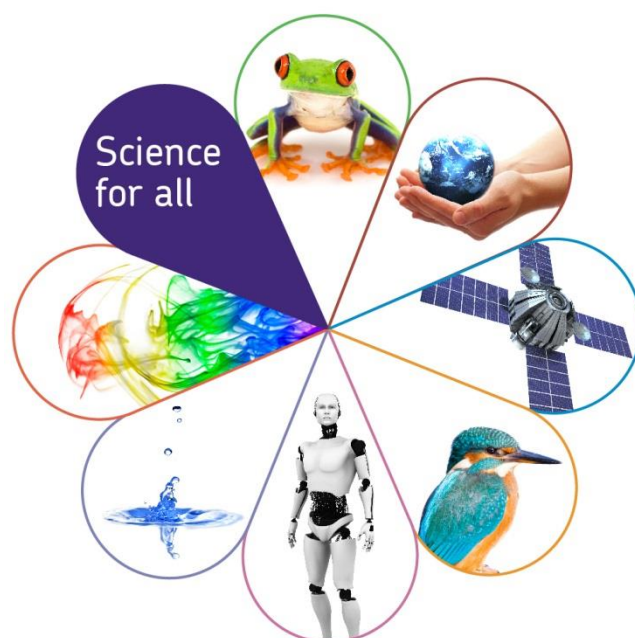


GCSE Science

Spring Hub Network Meeting

Accompanying materials

Published: Spring 2018



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GCSE Science Spring Hub Network Meeting

Spring 2018



This meeting will be recorded

Exam boards have an Ofqual requirement to record event audio.

Recordings are kept for one year and not shared as an accompaniment to session resources.

The recording will begin now.

Agenda

- Feedback from the mock exams using MERIT (Examprom analysis tool)
- Intervention
- Revision resources and ideas
- Marking extended response questions
- Updates
- Focus for summer

Feedback from mock exams

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Second set of specimen assessment materials

- Teacher feedback has identified some errors
- Where possible amendments have been made and new versions of papers and mark schemes have been posted on SKM
- We won't be able to discuss individual issues with questions in this meeting. Please refer any queries to the science team via teacher services gcsescience@aqa.org.uk

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Accessing MERiT



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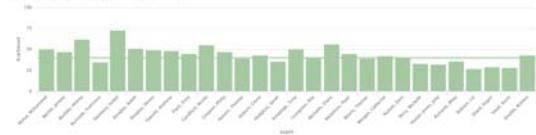


Accessing MERiT

The table below provides information about the performance of your pupils at test and at post-test.

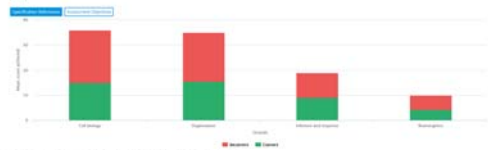
Test	Number of pupils	Marks available	Your group Mean score	POPULATION Mean score
Biological Higher	26	100	49.5	50.0
1. Cells (Paper 1: Biology 1)	26	100	43.0	39.0
Cell Biology	26	30	14.0	14.0
Organisation	26	30	15.0	12.0
Interaction and response	26	30	16.0	12.0
Bioenergetics	26	30	16.0	12.0

The graph below shows how your pupils performed on Biological Higher.



Accessing MERiT

The graph below shows how your pupils performed in each strand.
The length of each bar shows the number of marks available in the strand and the proportion of the bar that is green shows the mean marks achieved. A large area of red would indicate an area of poor performance.



The graph below shows the score distribution in SAMS 2 Paper 1H (BMS1/1H) for your pupils.



Accessing MERiT

The graph below shows performance per question for SAMS 2 Paper 1H (BMS1/1H).

Click the data point to view the question and mark scheme shown below the chart.



Question 14: What is produced during anaerobic respiration in humans? (2 marks)

Test type: Multiple choice

Options: Carbon dioxide, Carbon dioxide and lactic acid, Lactic acid, Oxygen and water

Accessing MERiT

The table below provides information about the performance of your pupils on each question in SAM5.2 Paper 1H (8461/1H).

[illegible]

Interpreting MERiT data

- Sample size is small compared with GCSE entry for example in 2017
 - Additional science in excess of 300,000
 - Separate science in excess of 140,000
- Mark scheme has not been standardised
- Teachers have not been standardised so marking may be inconsistent
- Final award is made on all papers combined
- Cannot know whether the sample is representative of the whole cohort

What does the analysis show?

- Rank order against the sample population.
- No indication of grades. For example the average mean mark on the Higher Tier doesn't correspond to a Grade 6.
- The type of questions students found challenging.

