IGCSE Physics Pastpapers
Year 2020
marking scheme

Summer22,42,62,41,43,61,63
winter22,42,62,41,43,61,63
march22,42,62

Class:_____
Name:_____

Cambridge IGCSE™

PHYSICS	**0625/22**
Paper 2 Multiple Choice (Extended)	**May/June 2020**
MARK SCHEME	
Maximum Mark: 40	

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

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Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

PMT

Question	Answer	Marks
1	A	1
2	A	1
3	A	1
4	C	1
5	B	1
6	C	1
7	B	1
8	C	1
9	A	1
10	B	1
11	C	1
12	A	1
13	C	1
14	B	1
15	A	1
16	D	1
17	A	1
18	A	1
19	D	1
20	B	1
21	A	1
22	B	1
23	C	1
24	A	1
25	D	1
26	C	1
27	C	1
28	B	1

Question	Answer	Marks
29	C	1
30	C	1
31	A	1
32	B	1
33	B	1
34	B	1
35	C	1
36	B	1
37	A	1
38	D	1
39	A	1
40	A	1

Cambridge IGCSE™

PHYSICS	**0625/42**
Paper 4 Extended Theory	**May/June 2020**
MARK SCHEME	
Maximum Mark: 80	

Published

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This document consists of **9** printed pages.

Generic Marking Principles

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• 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.
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Marks awarded are always **whole marks** (not half marks, or other fractions).
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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:
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GENERIC MARKING PRINCIPLE 5:

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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.

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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
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     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.

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Question	Answer	Marks
1(a)(i)	s = vt in any form OR (s =) vt OR relates distance to area (under graph)	**C1**
	any **one** of: $5 \times 20 / 60$ OR $40 \times 20 / 60$ OR $6 \times 22 / 60$	**C1**
	(s = 1.667 + 13.333 + 2.2 =) 17 km	**A1**
1(a)(ii)	average speed = candidate's (i) / time	**C1**
	(average speed = $17 \times 60 / 74$ =) 14 km / h	**A1**
1(b)	gradient	**B1**
	(gradient =) change of speed / time	**B1**
1(c)	0	**B1**
	(constant) gradient = 0 OR speed constant	**B1**

Question	Answer	Marks
2(a)	impulse OR Δp = m(v – u) in any form	**C1**
	(impulse =) 750 000 (84 – 42)	**C1**
	(impulse =) 3.2×10^7 N s or m kg / s	**A1**
2(b)	Ft = impulse OR Δp in any form OR (F =) (impulse OR Δp) / t	**C1**
	(F = 3.2 x 10^7 / 80 =) 3.9×10^5 N	**A1**
2(c)	reduces drag / air resistance (experienced by the train) / more streamlined	**B1**
2(d)	less drag / air resistance (at slower speeds)	**B1**
2(e)	(maximum) friction (force) between rails and train reduced / train may slide	**B1**

Question	Answer	Marks
3(a)	$E = mc\Delta T$ in any form OR $(E =) mc\Delta T$	**C1**
	efficiency = (energy) output / (energy) input in any form	**C1**
	$15 \times 4200 \times \Delta T = 5000 \times 3600 \times 0.2$	**C1**
	$(\Delta T = 5000 \times 3600 \times 0.2 / 15 \times 4200 =) 57\,°C$	**A1**
3(b)	e.g. renewable OR no <u>air</u> pollution OR low running costs OR no named polluting gas OR no greenhouse effect	**M1**
	explanation that follows from advantage stated	**A1**
	e.g. expensive to install OR not available at night OR visual pollution OR needs a suitable (roof) space	**M1**
	explanation that follows from disadvantage stated	**A1**

Question	Answer	Marks
4(a)	(place) in <u>melting</u> ice	**B1**
	when bead has stopped moving OR owtte mark as lower fixed point / 0 °C	**B1**
	(place) in <u>steam</u> (above boiling water)	**B1**
	when bead has stopped moving OR owtte mark as upper fixed point / 100 °C	**B1**
4(b)	bead would not be liquid owtte	**B1**
4(c)(i)	thinner bore / tube OR smaller bulb OR use liquid which expands more (per unit change in temperature)	**B1**
4(c)(ii)	longer tube OR larger (volume) glass bulb OR use liquid which expands less (per unit change in temperature)	**B1**
4(d)	expands uniformly (with temperature) OR same distance between all degree intervals	**B1**

Question	Answer	Marks
5(a)	three wavefronts parallel to each other AND same angles of reflection and incidence both by eye	**B1**
	two wavelengths same as original wavelength by eye	**B1**
	three reflected waves meet incident waves at barrier	**B1**
5(b)	v = fλ in any form OR (f =) v/λ	**C1**
	OR (f =) 1.2 / 0.36	**C1**
	(f =) 3.3 Hz	**A1**
5(c)	sound OR ultrasound	**B1**
	compressions	**B1**

Question	Answer	Marks
6(a)	incident ray travels straight on at first face of prism 1	**B1**
	ray reflected through 90° at sloping face of prism 1 continues vertically downwards to sloping face of prism 2	**B1**
	ray reflected through 90° at sloping face and leaves box horizontally	**B1**
6(b)	n = 1 / sin C in any form OR (n =) 1 / sin C	**B1**
	{(n=) 1 / sin 45 OR (n=) 1 / 0.707} AND (n=) 1.41	**B1**

Question	Answer	Marks
7(a)(i)	primary coil wound round iron AND (labelled primary or coil OR connected to labelled supply / 12 V)	**B1**
	secondary coil wound round iron AND (labelled secondary OR connected to labelled output / 2 V)	**B1**
	significantly more coils around primary	**B1**

Question	Answer	Marks
7(a)(ii)	two from three • links magnetic fields of coils / primary and secondary • stronger magnetic field <u>in secondary</u> • better induction owtte	B2
7(a)(iii)	$V_1 I_1 = V_2 I_2$ in any form OR $(I_1 =) V_2 I_2 / V_1$ OR $(I_1 =) 2 \times 0.10 / 12$	C1
	$(I_1 =) 0.017\,A$	A1
7(b)	metal case earthed	B1
	in case wire falls off / insulation fails / live(wire) touches case	B1

