



Cambridge O Level

COMBINED SCIENCE

5129/31

Paper 3 Experimental Skills and Investigations

May/June 2023

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **7** 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 descriptors 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.

Question	Answer	Marks
1(a)	to measure the mass of the spanner (only) // to remove zero error ; to select units of mass / grams / kilograms OR to know which unit of mass ;	2
1(b)	three corresponding measurements of d : 39, 26, 10 each ± 2 mm ; all measurements of d to the nearest mm ; tabulated data ; headings with units and separator ;	4
1(c)	Any two from: sensitive to/measures small changes in the reading ; suitable precision ; mass can be converted to weight ;	2
1(d)(i)	the smaller the value of d the smaller the reading ORA ;	1
1(d)(ii)	magnetic attraction changes (with distances) ;	1
1(e)	identifies anomalous results / outliers / allows error to be checked / confirms readings ; to check <u>repeatability</u> ;	1

Question	Answer	Marks
2(a)(i)	Initial AND final mass of fuel (and burner);	1
2(a)(ii)	22 °C ;	1
2(b)(i)	28° C ;	1
2(b)(ii)	All points plotted correctly \pm one small square ; line of best fit with even distribution of points above and below ; circle around anomalous result / anomalous result identified / circle around 27 ;	3
2(b)(iii)	best fit line extended to 11 carbon atoms ; value extrapolated where best fit line reaches 11 carbon atoms within \pm 1 square of the student's line ;	2
2(b)(iv)	The temperature would be greater than the boiling point of water ;	1
2(b)(v)	(Reason) energy loss (to environment) ; (Improvement) idea of insulation e.g. lid / stopper / wrapping ;	2

Question	Answer	Marks
3(a)(i)	all data in Fig.1.2 is recorded ;	1
	three correct calculations for change in mass ;	1
	results of all calculations recorded to the same number of decimal places / same sig. figs ;	1
3(a)(ii)	$3.3 + 2.4 + 3.0 = 8.7$;	1
	$8.7 / 3 = 2.9$;	1
3(b)(i)	Any two from: volume of solution used ; temperature ; pH ; volume of cylinder / diameter / volume to surface area ratio (of carrot) ; same carrot ; time left in solution / 3 hours ;	2
3(b)(ii)	there will always be slight differences in mass regardless of them being similar length / OWTTE ;	1
	allows results to be compared (fairly) ;	1
3(b)(iii)	horizontal line from y-axis value = 0 to curve ; any value from 0.22 to 0.24 ;	2

Question	Answer	Marks
4	<p data-bbox="338 213 1048 245">One mark from each section and any two other marks</p> <p data-bbox="338 284 539 316">1 apparatus</p> <p data-bbox="394 354 539 386">voltmeter ;</p> <p data-bbox="338 418 1637 584">2 method, measurements and safety (candidates can gain more than one marking point if they describe two different methods coherently) A – vary the material ; B – vary the frequency ; C – vary the loudness / distance ;</p> <p data-bbox="338 619 1361 785">3 detail of method:</p> <p data-bbox="394 689 1361 785">measure / record the voltage ; avoid using very loud / deafening sounds / use ear plugs or ear defenders ; repeat and average / at least 3 repeats ;</p> <p data-bbox="338 820 1043 1155">4 control and repeats.</p> <p data-bbox="394 890 1043 1018">corresponding control from: A – at the same loudness / frequency B – at the same loudness / for the same material C – at the same frequency / for the same material and either same distance from generator to material or same distance from material to detector ;</p> <p data-bbox="338 1190 1115 1350">5 processing and conclusion use of results. (compare results to find) lowest reading / voltage across a range of frequencies ; lowest ‘loudness’ across a range of materials ; Lowest loudness across a range of distances ;</p>	7