

Cambridge O Level

PHYSICS**5054/42**

Paper 4 Alternative to Practical

May/June 2025

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **10** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.

2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.

3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).

4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	information missing or insufficient for credit
	evaluation attempted
	benefit of the doubt given
	contradiction in response, mark not awarded
	incorrect point or mark not awarded
	error carried forward applied
	incorrect or insufficient point ignored while marking the rest of the response
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied.
	power of ten error
	point has been noted, but no credit has been given or blank page seen
	answer outside the tolerance of the mark scheme

Annotation	Meaning
	correct point or mark awarded
	response is too vague or there is insufficient detail in response
	incorrect unit

Question	Answer	Marks
1(a)	normal drawn at R, extending above AD (and below BC) $\theta = 30(.0) (^{\circ}) \pm 1$	1
1(b)	straight line through crosses to meet BC and straight line from E to R	1
1(c)(i)	$a = 2.3 \pm 0.1$ (cm)	1
1(c)(ii)	$b = 6.4 \pm 0.1$ (cm)	1
1(d)	c recorded to the nearest mm	1
1(e)(i)	n_1 in the range 1.3 to 1.5 inclusive	1
1(e)(ii)	n_2 correct from candidate's values	1
	statement to match results	1
	values used in a calculation to justify the statement	1
1(g)	thickness of the light rays / difficulty in aligning incident ray with SR / difficulty of placing crosses accurately	1

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Question	Answer	Marks
2(a)	$\theta_R = 21(.0) (^{\circ}\text{C})$	1
2(b)(i)	$V_{XY} = 3.1 \text{ (V)}$	1
2(b)(ii)	circuit as in Fig. 2.1, but with voltmeter in parallel with 220Ω resistor	1
2(c)(i)	to measure the highest temperature reached / to give the thermometric liquid time to expand / to record the maximum temperature of the hot water / to ensure that the temperature has stopped rising / to allow the liquid to expand / to allow the thermometer to adjust to the conditions	1
2(c)(ii)	to ensure that the water is at a uniform temperature	1
2(d)	resistance of <u>the thermistor</u> decreases	1
2(e)	0.00636 (A) and 0.015 (A)	1
2(f)	any answer between $480 (\Omega)$ and $520 (\Omega)$ inclusive and $80 (\Omega)$	1
2(g)	$(487 - 80) / (83 - 21)$	1
	to 2 significant figures	1

Question	Answer	Marks
3(a)(i)	39.0 (cm)	1
	41.1 (cm)	1
3(a)(ii)	diagram showing straight edge of set-square aligned from the bottom of coiled part of spring to the metre rule	1
3(b)(i)	2.1(0) (cm)	1
3(b)(ii)	(45.2 – 39.0 =) 6.2 (cm)	1
3(c)	axes labelled with quantity and unit and the right way around	1
	scales linear, not awkward	1
	points plotted accurately, to the nearest $\frac{1}{2}$ square	1
	thin best-fit straight line drawn	1
3(d)	<u>correct</u> graph reading for a 3.5 N load	1
	correct subtraction of l_0 from <u>their</u> graph value above	1
3(e)	NO and doubling L does not double l (or similar) / the ratio l/L is not constant / graph does not pass through the origin / length does not go up in equal increments for equal increases in load	1
3(f)	either of: view reading at eye level / perpendicular OR at right angles OR at 90° to rule / place rule close to / parallel to the spring	1
3(g)	reduces the <u>effect</u> of (random) errors / improves the precision	1

Question	Answer	Marks
4	additional apparatus: ruler / measuring tape <u>and</u> stopwatch / timer / clock	1
	method: all of: • <u>measure</u> the height of the liquid • drop the ball (from rest) • <u>measure</u> the time (it takes to reach the bottom)	1
	repeat for the other liquids / different density liquids	1
	control variables: one of: • same height / volume of liquid • same mass / volume / shape of the ball / same (type of) ball	1
	table: columns to include time / t / T and density / ρ / d with units	1
	processing and conclusion: one of: • plot a graph of density against (average) speed • (compare the results to) see if / how / whether the density of the liquid affects the average speed	1