Question	Answer	Marks
8(a)	two circuit symbols correct	B1
	three circuit symbols correct	B1
	symbol for cell, battery or power supply AND two other circuit symbols in series	B1
	LED correct way round	B1
8(b)	$R = V / I$ in any form OR $(R =) V / I$	C1
	$(R = 3.1 / 0.030 =) 100\,\Omega$	A1
8(c)(i)	uses $10.5 = 2.1 + V$ across heater	C1
	$(R = 8.4 / 1.5 =) 5.6\,\Omega$	A1
8(c)(ii)	$P = VI$ in any form OR $(P =) VI$	C1
	$(P = 8.4 \times 1.5 =) 12.6\,W$	A1

Question	Answer	Marks
9(a)	output 1, 1, 1, 0	**B1**
9(b)(i)	AND	**B1**
9(b)(ii)	first two lines of E 0,1	**B1**
	last two lines of E 1,1	**B1**
9(c)	$Q = It$ in any form OR $(Q =) It$	**C1**
	$(Q = 3 \times 60) = 180$ (C)	**C1**
	$(n = 3 \times 60 / 1.6 \times 10^{-19}) = 1.1 \times 10^{21}$	**C1**

Question	Answer	Marks
10(a)	(beam) narrow OR straight OR in one direction owtte	**B1**
	radiation in other directions absorbed	**B1**
10(b)(i)	out of page / towards viewer	**B1**
	equiv. to current in direction of beam	**B1**
10(b)(ii)	opposite to (i)	**B1**
	equiv. to current in opposite direction to beam OR LH rule mentioned or described	**B1**
10(b)(iii)	none	**B1**
	(γ) uncharged OR not equivalent to current	**B1**

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PHYSICS	**0625/62**
Paper 6 Alternative to Practical	**May/June 2020**
MARK SCHEME	
Maximum Mark: 40	

Published

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PMT

Question	Answer	Marks
1(a)	clear diagram showing use of set square and rule with horizontal line of set square across to vertical rule from approximate centre of bob	1
	rule positioned to enable measurement of d from bottom of clamp	1
	wording to include perpendicular viewing of the rule	1
1(b)(i)	t_1 = 28.12 (s)	1
1(b)(ii)	T_1 = 1.406 (s)	1
1(c)	m_A = 52	1
1(d)(i)	first box only ticked (error carried forward possible)	1
1(d)(ii)	justified by correct reference to results	1
1(e)(i)	rule or protractor used	1
	method explained / diagram drawn	1
1(e)(ii)	length	1

Question	Answer	Marks
2(a)	V = 0.2	1
	I = 0.28	1
	cm, V, A	1

Question	Answer	Marks
2(b)	graph: axes correctly labelled 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
2(c)(i)	conclusion matching readings (expect I constant)	1
2(c)(ii)	justification to match (i) with reference to results expect I values very close / equal	1
2(d)	method shown clearly on graph	1
	V_L correct to $\frac{1}{2}$ small square	1

Question	Answer	Marks
3(a)	23	1
3(b)(i)	47	1
3(b)(ii)	stir	1
3(b)(iii)	14 and 3.36 or 3.4	1
3(c)	26, 35 and 0.74(3)	1
	S and W with no units	1

Question	Answer	Marks
3(d)	statement to match results	1
	justification to match statement and including clear reference with appropriate number from the results	1
3(e)	room temperature	1
	temperature of hot water	1
3(f)	second and third boxes ticked	1

Question		Answer	Marks
4	**MP1**	diagram showing strip clamped to bench with majority overhanging	1
	MP2	means to measure bending, e.g. vertical metre rule at end of strip	1
	MP3	add load at / near end of strip and measure the amount of depression	2
	MP4	repeat with other strips	
	MP5	variables any **one** from: all strips to have same width / thickness / profile use of same load(s) allowance for unloaded depression	1
	MP6	table with columns for material, load and depression with correct units	1
	MP7	strip that bends most with same load is most bendy / alternative wording	1

Cambridge IGCSE™

PHYSICS	**0625/41**
Paper 4 Extended Theory	**May/June 2020**
MARK SCHEME	
Maximum Mark: 80	

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Cambridge IGCSE – Mark Scheme
PUBLISHED

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Question	Answer	Marks
1(a)(i)	$(a =) (v - u) / t$ OR $(62 - 6.0) / 35$ OR $56 / 35$	**C1**
	$1.6 \, m / s^2$	**A1**
1(a)(ii)	$(F =) ma$ OR $\Delta p / \Delta t$ OR $2.5 \times 10^5 \times 1.6$ OR $(62 \times 2.5 \times 10^5 - 6.0 \times 2.5 \times 10^5) / 35$	**C1**
	$4.0 \times 10^5 \, N$	**A1**
1(a)(iii)	$(p =) mv$ OR $2.5 \times 10^5 \times 6.0$	**C1**
	$1.5 \times 10^6 \, kg \, m / s$	**A1**
1(b)	curve of decreasing gradient from (0,0) to a point along dashed line	**B1**
	straight line of positive gradient after $t = 35 \, s$	**B1**
	gradient not zero at $t = 35 \, s$ OR no change of gradient (at $t = 35 \, s$)	**B1**
1(c)	thermal energy AND in something specific (e.g. brakes / air / tyres) OR kinetic energy of air	**B1**

Question	Answer	Marks
2(a)	0 (N) AND 8.0 N	**B1**
2(b)	$(k =) F / x$ OR $8.0 / 0.15$	**C1**
	$53 \, N / m$ OR $0.53 \, N / cm$	**A1**
2(c)(i)	elastic potential (energy)	**B1**
2(c)(ii)	15 cm	**B1**
2(c)(iii)	7.5 cm OR 2(c)(ii) / 2	**B1**

