

INTERNATIONAL GCSE **COMBINED SCIENCE**

9204/PE

Paper 3 Physics Extension

Mark scheme

June 2024

Version: 1.0 Final



2 4 6 Y 9 2 0 4 / P E / M S

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.

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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
- 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 errors/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.
01.1	(current that) repeatedly changes direction		1	AO1 3.22.1b

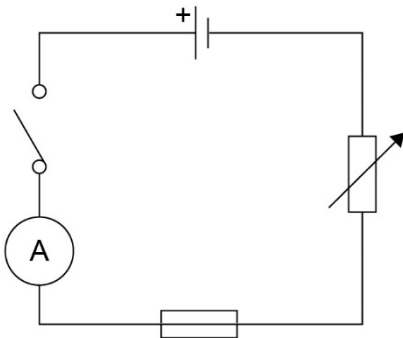
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	340 (V)		1	AO2 3.22.1b

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$T = 0.02 \text{ (s)}$	subsequent marks may be awarded if an incorrect value of T read from graph is used	1	AO3 3.22.1b
	$f = \frac{1}{0.02}$		1	
	50 (Hz)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	electrocution	allow electric shock ignore burns	1	AO3 3.22.1d

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	earth (wire)		1	AO1 3.22.1d

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	live (wire)		1	AO1 3.22.1e

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	(all in series) cell variable resistor ammeter	ignore any voltmeter unless drawn in series an answer of  scores 2 marks	2	AO4 3.21.1f

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	test a sample (of fuses) check the values are consistent	allow calculate a mean if MP1 is awarded	1 1	AO4 3.22.1d

Total		12
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Question	Answers	Mark	AO / Spec. Ref.
02.1	Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO4 3.21.2g
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content.	0	
	Indicative content Build an electromagnet - wrap the wire around the nail - connect the wire to the power supply (with connecting leads and crocodile clips) - switch on the power supply Method to change independent variable - change the number of turns (on the coil) - change the current (through the coil) Testing strength of electromagnet - suspend paperclips from the electromagnet - count how many paperclips can be suspended - clamp the electromagnet at different distances from the paperclip(s) - measure the distance from which paperclips can be attracted - test before and after making alterations to change the strength - compare the results from before and after making alterations		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	both axes correct		1	AO3 3.21.2g
	all 5 points plotted correctly	allow 1 mark if 3 or 4 points are correctly plotted	2	
	correct curved line of best fit through all the points		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	0.01 millimetres		1	AO3 3.21.2b
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$0.450 = P \times 3.0$		1	AO2 3.22.3f4–5
	$P = \frac{0.450}{3.0}$		1	
	$P = 0.150 \text{ (kW)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	energy transferred = $\frac{5.00}{0.40}$		1	AO2 3.22.3f
	energy transferred = 12.5 (kWh)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the devices are not all switched on constantly	allow different devices are used at different time allow a description such as not many devices are used at night	1	AO3 3.22.3f

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	any two from: - replace with more efficient devices - switch off when not being used - reduce time devices are used for	allow description of improving efficiency allow don't leave devices on standby	2	AO3 3.22.3f

Total		8
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	echoes		1	AO1 3.19.3c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	incidence and reflection	either order	1	AO1 3.19.4a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	indication of 10 cm representing 20 m	allow correct indication of scaling	1	3 × AO2 2 × AO3 3.19.3c 3.17.2a
	distance travelled by the reflected sound wave = 25 m	subsequent marks may be awarded for the use of an incorrect distance	1	
	$330 = \frac{5.0}{t}$	allow use of incorrect difference in distance	1	
	$t = \frac{5.0}{330}$		1	
	$t = 0.015 \text{ (s)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	sound would be distorted	allow the sound would be poor quality	1	AO3 3.19.3c

Total		8
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gravitational force (pulls together) dust and gas		1 1	AO1 3.24.1a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(very) high temperature (very) high density	allow high pressure	1 1	AO1 3.24.1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	${}^1_1\text{H} + {}^2_1\text{H} \rightarrow {}^3_2\text{He}$	allow hydrogen isotopes in either order 1 mark for the top row 1 mark for the bottom row if no other mark awarded allow 1 mark for 2 correct isotopes	2	2 × AO2 3.23.1f

