GCSE
Sciences

Marking and improving student outcomes in practical work questions

Support booklet and further information

Published: January 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.

Information to Examiners

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

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 areas 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.

6 (or 4) 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.

If 4 marks

Level2: 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 Summer 2018 papers

Biology common question

0 6 This question is about cell structures.

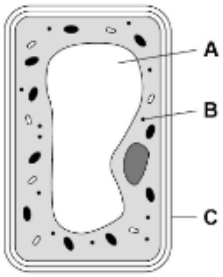
0 6 . 1 Draw **one** line from each cell structure to the type of cell where the structure is found.

[2 marks]

Cell Structure	Type of cell where the structure is found
Nucleus	Prokaryotic cells
Permanent vacuole	Plant cells only
Plasmid	Eukaryotic cells

0 6 . 2 **Figure 11** shows a plant cell.

Figure 11



What are the names of structures **A**, **B** and **C**?

[1 mark]

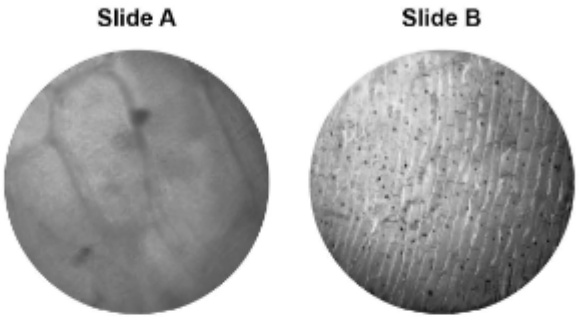
Tick **one** box.

Structure A	Structure B	Structure C	
Chloroplast	Vacuole	Cell wall	☐
Nucleus	Chloroplast	Cell membrane	☐
Vacuole	Mitochondrion	Cell membrane	☐
Vacuole	Ribosome	Cell wall	☐

A student observed slides of onion cells using a microscope.

Figure 12 shows two of the slides the student observed.

Figure 12



The cells on the slides are **not** clear to see.

0 6 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

0 6 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

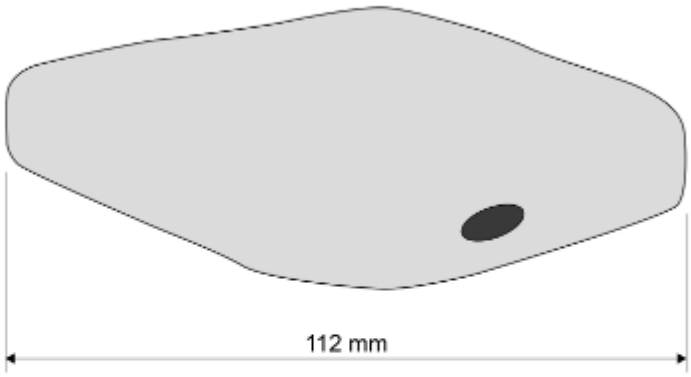
[2 marks]

Question 6 continues on the next page

0 6 . 5 The student made the necessary adjustments to get a clear image.

Figure 13 shows the student's drawing of one of the cells.

Figure 13



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

[3 marks]

Magnification = ×

Mark scheme

06.3	turn the (fine focusing) knob until the cells are in focus	allow focus it do **not** accept increase magnification ignore decrease magnification ignore clear ignore references to resolution / illumination ignore zoom in / out	1	AO2 4.1.1.2

Student responses

Script 1

0 6 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

Zoom in by a higher magnification

Script 2

0 6 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

Put the microscope into focus

Script 3

0 6 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

They Should Enlarge the microscope.

Script 4

0 6 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

Zoom out then in until focused.

Mark scheme

06.4	(rotate the) nosepiece / objective lens	allow change the (objective / eyepiece) lens	1	AO2 4.1.1.2
	to a higher power (lens)	allow (to) increase the magnification a comparator is required ignore change / adjust the magnification allow stronger or more powerful lens ignore references to resolution / illumination unqualified ignore zoom in / out ignore references to an electron microscope	1	

Student responses

Script 1

0 6 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

[2 marks]

They could increase the magnification, also raise the stage.

Script 2

0 6 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

[2 marks]

Zoom in

Script 3

0 6 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

[2 marks]

He/she should change the resolution on the microscope.

Script 4

0 6 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

[2 marks]

The student should zoom in, and ~~use~~ increase the magnification.

Mark scheme

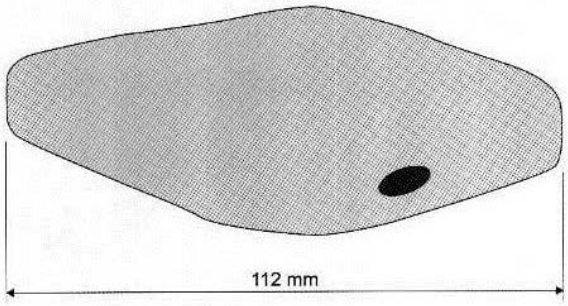
06.5		an answer of 400 (×) scores **3** marks		AO2 4.1.1.2
	conversion of units: (112 mm →) 112 000 (µm) **or** (280 µm →) 0.28 (mm)		1	
	(magnification =) $\frac{112}{0.28}$ **or** (magnification =) $\frac{112\,000}{280}$	allow **1** mark for no conversion of units 112 / 280 **or** incorrect value from step 1 correctly substituted	1	
	400 (×)	do **not** accept if units are given	1	
		if no other mark scored allow **1** mark for: magnification = $\frac{\text{size of image}}{\text{size of real object}}$ a triangle with words or letters in is insufficient, as the correct rearrangement is needed		

Script 1

0 6 . 5 The student made the necessary adjustments to get a clear image.

