CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2016 series

0625 PHYSICS

0625/62 Paper 6 (Alternative to Practical), maximum raw mark 40

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.

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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

Brackets ( )	Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
Underlining	Underlining indicates that this must be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers or words, any one of which is satisfactory for scoring the marks.
AND	Both answers or words must be given for credit to be awarded.
e.e.o.o.	This means “each error or omission”.
o.w.t.t.e.	This means “or words to that effect”.
c.a.o.	This means “correct answer only”.
NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
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1 **(a)** arrow indicating 0.4 V [1]

arrow indicating 0.08 A [1]

(b) graph:
- axes labelled with quantity AND unit [1]
- appropriate scales (plots occupying at least ½ grid) [1]
- plots all correct [1]
- well-judged line AND thin line, neat plots [1]

(c) **(i)** *G* present and triangle method seen using at least ½ line [1]

(ii) *R* in range 4.6 Ω to 4.9 Ω [1]

to 2 / 3 significant figures and with correct unit [1]

(d) statement matching graph with reference to straight line [1]

reference to passing through origin (within limits of experimental accuracy / owtte) [1]

(e) suitable change: [1]
e.g. reduce supply voltage / current,
use thinner / longer wire,
material with greater resistivity

[Total: 12]

2 **(a)** **(i)** l = 14.7 AND d = 2.5 [1]

(ii) boiling tube between blocks and ruler spanning gap [1]

suitable precaution e.g. [1]
measure in (at least) 2 places and take average,
avoid lip,
ensure blocks smooth,
no dirt between tube and block

(iii) V_1 = 72 [1]

(b) **(i)** V_2 = 54 [1]

(ii) line of sight perpendicular to reading / [1]
read from bottom of meniscus

(iii) V_3 correctly calculated [1]

(c) (i) ρ = 1.7 to 1.8 [1]

unit g / cm^3 [1]

(ii) m = 32 (g) [1]

(d) suitable source of inaccuracy [1]
e.g.
- any reference to <u>why</u> tube is not a cylinder,
- tube may contain some water when mass taken,
- difficult to fill to brim and then pour out

appropriate effect on value of ρ <u>explained</u> [1]

[Total: 12]

3 (a) (i) normal correct [1]

(ii) θ = 40(°) [1]

(b) P_1, P_2 marked on line NM <u>and</u> separation > 5.0 cm [1]

(c) (i) thin lines all in correct place [1]

a = 8.1 to 8.3 (cm) <u>and</u> b = 5.2 to 5.5 (cm) [1]

(ii) n correctly calculated [1]

2 / 3 sig figs <u>and</u> no unit [1]

(d) any two suitable precautions: [2]
e.g.
- view pins from base / ensure pins upright,
- large pin separations
- use of thin pencil lines / sharp pencil / thin pins
- repeat with different angles

[Total: 9]

4 **apparatus:** [1]
(set of) different sized beakers / containers, thermometer and stop clock / watch

method: [1]
pour hot water into container (and allow to cool)
and measure temperature and time

repeat for a second container with a different surface area [1]

precautions:
any two from: [2]
same volume of hot water
same initial hot water temperature
same room temperature or other environmental condition

graph:
temperature change / rate of cooling against surface area, [1]
temperature against time,
time to cool between fixed temperatures against surface area

additional point:
any one from: [1]
- at least 5 different surface areas,
- sensible range of container sizes given,
- sensible amount of water stated,
- use of lagging / insulating material for container walls,
- same type of container
- how surface area may be calculated

[Total: 7]

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/62**

Paper 6 Alternative to Practical **March 2017**

MARK SCHEME

Maximum Mark: 40

Published

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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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Question	Answer	Marks
1(a)	θ_A = 18 and θ_B = 37 (°C)	**1**
1(b)	units all correct (symbols or words)	**1**
	t values all present (30, 60, 90, 120, 150 and 180)	**1**
1(c)	any 2 appropriate precautions: stir before reading, keep thermometer at same level, set eye to same level as / perpendicular / right angles to scale, wait until reading stops rising (at start), position clock so that thermometer and clock can be easily seen	**2**
1(d)	conclusion matching results	**1**
	correct mention of comparative temperature change over 180 s	**1**
1(e)	**any suitable improvement to apparatus or procedure relating to comparison, e.g.:** • measure water into test-tube / beaker, • use same volume of water in test-tube / beaker, use same starting temperatures in tubes, • ensure all water in tube below level of water in beaker, • use insulation / lid on beaker	**1**
	matching explanation, e.g.: • ensure same amount of water being used each time, • cooling rates different / owtte at different volumes / temps, • all water in tube has same surrounding temperature, • keeps water in beaker at (more) constant temperature	**1**
1(f)	reading taken perpendicular to scale	**1**
	at bottom of meniscus	**1**
	Total:	**11**

Question	Answer	Marks
2(a)	correct voltmeter symbol shown in parallel	**1**
2(b)	V = 2.7 (V)	**1**
	I = 0.48 (A)	**1**
2(c)	correct calculations of R – 5.63 / ecf, 3.20, 2.59	**1**
	consistent 2 or consistent 3 sig figs	**1**
2(d)(i)	correct calculations of r – 6.26, 6.40, 6.48 or ecf from R values	**1**
	Ω / m seen at least once and not contradicted	**1**
2(d)(ii)	statement matching results	**1**
	justification matching statement and results – 'within limits of experimental accuracy' / owtte	**1**
2(e)	arrow on wire between the inside edge of each crocodile clip	**1**
2(f)	any suitable precaution: reduce current / voltage, use longer / thinner resistance wires,	**1**
	Total:	**11**

Question	Answer	Marks
3(a)	h_I = 4.5 (cm)	**1**
3(b)	correct *M* calculations – 3.00 / ecf, 1.50, 0.73, 0.50, 0.37	**1**
3(c)	graph: axes labelled with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to within ½ small square	**1**
	well judged line and single, continuous thin line	**1**
3(d)	construction line(s) clearly seen on graph	**1**
	u in range 28.0 to 32.0 (cm)	**1**
3(e)	any appropriate difficulty: e.g. hand / ruler in way of image	**1**
	matching improvement: e.g. use translucent screen and view from behind, fix ruler / grid to screen	**1**
3(f)	able to achieve a sharp / complete / focused image / owtte	**1**
	Total:	**11**

Question	Answer	Marks
4	**apparatus:** MP1 springs made by winding wire around rod (or similar)	**1**
	method: MP2 apply load, measure length / extension of spring	**1**
	MP3 repeat for spring(s) of different material	**1**
	MP4 record results in suitable annotated table / bar chart / graph	**1**
	control variables: MP5 mark gained for any <u>two</u> of: unstretched length of spring, diameter of wire, coil spacing, load / range of loads used diameter of spring	**1**
	MP6 **precautions / difficulties / additional points:** MP7 any two from: clamp retort stand / might topple, use small loads / spring might overstretch/spring too weak/use loads which don't overstretch spring to support loads need to apply force smoothly / slowly, suggested range of loads, workable arrangement for applying load to spring (e.g. small loop at end of spring) trial experiment to find (range of) loads to use how to determine extension of spring, repeat each reading <u>and</u> take average, at least 5 loads for each sample if producing graph	**2**
	Total:	**7**

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Cambridge IGCSE™

PHYSICS **0625/62**

Paper 6 Alternative to Practical **March 2021**

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[Turn over

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.

