Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2023**

MARK SCHEME

Maximum Mark: 30

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.

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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.

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.

Question	Answer	Marks
1(a)	candidate's value (°C) ;	**1**
1(b)(i)	At least 5 degrees higher than candidate's value in **1(a)** but no more than 20 degrees higher;	**1**
1(b)(ii)	Any **two** from: wait to take the reading until the reading just begins to fall and note the maximum value observed record to nearest 0.5 °C stir/agitate the water to spread the heat evenly thermometer in contact with the water only (avoid parallax error by) viewing the reading / scale of the thermometer perpendicularly ;;	**2**
1(b)(iii)	more accurate measurement of vol. / more water depth to cover the mass (or thermometer bulb) ;	**1**
1(b)(iv)	award mark for correct substitution if c_m is in range from 0.2 to 0.5 (J / (g °C)) ;	**1**
1(c)(i)	Any **two** from: the string has heat capacity the water in the string has heat capacity the glass in the beaker has heat capacity heat loss from mass during transfer / mass is less than 100 °C when it enters water the mass transfers heat to glass (by conduction) heat loss from beaker / water cools down (by convection) not enough water to cover the mass not enough water to fully immerse the thermometer bulb temperature change is small ;;	**2**
1(c)(ii)	Any **two** from: use non-absorbent string put a lid on the beaker insulate the beaker / wrap the beaker ; use the heat capacity of the glass beaker **and modify the equation to allow for this** use more water to completely cover the mass **and use a modified equation** transfer mass as quickly as possible ;;	**2**

Question	Answer	Marks
2(a)	all correct ;;; **or** **up to maximum two marks** from: three cells in the battery correct symbols of switch, resistor and thermistor voltmeter across thermistor ;;	**3**
2(b)	Room temperature to nearest half degree or 3 sig figs. **and** At room temp: V_w = 2.6 ± 0.35 to nearest 0.1 (V) ;	**1**
2(c)	In iced water: V_c = 3.1 ± 0.3 (V) ;	**1**
2(d)(i)	Calculation correct ;	**1**
	Correct unit V / °C ;	**1**
2(d)(ii)	Correct calculation: (their Vc) – (37 × their ans to **(d)(i)**) ;	**1**
2(d)(iii)	Statement matches their results from the calculation in **2(d)(ii) ;**	**1**
	Correct calculation to support statement using their values ;	**1**

Question	Answer	Marks
3(a)(i)	candidate's measurement, 98.0 ± 1.0 cm, to nearest mm ;	**1**
3(a)(ii)	One source of error and one improvement specifically aimed at reducing that error in measuring the height *h*, e.g. *Source of error*: difficult to hold rule still ; *source of error*: difficult to put rule vertical ;	**1**
	improvement: use a set square set against the base of rule ; *Improvement*: use a clamp to hold the rule in place ; The second mark for improvement can not be awarded if no source of error is given. Improvement must match source of error.	**1**
3(b)(i)	Two measurements of time written down and average calculated ;	**1**
	to more than 1 significant figure and correctly rounded ;	**1**
3(b)(ii)	column headings with units and separators () or / ; five sets of readings of t(av) with correct trend; consistent recording of raw time readings (d.p. or sig.figs) ;	**3**
3(c)	axes labelled with units ; suitable, convenient, sensible scale ; all values in table plotted to nearest ½ small square ; smooth curve of best fit ;	**4**
3(d)	time decreases as mass increases ORA ; non-linear (owtte) ;	**2**

Question	Answer	Marks
4	**Method** (2 marks) **MP1** vary V **and** record the reading on balance ; **MP2** Five or more readings of V between 2 and 12 V ;	**2**
	Key Variables(2 marks) **MP3** Same distance between propeller and balance ; **MP4** Any one from ; same area of balance pan same spin direction of propeller same room temperature / air pressure same motor	**2**
	MP5 **Table** (1 mark) ; columns for balance reading and voltage / p.d. / emf, both with units ;	**1**
	MP6 **Conclusion** (1 mark) ; plot a graph of voltage against force / mass **or** use results table to compare voltage and balance reading **or** look to see if changing the voltage changes the balance reading	**1**