Question	Answer	Marks
3(a)	liquid levels in the two limbs of the tube are equal	**B1**
3(b)	molecules collide with the walls (of the container)	**B1**
	momentum of molecules changes (reverses)	**B1**
	this causes a force AND force spread out (over area of walls)	**B1**
3(c)(i)	$(p_2 =) p_1 V_1 / V_2 = 1.0 \times 10^5 \times 60 / 50$	**C1**
	1.2×10^5 Pa	**A1**
3(c)(ii)	$p_2 = p_{atm} + h\rho g$ OR $1.2 \times 10^5 - 1.0 \times 10^5$ OR 2.0×10^4 OR $(\rho =) 2.0 \times 10^4 / (0.15 \times 10)$	**C1**
	1.3×10^4 kg m^{-3}	**A1**

Question	Answer	Marks
4(a)	<u>temperature</u> at which liquid turns into gas	**B1**
4(b)(i)	$(E =) mc\Delta T$ OR $0.30 \times 4200 \times (100 - 95)$	**C1**
	6300 J	**A1**
4(b)(ii)	$(C =) E / \Delta T$ OR $6300 / 84$	**C1**
	75 J / °C	**A1**
4(b)(iii)	molecules do work against attractive force as they evaporate	**B1**
	more energetic molecules more likely to escape	**B1**
	average energy of remaining molecules decreases	**B1**

Question	Answer	Marks
5(a)	(point) where incident parallel rays meet after passing through lens OR origin of rays that emerge parallel after passing through lens	**M1**
	on principal axis OR use of term paraxial OR centre line	**A1**
5(b)(i)	**enlarged virtual upright** two correct answers underlined AND no more than one wrong answer underlined	**M1**
	three correct answers underlined AND no wrong answer underlined	**A1**
5(b)(ii)1	both principal focuses marked at points 5.0 cm from the optical centre	**B1**
5(b)(ii)2	any **two** construction lines from: • line from top of I towards far principal focus and traced back from lens horizontally • line from top of I to (and through) centre of lens • horizontal line from top of I to lens and traced back to near principal focus	**B2**
	O marked with top at intersection	**B1**
5(b)(iii)	2.7 cm $\geqslant$ distance $\geqslant$ 3.1 cm	**B1**

Question	Answer	Marks
6(a)	($\lambda =$) v/f OR 340 / 20 000 OR 340 / 20	**C1**
	0.017 m AND 17 m	**A1**
6(b)	(longitudinal wave) <u>vibration</u> direction parallel to propagation / energy travel direction	**B1**
	transverse wave <u>vibration</u> direction perpendicular to propagation / energy travel direction	**B1**
	consists of rarefactions AND compressions	**B1**

Question	Answer	Marks
6(c)	diffraction mentioned	**B1**
	wavelength of sound from drum / low frequency sound greater (than wavelength of high frequency sound)	**B1**
	more diffraction of sound from drum OR less diffraction of high frequency sound	**B1**

Question	Answer	Marks
7(a)(i)	(copper) contains free electrons	**B1**
	good <u>electrical</u> conductor	**B1**
7(a)(ii)	magnetic material OR easily magnetised	**B1**
	temporary magnetic material OR easily demagnetised	**B1**
7(b)(i)	alternating / changing / varying magnetic field (produced by X)	**B1**
	(electromagnetic) induction in Y	**B1**
	(alternating) electromotive force (e.m.f.) between terminals of Y / in Y	**B1**
7(b)(ii)	current in X increases	**B1**
	to supply the power used in Y / the lamp	**B1**

Question	Answer	Marks
8(a)	990 / (54 / 1.2) OR 990 / 45 OR (number of cells in pack =) 54 / 1.2 OR 45	**C1**
	22	**A1**
8(b)(i)	$(P =) EI$ OR 1.2×3.5	**C1**
	4.2 W OR 4.2 J / s	**A1**

PMT

Question	Answer	Marks
8(b)(ii)	thick wires have a smaller resistance	**B1**
	less thermal energy generated in wires	**B1**
	more efficient OR less risk of fire / insulation melting	**B1**

Question	Answer	Marks
9(a)	digital signal: consists of high and low states / voltages	**B1**
	analogue signal: continuously varying voltage	**B1**
9(b)(i)	AND gate OR gate AND	**B1**
9(b)(ii)	when the inputs differ AND 'AND gate' produces 0 AND 'OR gate' produces 1	**B1**
9(c)(i)	both inputs to upper NOR gate are 0s	**B1**
9(c)(ii)	two (identical) inputs to NAND gate are 1s	**M1**
	lower input to lower NOR gate is 1	**M1**
	output Q is 0	**A1**

Question	Answer	Marks
10(a)	equal number of electrons OR equal number of protons	**B1**
10(b)(i)	$^{13}_{5}X$	**C1**
	$^{0}_{-1}\beta$	**C1**
	$^{13}_{6}Y$	**A1**
10(b)(ii)	any **three** from: • β-particles have charge of smaller size • β-particles have smaller mass • β-particles have less energy • β-particles travel faster / less time near to air molecule • effect / force on electrons in air molecules less	**B3**

Cambridge IGCSE™

PHYSICS	0625/43
Paper 4 Extended Theory	**May/June 2020**
MARK SCHEME	
Maximum Mark: 80	

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

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

Generic Marking Principles

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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:

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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.