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	<u>'List rule' guidance</u> 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)	method outlined e.g. measure distance of rule from bench at two places and horizontal if equal	**1**
1(b)	d = 96.0 (cm)	**1**
1(c)	any suggestion with reference to checking if t measurable / checking if d value appropriate / establishing a range of d and t values	**1**
1(d)	$1 / T$ = 0.28 (1 / s)	**1**
1(e)	graph: • axes labelled with quantity and unit	**1**
	• appropriate scales (plots occupying at least ½ grid)	**1**
	• plots all correct to ½ small square and precise plots	**1**
	• well-judged line and thin line	**1**
1(f)	G present and triangle method seen on graph	**1**
1(g)(i)	timing errors have less effect / smaller % uncertainty	**1**
1(g)(ii)	repeat each reading and calculate average value	**1**

Question	Answer	Marks
2(a)(i)	θ_R = 23 (°C)	**1**
2(a)(ii)	suitable precaution e.g.: line of sight perpendicular to scale wait until reading stops rising (at start) stir before reading	**1**
2(b)	s, °C, °C	**1**
2(c)	clear statement that cup B is more effective	**1**
	comparison of temperature changes over 180 s, matching statement	**1**
2(d)(i)	x_A = 0.058	**1**
	unit °C / s	**1**
2(d)(ii)	repeat cup A experiment <u>without a lid</u>	**1**
	calculate cooling rate and subtract x_A	**1**
2(e)	any 2 suitable control: same volume of water, same initial temperature, same diameter / height of cup, same room temp / named appropriate environmental condition	**2**

Question	Answer	Marks
3(a)	I = 0.18 (A)	**1**
	V_R = 3.7 (V)	**1**
3(b)	R_L and R_R calculated correctly	**1**
	R_L and R_R all consistent 2 or consistent 3 significant figures	**1**
3(c)(i)	R_L decreases (as V_L decreases)	**1**
3(c)(ii)	statement matching results	**1**
	within limits of experimental accuracy / owtte and supported by values from table	**1**
3(d)	obtain more values and plot a graph of R_L vs V_L	**1**
	extend line to R_L axis and read intercept	**1**
3(e)	correct variable resistor symbol (rectangle with strike-through arrow only)	**1**
	in completed series circuit and correct voltmeter symbol connected in parallel with resistor	**1**

Question	Answer		Marks
4	**MP1**	**factor:** named factor	**1**
	MP2	**method:** measure time for motion of ball and means of doing so (stopwatch / timer) over measured distance and means of measuring (probably metre rule / tape measure) / mention of between fixed points	**1**
	MP3	repeat for new value of the independent variable	**1**
	MP4	**control:** any variable appropriate to independent variable e.g. mass of ball if diameter is factor	**1**
	MP5	**table:** columns, with units, at least for independent variable, time	**1**
	MP6	**analysis:** compare readings in the table to see if change in factor produces change in speed, plot line graph (with axes specified)	**1**
	MP7	**additional point** (one from)**:** at least 5 sets of data taken, repeat each measurement <u>and</u> take average, repeat (whole) experiment for same factor but a new condition use of fiducial aid (e.g. mark fixed points to time between) release ball without pushing suitable means of release	**1**

Cambridge Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2736667153

PHYSICS **0625/62**

Paper 6 Alternative to Practical **February/March 2021**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

1 A student investigates the motion of an oscillating metre rule.

He uses the apparatus shown in Fig. 1.1.

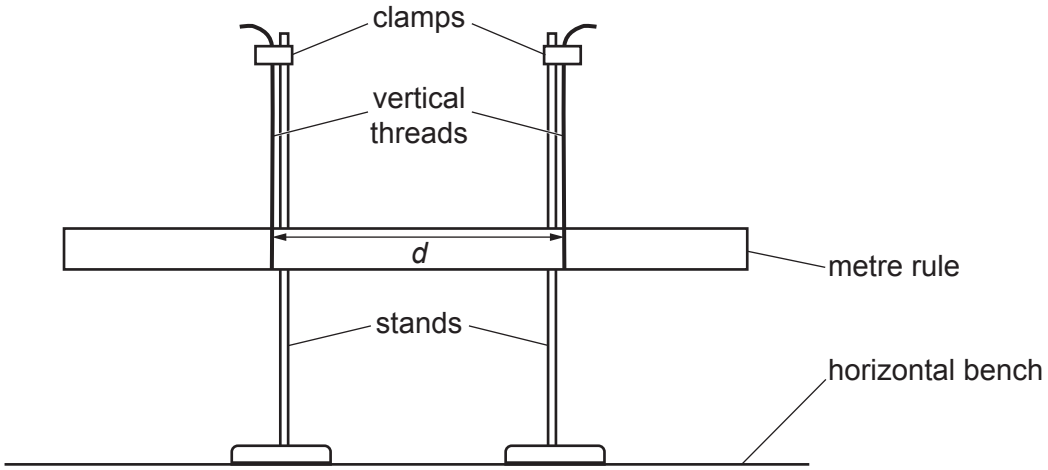


Fig. 1.1

(a) The student ensures that the metre rule is horizontal.

Briefly describe how to check that the metre rule is horizontal. You may draw a diagram or draw on Fig. 1.1 if it helps to explain your answer.

.....

.....

..... [1]

(b) The student moves the stands so that the vertical threads are at the marks on the metre rule shown in Fig. 1.2.

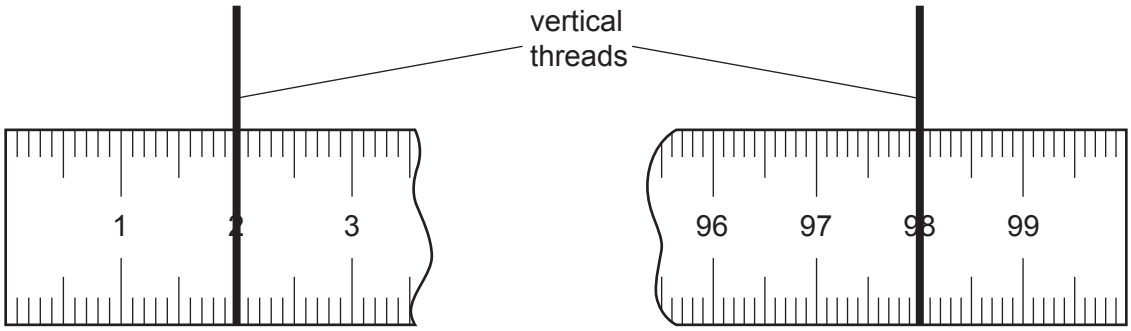


Fig. 1.2

Calculate the distance *d* between the threads.

d =..... cm [1]

(c) He twists the metre rule a small amount, as shown in Fig. 1.3, and then lets it go so that it oscillates in a rotating motion.

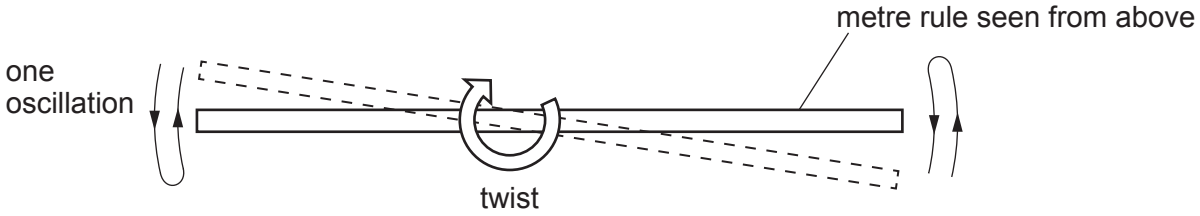


Fig. 1.3

He measures the time *t* for 5 complete oscillations of the metre rule.

t = 3.63 s

Suggest why it is useful to take a trial reading for this experiment.

.....

..... [1]

(d) The student carries out the same procedure for d values of 20.0 cm, 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm. His readings are shown in Table 1.1.

