SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: SYNERGY

PAPER 4F

Mark scheme

Specimen 2018

Version 1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. The final mark scheme will include any amendments made at the standardisation events which all examiners participate in and is the scheme which is used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers that have not been raised they are required to refer these to the Lead Assessment Writer.

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.

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 and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- 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 e.c.f. 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 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are 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.

Do **not** allow 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 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. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in 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 and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 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.

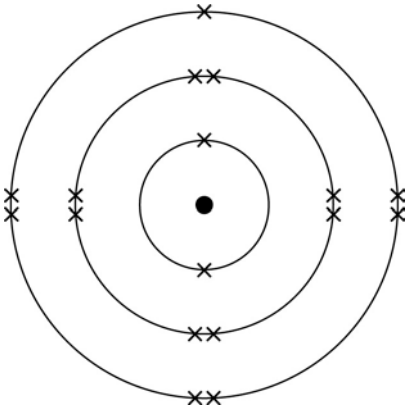
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Gravity		1	AO1/1 4.6.1.4
01.2	Mass of marble		1	AO3/3b 4.6.1.5
01.3	Drop height		1	AO2/1 4.6.1.5
01.4	31 (cm)		1	AO2/1 4.6.1.5
01.5	the result was anomalous	allow the result was too different from the other values	1	AO3/1a 4.6.1.5
01.6	increasing the drop height increases the roll height		1	AO3/2b 4.6.1.5
01.7	energy losses (due to friction)	allow air resistance, friction, drag	1	AO2/1 4.6.1.1
Total			**7**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the melting point increases		1	AO3/1a 4.5.1.5
02.2	337 °C	allow an answer in the range 278 °C to 337 °C	1	AO3/2a 4.5.1.5
02.3	bromine		1	AO2/1 4.5.1.5
02.4	Group 7		1	AO1/1 4.5.1.5
02.5		7 electrons in outer shell	1	AO2/1 4.5.1.1
02.6	Cl_2 + **2**NaBr $\longrightarrow$ Br_2 + **2**NaCl	correct formulae for products correct balancing	1 1	AO1/1 AO2/1 4.5.1.5
02.7	fluorine (because it is) more reactive than chlorine	 allow because it is the most reactive element	1 1	AO2/1 AO1/1 4.5.1.5
Total			**9**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	Cobalt Nickel		1 1	AO1/1 4.6.3.2
03.2	**Either** • put iron filings • on a piece of paper • over the magnet **or** • use (plotting) compass(es) (1) • around the magnet (1) • with the needle showing the direction (1)		1 1 1	AO1/1 4.6.3.2
03.3	all points plotted correctly correctly drawn line of best fit	2 points plotted correctly for **1** mark allow ecf from incorrectly drawn points	2 1	AO2/2 4.6.3.4
03.4	as the number of turns increases so does the amount of paper clips picked up linear/directly proportional	 allow doubling the number of turns doubles the number of paper clips picked up	1 1	AO3/1a 4.6.3.4
03.5	32	allow number correctly extrapolated from student's graph	1	AO3/2a 4.6.3.4
Total			**11**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	<table><tr><th></th><th>contact</th><th>non-contact</th></tr><tr><td>Electrostatic</td><td></td><td>✓</td></tr><tr><td>Friction</td><td>✓</td><td></td></tr><tr><td>Gravity</td><td></td><td>✓</td></tr></table>	one mark for each correct tick	3	AO1/1 4.6.1.1
04.2	Velocity Displacement		1 1	AO1/1 4.6.1.1
04.3	Use a pointer from the spring to measure the length		1	AO3/3b RPA13
04.4	25 g = 0.025 kg weight = 0.025 × 9.8 = 0.25 (N)	 allow 0.25 with no working shown for **3** marks	1 1 1	AO2/1 AO2/1 AO2/1 RPA13
04.5	Extension is directly proportional to force		1	AO3/2a RPA13
04.6	1.125 (N)	allow values between 1.12 and 1.15	1	AO2/1 RPA13
04.7	elastic potential energy = $0.5 \times 13.5 \times (0.12)^2$ = 0.097 (J)	 allow 0.097 with no working shown for **2** marks	1 1	AO2/1 4.6.1.7
Total			**13**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	50 Hz		1	AO1/1 4.7.2.5
05.2	Top: Earth Bottom: Neutral		1 1	AO1/1 4.7.2.6
05.3	potential difference current		1 1	AO1/1 4.7.2.6
05.4	energy = 2500 × 180 = 450 000 = 450 kJ	allow 450 with no working shown for **3** marks	1 1 1	AO2/1 4.7.2.8
05.5	energy transferred = charge flow x potential difference	allow E = QV	1	AO1/1 4.7.2.8
05.6	4 200 = Q × 230 Q = 4 200 ÷ 230 = 18.3 (C)	allow 18.3 with no working shown for **3** marks	1 1 1	AO2/1 4.7.2.8
Total			**12**	

Question 6

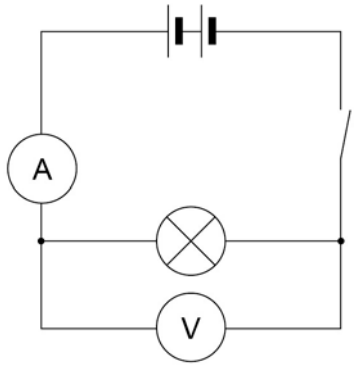
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	Carbon and hydrogen only		1	AO1/1 4.8.1.2
06.2	Methane has the lowest boiling point and decane has the highest melting point Octane is liquid over a larger temperature range than methane		1 1	AO3/2a 4.8.1.2
06.3	heat/steam catalyst		1 1	AO1/1 4.8.1.4

