GCSE
COMBINED SCIENCE SYNERGY
8465/4F

Foundation Tier Paper 4 Physical Sciences

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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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, level of demand 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 errors / 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.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	measuring cylinder		1	AO1 4.7.5.3 RPA 21
01.2	cell	allow battery	1	AO1 4.7.2.4
01.3	electrolyte		1	AO1 4.7.5.2 4.7.5.3 RPA 21
01.4	current that always passes in the same direction		1	AO1 4.7.2.5
01.5	chloride ions are negatively charged **or** opposite charges attract		1	AO2 4.5.1.5 4.7.5.2 RPA 21
01.6	a burning splint		1	AO1 4.7.5.4
01.7	hydrogen is less reactive than potassium		1	AO1 4.7.5.3 RPA 21

01.8	similarity any **one** from: • volume of gas increases (with time) • after 10 minutes collected at same rate difference any **one** from: • (at any time) more hydrogen collected • the rate of hydrogen collection is constant • from 0 to 10 minutes hydrogen is collected faster than chlorine	 allow (at any time) less chlorine collected allow from 0 to 10 minutes the rate of chlorine collection increases	1 1	AO3 4.7.5.3 RPA 21
Total			**9**	

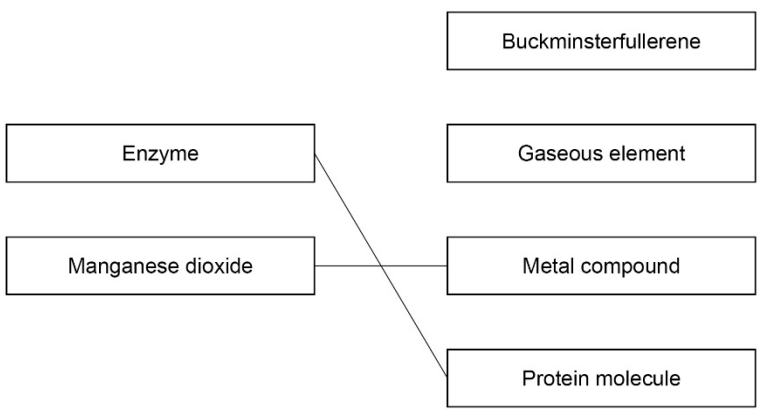
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	decrease decrease increase		1 1 1	AO1 4.7.2.9
02.2	E = 350 000 000 × 60 E = 2.1×10^{10} (J) **or** 21 000 000 000 (J)		1 1	AO2 4.7.2.7
02.3	nuclear no carbon dioxide emitted		1 1	AO3 AO1 4.8.2.4 4.4.1.1
02.4	coal produces sulfur dioxide	ignore produces carbon dioxide	1 1	AO3 AO1 4.8.2.4
Total			**9**	

Question	Answers	Mark	AO / Spec. Ref.
3.1	**Level 2:** The method would lead to the production of a valid outcome. Key steps are identified and logically sequenced.	3–4	AO3 4.6.1.6
	Level 1: The method would not necessarily 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 the drop height • using a metre rule • use 10 cm intervals • measure the bounce height • using a metre rule • repeat for different drop heights • use a range of 20 cm to 60 / 80 cm • ensure your eye is in line with the ruler and the ball • take repeat readings • calculate a mean		

3.2	drop height = 40 (cm) does not fit the pattern **or** would not lie on the line of best fit	 dependent on scoring the 1st mark	1 1	AO3 4.6.1.6
3.3	2 correctly plotted points straight line of best fit ignoring anomaly		1 1	AO2 4.6.1.6
3.4	drop height and mean bounce height show a linear relationship		1	AO3 4.6.1.6
3.5	uncertainty = ±1 cm		1	AO3 4.6.1.6

3.6	it is difficult to judge when the ball is at maximum height		1	AO3 4.6.1.6
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4.1	any **one** from: • height / angle / gradient / length */ position* of ramp • trolley (type) • floor surface • ramp surface		1	AO3 4.6.1.5
4.2	a value between 4.0 and 6.0 inclusive		1	AO3 4.6.1.5 4.7.1.4
4.3	any **one** from: • the greater the mass of the trolley the further the trolley travelled after the end of the ramp • the greater the mass of the trolley the faster the trolley at the end of the ramp • the greater the mass of the trolley the greater the kinetic energy at the end of the ramp	*allow weight for mass*	1	AO3 4.6.1.5 4.7.1.9
4.4	$E_p = 2.50 \times 9.8 \times 0.600$ $E_p = 14.7$ (J)		1 1	AO2 4.6.1.5
4.5	gravitational potential kinetic thermal		1 1 1	AO1 4.6.1 4.6.1.5 4.7.1.9
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	hydrogen **and** oxygen	in either order both needed for **1** mark ignore H and/or O	1	AO2 4.5.2.1
05.2	4 / four		1	AO2 4.5.2.1
05.3	hydrogen peroxide → oxygen + water		1	AO2 4.5.2.1
05.4	55 (cm^3)		1	AO2 4.7.4.6
05.5	**A**		1	AO3 4.7.4.1
05.6	**D**		1	AO3 4.7.4.1
05.7			1 1	AO1 AO2 4.5.1.2 4.5.2.1 4.7.4.6 4.7.4.7