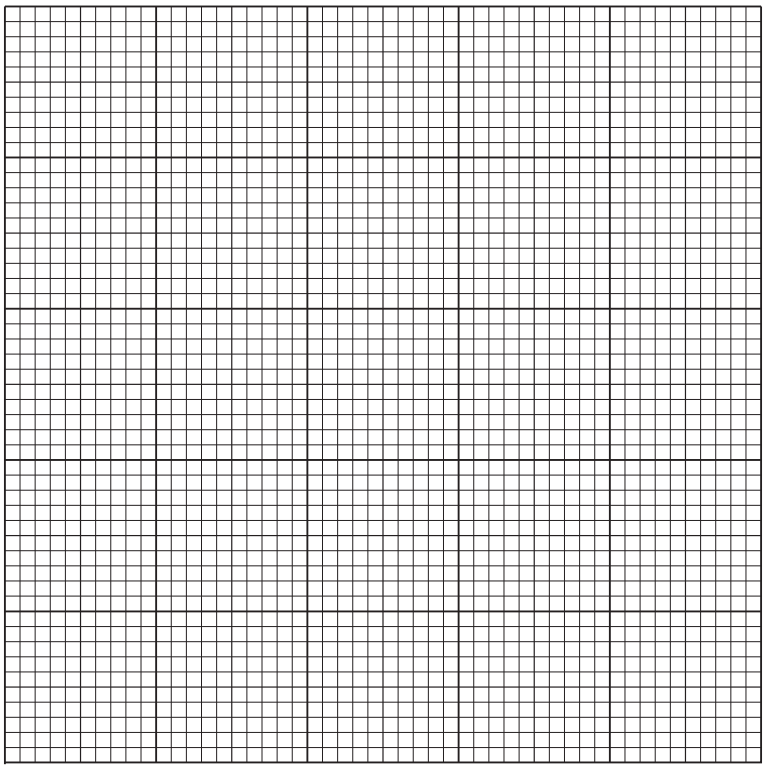
Table 1.1

d / cm	t / s	$\frac{1}{T}\Big/\frac{1}{\text{s}}$
20.0	17.85	
30.0	11.36	0.44
40.0	8.77	0.57
50.0	6.93	0.72
60.0	5.68	0.88

For distance d = 20.0 cm, calculate and record in Table 1.1, the value of $\frac{1}{T}$ where T is the time for 1 oscillation of the metre rule.
Use the value of time t from Table 1.1 and the equation $\frac{1}{T} = \frac{5}{t}$.

[1]

(e) Plot a graph of distance d / cm (y-axis) against $\frac{1}{T}\Big/\frac{1}{\text{s}}$ (x-axis).



[4]

(f) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G =..... [1]

(g) (i) Explain why it is more accurate to measure the time for 5 oscillations rather than for 1 oscillation.

.....

.....

..... [1]

(ii) Describe how the experiment could be improved to make the readings more reliable.

.....

.....

..... [1]

[Total: 11]

2 Students investigate the cooling of hot water in two different cups.

They use the apparatus shown in Fig. 2.1.

Cup A is made from thin plastic. The top of cup A has an inside diameter of 7 cm. Cup B is made from expanded polystyrene. The top of cup B has an inside diameter of 8 cm.

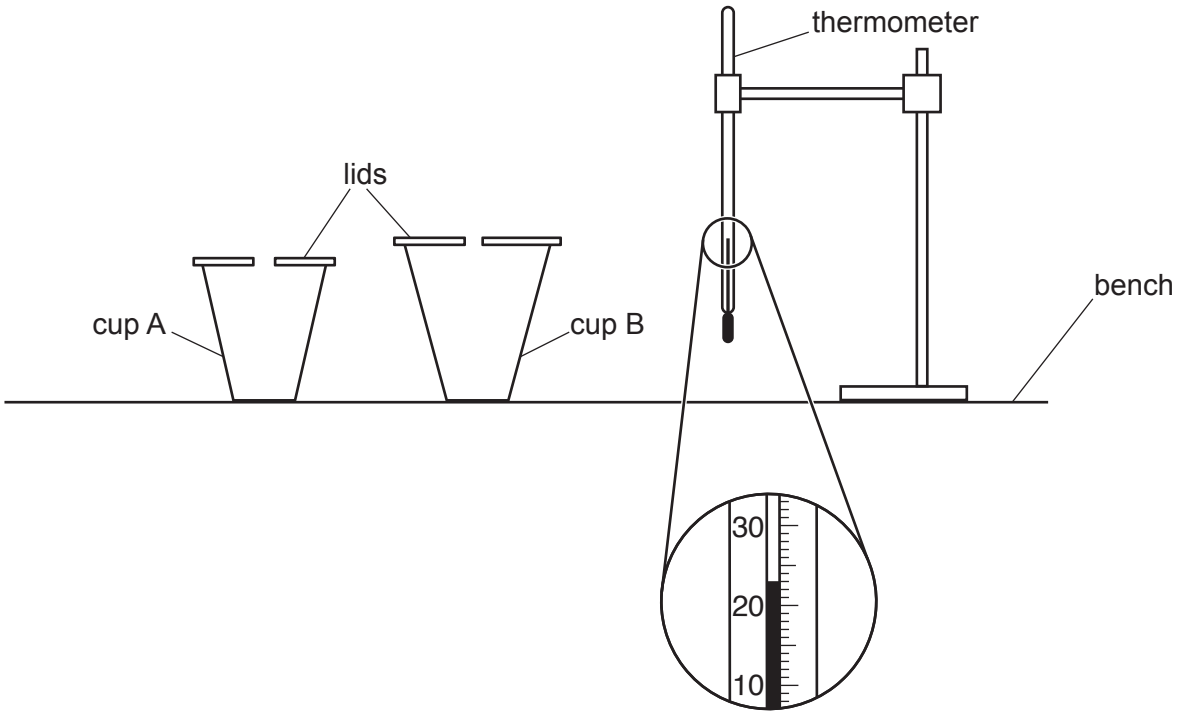


Fig. 2.1

(a) (i) Record the room temperature θ_R shown on the thermometer in Fig. 2.1.

θ_R =..... [1]

(ii) Describe **one** precaution that you would take to ensure that temperature readings in the experiment are as accurate as possible.

.....

..... [1]

(b) A volume of 100 cm^3 of hot water is poured into each cup and the initial temperature θ is recorded in Table 2.1.
The temperature of the water in each cup is recorded every 30 s. The values are shown in Table 2.1.

Table 2.1

	cup A	cup B
t/	θ/	θ/
0	87.5	88.0
30	84.5	86.0
60	82.0	84.5
90	80.5	83.0
120	79.0	82.0
150	78.0	81.0
180	77.0	80.5

Complete the headings in Table 2.1. [1]

(c) Write a conclusion stating which cup, A or B, is the more effective in reducing the cooling rate of the hot water in this experiment.

Justify your answer by reference to the results.

.....

.....

.....

..... [2]

(d) **(i)** Calculate x_A, the average cooling rate for cup A over the whole experiment. Use the readings for cup A from Table 2.1 and the equation

$$x_A = \frac{\theta_0 - \theta_{180}}{T}$$

where T = 180 s and θ_0 and θ_{180} are the temperatures at time t = 0 and at time t = 180 s.
Include the unit for the cooling rate.

x_A =..... [2]

(ii) Suggest an additional experiment to show how the lid affects the cooling rate of cup A.

Explain how to use the additional results to show the effect.

additional experiment .....

.....

explanation .....

.....

.....

[2]

(e) A student wishes to compare the effect of the materials of the cups on cooling rates. Suggest **two** variables that she should control to make this test fair.

1. .....

.....

2. .....

.....

[2]

[Total: 11]