Figure 13 shows the student's drawing of one of the cells.

Figure 13



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

[3 marks]

112 ÷ 280 = 0.4

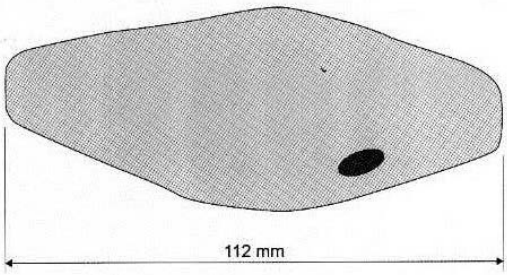
Magnification = × 0.4

Script 2

0 6 . 5 The student made the necessary adjustments to get a clear image.

Figure 13 shows the student's drawing of one of the cells.

Figure 13



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

[3 marks]

$\frac{112}{280} = 0.4$ 0.4 x 1000 = 400

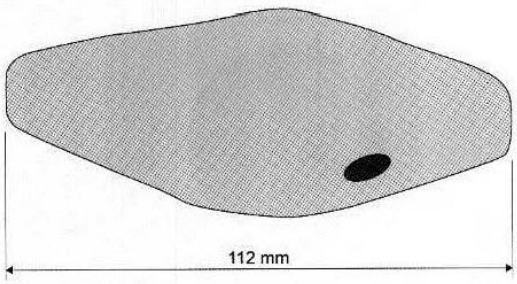
Magnification = × 400

Script 3

0 6 . 5 The student made the necessary adjustments to get a clear image.

Figure 13 shows the student's drawing of one of the cells.

Figure 13



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

[3 marks]

$\frac{112}{280}$ =

Magnification = ×

Chemistry common question

0 3 A student plans a method to prepare pure crystals of copper sulfate.

The student's method is:

1. Add one spatula of calcium carbonate to dilute hydrochloric acid in a beaker.
2. When the fizzing stops, heat the solution with a Bunsen burner until all the liquid is gone.

The method contains several errors and does not produce copper sulfate crystals.

Explain the improvements the student should make to the method so that pure crystals of copper sulfate are produced.

[6 marks]