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	For questions that require **n** responses (e.g. State **two** reasons …):
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	• Non-contradictory responses after the first **n** responses may be ignored even if they include incorrect science.
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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.
	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)	rate of change of velocity OR change in speed per unit time / s	**B1**
1(b)(i)	deceleration	**C1**
	constant deceleration	**A1**
1(b)(ii)	acceleration	**C1**
	increasing acceleration	**A1**
1(b)(iii)	decreasing speed / velocity OR deceleration	**B1**
1(b)(iv)	constant speed	**B1**

Question	Answer	Marks
2(a)	$V (= 0.3 \times 0.3 \times 0.4) = 0.036$ (m^3)	**C1**
	$\rho = m / V$ in any form OR (m =) ρV OR 1020×0.036	**C1**
	(m =) 37 kg	**A1**
2(b)(i)	$P = \rho gh$ in any form	**C1**
	(h =) $400 \times 10^3 / (1020 \times 10)$	**C1**
	(h =) 39 m	**A1**
2(b)(ii)	$P = F / A$ OR (F =) PA OR $500 \times 10^3 \times 0.62$	**C1**
	(F =) 310 000 N OR 310 kN	**A1**

Question	Answer	Marks
3(a)	line of action of the centre of mass falls outside the base of the bus OR anticlockwise moment is greater than clockwise moment	B1
3(b)	bus more likely to fall over / topple / less stable	M1
	(line of action of) centre of mass may fall outside (the base of) the bus	A1
3(c)(i)	total mass of passengers = 73×65 (kg) OR 4700 kg	C1
	(total mass of bus, driver and 73 passengers) = 21 000 kg	A1
3(c)(ii)	(F =) ma in any form	C1
	(F =) 15 000 N	A1

Question	Answer	Marks
4(a)	molecules escape from the surface of the liquid	B1
	more energetic / faster moving molecules escape	B1
	slower / less energetic molecules are left behind	B1
	temperature of liquid decreases because average K.E. of remaining molecules is lower	B1
4(b)	any **two** from: air temperature increases more wind cloud stops covering the Sun	B2

Question	Answer	Marks
5(a)(i)	E = Pt in any form	**C1**
	(E =) 6000 J	**A1**
5(a)(ii)	E = mc∆T in any form	**C1**
	$c = \dfrac{6000}{550\,(33-20)}$	**C1**
	(c =) 0.84 J / (g °C) OR 840 J / (kg °C)	**A1**
5(a)(iii)	EITHER some of energy supplied by the heater heats the heater / goes to lagging / goes to surroundings	**M1**
	specific heat capacity is lower than value in (ii)	**A1**
	OR some energy may be absorbed from surroundings if they are at a higher temperature	**M1**
	specific heat capacity is higher than value in (ii)	**A1**
5(b)	(specific) heat capacity of water is much higher than (specific) heat capacity of sand	**B1**
	same rate of energy supplied to sand and sea	**B1**
5(c)	cold junction labelled or shown in ice or something similar OR diagram with two junctions with voltmeter labelled	**B1**
	two different metals labelled	**B1**
	galvanometer or voltmeter joining ends of wires	**B1**

Question	Answer	Marks
6(a)	three wavefronts parallel to each other	**B1**
	two wavelengths same as reflected by eye	**B1**
	three wavefronts at same angle to barrier as original	**B1**
6(b)	second, third, fifth and sixth boxes ticked	**B3**
6(c)	1500 m / s	**B1**

Question	Answer	Marks
7(a)	sin i / sin r = n in any form	**C1**
	r = 18°	**A1**
7(b)	light travelling from optically dense medium to optically less dense medium	**B1**
	all light reflected OR no light refracted	**B1**
	angle of incidence is greater than the critical angle	**B1**
7(c)	ray reflected at face AB with i = r by eye	**B1**
	ray refracted at face BC and bent away from the normal	**B1**

Question	Answer	Marks
8(a)(i)	region in which an electric charge experiences a force	**B1**
8(a)(ii)	direction of force on a positive charge	**B1**

Question	Answer	Marks
8(b)	any **four** from: • ball moves towards positive plate • ball touches positive plate • made of conducting material so becomes positively charged • repelled from positive plate • touches negative plate and loses charge • negatively charged ball attracted back to positive plate and process repeats	**B4**
8(c)	$I = Q / t$ in any form	**C1**
	$t = Q / I$	**C1**
	($t = 15 / 0.29 =$) 52 s	**A1**

Question	Answer	Marks
9(a)(i)	anti-clockwise (seen from brushes)	**M1**
	I correctly described	**A1**
	F down on left / up on right	**A1**
9(a)(ii)	arrow labelled correct direction on coil	**B1**
9(a)(iii)	electrons –ve OR repelled from –ve connection of supply	**B1**
9(b)(i)	rotates in opposite direction	**B1**
9(b)(ii)	turns faster OR greater moment / turning effect	**B1**
9(b)(iii)	turns faster OR greater moment / turning effect	**B1**

Question	Answer	Marks
10(a)	$^0_{}X$	B1
	$_{-1}X$	B1
	β OR beta (particle)	B1
10(b)(i)	background radiation	B1
	rocks / ground / buildings / food / space / weapons testing / nuclear accidents or waste / sun / air / radon / argon	B1
10(b)(ii)	subtracts 10 from 80	B1
	evidence of recognising two half-lives OR compares 70 and 10	B1
	(final reading =) 70/4 + 10 = 27 OR (70/10 = 7) age > 2 half-lives OR age nearly 3 half-lives	B1
	age > 11 400	B1

Cambridge Assessment
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PHYSICS **0625/61**

Paper 6 Alternative to Practical **May/June 2020**

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of **7** printed pages.

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Question	Answer	Marks
1(a)	0.025, 0.037, 0.050, 0.063, 0.075	1
	Consistent significant figures	1
1(b)	Graph: Axes correctly labelled 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
1(c)	(0.02) Method shown clearly on graph	1
	Value correct to $\frac{1}{2}$ small square	1
1(d)	Clear wording or diagram	1
1(e)(i)	Difficult to obtain balance point	1
1(e)(ii)	Idea of obtaining nearest to balance	1

Question	Answer	Marks
2(a)(i)	$V_1 = 3.5$	1
2(a)(ii)	$I_1 = 0.38$	1
2(a)(iii)	$R_1 = 9.21$ (ecf allowed)	1
	Unit Ω	1

Question	Answer	Marks
2(b)	R_2 = 5.7 and R_3 = 4.6, with consistent 2 sf	1
2(c)	Total R = 20	1
2(d)	Statement matches readings (Expect B)	1
	Justification with suitable numbers quoted	1
2(e)	Three lamps in series, correct symbol	1
	Voltmeter across lamp L_3	1
	Other symbols and circuit correct	1

