SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: TRILOGY

PAPER 6: PHYSICS 2H

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. 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 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.

Further copies of this mark scheme are available from aqa.org.uk

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.

Level of response marking instructions

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	the time it took from seeing the green light to pressing a key		1	AO1/1 6.5.4.3.2
01.2	he could have been distracted		1	AO3/3a 6.5.4.3.2
01.3	boys have a shorter reaction time than girls **or** reaction time improves with practice		1	AO3/2b 6.5.4.3.2 WS3.5
01.4	collect more data / larger sample size **or** take more repeat readings per person	must link to response in 1.3	1	AO3/3b 6.5.4.3.2 WS3.7
01.5	reaction time will have less effect (as distance increases) because it is a smaller proportion of the total race time		1 1	AO2/1 6.5.4.3.2

01.6	**Level 3:** A coherent description of the race, which uses data from the graph, including discussion of the meanings of the changing gradient of both of the lines.	5–6	6	AO3/1a 6.5.4.3.2 6.5.4.1.4 WS3.5
	Level 2: Multiple pieces of data taken from the graphs used to evidence a comparison between the runners. Likely to include discussion of the meaning of the (changing) gradient of one of the lines. Answer not coherently structured.	3–4		
	Level 1: Some data taken from the graph, but may be limited to one aspect or simple readings. Lack of coherence in answer.	1–2		
	No relevant content.	0		
	Indicative content • A starts at constant speed *for 440 m / 60 s* • A then slows down *from 60 s* • the gradient for B is lower at the start so B starts at a slower speed • the gradient for B increases so B accelerates • B overtook A *at 700 m /114 s* • B has a greater top speed because the maximum gradient is greater • B won the race *in 126 s* / beat A *by 34 s*			

01.7	tangent drawn at 60s		1	AO2/2
	data obtained using correct information		1	6.5.4.1.4
	5.5(m/s)	accept answer in range 5.3 to 5.7	1	WS 3.2, 3.3

Total			**15**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **four** from: • light waves are transverse whereas sound waves are longitudinal • light waves travel faster than sound waves • light waves have a higher frequency than sound waves • light waves have a shorter wavelength than sound waves • light waves have oscillations perpendicular (to the direction of energy transfer) whereas sound waves are parallel (to the direction of energy transfer)		4	AO1/1 6.6.1.1 6.6.1.2 6.6.2.1 WS 1.4
02.2	the baby can be seen in the dark		1	AO2/1 6.6.2.4 WS1.4
02.3	wave speed = frequency × wavelength	accept v = f λ	1	AO1/1 6.6.1.2
02.4	$3 \times 10^8 = f \times 0.125$ $f = 3 \times 10^8 / 0.125$ $f = 2.4 \times 10^9$ (Hz)	allow 2.4×10^9 with no working for **3** marks	1 1 1	AO2/1 6.6.1.2 WS3.3
Total			**9**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	mass		1	AO1/1
	velocity		1	6.5.5.1
				WS4.1
03.2	kg m/s		1	AO1/1
				6.5.5.1
				WS4.3
03.3	momentum before = momentum after		1	AO1/1
				6.5.5.2
	and before diving in the momentum of the diver and (small) boat is zero		1	WS1.2
	after diving the diver has forwards momentum/ momentum to the right		1	
	therefore the (small) boat has equal backwards momentum/ equal momentum to the left		1	
03.4	the boat moves back more slowly		1	AO2/1
	because there is more mass (but momentum stays the same)		1	AO1/1
				6.5.5.1
03.5	as she swims there is a drag force		1	AO2/1
	as speed increases so does the drag force		1	AO2/1
	she accelerates less		1	AO2/1
	drag force = thrust force	accept resultant force = 0	1	AO1/1
	the swimmer reaches terminal velocity		1	AO1/1
				6.5.4.2.1
Total			**14**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	force = spring constant x extension	accept f = ke	1	AO1/1 6.5.3
04.2	extension is directly proportional to the force applied because it is straight line through the origin		1 1	AO3/2a AO1/2 6.5.3
04.3	test a greater range of load **or** test more springs		1	AO3/3b 6.5.3 WS2.5
04.4	work done is equal to elastic potential energy as long as the spring does not go past the limit of proportionality		1 1	AO1/2 6.5.3
04.5	line extending with a greater gradient than existing line a stiffer spring has a greater spring constant (*k*) *k* = F / e		1 1 1	AO3/2a AO3/2b AO3/2b 6.5.3
04.6	the spring will be deformed because it has passed the elastic limit	accept not gone back to original shape	1 1	AO1/2 6.5.3
Total			**11**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	arrow of equal size pointing vertically downwards	judged by eye	1	AO2/1
	labelled 'weight'		1	AO1/1 6.5.1.1/2/3
05.2	the upwards force is greater than the downwards force		1	AO2/1
	because air resistance increases		1	6.5.4.2.2
05.3	$v^2 = (2 \times 2 \times 209) + 8^2$		1	AO2/1 6.5.4.1.5
	$v = \sqrt{900}$		1	WS3.3
	v = 30 (m/s)	allow 30 (m/s) without working shown for **3** calculation marks	1	
05.4	vertical force (300 N) drawn with a suitable scale		1	AO2/1
	horizontal force (60 N) drawn to the same scale		1	6.5.1.4
	resultant force drawn in correct direction		1	
	value of resultant in the range 304 N – 308 N		1	
Total			**11**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	thumb, index finger and third finger are held mutually at right angles		1	AO1/2
	index finger shows the direction of the magnetic field from North to South, third finger shows the direction of the current from positive to negative terminal		1	6.7.2.2
	the thumb then shows the direction of the force acting on the copper rod		1	
	so the copper rod will move from left to right		1	
06.2	any **one** from: use a stronger magnet increase the magnetic flux density increase the length of the copper rod in the magnetic field coil the copper rod		1	AO2/2 6.7.2.2
06.3	$W = 9.8 \times 4 \times 10^{-4} = 3.92 \times 10^{-3}$		1	AO2/2
	conversion of the length 7cm to 0.07m		1	6.5.1.3 6.7.2.2
	$3.92 \times 10^{-3} = B \times 1.12 \times 0.07$		1	WS4.5
	$B = 3.92 \times 10^{-3} / 0.0784$		1	
	$B = 0.05$ (T)	allow 0.05 (T) without working shown for the **5** calculation marks	1	
Total			**10**	