Analysis from MERiT: Trilogy

Taken 2/2/2018	Tier	Total marks	Mean mark	Mean %
Trilogy Biology	F	70	20	29
Trilogy Chemistry	F	70	17	24
Trilogy Physics	F	70	23	33
Trilogy Biology	H	70	18	26
Trilogy Chemistry	H	70	15	21
Trilogy Physics	H	70	19	27

Approximate entries:
Foundation Tier 12,000
Higher Tier 14,000

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Analysis from MERiT: Synergy

Taken 2/2/2018	Tier	Total marks	No of students	Mean mark	Mean %
Paper 1	F	100	287	30	32
Paper 2	F	100	74	23	23
Paper 3	F	100	206	32	32
Paper 4	F	100	47	28	32
Paper 1	H	100	262	21	22
Paper 2	H	100	128	21	19
Paper 3	H	100	93	22	23
Paper 4	H	100	73	22	39

Approximate entries: 300 entries for each tier

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Analysis from MERiT: Separate sciences

Taken 2/2/2018	Tier	Total marks	Mean mark	Mean %
Biology	F	100	33	33
Chemistry	F	100	33	33
Physics	F	100	30	30
Biology	H	100	39	39
Chemistry	H	100	36	36
Physics	H	100	37	37

Approximate entries:
Foundation Tier 1,000
Higher Tier 10,000

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Headlines from item analysis:

Types of question students found challenging:

- Applying knowledge and understanding in unfamiliar contexts.
- Using formulae in unfamiliar contexts.
- Using maths skills in a scientific context.
- Linking ideas from different parts of specification.
- 'Explain' questions.

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Headlines from item analysis:

- At low demand, students could use formulae but found unit conversion challenging.
- At standard demand, students couldn't recall equations correctly, so couldn't apply them.
- Lack of understanding of language of working scientifically: accurate, precise, resolution, controls.
- Lack of knowledge of why repeats are done, what particular pieces of equipment are used for.

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What did you find out from your school data?

- In general, how did your students find the papers?
- Did students have enough time to finish the paper?
- Were there particular types of question students found challenging?
- How did your students manage with the physics formulae?

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Intervention

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Intervention

- One approach is to put the required practicals at the heart of the revision lesson.
- Revise content, maths skills, scientific language and working scientifically through the required practical.
- Examples on Teachit:
 - microscopes
 - rates of reactions

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Intervention: how to address areas of concern

The next step is to consider how to tackle some of these areas of concern in the short time available.

In summary the main areas seem to be around:

- how to revise the basics
- how to address AO2
- all things practical
- maths in science
- understanding and applying formulas

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Intervention: how to address areas of concern

Choose one of the areas mentioned, or something else that you have identified in your school.

Discuss how your department is going to tackle this.

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Revision resources

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Revision resources

- Please share any good revision resources/strategies you are using.
- [21 GCSE Physics Equations song](#)
- [Dunlosky research on how improving how students learn](#)

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Revision resources

- Guardian article: [What every teacher should know about memory](#)
- Required practical videos:
 - are there any references to working scientifically and the ATs?
 - does the presenter use the subject specific vocabulary connected to the practical?

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Extended response questions and mark schemes

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What is extended response?

An extended response is defined by Ofqual as:
“...evidence generated by a Learner which is of sufficient length to allow that Learner to demonstrate the ability to construct and develop a sustained line of reasoning which is **coherent, relevant, substantiated and logically structured**”.

Use a holistic approach to marking, which takes into account the many ways a student can correctly answer a given question.

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What does this mean for our assessments?

- May require linking in terms of knowledge, understanding and skills.
- Can be a multi-step calculation.
- Typically use the following command words: describe, explain, design/plan, compare, evaluate, calculate.
- Requires an answer that clearly communicates scientific ideas (4–6 marks).
- Not all questions worth 4–6 marks will be classified as extended response.
- Requires a coherent and relevant sustained line of reasoning.

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Levels of response mark schemes

- Allow students to gain credit for the science they know using a holistic marking technique.
- Generic level descriptors linked to specific command words.
- Same descriptors apply to all GCSE science specifications.
- Different from QWC as there is no communication mark as it is incorporated into the holistic marking approach.

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Applying the levels of response mark scheme

- First determine the level by:
 - holistically looking at the overall quality of the answer
 - taking into account the descriptor for each level
 - looking at the indicative content
 - using a 'best-fit' approach.
- Then determine the mark within the level.

Choose one of the student responses and mark it.

How did you do?

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Marks awarded

Example	Question reference	Marks awarded		
1	SAMs 1 Physics 2H Explain	2	4	
2	SAMs 2 Physics 2H Describe	1	6	3
3	SAMs 2 Synergy 3F Explain	3	1	
4	SAMs 2 Trilogy Chemistry 2F Plan	1	6	
5	SAMs 2 Biology 1H Evaluate	5	3	
6	SAMs 2 Trilogy Biology 2H Explain	1	3	

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Updates

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GCSE resources update

- Updated practical handbook
 - titles not changed
 - removed extension activities from methods
 - removed any inappropriate ATs
 - not editable format
- Technician advisors for GCSE as well as A-level
- Extended end of Year 10 test will be available in May 2018

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ELC

- Teachers need to standardise their marking using teacher online standardisation (T-OLS)
- T-OLS has examples of marked TDAs to support
- Your exams officer can set you up with log-in details
- A teacher network group is being set up

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Suggestions for the summer meetings

- Exam results analysis (ERA)
- Teaching ideas for setting the required practicals in an unfamiliar context
- Resources for new teachers
- Review of route through course:
 - What went well?
 - What needs attention?
- Mapping required practicals, working scientifically, subject specific vocab

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How did we do?