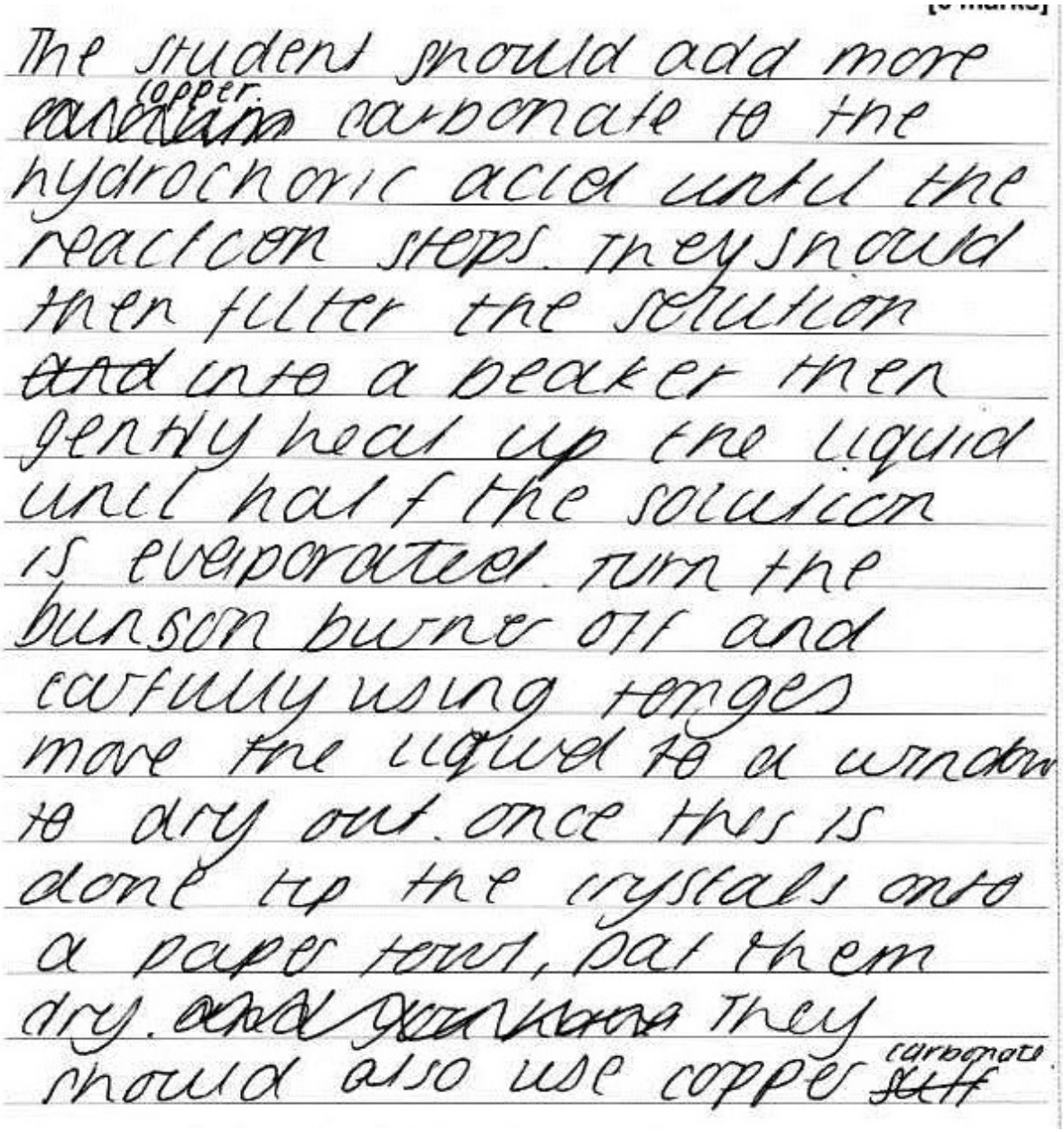
Question	Answers	Mark	AO / Spec. Ref.
03	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	2xAO1/2 2xAO3/3a 2xAO3/3b 5.4.2.3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. 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	
	Indicative content: • uses sulfuric acid not hydrochloric acid **or** sulfuric acid needed • uses copper carbonate/oxide not calcium carbonate **or** copper carbonate/oxide needed • add solid until solid remains **or** is in excess **or** no more reacts / dissolves so that most / all of the acid reacts • filter to remove excess **or** unreacted carbonate / oxide / solid • heat gently **or** partially evaporate **or** leave until crystals appear **or** to crystallise For level 3 **the correct chemicals must have been selected**		

Student responses

Script 1

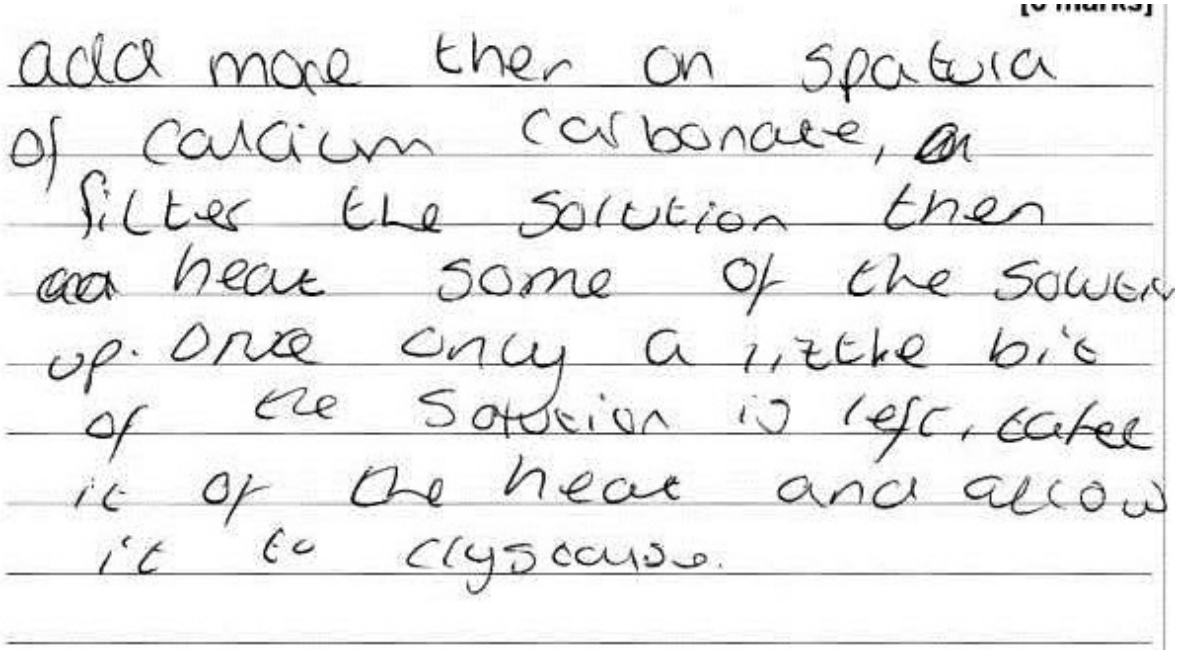
Adding calcium carbonate to dilute hydrochloric acid will not produce copper sulphate solution. Instead, the student should add copper oxide into dilute sulphuric acid in a beaker. The student should carry on adding copper oxide to the dilute sulphuric acid until they cannot react. The student should stir the solution using a glass rod. And before adding the copper oxide, gently heat the sulfuric acid until it's almost boiling. Now the student should filter out the excess, insoluble copper oxide using filtration. Next, pour some of the solution into an evaporating dish and gently heat over a beaker of boiling water until almost boiling. Now leave the evaporating dish in a cool dry place for 24 hours and pure crystals of copper sulphate should be produced.