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	**Level 3:** A detailed and coherent evaluation is provided that considers a range of relevant points, quotes relevant data from the table and comes to a conclusion consistent with the reasoning.		5–6	AO3/1b
	Level 2: An attempt to describe relevant points which comes to a conclusion. The logic and use of data may be inconsistent at times but builds towards a coherent argument.		3–4	
	Level 1: Discrete, relevant points made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.		1–2	
	No relevant content.		0	
	Indicative content • conclusion as to which bag is more environmentally friendly Points that may be used in argument • Paper bags are made from a renewable resource (wood) • Paper bags more sustainable • Paper bags are biodegradable • Plastic bags are made from a finite resource (oil or gas) • Plastic bags not sustainable • Paper bags require more energy to manufacture (1.7 MJ compared with 1.5 MJ) • Paper bags produce more waste (50 g compared with 14 g) • Paper bags create less CO_2 than plastic bags • So manufacture of plastic bags has more effect on global warming/climate change/environmental effects • Plastic bags can be recycled • Recycling reduces use of energy sources in manufacture • justified			4.8.2.8 4.8.2.9 4.8.2.4
Total			**11**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		battery connected correct way round ammeter and voltmeter correct way round	1 1	AO3/3a RPA16
07.2	6.4 V		1	AO2/2 RPA16
07.3	(the lamp will) get dimmer because increasing the resistance decreases the current		1 1	AO2/2 4.7.2.2
07.4	potential difference = current × resistance	allow $V = IR$	1	AO1/1 4.7.2.2
07.5	3.3 = 0.15 × R R = 3.3 ÷ 0.15 = 22(Ω)	allow 22 with no working shown for **3** marks	1 1 1	AO2/1 4.7.2.2
Total			**9**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Ionic		1	AO2/1 4.6.2.3
08.2	electrolyte		1	AO1/1 4.7.5.2
08.3	because the ions are free to flow		1	AO1/1 4.7.5.2
08.4	because potassium is higher in the reactivity series than hydrogen so it is less easily discharged than hydrogen		1 1	AO2/1 RPA21
08.5	because water is covalent / molecular / contains molecules so there are no free electrons to move **or** does not have an overall electrical charge		1 1	AO2/1 RPA21
08.6	conductivity of the solution increases with concentration in a linear relationship **or** directly proportional		1 1	AO3/1a RPA21
Total			**9**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(as concentration increases)	answers **must** refer to data from graph to gain full marks		AO3/1b RPA19
	relationship identified from the graph	eg the same volume of gas is collected in a shorter time **or** more gas is collected in the same time **or** reaction reaches completion in a shorter time	1	
	reference to relevant data to evidence relationship	eg 20 ml collected in 10 seconds at 0.5 mol/dm^3 in 6.5 s at 1.0 mol/dm^3 and in 4 s at 2.0 mol/dm^3 **or** at 10 seconds volume collected is 20 cm^3 with 0.5 mol/dm^3, 30 cm^3 with 1.0 mol/dm^3, 50 cm^3 with 2.0 mol/dm^3 **or** total volume collected reaches maximum of 100ml in 20 seconds at 2.0 mol/dm^3 but takes twice as long at 1.0 mol/dm^3 and at 0.5 mol/dm^3	1	
09.2	reactions occur when particles collide		1	AO1/1
	increasing concentration means there are more particles in the same volume		1	AO2/1
	so there are more collisions		1	AO2/1 4.7.4.3

Question 9 continues on the next page

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	leave for longer if gas continues to be produced student A is right **or** repeat with more acid (1) if more gas is produced student B is right (1)		1 1	AO3/3b RPA19
Total			**7**	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	6.1 circled on table (15 °C, test 1)		1	AO3/1a RPA20
10.2	1.8	do not allow 1.83	1	AO2/2 RPA20
10.3	16 (minutes)	correct number extrapolated from curve	1	AO3/2a RPA20
10.4	4.0 min – blue / black / purple 7.0 min – yellow / orange / brown		1 1	AO3/2a RPA20
10.5	The amylase solution had been prepared with water at 95 °C		1 1	AO3/2b RPA20

Question 10 continues on the next page

Question 10 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	**Level 3:** A clear and coherent method is described using logical steps and demonstrating a good understanding of how to improve the validity of the method. The method would lead to the production of valid results that would give rise to a more valid conclusion.		5–6	AO3/3a AO3/3b
	Level 2: The substantive content of a method is present and demonstrates reasonable understanding of how to improve the validity but may be missing some detail. The plan may not be in a completely logical sequence but leads towards the measurement of rate of the reaction.		3–4	
	Level 1: Simple relevant statements made, which demonstrate limited understanding of how to improve the experimental method. The response lacks logical structure and would not lead to the production of valid results or a more precise optimum temperature.		1–2	
	No relevant content		0	
	Indicative content • conduct at a greater range of temperatures • use temperatures both above and below 40 °C • use smaller temperature intervals to get a more accurate optimum (eg go up in 2 °C increments) • take samples at smaller time intervals to get a more accurate result for 'time taken' • control the volume of starch used (eg 5 cm^3) • control the volume of the amylase solution (eg 1 cm^3) • control the temperature (eg using a water bath) • heat the two solutions separately before mixing • control the concentration of the starch solution • control the concentration of the amylase solution			RPA20
Total			**12**	

7 July 2015