Please take a moment to complete a brief evaluation form for today's event. Your feedback is very important to us as it helps us improve and plan future training.

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alevelscience@aqa.org.uk

Call: 01483 477756



Thank you

GCSE SAMs 2 Paper 1

performance data

The following tables have been generated from the MERiT data set. The sample size is small compared with summer GCSE entry. The mark scheme has not been standardised and teachers were not standardised so marking may be inconsistent. The final award is made on all papers combined.

The tables below indicate the mark required for a student to fall within that particular rank of the sample population. This information is NOT an indication of potential future grade boundaries.

Separate Sciences – 8461, 8462, 8463

Rank	Biology P1 Foundation	Biology P1 Higher	Chemistry P1 Foundation	Chemistry P1 Higher	Physics P1 Foundation	Physics P1 Higher
Top 90%	19	21	16	16	15	18
Top 80%	25	26	23	22	22	24
Top 70%	29	31	28	27	26	29
Top 60%	33	36	33	32	30	33
Top 50%	36	40	37	37	34	38
Top 40%	39	45	41	42	37	43
Top 30%	42	50	45	47	41	48
Top 20%	46	56	50	53	45	54
Top 10%	51	64	54	63	51	63

Combined Science: Trilogy – 8464

Rank	Biology P1 Foundation	Biology P1 Higher	Chemistry P1 Foundation	Chemistry P1 Higher	Physics P1 Foundation	Physics P1 Higher
Top 90%	10	9	9	7	10	8
Top 80%	14	12	12	10	17	12
Top 70%	17	14	14	12	20	15
Top 60%	19	16	16	14	23	17
Top 50%	22	19	18	16	26	20
Top 40%	24	22	20	18	28	23
Top 30%	27	25	23	21	31	26
Top 20%	30	28	26	24	34	30
Top 10%	34	34	31	30	38	36

Intervention

Planning revision lessons – one approach:

One approach to revising GCSE Combined Science is to use the required practicals as the focus of the lesson. Within each lesson you would then incorporate the related content from the specification, one or two working scientifically skills and any challenging maths skills that relate to that practical.

Teachit have used this approach to produce a number of lesson plans, which you can find here: [teachitscience.co.uk/resources/ks4/cells-organs-and-systems-ks4/biology/rp-microscopy-revision-activities/30133](https://www.teachitscience.co.uk/resources/ks4/cells-organs-and-systems-ks4/biology/rp-microscopy-revision-activities/30133)

[teachitscience.co.uk/resources/ks4/chemical-reactions-and-energetics/chemistry/rp-rates-of-reaction-revision/30527](https://www.teachitscience.co.uk/resources/ks4/chemical-reactions-and-energetics/chemistry/rp-rates-of-reaction-revision/30527)

The table below is an extract from the teachers' guide: intervention/revision plan which you can find on the teach section of our website. It attempts to illustrate the different components of the specification you could pull together into a revision lesson around each of the required practicals.

This framework can be used as a starting point, the next step would be to add the classroom activities from Teachit and other sources to make your interactive revision lesson for your students.

Biology required practical

Enzymes	Spec.ref.	Skills	Content	Key words
<p>Investigate the effect of pH on the rate of reaction of amylase enzyme.</p> <p>Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater.</p>	<p>Trilogy 4.2.2.1</p> <p>Synergy 4.7.4.7</p> <p>Biology 4.2.2.1</p>	<p>AT 1 – use of appropriate apparatus to make and record a range of measurements accurately including time, temperature, volume of liquids and pH.</p> <p>AT 2 – safe use of appropriate heating devices and techniques including use of a Bunsen burner and water bath or electric heater.</p> <p>AT 5 – measurement of rates of reaction by a variety of methods including using colour change of an indicator.</p> <p>WS 2.4, 2.5 MS 1a, 1c</p>	<p>Enzymes as biological catalysts:</p> <ul style="list-style-type: none"> • their function in process of digestion • simple structure and how they work • how temperature and pH affect them <p>Names of enzymes and type of molecule they act on:</p> <ul style="list-style-type: none"> • Carbohydrases: starch, carbohydrate, glucose • Lipases: fats and oils, lipids, glycerol and fatty acids • Proteases: proteins, amino acids <p>Function of liver</p> <p>pH scale</p> <p>Why use a water bath, why use continuous sampling</p> <p>Carry out rate calculations</p>	<p>Catalysts</p> <p>Active site</p> <p>Substrate molecule</p> <p>Denature</p> <p>Carbohydrase</p> <p>Lipids</p> <p>Glycerol</p> <p>Fatty acids</p> <p>Protease</p> <p>Amino acids</p>