05.8	the hydrogen peroxide will decompose at a slower rate		1	AO3 4.7.4.7
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	salt		1	AO1 4.7.3.2
06.2	(M_r =) 65 + 32 + (4 × 16) (M_r =) = 161	an answer of 161 scores **2** marks ignore units	1 1	AO2 4.5.2.3
06.3	$\frac{3.5 + \mathbf{X} + 3.5}{3} = 4.0$ (**X**) = 5.0 (°C)	an answer of 5.0 (°C) scores **2** marks allow 5 (°C)	1 1	AO2 4.7.3.3 4.7.5.1 RPA 18
06.4	°C missing on y-axis zinc / *Zn* not labelled magnesium / *Mg* is plotted incorrectly	*allow no unit on y-axis* *allow final bar not labelled*	1 1 1	AO3 4.7.3.3 4.7.5.1 RPA 18
06.5	(Most reactive) magnesium zinc iron (Least reactive) nickel	allow Mg allow Zn allow Fe allow Ni	1	AO3 4.7.3.3 4.7.5.1 RPA 18
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	Newton's first law		1	AO1 4.7.1.5 4.7.1.7
7.2	between 20 and 25 seconds		1	AO1 4.7.1.4
7.3	distance = 6 × 5 distance = 30 (m)		1 1	AO2 4.7.1.2
7.4	(between) 5 (seconds and) 10 (seconds)	both values needed either order	1	AO2 4.7.1.2
7.5	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$ **or** $a = \frac{\Delta v}{t}$		1	AO1 4.7.1.4
7.6	$a = (-)\ \frac{1.8}{5}$ $a = (-)\ 0.36\ (m/s^2)$	an answer of (–) 0.36 m/s^2 scores **2** marks	1 1	AO2 4.7.1.4
7.7	kinetic energy = 0.5 × mass × speed^2 **or** $Ek = 0.5 \times m \times v^2$		1	AO1 4.7.1.9

7.8	$1\,080\,000 = 0.5 \times m \times 6.0^2$ $m = \frac{1\,080\,000}{0.5 \times 6.0^2}$ m = 60 000 (kg)		1 1 1	AO2 4.7.1.9
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	number of repeating units **or** a large number	allow number of monomers (joined together)	1	AO1 4.6.2.4
08.2	any **one** from: • only shows in 2D • doesn't show the shape of the molecule • only shows a very small proportion of all atoms bonded together.		1	AO1 4.6.2.4
08.3	50 nm = 0.000 000 05 m = 5×10^{-8} (m)	allow 50×10^{-9} (m) allow correct value in standard form obtained from an incorrect conversion	1 1	AO2 4.6.2.4 4.8.1.3
08.4	marine animals eat them build up in food chain	 allow too small to be seen	1 1	AO3 4.8.2
08.5	any **two** from: • stop using plastic items • recycle plastic items • reuse plastic items • charge for plastic bags • refill own water bottle instead of buying new bottle • deposit schemes for plastic bottles.	allow specific examples eg, stop using plastic drinking straws, or plastic bags	2	AO3 4.8.2
Total			**8**	

Question	Answers	Mark	AO/ Spec. Ref
09	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO3 4.7.3.2 RPA 17
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content • place sulfuric acid in beaker • add copper carbonate one spatula at a time • until no longer dissolves **or** no effervescence seen • filter mixture • to remove excess copper carbonate • add solution to an evaporating basin • heat to crystallisation point **or** heat till half water gone **or** heat till crystals just start to form • using water bath or electric heater • leave to cool (until crystals form)		
Total		**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	measure initial length and final length of spring extension = final length – initial length	 allow extension = 1.3 cm	1 1	AO1 4.6.1.6 RPA13
10.2	force = spring constant × extension **or** $F = ke$		1	AO1 4.6.1.6 RPA13
10.3	 $3.0 = k \times 0.12$ $k = \frac{3.0}{0.12}$ k = 25 (N/m)		 1 1 1	AO2 4.6.1.6 RPA13
10.4	 extension = 9 (cm) extension = 0.09 (m) $E_e = 0.5 \times 40 \times 0.09^2$ E_e = 0.162 (J)	 allow a correct conversion from an incorrect extension allow a correct substitution of their incorrectly / not converted extension allow a correctly calculated value for E_e using their incorrectly / not converted extension	 1 1 1 1	 AO3 AO2 AO2 AO2 4.6.1.7 RPA13
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	length of card time that light gates are blocked by the card		1 1	AO1 4.7.1.6 RPA14
11.2	to compensate for the effect of friction		1	AO1 4.7.1.6 RPA14
11.3	no reaction time error performs calculations automatically		1 1	AO3 4.7.1.6 RPA14
11.4	resultant force = mass × acceleration **or** F = ma		1	AO1 4.7.1.6 RPA14
11.5	1.2 = m × 2.4 $m = \frac{1.2}{2.4}$ m = 0.50 (kg)		1 1 1	AO2 4.7.1.6 RPA14
Total			**9**	