Script 2



The student should add more copper carbonate to the hydrochloric acid until the reaction stops. They should then filter the solution into a beaker then gently heat up the liquid until half the solution is evaporated. turn the bunson burner off and carfully using tonges move the liquid to a window to dry out. once this is done tip the crystals onto a paper towel, pat them dry. They should also use copper carbonate stuff.

Script 3


add more ther on spatula of calcium carbonate, filter the solution then heat some of the sower up. once only a little bit of the solution is left, take it of the heat and allow it to crystallise.

Physics common question

0 2 A student wanted to determine the density of the irregular shaped object shown in **Figure 3**

Figure 3

0 2 . 1 Plan an experiment that would allow the student to determine the density of the object.

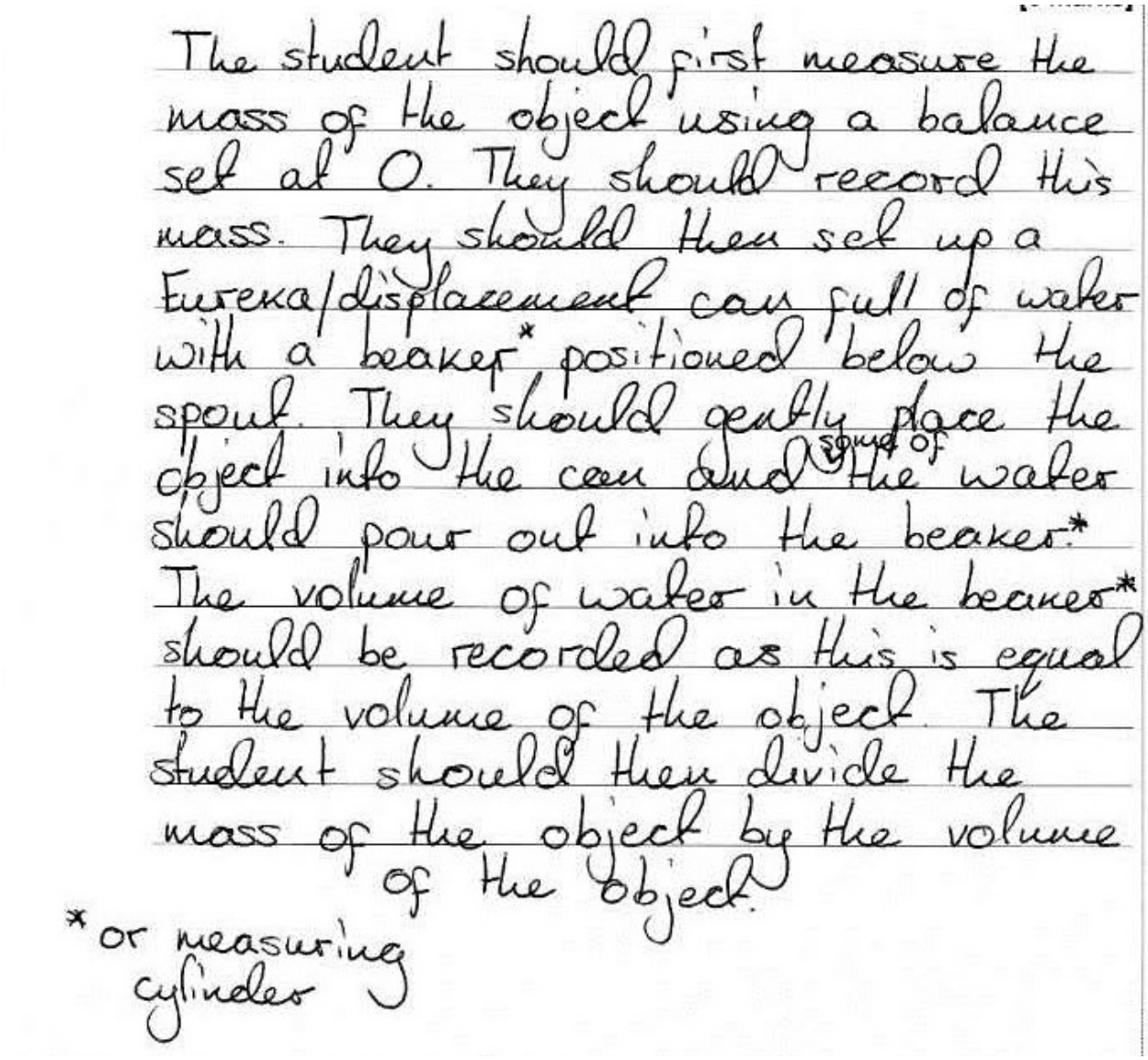
[6 marks]