Chemistry required practical

Making salts	Spec. ref.	Skills	Content	Key words
Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.	Trilogy 5.4.2.3 Synergy 4.7.3.2 Chemistry 4.4.2.3	AT 2 – safe use of appropriate heating devices and techniques including the use of a Bunsen burner and water bath or electric heater. AT 4 – safe use of a range of equipment to purify and/or separate a chemical mixture including evaporation, filtration and crystallisation. AT 6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products. WS 2.3, 2.4	Acids and alkalis Reactions of acids with metals and metal carbonates – word equations pH scale and neutralisation Weak and strong acids (HT) Making soluble salts from metals, metal oxides, hydroxides and carbonates Processes – filtration and crystallisation	Acid Base Alkali Salt Soluble Insoluble Neutralisation Reactants Filtration Crystallisation

Physics required practical

Resistance	Spec. ref.	Skills	Content	Key words
<p>Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits.</p> <p>This should include:</p> <ul style="list-style-type: none"> the length of a wire at constant temperature combinations of resistors in series and parallel. 	<p>Trilogy 6.2.1.3</p> <p>Synergy 4.7.2.2</p> <p>Physics 4.2.1.3</p>	<p>AT 1 – use appropriate apparatus to measure and record a range of measurements accurately including length.</p> <p>AT 6 – use of appropriate apparatus to measure current, potential difference and resistance and to explore the characteristics of a variety of circuit elements</p> <p>AT 7 – use circuit diagrams to construct and check series and parallel circuits including a variety of common circuit elements</p> <p>WS 2.4, 3 (Analysis and evaluation), 4.2, 4.3</p>	<p>Standard circuit symbols</p> <p>Difference between series and parallel circuits</p> <p>Electrical charge and current</p> <p>Charge flow = current \times time</p> <p>The relationship between current, resistance and potential difference</p> <p>Potential difference = current \times resistance</p> <p>Explain behavior of current/ potential difference and resistance in series and parallel circuits</p> <p>$R = R_1 + R_2$</p>	<p>Electrical charge</p> <p>Current</p> <p>Potential difference</p> <p>Resistance</p> <p>Amps</p> <p>Ohms</p> <p>Volts</p>

Extended response questions and mark schemes

An extended response question allows the student to demonstrate the ability to construct and develop a sustained line of reasoning which is **coherent, relevant, substantiated and logically structured**.

Questions may require linking in terms of knowledge, understanding and skills from more than one area of the specification. They can also be a multi-step calculation (two or more steps are completed in the correct order).

Typically they have a command word such as: calculate, compare, describe, design /plan, evaluate and explain.

Marks awarded can range from 4 to 6 depending on the questions so 1, 2 or 3 levels may appear in the mark scheme.

Extended questions are marked using a levels of response mark scheme. This is a holistic approach to marking which takes into account the many ways a student can correctly answer a given extended question. As with all our mark schemes, this mark scheme is designed to ensure students are credited with the maximum marks possible for their answers.

How extended response questions are marked

General information taken from the mark scheme

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.

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.

Explanation of 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.

6 or 4 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

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

Activity

Choose one of the following student responses and mark it.

First determine the level by:

- holistically looking at the overall quality of the answer
- taking into account the descriptor for each level
- looking at the indicative content
- using a 'best-fit' approach.

Then determine the mark within the level.

Example student responses

The following responses and examiner comments provide teachers with the best opportunity to understand the application of the mark scheme.

The student responses are examples of typical answers only and were not written by real students.

Physics

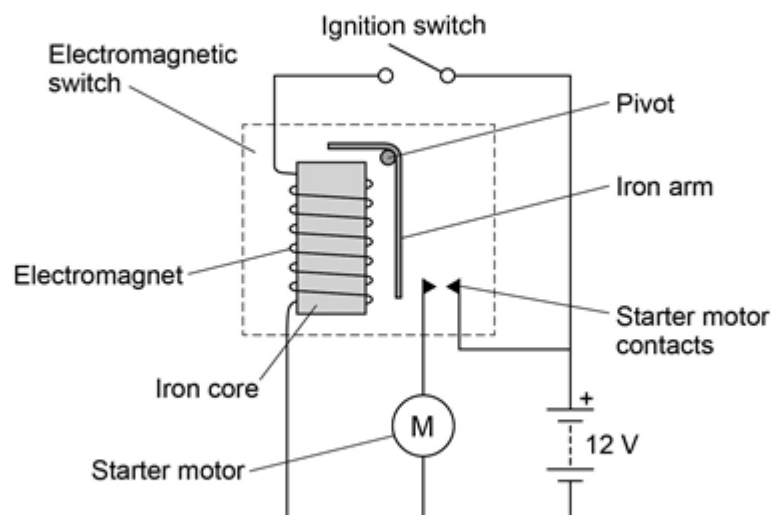
SAMs 1 Physics 2H, standard demand – Explain

Question

0 4 . 2 Figure 11 shows the ignition circuit used to switch the starter motor in a car on.