3 A student investigates a resistor and a lamp connected in series.
She uses the circuit shown in Fig. 3.1.

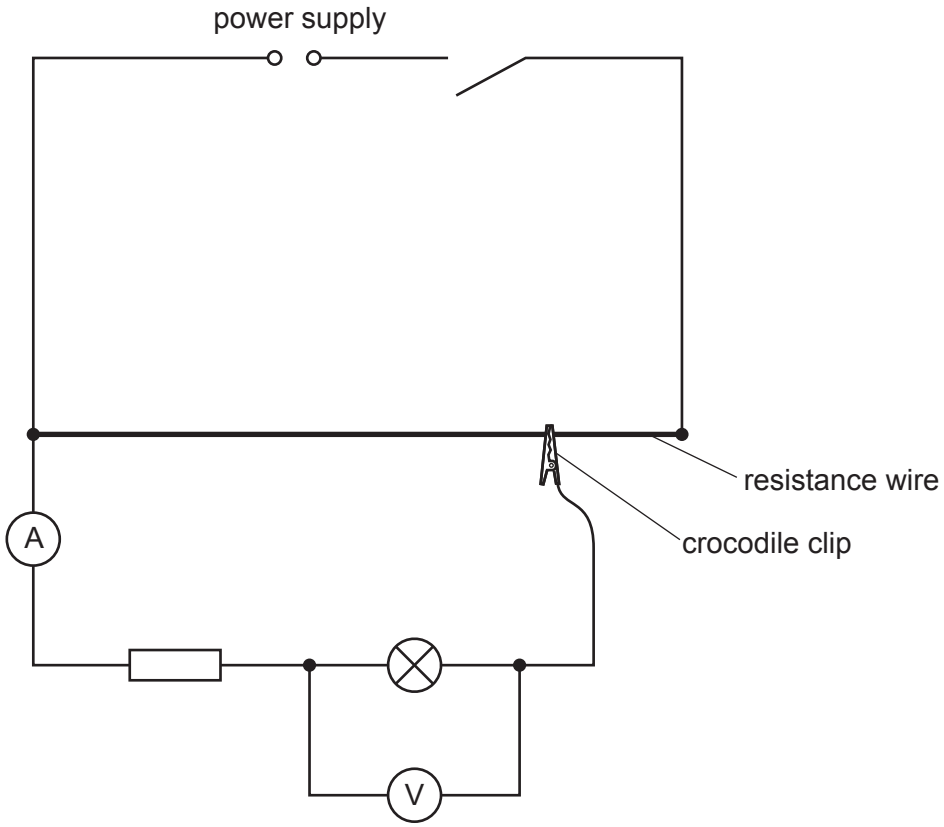


Fig. 3.1

(a) The student moves the crocodile clip on the resistance wire so that the value of the potential difference V_L across the lamp is 2.0 V.

She measures the current I for the lamp and resistor in series.

She then connects the voltmeter to measure the potential difference V_R across the resistor.

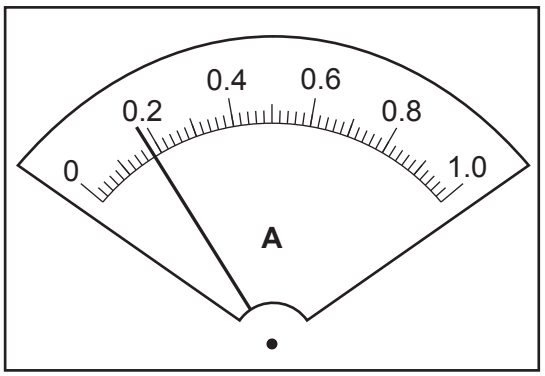


Fig. 3.2

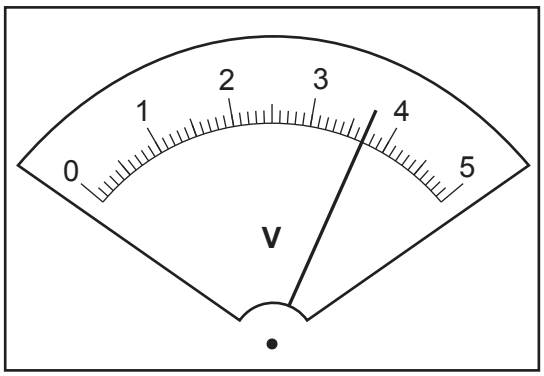


Fig. 3.3

Read, and record in Table 3.1, the values of I and V_R shown on the meters in Fig. 3.2 and Fig. 3.3.

[2]

(b) The student repeats the steps in **(a)** for values of V_L = 1.0 V and V_L = 0.5 V.
Her readings are shown in Table 3.1.

Table 3.1

V_L/V	I/A	V_R/V	R_L/Ω	R_R/Ω
2.0				
1.0	0.15	3.0		
0.5	0.12	2.4		

Calculate, and record in Table 3.1, the resistance of the lamp R_L for each value of V_L.

Use the values of V_L and I from Table 3.1 and the equation $R_L = \frac{V_L}{I}$.

Calculate, and record in Table 3.1, the resistance of the resistor R_R for each value of V_L.

Use the values of V_R and I from Table 3.1 and the equation $R_R = \frac{V_R}{I}$.

[2]

(c) **(i)** Describe the pattern of any change in the value of R_L as V_L decreases.

.....

..... [1]

(ii) A student suggests that R_R should be constant.

State whether your results support this suggestion.
Justify your statement by reference to values from Table 3.1.

statement .....

.....

justification .....

.....

.....

[2]

(d) A student wishes to determine the resistance of the lamp R_L when the potential difference across the lamp V_L = 0.0 V.

Describe how the experiment can be extended to do this with the help of a suitable graph.

.....

.....

.....

..... [2]

(e) It is possible to use a variable resistor instead of a resistance wire to change the potential difference across the lamp.

Complete the circuit in Fig. 3.4 to show:

- a variable resistor used for this purpose
- the voltmeter connected to measure the potential difference across the resistor

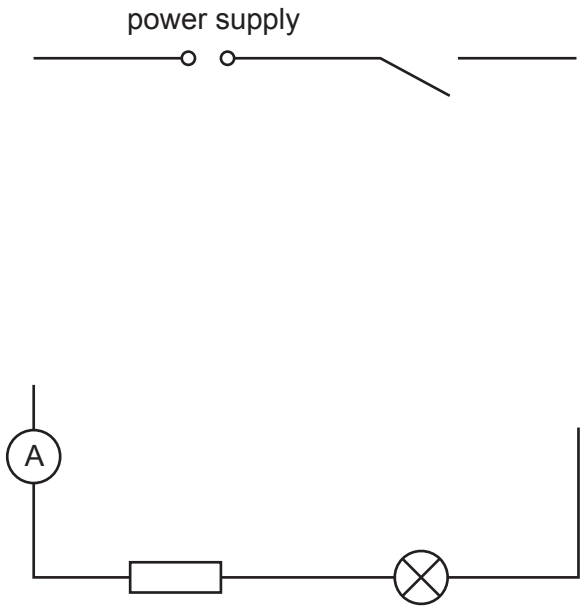


Fig. 3.4 [2]

[Total: 11]

4 A student investigates the motion of a ball rolling down a slope.

Plan an experiment which enables him to investigate how **one** factor affects the average speed of the ball.

Average speed can be calculated using the equation:

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

The apparatus available includes:

balls of various sizes and materials
a board which can act as a slope
blocks to support one end of the board.

In your plan, you should:

- state a factor which can be measured
- list any additional apparatus needed
- explain briefly how to carry out the experiment including exactly which measurements are to be taken
- state the key variables to be kept constant
- draw a table, or tables, with column headings, to show how to display the readings (you are **not** required to enter any readings in the table)
- explain how to use the readings to reach a conclusion.

You may draw a diagram if it helps to explain your plan.

[7]

[Total: 7]

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Cambridge Assessment International Education

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **February/March 2022**

MARK SCHEME

Maximum Mark: 40

Published

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- marks are awarded when candidates clearly demonstrate what they know and can do
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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.

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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)	l_0 = 2(.0) (cm) and l_S = 6.2 (cm)	**1**
	both to 1 decimal place	**1**
1(b)	suitable method e.g. measure distance from bench at each end and check equal	**1**
1(c)(i)	graph: • axes labelled with quantity and unit	**1**
	• appropriate scales (occupying at least ½ grid)	**1**
	• plots all correct to ½ small square and precise plots	**1**
	• line well-judged and thin and extended to axis	**1**
1(c)(ii)	*L* read correctly from graph	**1**
1(c)(iii)	W_R in range 1.3 to 1.6 and with unit of N	**1**
1(d)(i)	suspend load from loop of thread / any other suitable method to avoid standing load over marks on rule	**1**
1(d)(ii)	valid source of uncertainty e.g. test load not exactly 1.0 N / spring extension not linear / metre rule not uniform	**1**

Question	Answer	Marks
2(a)	θ_R = 23 (°C)	**1**
2(b)(i)	2 suitable precautions e.g. view scale reading perpendicularly, wait until reading stops rising (at the start), avoid thermometer touching beaker	**2**
2(b)(ii)	s, °C, °C all correct	**1**
2(c)	statement matching readings in table	**1**
	comparison of temperature changes over 180 s, matching statement (need to see correct values used in justification)	**1**
2(d)	suitable change e.g. use conducting material / metal for beaker B / support beaker A in beaker B so that there is an air gap underneath too	**1**
2(e)	2 suitable control variables e.g. initial temperature / volume of water / room temperature or other appropriate environmental condition	**2**
2(f)	R = 0.0972	**1**
	unit °C / s	**1**