Mark scheme

02.1	**Level 3:** The plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.3.1.1	E
	Level 2: The 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 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		
	Indicative content • measure mass • use a top pan balance or scales • part fill a measuring cylinder with water • measure initial volume • place object in water • measure final volume • volume of object = final volume – initial volume • fill a displacement/eureka can with water • water level with spout • place object in water • collect displaced water • measuring cylinder used to determine volume of displaced water • use of density = mass / volume			

Student responses

Script 1



The student should first measure the mass of the object using a balance set at 0. They should record this mass. They should then set up a Eureka/displacement can full of water with a beaker* positioned below the spout. They should gently place the object into the can and the sound of water should pour out into the beaker.* The volume of water in the beaker* should be recorded as this is equal to the volume of the object. The student should then divide the mass of the object by the volume of the object.

* or measuring cylinder

Script 2

Displacement Reaction

- Place the object on a set of scales and record the result for the mass
- Fill beaker with 10ml of water
- Place the object into the water and record how many ~~ml~~ ml it increases (ml)
- Then to work out the volume do you new recording - 10ml
- And to work out the density do the mass x volume

Script 3

Firstly they would measure the mass of the object in Kilog-rams. Secondly they should fill a eurika can to just below / level with the spout. They should then place a beaker under the spout to meas ure the volume of the displaced water. By placing the chess peece in the water it will displace a volume of water equivalent to its own volume. The student should the use the formula $\rho = \frac{m}{v}$ in order to gain the density. Recording their value with units kg/cm^3.

Script 4

to work out the density of an irregular object the student must work out the mass and divide what ever the mass is by the volume. an experiment to do this would be:

1 - get an irregular object and a set of scales.

2. - put the irregular object on the scales to work out the mass.

3 - then work out the volume of the object.

4 - finally divide the mass of the irregular object by the volume to work out the density.

Physics common question

0 2 . 2 Another student did a similar experiment.

He determined the density of five common plastic materials.

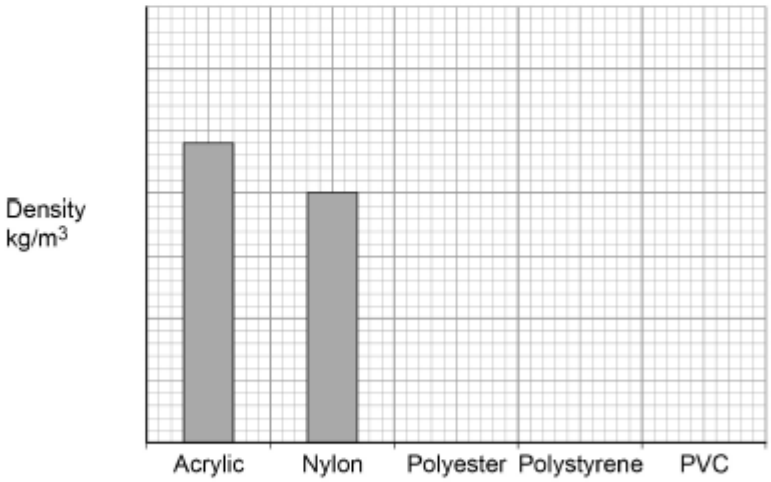
Table 1 shows the results.

Table 1

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

Figure 4 shows the results plotted in a bar chart.

Figure 4



Complete **Figure 4**

You should:

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

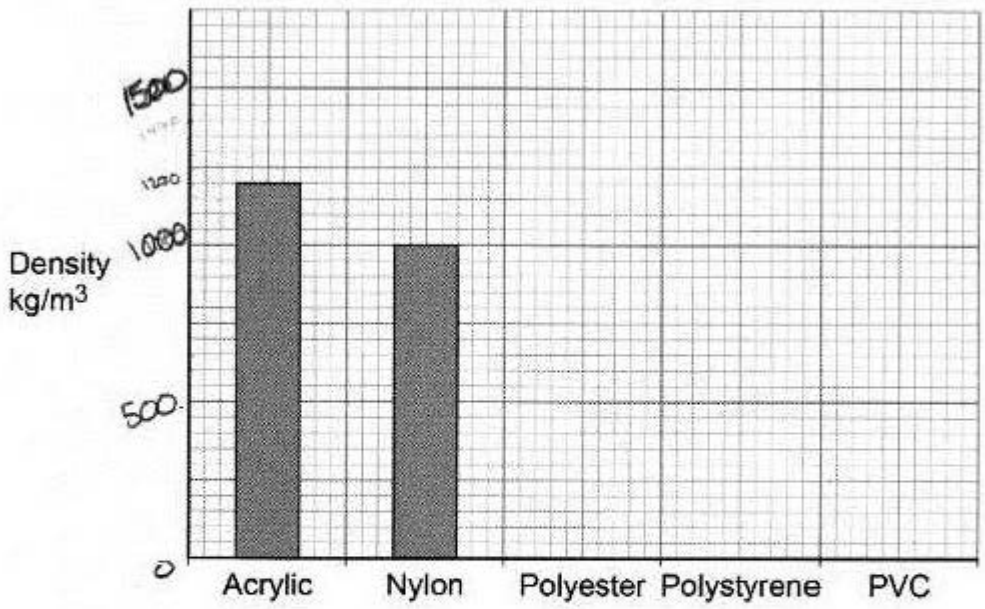
[4 marks]

Student responses

Script 1

Figure 4 shows the results plotted in a bar chart.