Question	Answer	Marks
3(a)(i)	P_2 at least 5.0 cm from P_1	1
3(a)(ii)	Straight line joining pin positions	1
	Extended at least 7 cm behind mirror	1
3(b)(i)	Correct line and correct position of Y labelled	1
3(b)(iii)	Correct a to within $\pm$ 2 mm	1
3(b)(iii)	Correct b to within $\pm$ 2 mm	1
3(c)(i)	Correct x measured and correct unit seen at a, b or x and not contradicted	1
3(c)(ii)	Diagram to show image in mirror meeting top of pin above mirror	1
3(d)	Statement to match results	1
	Justification to match statement with correct reference to results	1

PMT

Question	Answer	Marks
3(e)	Any **one** from: Thickness to mirror Thickness of lines Difficulty in judging exact lining up of pins.	1

Question	Answer	Marks
4	**MP1** Diagram to show container and thermometer	1
	MP2 Hot water in a container. Record initial temperature and take temperature at intervals as it cools	1
	MP3 Repeat with at least three other colours	1

	Any **two** from:
	MP4 Same starting temperature
	        Same room temperature
	MP5 Use of a lid
	        At least three named colours
	        Same thickness of paint
		2

	MP6 Table with clear columns for temperature and / or time (to match method), with appropriate units	1
	MP7 Conclusion: Greatest temperature drop shows best radiator (or reverse argument)	1

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Cambridge IGCSE™

PHYSICS	**0625/63**
Paper 6 Alternative to Practical	**May/June 2020**
MARK SCHEME	
Maximum Mark: 40	

Published

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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)(i)	l = 15.0 (cm)	1
	centre of weight at 25(.0) cm seen or implied / clear subtraction of 10.0 cm from candidate's value	1
1(a)(ii)	1.3 (N)	1
1(a)(iii)	ensure distances from bench at both ends are equal OR use set square between rule and stand OR align with known horizontal line (e.g. window ledge)	1
1(b)	graph: • axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least $\frac{1}{2}$ grid)	1
	• plots all correct to $\frac{1}{2}$ small square and precise plots	1
	• well judged line <u>and</u> thin line	1
1(c)(i)	F_0 correct from graph	1
1(c)(ii)	W_R in range 1.2 to 2.0	1
1(d)	hang load from cotton loop on metre rule <u>and</u> cotton can be placed on precise mark on metre rule	1

Question	Answer	Marks
2(a)(i)	correct voltmeter symbol in parallel with resistor	1
	correct ammeter symbol in series	1

Question	Answer	Marks
2(a)(ii)	V_A = 2.4 (V)	1
	I_A = 0.48 (A)	1
2(a)(iii)	correct calculation of R_A = 5(.0) / ecf	1
2(b)	correct unit for $R - \Omega$	1
2(c)	all R values to consistent 2 or consistent 3 significant figures	1
2(d)	statement matching results	1
	justification matching statement with <u>values</u> from results used, e.g. within limits of experimental accuracy	1
2(e)(i)	correct symbol for potentiometer	1
2(e)(ii)	can obtain average value / plot a graph	1

Question	Answer	Marks
3(a)(i)	u = 4.0 (cm) <u>and</u> v = 8.6 (cm)	1
3(a)(ii)	U = 20.0 (cm) <u>and</u> V = 43.0 (cm)	1
3(a)(iii)	f_1 = 13.7 <u>and</u> unit	1
3(a)(iv)	move screen backwards and forwards / slowly	1
3(b)(i)	v = 3.5 (cm) <u>and</u> V = 17.5 (cm)	1
3(b)(ii)	h_O = 2.0 (cm) <u>and</u> h_I = 0.8 (cm)	1
3(b)(iii)	M = 0.4 <u>and</u> no unit	1
3(b)(iv)	f_2 = 12.5 (cm)	1

Question	Answer	Marks
3(c)	any **one** from: mark position of lens on holder clamp rule / place rule on bench ensure screen, lens and object all perpendicular view scale perpendicularly	**1**
3(d)(i)	difficult to measure height of image (accurately) as image is small	**1**
3(d)(ii)	use larger object / graph paper on screen OR mark top and bottom of image and measure later	**1**

Question	Answer	Marks
4	**MP1** **additional apparatus:** voltmeter, protractor, metre rule	**1**
	MP2 **control variable (one from):** distance of lamp from solar panel height of lamp / height of solar panel brightness of lamp	**1**
	MP3 **method (one from):** measure angle between panel and stand / other fixed datum (switch on lamp) measure potential difference	**1**
	MP4 repeat for different angle	**1**
	MP5 **table:** appropriate columns with clear headings and units	**1**
	MP6 **analysis:** suitable analysis of readings, e.g. calculation of rate of change of potential difference with angle draw a suitable graph with correct axes stated	**1**

Question	Answer	Marks
4	**MP7** **additional point / precaution (one from):** reading with only ambient light first / subtract ambient light reading make room dark fix protractor keep axis of solar panel and line of lamp perpendicular to each other at least five sets of data taken repeat each reading and take an average repeat for different distance of lamp	**1**

This document consists of **3** printed pages.

Question	Answer	Marks
1	D	**1**
2	C	**1**
3	C	**1**
4	B	**1**
5	D	**1**
6	C	**1**
7	A	**1**
8	B	**1**
9	C	**1**
10	C	**1**
11	D	**1**
12	A	**1**
13	C	**1**
14	C	**1**
15	D	**1**
16	C	**1**
17	C	**1**
18	A	**1**
19	C	**1**
20	A	**1**
21	D	**1**
22	C	**1**
23	D	**1**
24	B	**1**
25	B	**1**
26	B	**1**
27	B	**1**
28	A	**1**

Question	Answer	Marks
29	C	1
30	B	1
31	C	1
32	A	1
33	B	1
34	B	1
35	A	1
36	C	1
37	D	1
38	A	1
39	A	1
40	C	1

Cambridge IGCSE™

PHYSICS	**0625/42**
Paper 4 Extended Theory	**October/November 2020**
MARK SCHEME	
Maximum Mark: 80	

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 2020 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 **19** printed pages.