Question	Answer	Marks
3(a)(i)	normal correct	**1**
3(a)(ii)	$\theta_1 = 15 \pm 1(°)$	**1**
3(b)(i)	d = 3(.0) (cm)	**1**
3(b)(ii)	separation not suitable and pin separation should be as large as possible / much larger / pin separation is too small / owtte	**1**
3(c)	all lines complete, straight and in correct position	**1**
3(d)(i)	$\beta = 18° \pm 2°$	**1**
3(d)(ii)	statement matching results	**1**
	justification with correct values matching statement	**1**
3(e)	two suitable precautions from: • use thin lines OR sharp pencil • view bottom of pins OR keep pins upright • ensure pins far apart • use thin pins	**2**
3(f)	difficult to align pins / place pins accurately, pins (too) thick mirror (too) thick	**1**

Question		Answer	Marks
4	**MP1**	**factor:** valid factor which may affect rate of temperature rise	**1**
	MP2	**apparatus:** thermometer and additional apparatus necessary to measure independent variable	**1**
	MP3	**method:** • measure independent variable • measure temperature (change) and / or time appropriate to procedure • repeat for new value of independent variable	**1**
	MP4	**control variable:** any significant variable (e.g. volume of water if current is the independent variable)	**1**
	MP5	**table:** columns, with units, for independent variable and dependent variable	**1**
	MP6	**analysis:** compare readings in the table to see if change in factor produces change in (rate of) temperature rise, plot (line) graph (with axes specified)	**1**
	MP7	**additional point** (one from)**:** 2nd valid control variable stated, at least 5 sets of data taken, repeat each measurement and take average,	**1**

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/62**

Paper 6 Alternative to Practical **May/June 2016**

MARK SCHEME

Maximum Mark: 40

Published

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MARK SCHEME ABBREVIATIONS

Brackets ( )	The word, phrase or unit in brackets is not required but is in the mark scheme for clarification.
accept	Accept the response.
AND	Both responses are necessary for the mark to be allowed.
NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
Ignore	This indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
Underlining	Mark is not allowed unless the underlined word or idea is used by the candidate.
c.a.o.	Correct answer only.
e.e.o.o.	This means "each error or omission".
o.w.t.t.e.	This means “or words to that effect”.
ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.
Significant figs.	Significant figures or decimal places will be penalised only where indicated.
Arithmetic errors	Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.
Transcription errors	Deduct one mark if the **only** error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.
Any [number] from:	accept the [number] of valid responses from list
Max	Indicates the maximum number of marks
Fractions	Allow these **only** where specified in the mark scheme.
Crossed out work	Work which has been crossed out **and not replaced but can easily be read,** should be marked as if it had not been crossed out.
Use of NR	(# key on the keyboard). Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)	l_0 = 55 (mm) c.a.o.	**1**
1(b)(i)	4, 9, 14, 19, 23 ecf **(a)**	**1**
1(b)(ii)	Viewing scale at right angles or use of straight edge / set square / pointer between bottom of spring and scale / ruler	**1**
1(c)	Graph: Axes correctly labelled with quantity and unit Suitable scales All plots correct to ½ small square Good line judgement, thin, continuous line, neat plots	 **1** **1** **1** **1**
1(d)(i)	*e* = 17 (mm) ecf **(a)**	**1**
1(d)(ii)	method clearly shown on graph *W* value 3.5–3.75 Unit N needed No ecf from **(i)**	**1** **1**
		Total: 10

Question	Answer	Marks
2(a)	*x* shown clearly from centre of **P** to pivot	**1**
2(b)	Make **Q** into a cube / regular shape / small contact area with rule	**1**
2(c)	Move Q or P slowly one way until it just tips, then back other way until it tips back and take middle reading OR repeat procedure / experiment **AND** take average	**1**

Question	Answer	Marks
2(d)	Measure width w of cube Place w / 2 either side of desired position OR draw centre line on cube / find centre of mass of cube and mark side of rule in desired position OR take readings on both sides of the cube and find the mean	1 1
2(e)	Place rule on pivot (without P and Q) and record / find balance point	
		Total: 6

Question	Answer	Marks
3(a)	m_1 =2.94	1
3(b)	(m_2 = 0.329 OR 0.33) m_1 **and** m_2 to 2 or 3 significant figures only **AND** both m with no unit (accept ×)	1
3(c)	Statement, expect YES. Must match results. e.c.f .allowed Justification to include idea of within (or beyond) limits of (experimental) accuracy	1 1
3(d)	Any two from: • Use of darkened room / brighter lamp / no other lights • Mark position of centre of lens on holder • Place metre rule on bench (or clamp in position) • Ensure object and centre of lens are same height from the bench • Move **lens** slowly / to and fro (when focussing) • Lens, object, screen vertical / perpendicular to bench • Repeat with different D • Use of graph paper / cm scale on screen to measure image	**max 2**

Question	Answer	Marks
3(e)	image appears well focused over a (small) range of lens positions / not all of image focussed at same time / relevant reference to chromatic aberration	**1**
		Total: 7

Question	Answer	Marks
4	Circuit diagram: **MP1** Sample of wire must be clearly identifiable by a label on the diagram or by letters on the diagram with an explanation in the text **MP2** All circuit symbols correct (even if circuit is incorrect) Method: **MP3** Take readings of V and I **MP4** For 5 or more lengths **MP5** Range of lengths must be between 5 cm and 2 m **with the largest length at least twice the smallest** Table drawn with headings: **MP6** l/m, V/V, I/A, R/ Ω Key variables to control: **MP7** Any one from • Material / resistivity / conductivity / type of wire • Diameter / radius / thickness / cross sectional area • Temperature of wire	**1** **1** **1** **1** **1** **1** **1**
		Total: 7

Question	Answer	Marks
5(a)(i)	s, °C, °C, °C	**1**
5(a)(ii)	83(°C)	**1**
5(b)(i)	First box / sentence indicated	**1**
5(b)(ii)	Clear reference to readings with examples of temperature differences	**1**
5(c)	Any two from: • Room temperature (or suitable reference to draughts or similar) • Starting temperature (of water) • Density of packing / amount / type of insulation • Thickness of lids / identical lids	**max 2**
5(d)	Card or any suitable insulating material Should be a good insulator / poor conductor	**1** **1**
5(e)	Perpendicular viewing / view at right angles / eye level Reading to bottom of meniscus	**1** **1**
		Total: 10

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PHYSICS **0625/62**

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Question	Answer	Marks
1(a)(i)	V = 0.8 (V)	**1**
	I = 0.65 A both units correct	**1**
1(a)(ii)	R = 1.2(3) (Ω)	**1**
1(b)(i)	1.31(Ω) (e.c.f.)	**1**
1(b)(ii)	length (directly) proportional to resistance/$l \propto R/l = kR$	**1**
1(c)	second box down to be ticked	**1**
1(d)	different heating effects on wires/wires may be at different temperatures different interpolation of readings between marks on meters/difficult to read the meter (or ammeter/voltmeter/current/voltage) accurately difficult to measure length of wire to nearest mm/to judge the position of the sliding contact cell may run down/power of cell may be less **Any 2 × 1 mark each**	**2**
	Total:	**8**

Question	Answer	Marks
2(a)	normal in centre of AB at the top face	**1**
	FE at 40° to the left of the normal	**1**
	P_1 P_2 distance at least 5 cm	**1**
2(b)	P_3 P_4 straight line and K correctly marked on CD	**1**
2(c)	$\alpha = 40 \pm 2$	**1**
	$x = 17 \pm 2$ mm	**1**
2(d)	statement is a definite YES or NO, depending on candidate's measured value of x justification to include the idea of within the limits of experimental accuracy/(very)close/almost equal etc. if YES	**1**
	justification to include the idea of outside the limits of experimental accuracy/too far apart/too different etc. if NO	**1**
2(e)	any one from: large pin separation/pins must be >5 cm apart ensure pins vertical/upright/perpendicular to the paper view bases of pins use thin pencil lines/thin pins	**1**
	Total:	**9**