Figure 4



Complete **Figure 4**

You should:

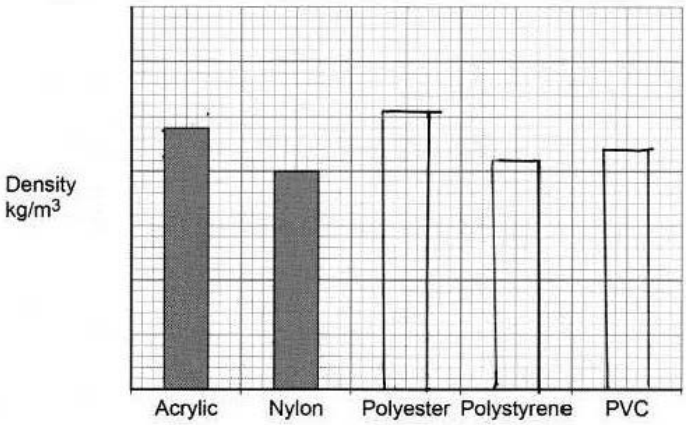
- Write the correct scale on the y-axis.
- Draw the bars for polyester, polystyrene and PVC.

[4 marks]

Script 2

Figure 4 shows the results plotted in a bar chart.

Figure 4



plastic material.

Complete **Figure 4**

You should:

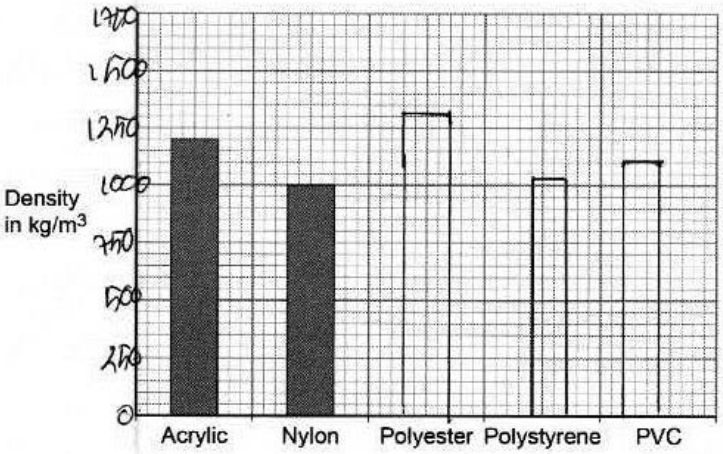
- Write the correct scale on the y-axis. ✓
- Draw the bars for polyester, polystyrene and PVC.

[4 marks]

Script 3

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]

Physics common question

0 2 . 3 The student is given a piece of a different plastic material.

The student determined the density of the material three times.

Table 2 shows the results.

Table 2

	Density in kg/m^3
1	960
2	1120
3	1040

Determine the uncertainty in the student's results.

[2 marks]

Uncertainty = _____ kg/m^3

Mark scheme

02.3	(1120 – 960) / 2 = 80 (kg/m^3)	an answer of 80 scores **2** marks ignore + and/or – signs an answer of 160 scores **1** mark	1 1	AO3 6.3.1.1	E

Student responses

Script 1

0 2 . 3 The student is given a piece of a different plastic material.

The student determined the density of the material three times.

Table 2 shows the results.

Table 2

	Density in kg/m^3
1	960
2	1120
3	1040

Determine the uncertainty in the student's results.

[2 marks]

1120 - 960 = 160

Uncertainty = 160 kg/m^3

Script 2

0 2 . 3 The student is given a piece of a different plastic material.

The student determined the density of the material three times.

Table 2 shows the results.

Table 2

	Density in kg/m^3
1	960
2	1120
3	1040

Determine the uncertainty in the student's results.

[2 marks]

$\frac{\text{Range}}{2} = \frac{1120 - 960}{2}$

Uncertainty = 80 kg/m^3

Script 3

0 2 . 3 The student is given a piece of a different plastic material.

The student determined the density of the material three times.

Table 2 shows the results.

Table 2

	Density in kg/m^3
1	960
2	1120
3	1040

Determine the uncertainty in the student's results.