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 <u>Calculation specific guidance</u>

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 <u>Guidance for chemical equations</u>

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.

PUBLISHED

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. However, an A mark following an M mark is a dependent mark and is only awarded if the M mark has been awarded.
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.
<u>Underlining</u>	Underlining indicates that this **<u>must</u>** 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

Significant   Answers are normally acceptable to any number of significant figures ≥ 2.
Figures   Any exceptions to this general rule will be specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f

Units   Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Annotate with U.
                For more than one unit error in a question, annotate UU to indicate an error which has not been penalised.
                Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. kg m s^{-2} for N is NOT acceptable. The following are acceptable alternatives: Nm for J, Js^{-1} or Nms^{-1} for W, Nm^{-2} for Pa, Ns and kg m s^{-1} are both acceptable for both momentum and impulse.
                Beware : J NOT acceptable for moments.
                Condone wrong use of upper and lower case symbols, e.g. pA for Pa.

                Arithmetic errors   If the **only** error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one mark lower than the maximum mark.
                Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. Do not penalise the same POT error more than once. Annotate POT POT. However, if the power-of-ten error is due to the wrong omission or inclusion of *g* (= 10 N / kg) this rule does not apply.
                The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error.

                Transcription errors If the only error in arriving at a final answer is because previously calculated data has clearly been misread, but used correctly, then for that part question the mark will be one less than the maximum mark.

Fractions   Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.

Crossed out   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.
Look to see if it has been replaced on a blank page or another part of the same page.

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.

RM Assessor 3

Please note that 0625 papers are now marked using RM assessor3. Videos and documents are available by using the
Help icon in the top right hand cornet when logged in or from the RM support site. Familiarisation mode is also available on RM Assessor 3.
The tool bar is now located on the left of the screen and you drag items used frequently to the right hand side of the
tool bar. Note – the tool bar won't be visible until you have scripts to mark rather than just browse.

RM Assessor3 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

Guidance on the expression : words, symbols or numbers
Accept numbers if, in the context of the question, that number can reasonably be a value for the quantity in the equation/formula.
Accept alternative symbols that can reasonably represent the quantity in the equation but not if there is confusion with another quantity that is represented by that symbol in the syllabus e.g. Q is often acceptable for thermal energy but not if, as has happened, if there is confusion with charge.

Linking pages to other questions RM Assessor3

It is not unusual for candidates to write all or parts of answers to question outside the normal marking zone for that question. It is absolutely vital that such work is marked. Examiners need to follow up cases where candidates reach the end of the answer zone in the middle of a sentence or cross out all the work that fills the answer zone, or use an asterisk or arrowed line or otherwise to suggest that an answer is completed or replaced elsewhere on the paper.

If all the extra work is clearly visible **in the next marking zone** there is no need to link it.
In all other cases where there is extra work that cannot be seen in the normal marking zone, examiners will need to use full screen mode to find the page which needs linking to a particular question and click 'link to question'. The page is then automatically linked to that question and will appear below the zone for that question when marked.

Blank Pages and Blank AOs

There are no blank pages.
Annotate with 'seen' from toolbar that you have seen any blank Additional Objects.

Annotation

To increase marking transparency, reduce the number of enquiries about results and assist team leaders, the following is <u>mandatory :</u>
- For **all** questions with two or more marks, examiners should tick to indicate where each credit is awarded.
- For questions with one mark, examiners do not need to annotate the script to indicate that credit is awarded.
- Any text annotation or annotation in a comment box should never contain -1 or allow a possible misinterpretation that negative marking was applied.

Normally place the ticks close to where the mark is scored.

Question	Answer		Guidance
			Any correct final answer scores full marks even if reached by wrong Physics.
			Any numerically correct final answer with a unit error scores (full marks – 1) even if reached by wrong Physics. Annotate U.

Question	Answer	Marks
1(a)(i)	X near (30,60)	**B1**
1(a)(ii)	Y AND Z near any horizontal section of graph	**B1**
1(b)	any **two** from: • <u>weight</u> OR <u>force</u> of / due to gravity acts down • (force of / due to) air resistance / drag / friction acts up / opposes motion • initially / up to 10 s: resultant force is downward OR downward force is greater than upward force • resultant force causes acceleration • air resistance increases as speed increases / she accelerates	**B1**
	any **two** from: • acceleration (down) initially / for first 10 s • acceleration decreases as air resistance increases / resultant force decreases • zero acceleration / constant speed / terminal velocity reached when upwards force = downwards force OR when no / zero resultant OR when forces balanced OR when downward force = air resistance • terminal velocity / constant speed reached after (about) 10 s OR at 60 m / s	**B2**
1(c)	(average speed =) {initial speed + final speed} / 2 words, symbols or numbers OR (average speed =) distance (from area) / time words, symbols or numbers	**C1**
	(average speed = 40 / 2 =) 20 m / s OR (av speed = 80 / 4 =) 20 m / s	**A1**

Question	Answer	Marks
2(a)	force × <u>perpendicular</u> distance (from point)	**B1**
2(b)(i)	0.80 N	**B1**
2(b)(ii)	(moment = force × distance =) 0.8 × 0.25	**C1**
	(moment =) 0.20 N m	**A1**
2(b)(iii)	same value as (ii) with correct unit	**B1**
2(b)(iv)	F × 0.75 = 0.20 in any form OR (F =) 0.2 / 0.75	**C1**
	(F = 0.2 / 0.75 =) 0.27 N	**A1**
2(c)	(perpendicular) distance (from pivot) of F decreases / is less (than 0.75 m) OR (perpendicular) distance (from pivot) of W increases / is more (than 0.75 m)	**M1**
	(so) increased / greater (force F) (needed for greater moment)	**A1**