Question	Answer	Marks
3(a)	50 – 200 cm inclusive	**1**
3(b)	move (the screen) slowly/carefully back and forth until the best position is found	**1**
3(c)	9.966/9.97/10 cm	**1**
	answer to 2/3 significant figures (regardless of value – even if incorrect)	**1**
3(d)	upside down/magnified/fainter/coloured	**1**
3(e)	A, D, F	**3**
	Total:	**8**

Question	Answer	Marks
4(a)	graph: axes correctly labelled	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
4(b)	expect NO line does not pass through origin	**1**
4(c)	6,40,34	**1**
	consistent units of N cm	**1**
4(d)	have not taken the weight of the rule/moment of the weight into account/not realised that $Qb + mX = Pa$ /the pivot is not at the centre (of mass) of the rule	**1**
	Total:	**8**

Question	Answer	Marks
5	method to include:	
MP1	measurements of temperature of hot water over a period of time/measurement of temperature at start and end of a specified cooling time /measurement of time for a specified temperature drop	**1**
MP2	repeat using variety of fan speeds (blowing air over water surface)	**1**
MP3 MP4	two from: room temperature initial/starting temperature of hot water volume/mass/amount of (hot) water distance of beaker to fan for each speed setting time of cooling (for a fixed temperature drop) temperature drop (for a fixed time) same beaker size/material	**2**
MP5	table with columns for fan speed, time and temperature with units in the table headings (not the body of the table) for time and temperature, but fan speed units not required	**1**
MP6	compare readings <u>to find out which fan speed</u> produces the greatest temperature drop / takes least time **or** plot a graph of temperature against time	**1**
MP7	in the same time / for same temperature drop **or** steepest gradient gives the fastest rate of cooling	**1**
	Total:	**7**

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Cambridge IGCSE™

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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)	280–350 (cm^3) given to nearest 5 cm^3	**1**
1(b)	wind string round beaker (several times)	**1**
	measure the length of the string (and divide by the number of turns)	**1**
1(c)(i)	*h* shown clearly on diagram	**1**
1(c)(ii)	V_B = 324(.064) (cm^3)	**1**
	given to 2 or 3 significant figures	**1**
1(d)(i)	208 (g)	**1**
1(d)(ii)	m_S = 516 (g) / 515.7 (g)	**1**
1(d)(iii)	ρ = 1.59 / 1590	**1**
	g / cm^3 / kg / m^3	**1**
1(e)	diagram showing a clear line of sight drawn at right angles to measuring cylinder level with the top of its contents	**1**

Question	Answer	Marks
2(a)	normal (any length) at centre of MR	**1**
	CD and EF in correct positions	**1**
2(b)	$i = 20° \pm 1°$	**1**
2(c)	P_1P_2 distance at least 5 cm / 50 mm and at most 15 cm / 150 mm	**1**
2(d)(i)	$a = 1.8 \pm 0.1$ (cm) and $b = 3.5 \pm 0.1$ (cm)	**1**

Question	Answer	Marks
2(d)(ii)	correct unit seen at least once and not contradicted	**1**
2(d)(iii)	a / b = 0.51 / correct from candidate's measurements	**1**
2(e)	a / b = 0.506	**1**
	both values of a / b with no unit	**1**
2(f)	(expect YES and) values are within the limits of experimental accuracy / error / uncertainty or values (very) close / close enough / not (very) far apart / both round to the same number / approximately equal / within 5% (or 10%) of each other	**1**
2(g)	any one from: difficulty in lining up pins size of pin holes / thickness of pins / thickness of lines thickness of mirror	**1**

Question	Answer	Marks
3(a)(i)	V_1 = 0.6(0) (V)	**1**
	I_1 = 0.32 (A)	**1**
3(a)(ii)	R_1 = 1.875 (Ω)	**1**
	Units Ω, V, A, all correct	**1**

Question	Answer	Marks
3(b)	graph: axes correctly labelled with quantity and unit and right way round	**1**
	suitable scales	**1**
	all plots correct to $\frac{1}{2}$ small square	**1**
	good line judgement, thin, continuous line	**1**
3(c)	method shown clearly on graph	**1**
	l correctly read to $\pm \frac{1}{2}$ small square	**1**
3(d)	5.5–6.5 (Ω) inclusive	**1**

Question	Answer	Marks
4	**MP1** **apparatus:** diagram: spring attached to a fixed support, (load and metre rule)	**1**
	MP2 at least three metals listed	**1**
	MP3 **method:** measure / record length of the spring and add load(s) and measure / record new length OR add load(s) and measure / record the extension	**1**
	MP4 repeat with other springs of different materials	**1**
	MP5 **key variables:** one from: original length of spring / diameter of spring / number of turns (of the spring) / diameter of the wire (of the spring) / length of the wire (of the spring)	**1**
	MP6 **table:** table with columns for metal and extension / length with correct unit(s) (in headings or in the body of the table)	**1**
	MP7 **conclusion:** plot a graph of extension against load (or axes other way around) for each spring (and compare) OR compare extensions for a fixed load for each spring OR plot a bar chart of extension against metal for a fixed load	**1**

Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/62**

Paper 6 Alternative to Practical **May/June 2022**

MARK SCHEME

Maximum Mark: 40

Published

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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 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[Turn over

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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)	explanation or diagram showing: equal readings either side of the 10 cm mark OR average of readings either side of the mark = 10	**1**
1(b)	71.2 – 50(.0)	**1**
	21.2	**1**
1(c)	axes correctly labelled with quantity AND unit AND the right way round	**1**
	suitable scales (filling ⩾ ½ the grid)	**1**
	five plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
1(d)	triangle method clearly shown on graph, covering at least ½ of candidate's line between extreme plots	**1**
	G = 1.6–1.9 inclusive	**1**
1(e)	$R = G$	**1**
	R given to 2 or 3 significant figures	**1**

Question	Answer	Marks
2(a)	X marked <u>anywhere</u> in the series circuit	**1**
2(b)(i)	I_1 = 0.24 (A)	**1**
2(b)(ii)	V_1 = 2.2(0) (V)	**1**
2(c)	R_1 = 9.17 / 9.2 (Ω)	**1**

Question	Answer	Marks
2(d)(i)	R_C in parallel with resistors in series	**1**
	voltmeter across candidate's combination AND the rest of the circuit correct	**1**
2(d)(ii)	3.09 with unit Ω seen at least once in **(c) (d)** or **(e)** and not contradicted	**1**
2(e)	R_3 = 7.24 (Ω) to 2 or 3 significant figures	**1**
2(f)(i)	use of a voltmeter and/or an ammeter	**1**
	measure *V* and *I* for each resistor and calculate *R* OR connect each resistor to the same voltage supply and measure the current OR connect resistors in series and measure the voltage across each of them OR connect resistors in parallel and measure the current through them	**1**
2(f)(ii)	check to see if the results are equal / close / within 10%	**1**

Question	Answer	Marks
3(a)(i)	*x* = 7.5 cm, *y* = 2.0 cm and *z* = 5.5 cm	**1**
	all to nearest millimetre	**1**
3(a)(ii)	*u* = 20 and *v* = 55	**1**
3(a)(iii)	*f* = 14.6(6666667) (cm)	**1**
3(b)	working shown	**1**
	f_A calculation correct	**1**

Question	Answer	Marks
3(c)	any **two** from: use darkened room / bright(er) object move **lens** slowly (to find sharpest image) move **lens** back and forth (to find sharpest image) ensure that object, lens and screen are vertical object and (centre of) lens same height (above bench) perpendicular reading/viewing of the ruler scale mark the centre of the lens on its holder	**2**
3(d)(i)	any integer between 5 and 15 (inclusive)	**1**
3(d)(ii)	(a straight line) is a way of taking an average	**1**
	anomalous results can be seen (and repeated or ignored)	**1**

