GCSE
COMBINED SCIENCE: TRILOGY

PAPER 6: PHYSICS 2F

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.

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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 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

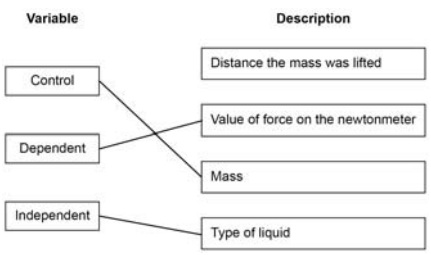
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	C		1	AO1/1 6.5.1.2
01.2	2040 / 120 17 (m/s)	 allow 17 (m/s) with no working shown for **2** marks	1 1	AO2/1 6.5.4.1.2
01.3	the thinking distance and the braking distance combined	accept 36 m	1	AO2/1 6.5.4.3.1
01.4	thinking distance increases braking distance stays the same		1 1	AO1/1 6.5.4.3.1/2
Total			**6**	

Question 2

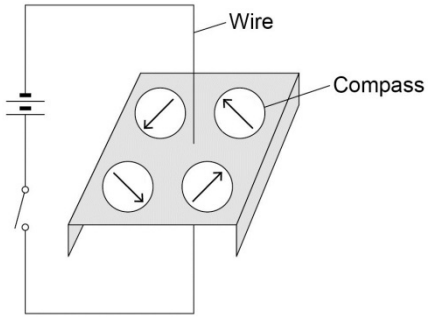
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	5.5 (N)		1	AO2/2 6.5.3 WS2.6
02.2	The spring gets shorter		1	AO1/1 6.5.3
02.3	**Level 2:** A detailed and coherent description of the experiment. The response provides a logical sequence.	3–4	4	AO1/2 6.5.3
	Level 1: Simple description of the experiment with some steps missing. The response may not be in a logical sequence and may not lead to the collection of valid results.	1–2		
	No relevant content.	0		
	Indicative content • set up a clamp stand with a clamp and hang a spring on it • use another clamp and boss to fix a half metre rule alongside the spring • record the metre rule reading that is level with the bottom of the spring • hang a weight from the bottom of the spring • record the new reading on the rule and the extension on the spring • remove the weight and check the length of the spring • repeat by adding more weights and record the readings on the rule			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	Use a pointer from the spring to measure the length. Make sure the spring is stationary before measuring length.		1 1	AO3/3b 6.5.3
02.5	Extension is directly proportional to force	if more than **one** box ticked apply list principle	1	AO3/2b 6.5.3 WS3.5
02.6	0.5 (N)		1	AO2/1 6.5.3
02.7	0.100 m	if more than **one** box ticked apply list principle	1	AO3/2a 6.5.3 WS3.5
02.8	0.5 x 20 x $(0.050)^2$ = 0.025 (J)	 allow 0.025 (J) with no working for **2** marks	1 1	AO2/1 6.5.3
Total			**13**	

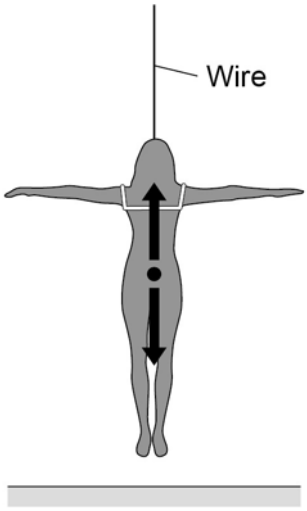
Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1		allow **one** mark for each correct line if more than one line is drawn from any variable then all of those lines are wrong	1 1 1	AO3/3a AO2/2 AO2/2 6.5.1.2 WS2.2, 4.1
03.2	0.1 N	if more than **one** box ticked apply list principle	1	AO2/2 6.5.1.2 WS2.3
03.3	A bar chart	if more than **one** box ticked apply list principle	1	AO2/2 6.5.1.2 WS3.1
03.4	some of the data is categoric		1	AO2/2 6.5.1.2 WS3.1
03.5	13.8 × 0.30 4.14 J	allow 4.14 without working shown for **2** marks	1 1 1	AO2/1 AO2/1 AO1/1 6.5.2 WS4.3
Total			**9**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	S – top, N – bottom		1	AO1/1 6.7.1.1
04.2	touch / attracted to magnet **A**		1	AO2/1 6.7.1.1
04.3	the magnetic needles point to the north pole because The Earth has a magnetic field	 accept the needles align to the Earth's magnetic field for **2** marks	1 1	AO1/1 6.7.1.2
04.4			1	AO2/1 6.7.2.2
04.5	point in the opposite direction	change direction is insufficient	1	AO2/1 6.7.2.2
04.6	uniform field lines through the wire coil. field lines curving round the top and bottom of the wire coil. arrows indicating direction from N to S	 do **not** accept conflicting arrows	1 1 1	AO1/1 6.7.2.2
Total			**9**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1		arrow pointing vertically upwards arrow pointing vertically downwards	1 1	AO1/1 6.5.1.4
05.2	Gravitational force Tension force	if more than **two** boxes ticked apply list principle	1 1	AO1/1 6.5.1.2
05.3	0 (N)		1	AO1/1 6.5.4.2.1 WS1.2
05.4	weight = 70 × 9.8 (= 686) weight = 690 (N)	allow 690 (N) with no working shown for **2** marks allow 686 (N) with no working shown for **1** mark	1 1	AO2/1 6.5.1.3
05.5	34 (N) / 30 (N)	allow ecf from 05.4 correctly calculated	1	AO2/1 6.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	resultant force = mass × acceleration	accept F = ma accept equation correctly rearranged for a	1	AO1/1 6.5.4.2.2
05.7	25 = 65 × a a = 25 / 65 a = 0.38(4615…) (m/s^2)	 allow 0.38 (m/s^2) with no working for **3** marks	1 1 1	AO2/1 6.5.4.2.2 WS3.3
Total			**12**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	the time it took from seeing the green light to pressing a key		1	AO1/1 6.5.4.3.2
06.2	he could have been distracted		1	AO3/3a 6.5.4.3.2
06.3	boys have a shorter reaction time than girls **or** reaction time improves with practice		1	AO3/2b 6.5.4.3.2 WS3.5
06.4	collect more data / larger sample size **or** take more repeat readings per person	must link to response in 06.3	1	AO3/3b 6.5.4.3.2 WS3.7
06.5	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

06.6	**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*			

Total			**12**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	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
07.2	the baby can be seen in the dark		1	AO2/1 6.6.2.4 WS1.4
07.3	wave speed = frequency × wavelength	accept $v = f \lambda$	1	AO1/1 6.6.1.2
07.4	$3 \times 10^8 = f \times 0.125$ $f = 3 \times 10^8 / 0.125$ $f = 2.4 \times 10^9$ (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**	