The circuit includes an electromagnetic switch.

Figure 11



Explain how the ignition circuit works.

[4 marks]

Mark scheme

04.2	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2/1 4.7.2.1 standard
	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 <ul style="list-style-type: none"> • closing the (ignition) switch causes a current to pass through the electromagnet • the iron core (of the electromagnet) becomes magnetised • the electromagnet/iron core attracts the (short side of the) iron arm • the iron arm pushes the contacts (inside the electromagnetic switch) together • the starter motor circuit is complete a current flows through the starter motor (which then turns)		

Typical student response a

The electromagnet is on when the switch is closed. The motor works when the contacts get pushed together by the iron arm which moves when the electromagnet is on.

Typical student response b

When the ignition switch is closed a current goes through the electromagnet and switches it on. There is a force between the electromagnet and the iron arm which pulls the iron arm across to the electromagnet. The iron arm pushes the starter motor contacts together which makes a current go through the motor and switches the motor on.

SAMs 2 Physics 2H, standard demand – Describe

The context for this question is one of the required practicals, and concerns the acceleration of a trolley and how the acceleration depends upon the force applied to the trolley. There is a brief introduction shown below and students would have answered parts 03.1 and 03.4 before attempting the extended response question.

Question

0 3

Two students investigated how the acceleration of a trolley depends on the force applied to the trolley.

Before starting the investigation each student wrote a hypothesis.

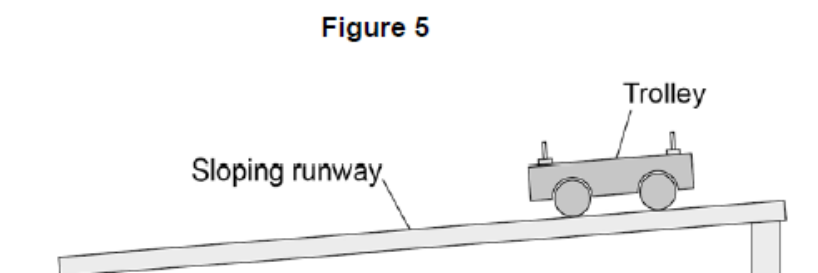
Hypothesis of Student **A**:

‘The acceleration of the trolley is directly proportional to the force applied to the trolley.’

Hypothesis of Student **B**:

‘Changing the force applied to the trolley will change the acceleration of the trolley.’

Figure 5 shows some of the equipment used by the students.



0 3 . 3

Write a list of any other equipment the students will need in order to complete the investigation.

[2 marks]

03.4 Why should the students use a sloping runway?

[1 mark]

Tick **one** box.

To reduce the effect of friction on the trolley.

☐

To decrease the acceleration of the trolley.

☐

To stop the trolley rolling back up the runway.

☐

03.5 Describe a method the students could have used for their investigation.

[6 marks]

Mark scheme

03.5	Level 3: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.5.6.2.2 Standard
	Level 2: The method 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 method 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 <ul style="list-style-type: none"> method by which the trolley is to be accelerated how the accelerating force is varied to give a suitable range of results how the accelerating force is measured the use of suitable apparatus to measure the change in velocity of the trolley over a given distance or time what data is to be collected in order to calculate acceleration how the data required is to be measured 		

Typical student response a

Pull a trolley along a bench and see how long it takes to go all the way along. Do it again pulling the trolley faster and then slower.

Typical student response b

Join a pulley clamp to the end of a flat runway. Tie a piece of string to the front of the trolley and add a 1 newton weight to the other end. Stick a piece of ticker tape to the back of the trolley and thread the tape through a ticker tape timer. Hang the weight over the pulley and hold the trolley at the end of the runway so that the string is tight. Now switch on the ticker timer and let go of the trolley. The falling weight pulls the trolley along the runway and accelerates it. Stop the trolley when it is at the end of the runway and take the piece of ticker tape off the trolley. Measure the distance between the dots on the tape at the start and end of the tape, so I can work out the speed of the trolley at each end. Count the number of dots on the tape and work out how long it took the trolley to go down the runway. Now do it again with different weights on the string.