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	high frequency <u>electromagnetic</u> radiation	allow high energy for high frequency	1	AO1 3.23.2c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	Sirius will expand become a red giant and Canopus will expand and become a red super giant.		1	AO1 3.24.1g,h,j
	next, Sirius will contract and become a white dwarf		1	
	whilst Canopus will contract and explode in a supernova		1	
	Sirius will end its life cycle as a black dwarf		1	
	Canopus will end its life cycle as a neutron star		1	
	or Canopus will end its life cycle as a black hole			
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	the temperature of the filament increases		1	AO3 3.21.1j

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$I = 0.640 \text{ (A)}$	subsequent marks may be awarded if I is incorrectly/not converted	1	AO2 3.21.1g
	$2.40 = 0.640 \times R$		1	
	$R = \frac{2.40}{0.640}$		1	
	$R = 3.75 \text{ (}\Omega\text{)}$	allow $R = 3.8 \text{ (}\Omega\text{)}$	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	regular arrangement of ions		1	2 × AO1 2 × AO2 3.20.1a 3.20.2a 3.21.1j
	that vibrate about fixed positions		1	
	and free electrons		1	
	which collide with the ions as they move through the filament		1	

Total		9
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	same magnitude		1	AO1 3.17.3a
	opposite direction		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	$16 = \frac{1}{2} \times m \times 80^2$		1	AO2 3.18.1e
	$m = \frac{(2 \times 16)}{80^2}$		1	
	$m = 0.0050 \text{ (kg)}$		1	
	$m = 5 \text{ (g)}$	allow $m = 5.0 \text{ (g)}$	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(large) air resistance acts		1	2 × AO1 2 × AO2 3.17.3c,h
	so resultant force in opposite direction to motion		1	
	as it slows, air resistance decreases		1	
	so resultant force decreases (so the deceleration decreases)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	height = 7.0×0.5		1	AO2 3.17.3f
	height = 3.5 (m)		1	

Total		12
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	the oscillations/vibrations are perpendicular to the direction of energy transfer	allow the oscillations/vibrations are perpendicular to the direction of wave travel	1	AO1 3.19.2a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(radio waves and microwaves) have lower frequency	allow low	1	AO1 3.19.2b
	(radio waves and microwaves) have a longer wavelength	allow long	1	
	(all electromagnetic waves) travel at the same speed (in a vacuum)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	satellite television systems or cooking food	allow other named electronic communication systems	1	AO1 3.19.2f

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	$f = 1.8 \times 10^9 \text{ Hz}$	subsequent marks may be awarded for an incorrectly/not converted f	1	AO2 3.19.1h
	$3.0 \times 10^8 = 1.8 \times 10^9 \times \lambda$		1	
	$\lambda = \frac{3.0 \times 10^8}{1.8 \times 10^9}$		1	
	$\lambda = 0.1666\dots$		1	
	$\lambda = 0.167 \text{ (m)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	geostationary advantage – can connect to just one satellite		1	2 × AO1 2 × AO3 3.24.2c
	disadvantage – long distance so signal may be weak		1	
	low polar orbit advantage – shorter distance so signal may be stronger		1	
	disadvantage – need to connect to different satellites as line of sight is lost		1	
Total			14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	volume of solution		1	AO4 3.20.1b
	starting temperature		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$c = 2400$	allow $c = 2350$ subsequent marks may be awarded if incorrect values are read from the graph	1	AO2 3.20.1b 3.22.3b
	and boiling point = 104			
	$E = 0.150 \times 2400 \times 80$	for subsequent marks to be awarded a value of E must have been calculated using the correct equation	1	
	$E = 28\,800$		1	
	$75 = \frac{28\,800}{t}$		1	
	$t = \frac{28\,800}{75}$		1	
	384 (s)		1	

Question	Answers	Mark	AO / Spec. Ref.
09.3	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	4 × AO2 2 × AO3 3.20.1b
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical 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 linking.	1–2	
	No relevant content.	0	
	Indicative content • as concentration increases specific heat capacity decrease • so energy required decreases • so time taken decreases • as concentration increases boiling point increases • so energy required increases • so time increases • greater effect of specific heat capacity at lower concentration • greater effect on boiling point at higher concentrations • the specific heat capacity falls in a linear manner with increasing concentration • the decrease in specific heat capacity has a greater effect than the increase in boiling point so time take to reach boiling point decreases with increasing concentration		
Total		14	