Question	Answer	Marks
3	(output) $P = VI$ OR $E = VIt$ OR $E = Pt$ in any form words, symbols or numbers OR ($P =$) VI OR ($P =$) 240×9 OR ($P =$) 2160 (W) OR ($E =$) $240 \times 9 \times 60$ = 129 600 (J)	**C1**
	(rate of energy input = 720 000 / 60 =) 12 000 (J / s) OR energy input = 720 000 (J)	**C1**
	(efficiency =) (100 ×) output power / input power OR (100 ×) output energy / input energy words, symbols or numbers	**C1**
	(efficiency =) $100 \times \{2160 / 12\,000\}$	**C1**
	(efficiency =) 18(%)	**A1**

Question	Answer	Marks
4(a)	thermocouple	**B1**
4(b)	($\Delta T =$) $\{1.7 / 5.4\} \times 100$	**C1**
	($T = 31 + 20 =$) 51°C	**A1**
4(c)	any application involving high(er) / low(er) temperatures OR rapidly changing temperatures OR on vibrating machinery OR remote sensing OR data logging OR small areas / masses	**B1**

Question	Answer	Marks
5(a)(i)	(thermal) energy (needed) to change state	**M1**
	of unit mass / 1 kg (of material) NOT per °C	**A1**
5(a)(ii)	molecules must be separated OR (intermolecular) bonds must be broken / overcome	**B1**
	work done (against bonds) OR energy is required / needed NOT increase of KE / speed	**B1**
5(b)	$E = ml$ in any form or $(l =) E \div m$ words, symbols or numbers	**C1**
	$(m =)$ 1.5 OR 1500 OR OR 3.8 – 2.3 OR 3800 – 2300	**C1**
	$(l = 1.26 \times 10^6 \div 1.5 =) \ 8.4 \times 10^5 \ J / kg$	**A1**
5(c)	insulate OR apply lagging / insulation (to container)	**B1**
	reduction of thermal energy / heat losses	**B1**

Question	Answer	Marks
6(a)(i)	**1** amplitude marked correctly	**B1**
	2 wavelength marked correctly	**B1**
6(a)(ii)	trough labelled T	**B1**
6(b)	f = 15 / 60 (= 0.25)	**B1**
	$v = f\lambda$ in any form OR (v =) $f\lambda$ words, symbols or numbers	**B1**
	(v =) 0.08×0.25 (= 0.02 m / s) OR 0.25×8 (= 2.0 cm / s)	**B1**
	Alternative route 1 : $v = d \div t$ words, symbols or numbers	**(B1)**
	distance moved in one minute = 15×8 OR 120 OR 15×0.08 OR 1.2	**(B1)**
	(v =) 120 / 60 (= 0.02 m / s) OR $120 \div 60$ OR $15 \times 0.08 \div 60$ OR $1.2 \div 60$	**(B1)**
	Alternative route 2 : time for 1 oscillation = 4 s	**(B1)**
	distance moved in 4 s = 8 cm	**(B1)**
	so speed = $8 \div 4$ = 2 cm / s	**(B1)**
6(c)	oscillation at right angles to the direction of propagation / travel / energy transfer (of the wave)	**B1**
	oscillation parallel to / in the direction of propagation / travel / energy transfer (of the wave) OR has compressions and rarefactions OR needs / must have a medium	**B1**

Question	Answer	Marks
7(a)(i)	total internal reflection OR T.I.R.	**B1**
7(a)(ii)	sin C = 1 ÷ n in any form OR (C =) $\sin^{-1}$ {1 ÷ 1.4}	**C1**
	(C = $\sin^{-1}$ {1 ÷ 1.4} = $\sin^{-1}$ 0.714 =) 46°	**A1**
7(b)	description of fibre passing to site to be examined / treated	**B1**
	light passes down fibre (to site) AND (image) returns (to sensor / observer) OR alternative use to endoscopy	**B1**
	extra detail, e.g. laser light source, illuminated organ, image, camera / type of sensor	**B1**
7(c)	any mention of frequency	**B1**
	(all of light) same / single / one frequency	**B1**

Question	Answer	Marks
8(a)	conditions (outdoors) may be damp / wet	**C1**
	water conducts (electricity) OR clear statement of need for waterproof / outdoor specification (components)	**A1**
8(b)	protects components / appliances / circuit / wires / user / mains supply prevents electrical supply overheating / fires / electrocution / shocks	**B1**
	excess current / power in circuit / wires OR fuse melts / blows OR circuit breaker opens	**B1**

Question	Answer	Marks
9(a)(i)	C pointing horizontally to right	**B1**
	B AND D pointing horizontally to left	**B1**
9(a)(ii)	S on left AND N on right	**B1**
9(b)	any one of the following methods:	
	1 heat magnet	**C1**
	to high temperature / red hot	**A1**
	2 hammer the magnet	**(B1)**
	repeatedly / in E–W direction	**(B1)**
	3 (place) magnet in a coil / solenoid carrying a.c.	**(M1)**
	remove magnet from coil OR decrease current (slowly) to zero	**(A1)**
9(c)(i)	at least 3 concentric circles	**B1**
	closer together near the wire AND clockwise arrow	**B1**
9(c)(ii)	arrows OR field reverses / is in opposite direction	**B1**