Typical student response c

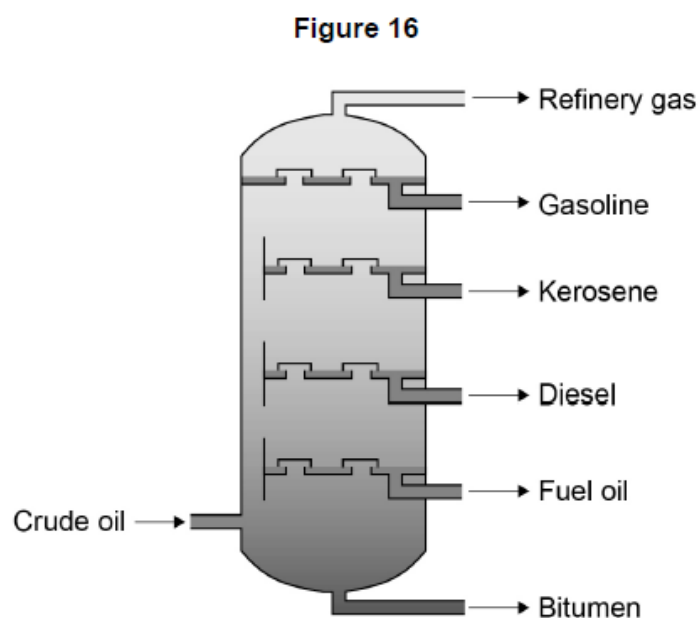
Put the runway at an angle and let a trolley run down the runway. Use light gates at the top and bottom to measure the speed of the trolley. Time it with a stop watch. Do it again with a steeper runway. Measure how high the runway is'.

Chemistry

SAMs 2 Synergy 3F (common question) standard demand -Explain

Question

0 9 . 4 **Figure 16** shows the separation of crude oil in a fractionating column.



Explain how crude oil is separated into different fractions by fractional distillation.

[6 marks]

Mark scheme

09.4	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.8.1.3 Standard
	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	
	Indicative content <ul style="list-style-type: none"> • crude oil is heated • hydrocarbons/compounds vaporise • vapours enter the fractionating column near the bottom • there is a temperature gradient in the column or the column is hotter at the bottom and cooler at the top • vapours / hydrocarbons / fractions condense • to become liquid • at their boiling points • different substances have different boiling points • so the different fractions collect at different levels • hydrocarbons / fractions with smallest molecules have lowest boiling points • collect as gases at top of the column where temperature is lower • hydrocarbons / fractions with larger molecules have higher boiling points • so collect nearer the bottom • where temperature is higher 		

Typical student response a

Crude oil contains lots of different things. It is heated to separate the fractions. The fraction gas has the lowest boiling point and is released at the top of the column. Bitumen has a high boiling point so its at the bottom. Crude oil is heated because it will evaporate at different boiling points of the fraction. Crude oil contains hydrocarbons like Methane. Methane causes global warming. Methane is a gas it does not condense but goes out the top.

Typical student response b

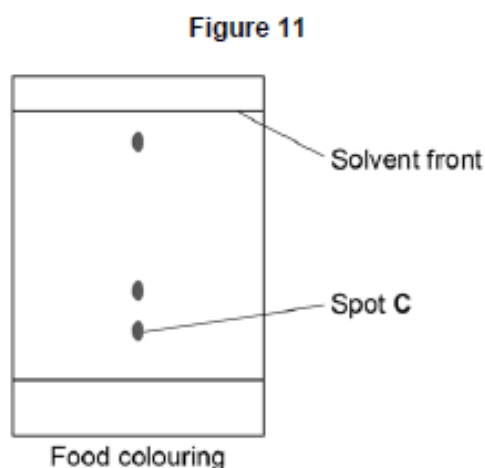
There is not much use for crude oil. Crude oil is heated to make diesel, petrol and gas. Gas is lighter so it rises to the top, bitmen is heavier and falls to the bottom. Diesel and petrol have different temperatures so come out at different levels. That's why petrol is used in cars and diesel in lorries. Crude oil distillation makes pollution and covers birds, killing them. Crude oil will run out so we should not use it.

SAMs 2 Trilogy Chemistry 2F (common question), standard demand – Plan

Question

0 6

Figure 11 shows a chromatogram for a food colouring.



0 6 . 3

Plan a chromatography experiment to investigate the colours in an ink.

[6 marks]

Mark scheme

06.3	Level 3: The plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 AO3 5.8.1.3 Standard
	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 <ul style="list-style-type: none"> put dots of known colours, and a dot of the ink on a pencil line on the chromatography paper. place the bottom of the paper in water, making sure the start line is above the water leave for solvent to rise up through paper. when solvent near top of paper, remove and leave to dry. compare positions of dots for known colours with those from ink 		

Typical student response a

I am going to draw 2 lines on a piece of paper. They must be straight. You need to use a ruler. Then I'll drop some ink on the paper. The paper goes in to the water. You best leaving it for a bit, like 10 mins. You get a pattern. You count the colours to get the results.

Typical student response b

Take a piece of chromatography paper. Draw a line in pencil 1 cm above the bottom of the paper. Use a dropping pipette to add one drop of ink on the pencil line. Put some water into a beaker. Add the water so that the level is 0.5 cm from the bottom of the beaker. Place the chromatography paper in the water so that the level of the water is below the pencil line.

