GCSE
COMBINED SCIENCE: TRILOGY
8464/P/2H

Physics Paper 2H

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.

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
- 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 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 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	iron and steel will be attracted (to the magnet) aluminium, copper and tin will not be attracted (to the magnet)	 allow **1** mark is one metal is in the incorrect list, but all the other four are correct if no other mark awarded allow **1** mark for iron and steel are magnetic	1 1	AO1 6.7.1.1
01.2	the paperclip would still be attracted to the magnet because of induced magnetism	 allow the paper clip becomes an induced magnet allow because the paper clip is a temporary magnet allow there is a magnetic field at the south pole	1 1	AO1 6.7.1.1
01.3	weight = mass × gravitational field strength or W = mg	do not accept gravity for gravitational field strength	1	AO1 6.5.1.3
01.4	1.0 g = 0.0010 kg weight of 1 paperclip = 0.0010 × 9.8 Force = 0.0098 x 20 = 0.196 (N)	allow 0.001 (kg) allow 0.0098 (N) allow correct substitution using incorrectly/not converted value of mass of paperclip allow correct calculation using incorrectly/not converted value of mass of paperclip	1 1 1	AO2 6.5.1.3

Total			**8**	

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3
	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	AO1
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	6.5.4.2.2 RPA19
	Indicative content **<u>measurements</u>** • place one wooden block under the ramp • vary the height by placing a different number of wooden blocks • measure the height of the ramp using a metre rule • measure the distance travelled using a metre rule • measure time taken using light gates (and computer/datalogger) • measure time taken using a stopclock or ticker timer • release trolley from the same position each time • release the trolley without applying a force **<u>results</u>** • repeat at the same height and calculate a mean • repeat for different heights • calculate acceleration using $a = (v-u)/t$ or $a = \frac{v^2 - u^2}{2s}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	all points plotted correctly	allow **1** mark for 3 points plotted correctly	2	AO2 6.5.4.2.2 RPA19
	height of ramp in metres on x-axis **and** acceleration in m/s^2 on y-axis)	both quantity and unit required for both axes	1	
	correct line of best fit		1	
02.3	resultant force = mass × acceleration or F = ma		1	AO1 6.5.4.2.2 RPA19
02.4	0.63 = m × 2.1		1	AO2 6.5.4.2.2 RPA19
	$m = \frac{0.63}{2.1}$		1	
	m = 0.30 (kg)	allow 0.3 (kg)	1	
Total			**14**	

question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	the spring will return to its original length when the force is removed		1	AO1 6.5.3
03.2	Any **two** from: • spring constant • (original) length • diameter		2	AO3 6.5.3
03.3	0.80 = k × 0.0040 $k = \frac{0.80}{0.0040}$ k = 200 (N/m)		1 1 1	AO2 6.5.3
03.4	the upward force on the spring is equal to the downward force the spring is inelastically deformed		1 1	AO3 6.5.3
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(vector quantity) has magnitude and a direction (scalar quantity) has magnitude only		1 1	AO1 6.5.4.1.3
04.2	resistive force acts on the ball so (resultant) force in opposite direction to velocity **or** so work is done on the ball	allow friction or air resistance	1 1	AO2 6.5.4.2.1
04.3	momentum = mass × velocity or p = mv		1	AO2 6.5.5.1
04.4	26 = m × 5.0 $m = \frac{26}{5.0}$ 5.2 (kg)		1 1 1	AO2 6.5.5.1
04.5	momentum is conserved in the collision (assuming no external forces) momentum of the pin increases therefore the momentum of the ball must decrease.	if no other mark is awarded, allow **1** mark for when the ball exerts a force on the pin, the pin	1 1 1	AO1 6.5.5.2

		exerts an equal and opposite force on the ball		
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	X-rays are absorbed by bone		1	AO1 6.6.2.4
	but can pass through flesh	ignore skin	1	
05.2	taking lots of X-rays would give a large dose		1	AO3 6.6.2.3
	which would increase the radiographer's risk		1	
	the screen absorbs some of the X-rays	allow screen reduces the risk/dose received by the radiographer	1	
05.3	electrical current / oscillations in the transmitter producing radio waves		1	AO1 6.6.2.3
	radio waves are absorbed by the receiver inducing electrical current / oscillations in the receiver		1	
	at the same frequency	if no other mark is awarded, allow **1** mark for radio waves transfer information/energy through the air	1	
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$13.5 \times \frac{2}{3}$ 9.0 (m/s) OR $13.5 \times \frac{1}{3} = 4.5$ (1) 13.5 - 4.5 = 9.0 (m/s) (1)	 allow 9 (m/s)	1 1	AO2 6.5.4.3
06.2	reduced speed reduces stopping distance means less chance of collision **OR** the car will have less kinetic energy (1) so less likely to cause injury in the event of a collision (1)	allow reduces thinking / braking distance	1 1	AO1 6.5.4.3.2 6.5.4.3.3
06.3	$14 = v \times 0.70$ $v = \frac{14}{0.70}$ v = 20 (m/s) $0^2 – 20^2 = 2 \times (–6.25) \times s$ $s = \frac{20^2}{(2 \times 6.25)}$ s = 32 (m)	 ignore minus signs throughout	1 1 1 1 1 1	AO2 6.5.4.1.2 6.5.4.1.5

06.4	same maximum force applied by the brakes because mass is less there is a greater deceleration braking distance is less **OR** reducing the mass reduced the kinetic energy of the van (at a given speed) (1) less work needed to be done to bring the van to a stop (1) (force from the brakes is the same) so braking distance is less (1)	allow momentum for mass	1 1 1	AO2 AO1 AO1 6.5.2
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	the downward force on the balance increased	allow when there is a current in the wire there is a magnetic field around the wire (which causes a magnetic force)	1	AO3 6.7.2.2 6.5.4.2.3
	therefore the wire must experience an equal and opposite force (which is upwards)		1	
07.2	calculate the difference between the two mass readings	allow 254.8 – 252.3 = 2.5	1	AO1 6.7.2.2
	convert to kg **and** multiply by gravitational field strength	allow (2.5 / 1000) × 9.8 = 0.02375 (N)	1	
07.3	gradient $= \frac{(0.0210 - 0.0)}{(0.70 - 0.02)}$		1	AO3
	gradient = 0.031	allow answer correctly given to any number of significant figures	1	AO3
	0.031 = B × 0.125	allow correct substitution using correctly calculated value given to any number of significant figures	1	AO2
	B = 0.25 T	allow answer correctly given to any number of significant figures	1	AO2
		any rounding must be correct for subsequent marks to be awarded.		6.7.2.2
		max **2** marks if a pair of readings from the graph are used instead of gradient calculation		
Total			**8**	