Question	Answer	Marks
4	**method:** **MP1** place disc between heated cylinder and metal cylinder / set up apparatus as shown in diagram	**1**
	MP2 measure the time for lower cylinder to reach a certain temperature (rise) / measure the temperature (rise) reached in a certain time.	**1**
	MP3 repeat with the other discs	**1**
	MP4, MP5 **key variables:** any **two** from: thickness of disc temperature of heated cylinder initial temperature of lower cylinder initial temperature of the disc voltage/current/power of heater time (of heating) (if temperature change is measured) OR temperature change (if time of heating is measured)	**2**
	MP6 **table:** table with columns for (material of) disc, time / temperature difference (depending on MP2) with units in the headings only	**1**
	MP7 **conclusion:** (draw a graph/bar chart to) compare temperatures reached (in a certain time) / heating times (for a given temperature rise) with the material of the insulator – the disc with the lowest (final) temperature (difference) / takes the longest time, is the best insulator	**1**

Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE:
- If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line. The only mark available in this case is the first (axes right way round and labelled) So maximum 1.
- If axes are wrong way round, the other 3 marks are still available.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	x = 30.2(cm)	**1**
1(a)(ii)	Measure width w of load Place w / 2 either side of desired position OR draw centre line on load / find centre (of mass) of load and mark **side** of rule in desired position OR take readings on both sides of the load and find the mean	**1** **1**
1(b)	W = 3.95 (N)	**1**
1(c)	new x at least 5 cm different from original and in the range 10 cm–45 cm	**1**
1(d)	**two** from: difficult to judge the best position of 'almost balanced' is the centre of mass of the ruler exactly over the pivot / has the ruler slipped on the pivot? the load(s) obscure the scale the position of the centre of the load(s) is difficult to judge	**2**
1(e)	3.995 or 4 seen 2 or 3 significant figures (whatever the answer)	**1** **1**
	Total:	**9**

Question	Answer	Marks
2(a)(i)	V_1 = 1.7 (V) I_1 = 0.32 (A)	1 1
2(a)(ii)	R = 5.3125 Ω	1
2(b)	statement YES justification to include the idea of within the limits of experimental accuracy	1 1
2(c)(i)	variable resistor / rheostat	1
2(c)(ii)	correct symbol for variable resistor circuit correct	1 1
	Total:	8

Question	Answer	Marks
3(a)	any two from: length of spring / number of coils diameter / thickness of spring material / type / stiffness / elasticity / spring constant of spring how far spring is displaced / amplitude (of oscillations)	**2**
3(b)(i)	increases has no effect on has no effect on	**1** **1** **1**
3(b)(ii)	one from: repeats large number of oscillations and divide timing sensor / light gate use a fiducial mark (however expressed) counting down to zero (before starting the timer)	**1**
	Total:	**6**

Question	Answer	Marks
4	clock / stopwatch and source of heat	1
	heat to boiling with and without lid	1
	measure time taken to reach **boiling point/boil**	1
	same volume / mass / amount of water	1
	same starting temperature	1
	suitable table with column headings and units (seconds or minutes)	1
	conclusion drawn	1
	Total:	**7**

Question	Answer	Marks
5(a)(i)	8.4 cm / 84 mm	**1**
5(a)(ii)	initial BP_2 distance at least 5.0 cm	**1**
5(b)	graph: axes correctly labelled suitable scales all plots correct to ½ small square good line judgement, thin, continuous line	 **1** **1** **1** **1**
5(c)	statement to match graph – expect NO justification to match statement with reference to graph line	**1** **1**
5(d)	any **two** from: difficult to judge when pins are exactly in line difficult to ensure that pins are vertical/straight thickness of lines thickness of pins protractor only measures to ±1°	**2 × 1**
	Total:	**10**

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Question	Answer	Marks
1(a)(i)	d = 5.0 (cm)	**1**
1(a)(ii)	D = 50 cm	**1**
1(a)(iii)	clear correct use of set-square AND vertical ruler	**1**
1(b)(i)	28.12	**1**
1(b)(ii)	1.406 / 1.41 / 1.4	**1**
	unit s / secs / seconds seen in **1(b)(i)** or **1(b)(ii)** at least once	**1**
1(c)	statement to match readings justification to include the idea of within (or beyond e.c.f.)	**1**
	the limits of experimental accuracy e.g. (very) close / almost equal	**1**
1(d)	final box ticked	**1**
1(e)	V, V, V, V, P, P all correct = 2 marks 4 or 5 correct = 1 mark Fewer than 4 correct = 0 marks	**2**

Question	Answer	Marks
2(a)	24 (°C)	**1**
2(b)	34 (°C)	**1**
2(c)	30 (°C) AND °C seen once in **2(a)**, **2(b)** or **2(c)**	**1**
2(d)	to make sure that the temperature is the same throughout / to allow the water to mix and reach its final temperature faster	**1**
2(e)	heat loss (to surroundings) / time delays in transferring the water / did not wait for thermometer readings to stabilise / (initial) temperatures of the (cold / hot) <u>water</u> not the same	**1**
2(f)	insulation	**1**
2(g)	same starting temperature (of hot / cold water) / same room temperature	**1**
2(h)	recognisable measuring cylinder	**1**
	perpendicular viewing	**1**
	to bottom of mensicus	**1**

Question	Answer	Marks
3(a)	Graph	
	axes correctly labelled	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good best-fit curve judgement thin, continuous line based on all the plots	**1**
3(b)(i)	2 points and straight line correct	**1**
3(b)(ii)	u_1 and v_1 read correctly to ½ small square	**1**
3(b)(iii)	correct (calculation of) *f* from candidate's values *f* value rounding to 14 – 16cm	**1**
3(c)	any **two** from: upside down less bright / brighter coloured edges different sizes	**2**
3(d)	any **two** from: darkened room / bright object object AND lens AND screen perp. to bench / vertical object and lens same height (from bench) move screen (**not** lens) slowly / backwards and forwards clamp rule / fix rule to bench	**2**

Question	Answer	Marks
4	**method:** **MP1** measure length of band	**1**
	MP2 hang load, measure new length	**1**
	MP3 repeat with different thicknesses/widths	**1**
	control variable: **MP4** use same (original) length of band each time	**1**
	table: **MP5** table with columns for thickness, (load) and length / extension with units	**1**
	conclusion: **MP6** plot a graph of extension / length against thickness (for the same load) OR load against extension / length for different thicknesses OR comparison via a table e.g. compare extensions / lengths of different thicknesses for the same load	**1**
	one additional point: **MP7** use same load / same range of loads use at least 5 thicknesses / take at least 5 different readings to plot a graph show how to measure extension e.g. $l - l_0$ use same type / material of rubber band	**1**

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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'.

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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.

Examples of how to apply the list rule
State **three** reasons…. [3]

A

1	Correct	✓	**2**
2	Correct	✓	
3	Wrong	×	

B
(4 responses)

1	Correct, Correct	✓, ✓	**3**
2	Correct	✓	
3	Wrong	ignore	

C
(4 responses)

1	Correct	✓	**2**
2	Correct, Wrong	✓, ×	
3	Correct	ignore	

D
(4 responses)

1	Correct	✓	**2**
2	Correct, CON (of 2.)	×, (discount 2)	
3	Correct	✓	

E
(4 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct, Wrong	✓	

F
(4 responses)

1	Correct	✓	**2**
2	Correct	✓	
3	Correct CON (of 3.)	× (discount 3)	

G
(5 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct Correct CON (of 4.)	✓ ignore ignore	

H
(4 responses)

1	Correct	✓	**2**
2	Correct	×	
3	CON (of 2.) Correct	(discount 2) ✓	

I
(4 responses)