Level the paper until the colours have separated. Mark the solvent front. Dry the paper. Measure how far each colour has moved up the paper. Work out the R_f values for each colour.

Biology

SAMs 2 Biology 1H, standard/high demand - Evaluate

Question

0 4 . 7 Stem cells can also be obtained from human embryos.

Evaluate the use of stem cells from a patient's own bone marrow instead of stem cells from an embryo.

Give a conclusion to your answer.

[6 marks]

Mark scheme

04.7	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.		5-6	AO3.1b 4.1.2.3 Std./High
	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	
	Indicative content embryos advantages <ul style="list-style-type: none"> can create many embryos in a lab painless technique can treat many diseases / stem cells are pluripotent / can become any type of cell (whereas bone marrow can treat a limited number) bone marrow advantages <ul style="list-style-type: none"> no ethical issues / patient can give permission can treat some diseases procedure is (relatively) safe / doesn't kill donor tried and tested / reliable technique patients recover quickly from procedure both procedures advantage can treat the disease / problem	embryos disadvantages <ul style="list-style-type: none"> harm / death to embryo embryo rights / embryo cannot consent unreliable technique / may not work bone marrow disadvantages <ul style="list-style-type: none"> risk of infection from procedure can only treat a few diseases procedure can be painful both procedures disadvantages <ul style="list-style-type: none"> risk of transfer of viral infection some stem cells can grow out of control / become cancerous 		

Typical student response a

Stem cells from embryos are best because they can become any type of cell and so can treat much disease, whereas the bone marrow stem cells only form a limited number of types of cells. These are surplus embryos from IVF and it does not hurt the embryo or the patient. You can get a lot of stem cells from 1 embryo in the lab.

On the other hand some people object to the use of embryos on ethical grounds. They believe the embryo has a right to life. Because of this some patients may prefer to use their own bone marrow if it will form the cells they need.

I think embryo stem cells to be the better option as it has the potential to cure more diseases.

Typical student response b

If you use the bone marrow from a patient then cells will not be rejected but stem cells from an embryo will and the patient will have to take anti-rejection drugs. Bone marrow cells only treat a few diseases but embryo stem cells can form any cells and treat lots of diseases.

People think it is killing potential humans to use embryos – that's why I think it's best to use bone marrow stem cells.

SAMs 2 Trilogy Biology 2H, standard/high demand – Explain

Question

06.4 In parts of Africa, aeroplanes have been used to spray insecticide on crops, to kill the worms.

Explain the advantages and disadvantages of spraying insecticide on the corn crops.

[4 marks]

Mark scheme

06.4	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2 AO3 4.5.3.4 Std./High High
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1–2	
	No relevant content	0	
	Indicative content advantages <ul style="list-style-type: none"> • killing worms will mean more corn / food for African people • so food security or no famine • it will stop the spread of the worms • so stop it reaching other countries and causing food shortages there • it will remove an invasive species • and so restore the natural ecosystem balance in the area disadvantages <ul style="list-style-type: none"> • insecticide will kill other (pollinating) insects • so will stop fertilisation of crops and lead to poor yields • insecticide will kill other insects • and upset the ecological balance in the area or reduce biodiversity in the area • insecticide may be toxic to humans • causing illness if they ingest it • insecticide may build up in the food chain • and poison / kill organisms further up the chain (ignore cost as it could be argued either way)		

Typical student response a

An advantage is there will be more corn. It will get rid of the worms which shouldn't be in Africa and might eat other things too.

Disadvantages is it will cost a lot for aeroplanes and the staff might be poisonous it could make you sick.

Typical student response b

It will be good because the people in Africa will not go hungry because the worms will be gone and not eating all their corn. It will also stop the worms moving over to other African countries. But it will be bad because insecticides are poisonous and it may kill other insects or even humans if they don't wash the corn. It might kill the bees that pollinate flowers.

Examiner commentaries and answers to levels of response mark scheme activity

SAMs 1 Physics 2H, standard demand – Explain

Examiners commentary a

This particular student has given a very basic explanation. They have not achieved level 2, as the explanation is not detailed enough but they have given some content which is worthy of credit. So this response is going to be in level 1. It can be awarded 1 or 2 marks.

To decide which, we can go through the content and see that the student has made some very basic statements but those statements are correct.

They have tried to link some ideas together, but there is no mention of a current in the electromagnet or the motor circuit and there is no detail as to why the iron arm moves when the electromagnet is switched on.

However, the basic statements are correct and therefore this student will be awarded 2 marks.

Examiners commentary b

The second example is a little more detailed. The whole answer flows. The statements are in a logical order and the statements that the student has made are correct. So this is a level 2 response.

As each of the points are correct and they are linked in a logical order, and if we follow the answer through we can clearly see and understand why the starter motor works. For this answer the student will be awarded 4 marks.