[2 marks]

1040 + 1120 + 960 = 3120 ÷ 3 = 1040

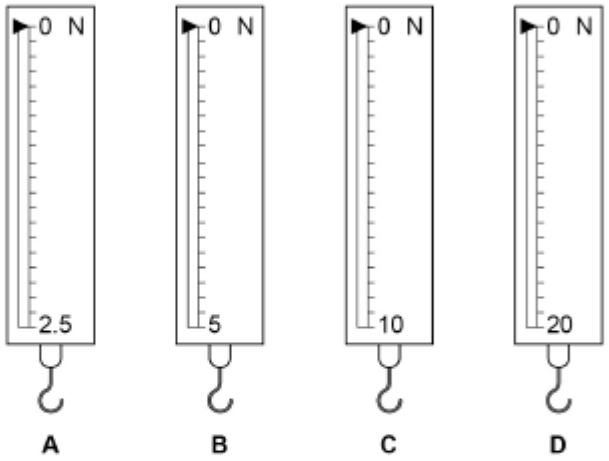
Uncertainty = 1040 kg/m^3

Physics P2 Higher Q4

0 4 . 1 **Figure 6** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter _____

Reason _____

_____

Mark scheme

04.1	**D** needs the greatest force to extend the spring the same amount	allow 20 (N) allow fourth (newtonmeter) reason only scores if correct newtonmeter selected	1 1	AO1 6.5.3

Student responses

Script 1

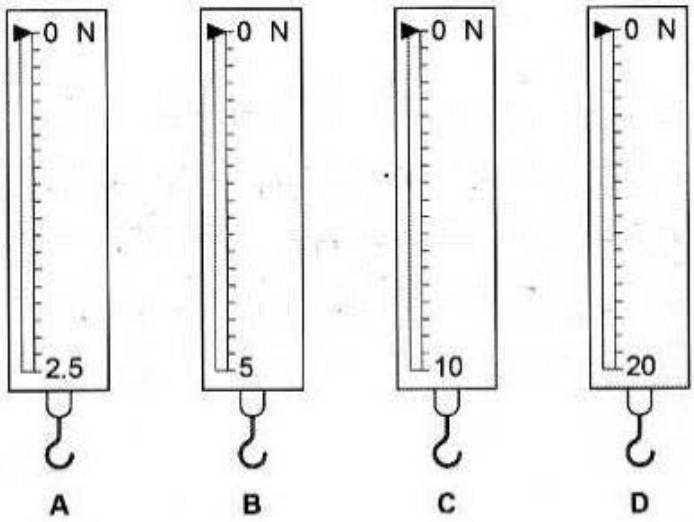
0 4 . 1 **Figure 6** shows four newtonmeters.

$F = kx$

$20 = k$

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter D

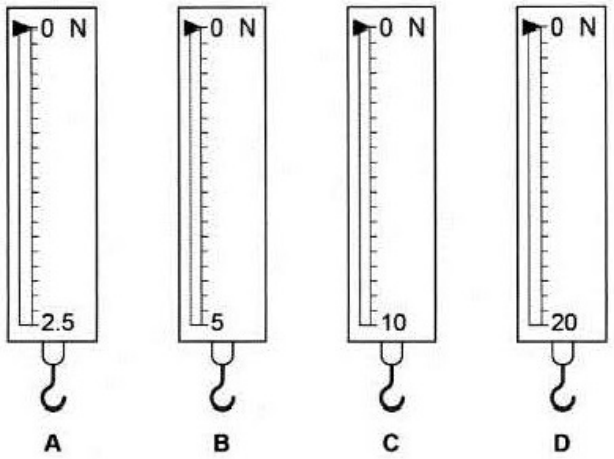
Reason It allows the most force to be applied with equal amounts of extension

Script 2

0 4 . 1 **Figure 6** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter D

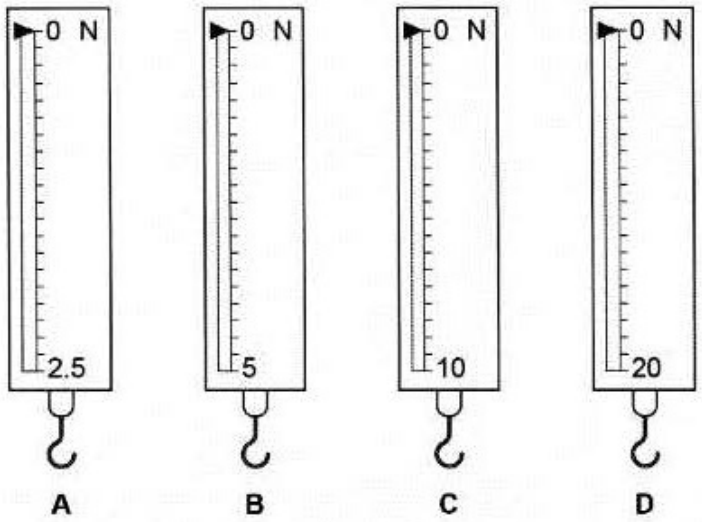
Reason It can go up to the the highest N

Script 3

0 4 . 1 **Figure 6** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter C

Reason The spring is tighter, therefore it is able to weigh heavier objects.

Physics P2 Higher Q4

0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7

Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error _____

Correction _____

_____

Mark scheme

04.2	zero (error) any **one** from: • record the value and subtract from readings taken • adjust the newtonmeter to zero	allow systematic (error) allow subtract 1 from all readings	1 1	AO3 6.5.3

Student responses

Script 1

0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7

Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error: Unfair start

Correction: The spring should be tightened so the arrow points to 0N.