1	Correct	✓	**2**
2	Correct	×	
3	Correct CON (of 2.)	✓ (discount 2)	

RM Assessor 3 annotations:

annotation	suggested use
tick	mark awarded (note the ticks are added up next to the tick annotation, check the total you enter agrees)
cross	no mark awarded
SEEN	indicates page seen
BOD	benefit of doubt given
NBOD	no benefit of doubt given
on page comment	gives a text box to write comment –much easier to use than in the previous version of RM assessor
ECF	error carried forward
^	omission mark
?	unclear
U UU	unit penalty applied unit penalty not applied because already applied earlier in same question

annotation	suggested use
wavy line (horizontal or vertical)	used to highlight a particular point
CON	contradiction
NAQ	not answered question
PD	poor diagram
SF SFSF	error in number of significant figures significant figure error not penalized.
POT POT POT	power-of-ten error POT penalty not applied as already applied
TV	too vague
I	ignore
SC	special case

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

Brackets ( )	Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given. However, if a word in brackets is replaced with another word that is clearly wrong then the mark should not be awarded.
Underlining	Underlining indicates that this **must** be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
eeoo.	This means "each error or omission".
owtte.	This means “or words to that effect”.
Ignore	This indicates that something which is not correct or irrelevant i.e. it is not a contradiction (CON) is to be disregarded and does not incur a penalty.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.
Not/NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf in the mark scheme. **Always annotate ecf if applied.**
cao	correct answer only
Use of **NR**	(# or / key on the keyboard). Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)(i)	l = 5.1 (cm) and w = 4.7 (cm)	**1**
1(a)(ii)	V = 95.88 (cm^3)	**1**
1(a)(iii)	64 (g)	**1**
1(a)(iv)	ρ to 2 or 3 significant figures	**1**
	unit g / cm^3	**1**
1(b)(i)	estimate of V_1 given to the nearest cm^3 and > ½V < V	**1**
1(b)(ii)	m_W numerically equal to V_1	**1**
1(c)(i)	d = candidate's **(a)(iii)** – **(b)(ii)** correct	**1**
1(c)(ii)	YES/NO and suitable comparison of d with m or m_W	**1**
1(d)	(float wood and) mark water level / remove and mark the water level	**1**
	measure submerged depth and multiply by the cross-sectional area	**1**
	OR	
	measure height of block that is not submerged	(1)
	multiply by the cross-sectional area then subtract from total volume of block.	(1)
	OR	
	use of a measuring cylinder / displacement can	(1)
	measure the volume of water displaced (by the floating block)	(1)

Question	Answer	Marks
2(a)(i)	V_S = 1.8(0)	**1**
	I_S = 0.38	**1**
2(a)(ii)	R_S = 4.7 (4.7368)	**1**
	units Ω, V, A seen	**1**
2(b)	R_L = 4.86 (Ω)	**1**
	to 2 or 3 significant figures	**1**
2(c)	symbols correct	**1**
	resistor and lamp in series, with voltmeter in parallel with both	**1**
2(d)	R_C = 8.1 (8.0952) (Ω)	**1**
2(e)	statement to match results – expect NO	**1**
	explanation of idea of beyond limits of experimental accuracy (e.g., values not close (enough)/too far apart/> 10% difference	**1**

Question	Answer	Marks
3(a)	u / v = 0.25	**1**
3(b)	axes correctly labelled with quantity and unit and right way round	**1**
	suitable scales with u axis starting at 15.0	**1**
	all plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
3(c)	method clearly shown on graph	**1**
	value correct to within ½ small square	**1**
3(d)	Correct value for f – candidate's **(c)** ÷ 2	**1**
	to 2 or 3 significant figures	**1**

Question	Answer	Marks
3(e)	**Read both parts of the answer together and award the marks in either order**	
	deciding the screen position for most clearly focused image	**1**
	move screen slowly / backwards and forwards	**1**
	OR	
	the image is difficult to see	(1)
	carry out in a darkened room / away from bright lights	(1)
	OR	
	(metre) rule moving	(1)
	clamp rule / tape rule to bench	(1)
	OR	
	the image is (small and) difficult to focus	(1)
	use a bigger object	(1)
	OR	
	difficult to find the centre of the lens	(1)
	use a marked lens holder	(1)
	OR	
	object, (centre of) lens (and screen) are not at the same height above the bench	(1)
	use a ruler / set-square to check	(1)

Question	Answer		Marks
4	**MP1**	**method** names of at least three metals / named alloys suggested	**1**
	MP2	add loads / masses to test wire until it breaks	**1**
	MP3	repeat with the other metals	**1**
	MP4	repeat for each individual metal wire (and take an average)	**1**
	MP5	**control variable** diameter / cross-sectional area/thickness of the wire	**1**
	MP6	**table** columns for metal / wire and load / mass / weight, with unit	**1**
	MP7	**conclusion** compare breaking force / load / weight to metal OR plot a bar chart of metal and breaking force / load weight	**1**

Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE: – If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only mark available in this case is the first (axes right way round and labelled) So maximum 1.
– If axes are wrong way round, the other 3 marks are still available.

Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2022**

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 October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

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.

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	<u>'List rule' guidance</u> 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)	23(.0) (°C)	**1**
1(b)(i)	any **two** from: stir the mixture view thermometer at right angles (to scale / reading) / at eye level wait until (the reading on) the thermometer stops rising thermometer not touching the sides / base of beaker	**2**
1(b)(ii)	$\Delta\theta_1$ = 42(.0) AND $\Delta\theta_2$ = 27(.0)	**1**
	unit °C	**1**
1(c)	correct method	**1**
	53.5 (°C)	**1**
1(d)	statement to match results – expect NO	**1**
	explanation of idea of beyond limits of experimental accuracy (e.g. values not close (enough) / too far apart / > 10% difference)	**1**
1(e)	any **two** from: perpendicular viewing of <u>scale</u> / view at eye level / eye level with the surface of the water take the reading at the bottom of the meniscus place the measuring cylinder on a (horizontal) flat surface / ensure that measuring cylinder is vertical	**2**

Question	Answer	Marks
2(a)	normal correct and extending above and below MR	**1**
2(b)	line at 30° to the normal (± 2°) and end of line labelled A	**1**
2(c)(i)	P_1 P_2 distance at least 5(.0) cm and no larger than 15(.0) cm inclusive	**1**
2(c)(ii)	greater accuracy / easier to line up pins	**1**
2(d)(i)	angle β = 58 ± 2°	**1**
2(d)(ii)	all headings °	**1**
2(e)	correct values of (α + β) from candidate's results	**1**
2(f)	values are identical (within the limits of experimental accuracy) / almost equal / really close / not too far apart	**1**
2(g)	at least 1 value < 30(°) and 1 value > 45(°)	**1**
	all recorded values less than 90°	**1**
2(h)	difficulty in lining up pins / pins too thick / lines too thick / thickness of mirror (glass) / precision of protractor	**1**

Question	Answer	Marks
3(a)	*S* = 48.8 (cm)	**1**
3(b)	perpendicular viewing (of scale)	**1**
3(c)	1/N or N^{-1}	**1**

Question	Answer	Marks
3(d)	axes correctly labelled with quantity and unit and correct way round	**1**
	suitable scales with *a* axis starting from 30	**1**
	all plots correct to ½ small square	**1**
	good line judgement with thin continuous line	**1**
3(e)	triangle method clearly shown on graph	**1**
	(triangle) covering at least ½ of candidate's line between the extreme plots	**1**
	$G = 40.0 \pm 1.0$ (i.e. any answer between 39.0 and 41.0 inclusive)	**1**
3(f)	$d = G$ and given to 2 or 3 significant figures	**1**

Question	Answer	Marks
4	**circuit diagram** **MP1** voltmeter correctly positioned with correct circuit symbol	**1**
	method **MP2** attach a load, record / note / check V and I (and the value of the load)	**1**
	MP3 calculate / measure / record the resistance of the wire	**1**
	MP4 repeat with at least two <u>other</u> loads	**1**
	control variable **MP5** distance / length of wire <u>between crocodile clips</u>	**1**
	table **MP6** columns for load / tension / mass / number of loads, V, I and R with units at the head of each column	**1**
	conclusion **MP7** compare load with resistance to see if there is <u>an effect</u> / plot graph of load against resistance	**1**

Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE:
- If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line. The only mark available in this case is the first (axes right way round and labelled) So maximum 1.
- If axes are wrong way round, the other 3 marks are still available.