



GCSE

COMBINED SCIENCE: TRILOGY

8464/P/2H

Physics Paper 2H

Mark scheme

Specimen (set 2)

Version: 1.0

Keep secure

Please be aware that not all schools and colleges will be using these tests at the same time.

Help us to maintain the security of these papers by ensuring they are not distributed on social media or other platforms.

Important – please note

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers.

It must be stressed that a mark scheme is a working document. This mark scheme has **not** been through the full standardisation process. 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.

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.

The Information to Examiners is included as a guide to how the mark scheme will function as an operational document.

The layout has been kept consistent so that future operational mark schemes do not appear different from these test materials.

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 not 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.

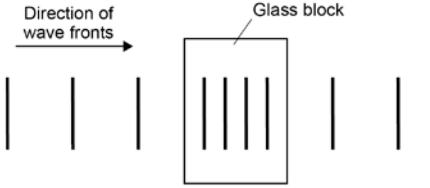
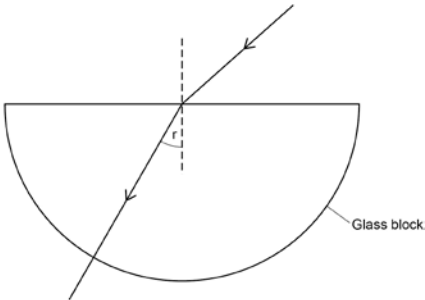
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
01.1	the forces of the bike on the trailer and the trailer on the bike are equal in size	allow the force of tension acts on the bike and the trailer	1	AO1 6.5.4.2.3 Standard
	and opposite in direction		1	
01.2	any two from: <ul style="list-style-type: none"> • the same trailer should be used • the weather conditions should be the same • the same road (surface) should be used • the same gradient road should be used • the same speed should be used • the cyclist should be at the same level of alertness throughout the experiment 	allow a description of this, eg the wind should be the same allow a description of a cause of this eg the cyclist should not drink coffee between experiments	2	AO3 6.5.4.3.3 Standard
01.3	straight line drawn above the original line, sloping upwards		1	AO3 6.5.4.3.3 Standard
01.4	the cyclist's reaction time increased		1	AO1 6.5.4.3.1 6.5.4.3.2 Standard
	so the thinking distance increased		1	
	stopping distance is thinking distance plus braking distance		1	
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
02.1	sound waves are longitudinal in longitudinal waves, the oscillations / vibrations are parallel to the direction of energy transfer water waves are transverse in transverse waves, the oscillations / vibrations are at 90 degrees to the direction of energy transfer	allow direction that the wave is travelling for direction of energy transfer ignore references to wave speed, wavelength or frequency an answer stating that sound waves travel in all directions but water waves don't is insufficient.	1 1 1 1	AO1 6.6.1.1 Standard
02.2	$0.0083 = \frac{1}{\text{frequency}}$ $\text{frequency} = \frac{1}{0.0083}$ frequency = 120 (Hz)	an answer of 120(.481...) scores 3 marks an answer of 0.12 scores 2 marks	1 1 1	AO2 6.6.1.2 Standard

02.3	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 6.6.1.2 Standard
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1–2	
	No relevant content	0	
	Indicative content equipment <ul style="list-style-type: none"> a stopclock / stopwatch should be used to time the waves a metre rule should be used to measure distance determining the frequency of the waves <ul style="list-style-type: none"> the frequency could be determined by finding the time for several waves to pass a point the frequency could be determined by finding the how many waves pass a point in a fixed time frequency is the average time for one wave to pass a point frequency = $\frac{\text{no. of waves}}{\text{total time for waves to pass}}$ determining the speed of the waves <ul style="list-style-type: none"> the speed can be determined by measuring the distance travelled by a wave and the time taken to travel that distance the distance used to determine speed should be as long as possible speed = distance/time determining the wavelength of the wave <ul style="list-style-type: none"> the wavelength can be calculated using the speed and frequency of the wave wavespeed = frequency x wavelength wavelength = $\frac{\text{wavespeed}}{\text{frequency}}$ wavelength = $\frac{\left(\frac{\text{distance}}{\text{time}}\right)}{\left(\frac{\text{no. of waves}}{\text{second}}\right)}$ 		
Total		13	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
03.1	<p>at least two wave fronts drawn to the right of the glass block, parallel to the other wave fronts and with equal spacing compared with the wave fronts to the left of the glass block</p> 		1	AO 1 6.6.2.2 Standard
03.2	<p>ray of light refracts towards the normal where it is incident on the glass block</p> <p>ray of light does not refract when it exits the glass block</p> <p>a normal is drawn on where the ray is incident on the glass block</p> <p>the angle of refraction is labelled</p> 	lines should be drawn with a ruler	1 1 1 1	AO 1 6.6.2.2 Standard Std./High
03.3	<p>light travels more slowly (in the glass block than in the air)</p> <p>so it changes direction</p>	allow so it bends towards the normal	1 1	AO1 6.6.2.2 Std./High