Script 2

0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7

Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error Technical

Correction the spring could over-
Steten, replace the spring

Script 3

0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7

Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error Zero error

Correction Adjust the newtonmeter to start on ON, or take away 1N from each reading to get actual reading/extension

Presentation slides

Marking and improving student outcomes in practical work questions

Elise Reece

January 2019

Welcome

Outline for the session

- Mark schemes and how we apply them
- Practical related questions in GCSE sciences
- Exercise using student work

Mark schemes and how we apply them

- What is the mark scheme for?
- Our GCSE Science mark schemes
- Points-based mark schemes
- Levels of response mark schemes

What is the mark scheme for?

- To evaluate the evidence from each student fairly
- To reward positive achievement
- To differentiate purely on evidence of subject knowledge, understanding and skills
- To fully and consistently reflect the agreed interpretation of command words
- To fully reflect the purpose of each assessment
- To credit appropriate responses that reflect the different ways in which learners may demonstrate what they know, understand and can do

Structure of our GCSE Science mark schemes

- The 'Information to examiners' section:
  - general guidance on the parts of the mark scheme
  - explicit guidance on what parts of the mark scheme mean and how they should be applied
  - marking levels of response questions
  - exactly the same for all GCSE Sciences.
- Detailed mark scheme for each question:
  - specific guidance on what is/is not acceptable
  - points or levels of response marked.

Points-based mark schemes

- Marks given for each correct point a student gives
- Explicitly define correct (and incorrect) answers
- Emphasis is on the correctness of the response, not the quality
- Usually used for lower-tariff questions (<10 marks)
- If well written are very reliable

Levels of response mark schemes

- Used for open questions where there is a variety of ways for students to arrive at a mark
- Reward the overall quality of the answer
- Divide performance into chunks of marks (levels) on a continuum
- Describes the performance at each level
- Generic level descriptors linked to specific command words
- Same descriptors apply to all GCSE sciences
- Section of indicative content specific to each question

Practical related questions in GCSE sciences

- Regulatory requirements
- How do we assess practical skills?
- Common issues with practical related questions in Summer 2018

Requirements for assessment of practical skills

Assessment in relation to practical work:

- the number of marks is no less than 15% of all the marks allocated.
- all three assessment objectives must be covered
- questions and tasks must draw on the theoretical and practical aspects of experimentation
- students are required to show and apply:
  - knowledge and understanding of practical activities
  - scientific thinking
  - use experimental skills and strategies
  - analyse and evaluate information.

How do we assess practical skills?

- Planning, explaining and evaluating procedures
- Knowledge and understanding of how to use apparatus and techniques
- Understanding of sampling techniques
- Safety and risk management in practical contexts
- Understanding and appropriate use of scientific terminology, eg accuracy, precision, variables, uncertainty
- Reading scales or taking measurements
- Appropriate mathematical procedures and analysis

Common issues in Summer 2018

- Lack understanding about the science underlying the practical's - model of osmosis cell and transects chemicals that make a salt and electrolysis acceleration and density.
- Didn’t fully understand why they had carried out each step in the practical.
- Unclear why they had taken specific measurements and the equipment needed to do this.
- Use of vague terms such as ‘amount’, ‘fair’, ‘results’.

Common issues in Summer 2018

Areas of working scientifically in the context of the required practicals:

- repeatable or its significance
- identify control variables and other variables
  term ‘fair’ is always inadequate unless suitably qualified types of errors
- how to improve accuracy - improves inaccuracy is insufficient for a type of experimental error, human error is insufficient.

Practical questions on Trilogy paper1

- Biology
  Foundation: Q2 photosynthesis, Q3 osmosis, **Q6 cells and microscopes (common)**
  Higher: Q3 photosynthesis, Q4 osmosis
- Chemistry
  Common questions Q5 (Q1H) electrolysis, Q7 (Q3H) salts
- Physics
  Common question Q7 (Q2H)

Exercise using student work

- Structure of a required practical question
- Using equipment from the ATs correctly
- Marking calculations
- Methods and plans
- Graphs
- Working scientifically

How did we do?

- Please rate this session on the **Sched Conference app**.
- Using the postcards provided, please write:
  - one thing you enjoyed about our session or will take away for your teaching
  - one thing you feel could be improved.
- Please hand your postcard in as you leave.

Get in touch

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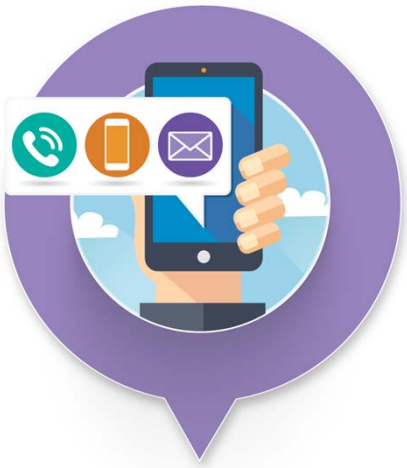

AQA Realising potential

Thank you

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Notes

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