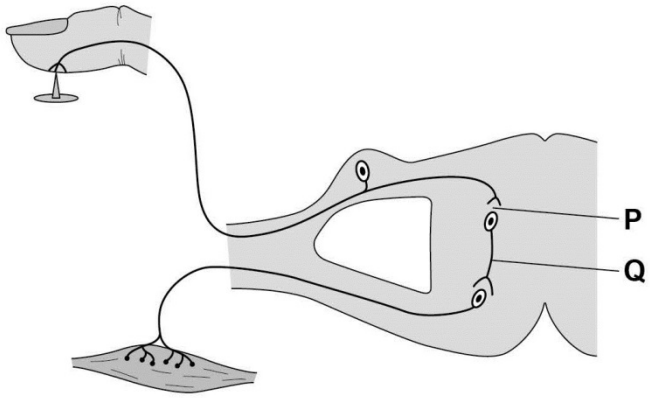
03.3	A = synapse B = motor (neurone)	in this order only	1 1	AO1 4.5.2

Higher question

0 4 This question is about the nervous system.

Figure 3 shows a reflex arc.

Figure 3



0 4 . 1 Name parts **P** and **Q** shown on **Figure 3**

[2 marks]

P _____

Q _____

04.1	(P) synapse	allow phonetic spelling	1	AO1 4.5.2
	(Q) relay neuron(e)	allow intermediate neuron(e)	1	

Comparing Foundation 3.4 and Higher 4.2

Both questions cover AO1 and the same subject content (4.5.2).

The Foundation tier question (low demand: grades 1-3) is very straightforward knowledge straight from the specification (known as AO1 in isolation) and scaffolded by making it multiple choice. The Higher tier question (high demand: grades 6-7) is more difficult as it requires students to think about how two parts of the pathway are different and to really understand what's happening (AO1 understanding rather than straight recall of knowledge).

Foundation question

0 3 . 4 When the finger touches the sharp pin, the muscle in the arm contracts to pull the arm away.

What type of action is this?

[1 mark]

Tick **one** box.

- A conscious action ☐
- A delayed action ☐
- A reflex action ☐

03.4	a reflex action		1	AO1 4.5.2

Higher question

0 4 . 2 Compare how information is transferred along a neurone with how information is transferred across gap **P**.

[2 marks]

04.2	(in neurone) as electrical impulse (across synapse / gap P) as diffusion / movement of chemical / neurotransmitter	allow electrical potential ignore signal / message if no mark awarded allow **1** mark for mention of electrical and chemical in that order	1 1	AO1 4.5.2

Comparing Foundation 3.5 and Higher 4.5

These two questions both assess AO2, application of knowledge and understanding, in the context of Section 4.5.2, using data analysis.

The Foundation question (grades 1-3) uses a low demand, straightforward maths question to do this, with a range of data to look at and a unit conversion.

The Higher question (grades 6-9) uses the same context (time taken for muscle to contract at different ages) but asks students to apply their knowledge in a different way: to look at a wider range of data and to describe a relationship rather than a simple calculation.

Foundation question

0 3 . 5 Doctors tested people of different ages to time how long it took between touching a sharp pin and the arm muscle contracting.

At each age they tested five men and calculated a mean value for the time.

Table 1 shows the results.

Table 1

Age in years	Mean time for muscle to contract in milliseconds
20	18
40	20
60	23
80	30

How much longer does it take for the muscle to contract at 80 years of age compared to at 20 years of age?

Give your answer in seconds.

[2 marks]

Time = _____ s

03.5	12 (ms) 0.012 (s)	an answer of 0.012 (s) scores **2** marks	1 1	AO2 4.5.2

Higher question

0 4 . 5 Doctors tested people of different ages to time how long it took between touching a sharp pin and the arm muscle contracting.

Table 3 shows the results.

Table 3

Age in years	Time for muscle to contract in milliseconds
30	18.9
40	20.2
50	23.1
60	26.7
70	31.3
80	37.0

Describe the relationship between age in years and time for the muscle to contract.

[2 marks]

04.5	as age (in years) increases the time for the muscle to contract increases at an increasing rate	do **not** accept directly proportional allow correct description of 'at an increasing rate'	1 1	AO2 4.5.2

Notes

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Contact us

T: 01483 477 756
E: gcsescience@aqa.org.uk

aqa.org.uk