03.4	the angle of incidence		1	AO 3 6.6.2.2 Std./High
	the type of glass used	allow the glass block	1	
03.5	the <u>resolution</u> of a normal protractor is too big		1	AO3 6.6.2.2 Std./High
	so it could not measure the difference between results	allow so it could not read angles to 2 decimal places	1	
03.6	a longer wavelength gives a greater angle of refraction		1	AO3 6.6.2.1 High
03.7	absorbed / reflected		1	AO1 6.6.2.2 Std./High
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
04.1	inertia		1	AO1 6.5.4.2.1 Std./High
04.2	<p>17 cm/s = 0.17m/s</p> <p>$P = mv = 0.14 \times 0.17$</p> <p>= 0.024 (kg m/s)</p>	<p>an answer of 0.024 (kg m/s) scores 3 marks</p>	<p>1</p> <p>1</p> <p>1</p>	AO2 6.5.5.1 Std./High
04.3	<p>the total momentum before the collision is zero</p> <p>and momentum is conserved</p> <p>so the total momentum after the collision is zero</p> <p>so the speed after the collision is zero</p>		<p>1</p> <p>1</p> <p>1</p> <p>1</p>	AO3 6.5.5.2 Std./High High
04.4	<p>more than one car may pass through a beam at a time</p> <p>(so) the light gate could not accurately measure the time for one car to pass</p> <p>the length of each car would be unknown</p> <p>(so) speed could not be calculated without the length</p>	<p>allow a description of this eg cars overtaking, cars passing in opposite directions etc</p> <p>allow cars come in different lengths.</p> <p>ignore references to the data logger</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	AO3 6.5.5.1 Std./High
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
05.1	between A and B (the elastic store decreases and) the kinetic and gravitational stores increase		1	AO1 6.5.3 Standard
	between B and C the kinetic store decreases and the gravitational store increases		1	
	the internal energy store of the surroundings increases		1	
		allow either some energy is dissipated to the surroundings or some energy is dissipated as heat / sound		
05.2	the weight and air resistance are equal and opposite		1	AO1 6.5.3 Standard
	so the resultant force is zero		1	
05.3	$25\,000 = \frac{1}{2} \times 125 \times e^2$ $e^2 = \frac{2 \times 25000}{125}$ $e = \sqrt{\frac{2 \times 25000}{125}}$ $e = 20 \text{ (m)}$	an answer of 20 (m) scores 4 marks	1	AO1 AO2 6.5.3 Std./High
			1	
			1	
			1	

05.4	acceleration = $(-9.8)(\text{m/s}^2)$ $0^2 - 26^2 = 2 \times (-9.8) \times s$ $s = \frac{-26^2}{2 \times (-9.8)}$ $s = 34 \text{ (m)}$	an answer of 34 (m) scores 4 marks allow any correct rounding of 34.489...	1 1 1 1	AO1 AO2 6.5.4.1.5 High
------	---	--	------------------	---------------------------------

Total			13
--------------	--	--	-----------

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
6.1	the current creates a magnetic field in the wire which interacts with the magnetic field from the permanent magnet Flemming's left hand rule says the force on the wire is upwards so the force on the permanent magnets is downwards		1 1 1 1	AO2 6.7.2.2 Std./High
6.2	x-axis labelled current and y-axis labelled (magnetic) force straight line through the origin	ignore units on labels	1 1	AO1 AO 2 6.7.2.2 Standard Std./High
6.3	$W = mg = 1.2 \times 10^{-3} \times 9.8$ $W = 0.01176$ $0.01176 = B \times 0.80 \times 4.8 \times 10^{-2}$ $B = \frac{1.2 \times 10^{-3} \times 9.8}{0.8 \times 4.8 \times 10^{-2}}$ $B = 0.31$	an answer of 0.31 scores 5 marks an answer of 0.031 scores 3 marks	1 1 1 1 1	AO2 6.7.2.2 High
Total			11	