SAMs 2 Physics 2H, standard demand – Describe

Examiners commentary a

This answer is giving some indication of how the trolley is to be accelerated – simply pulling it along the bench.

However, there is no detail about how that force is going to be measured or what data needs to be collected. Certainly with such a brief method, it would not lead to a valid outcome.

Therefore, this is a level 1 response. There is very little detail and what detail there is doesn't really link together. There is an indication that the force would be varied, however, the level of detail is very basic so it is a level 1 response with 1 mark awarded.

Examiners commentary b

This example contains a lot more detail.

Although this answer uses a ticker timer and recording the dots on the tape, there is no clear idea about how the spacing of the dots and the number of dots would be used to calculate speed and time.

However, the method would work and it would lead to valid results. It is very clear how the trolley is to be accelerated and how the accelerating force is to be varied. It is clear what apparatus the student is intending to use and how the data is to be collected.

This answer is a level 3 response. It is not a perfect answer, but in order to get into level 3 the answer does not have to be perfect. There is enough detail and there are enough points linked to make it clear what the students are doing. The method they have chosen to describe would lead to a valid set of results. Therefore, 6 marks have been awarded for this particular answer.

Examiners commentary c

The second example gives a lot more detail than the first one. However, there aren't enough points linked together to make this a level 3 response, so this answer is a level 2 response.

The method by which the student is going to accelerate the trolley is given – they are going to put the runway at an angle. Also, how the accelerating force will be varied is also clear – they will use a steeper runway.

There is however no link between the angle of the runway and the actual size of the force that causes the acceleration. The increase in force can only be recorded in terms of an increase in height.

The apparatus to use is clear, although not how the light gates would be used to measure the speed at the start and at the end and how all the data would be used to calculate the acceleration.

So, some of detail, some links made, but not sufficient to actually answer the question fully. This makes it a level 2 response and 3 marks are awarded.

SAMs 2 Synergy 3F (common question) standard demand - Explain

Examiners commentary a

The student has identified some of the relevant points and has made attempts at logical links e.g the separation of fractions in the column according to boiling points.

However, the response lacks detail in terms of the link between size of molecules and boiling points and makes little reference to condensation. There references to global warming etc. can be ignored.

So, some of detail and some logical links made, but not sufficient to actually answer the question fully. This makes it a level 2 response and 3 marks are awarded.

Examiners commentary b

The student has identified the need to heat the crude oil. Other points have been taken from the diagram but the student has not added any value to these points. For example, the student states that petrol and diesel have different temperatures and that the gas is lighter, but does not give sufficient explanation or a logical link as to why this leads to separation.

The incorrect spelling can be ignored.

The level of detail is very basic so it is a level 1 response with 1 mark awarded.

SAMs 2 Trilogy Chemistry 2F (common question), standard demand – Plan

Examiners commentary a

It looks as if the student has looked at the earlier part of the question where a developed chromatogram was given which the student has used to formulate this answer.

There are a few relevant points made. The paper does need to go into a beaker of water. However, there is nothing about the water surface should be below the bottom line. The idea of leaving the chromatogram to develop is correct but there is no reference to where the ink drops should go or any indication about adding known and unknown ink drops. The plan would not lead to a valid outcome so the response would go into level 1. As the detail is minimal this response would be awarded 1 mark

Examiners commentary b

The plan would lead to the production of a valid outcome. The key steps are identified and logically sequenced. There is lots of relevant detail. This is a level 3 response worth 6 marks.

Note that most, but not all, of the indicative content is there. To gain 6 marks the student does not have to give all the ideas shown in the indicative content.

SAMs 2 Biology 1H, standard/high demand – Evaluate

Examiners commentary a

The response has a conclusion/judgement which is closely linked to a sufficient range of correct answers. This answer reaches level 3. This question is targeted at grades 6 – 7 so you would expect a number of advantages and disadvantages for each case of using stem cells from embryos or bone marrow.

This is a level 3 response worth 5 marks.

Examiners commentary b

There is a basic conclusion and it has been supported by a couple of simple reasons.

However, the entire first point made about rejection is incorrect.

This answer just reaches level 2 but the information covered is limited so 3 marks would be awarded.

SAMs 2 Trilogy Biology 2H, standard/high demand – Explain

Examiners commentary a

The student has identified some relevant points for both advantages and disadvantages of using insecticides. These are very brief and there is no detail. There is one attempt at linking but it is not clear. For an explain question at this level of 6-9 there must be attempts at linking statements to reasons. An explain question on a foundation tier will have 3 levels and level 1 will be available for simple statements with no attempt at logical linking.

The reference to cost is ignored

This answer is in level 1 and 1 mark would be awarded.

Examiners commentary b

This is a better answer as it is a clear account. There are some advantages and disadvantages given that are written as logically linked points.

The science content is brief and not sufficient or very detailed. The response would meet level 2 but because of the limited science content would be awarded 3 marks.

Notes

Notes

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