Question	Answer	Marks
10(a)(i)	recognisable ammeter in gap AB AND straight lines in CD AND EF	**B1**
10(a)(ii)	recognisable voltmeter across 4 Ω	**B1**
	correct voltmeter symbol used	**B1**
10(a)(iii)	$V = IR$ in any form or ($V =$) IR words, symbols or numbers	**C1**
	($V_{2\Omega} = 2 \times 2.5 =$) 5 V	**C1**
	($I_{4\Omega} = 5 \div 4 =$) 1.3 A must be clear that I refers to 4 Ω OR calculates R_p = 1.33 Ω OR 4 ÷ 3 Ω	**C1**
	($I_{6\Omega} = 2.5 + 1.3 =$) 3.8 A OR ($I_{6\Omega} = 5 \div 1.33 =$) 3.8 A	**A1**
	Alternative route for first 3 mps	
	I proportional to 1 ÷ R OR $I_{2\Omega} \times R_{2\Omega} = I_{4\Omega} \times R_{4\Omega}$	**C1**
	$I_{4\Omega} = I_{2\Omega} \div 2$	**C1**
	($I_{4\Omega} = I_{2\Omega} \div 2 = 2.5 \div 2 =$) 1.3 A	**C1**
	Alternative route by potential divider	
	$V = IR$ in any form or ($V =$) IR words, symbols or numbers	**C1**
	($V_{2\Omega} = 2 \times 2.5 =$) 5 V	**C1**
	V_T = 7.33 × 5 ÷ 1.33 (= 27.51 V)	**C1**
	($I_{6\Omega}$ = 27.51 ÷ 7.33 =) 3.8 A	**A1**

Question	Answer	Marks
10(b)	any sort of triangle symbol pointing to left in EF	B1
	a wire in CD	B1

Question	Answer	Marks
11(a)	nuclear fission – nucleus / atom splits (into two) **AND** nuclear fusion – two nuclei / atoms join together	B1
	One from • {nuclear fission –large(r) mass (number) OR heavy nuclei / atoms involved OR neutrons involved / emitted} **AND** nuclear fusion – small(er) mass (number) OR light nuclei / atoms involved OR no neutrons • fission in a nuclear reactor AND fusion in Sun / stars • fission produces very radioactive / long lasting waste • fission makes lighter new elements AND fusion makes heavier new elements • fission at normal p / T AND fusion at high p / T • fusion produces more energy (than fission)	B1
11(b)(i)	longer half-life – radioactive substance active in body for a long time	B1
	shorter half-life – might be insufficient time for investigation OR it takes time / hours for the tracer to spread round the body	B1
11(b)(ii)	proton numbers balance for equation expected answer : $_{42}\mathrm{Mo} \rightarrow {_{43}}\mathrm{Tc} + {_{-1}}\beta$	B1
	all nucleon numbers correct	B1
	correct proton and nucleon number for β-particle	B1
11(b)(iii)	any suitable use, e.g. sterilisation of equipment, treatment of cancer, gamma for diagnosis, radiotherapy NOT any link to X-rays	B1

Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS   **0625/62**

Paper 6 Alternative to Practical   **October/November 2020**

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 2020 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 **9** printed pages.

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)	clear diagram showing a horizontal line (of set square across from spring to metre rule)	1
	drawn to <u>bottom</u> of spring	1
1(b)	14 / 14.5 / 15 (mm)	1
1(c)	graph	1
	axes correctly labelled and right way round	1
	all plots correct to ½ small square	1
	good line judgement, thin, continuous line	1
1(d)	intercept method clearly shown	1
	l_0 value correctly read to ½ small square	1
1(e)	$L - l_0$ correct calculation	1
	$L - l_0 = 0 \pm 2$ (mm)	1

Question	Answer	Marks
2(a)	normal in centre of AB to 2 mm and at 90° <u>and</u> F and G correctly labelled	**1**
2(b)	P_1P_2 pin separation at least 5.0 cm	**1**
2(c)(i)	line through P_3 and P_4 correctly drawn and its end labelled K	**1**
2(c)(ii)	points H and J correctly labelled, and FH correctly drawn	**1**
2(c)(iii)	a = 1.3 ± 0.1 cm <u>and</u> b = 4.2 ± 0.1 cm	**1**
2(d)	candidate's θ correct to ± 2(°)	**1**
	unit	**1**
2(e)	any one from: thin lines / pins / sharp pencil view bases of pins ensure pins vertical / perpendicular to ray trace sheet use large pin separation (securely) attach the ray trace sheet to the surface	**1**
2(f)	maximum range 27(°) – 33(°)	**1**
2(g)	repeat experiment <u>using more i values</u>	**1**
	uses at least 4 i values	**1**

Question	Answer	Marks
3(a)(i)	V_1 = 1.4(0) (V)	1
3(a)(ii)	I = 0.56 (A)	1
3(a)(iii)	R_1 = 2.5(0) (Ω)	1
3(b)	R_3 = 0.82 (Ω)	1
3(c)	V, Ω, V	1
3(d)(i)	second box ticked	1
3(d)(ii)	correct justification using results	1
3(e)	use different lengths (of the wire sample)	1
	measure the p.d. and current / determine the resistance (of each length)	1
3(f)(i)	variable resistor / resistance / rheostat	1
3(f)(ii)	correct circuit symbol for a variable resistor	1

Question	Answer	Marks
4	**Apparatus:** **MP1** method of heating water **and** timer	1
	MP2 method: measure the temperature of the water <u>and</u> then place the ice cube(s) in the water <u>and</u> measure the time taken to melt	1
	MP3 method: melt repeat with water at different temperature(s)	1
	Key variables: Any two from: **MP4** mass / volume of ice cubes **MP5** number / size of ice cubes (per test) temperature of ice cubes / keep ice cubes in freezer volume / amount of water in the beaker room temperature amount of stirring	2
	Table: **MP6** table with columns for time / *t* and water temperature with correct units	1
	Conclusion: **MP7** explanation of how to reach a conclusion	1

Additional graph notes:

Note: The principle to apply here is 'could I draw a significantly better line, using these points, <u>under examination conditions?</u>' 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 IGCSE™

PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2020**

MARK SCHEME

Maximum Mark: 80

<div style="border:1px solid black; text-align:center;">

Published

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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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This document consists of **17** printed pages.

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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.

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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.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. However, an A mark following an M mark is a dependent mark and is only awarded if the M mark has been awarded.
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.
<u>Underlining</u>	Underlining indicates that this **<u>must</u>** 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. **<u>Always annotate ecf if applied.</u>**
cao	correct answer only
Significant	Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this this general rule will be
Figures	specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Unless listed here or stated in the mark scheme for the question, do not accept derived units, e.g. $kg\,m\,s^{-2}$ for N is NOT acceptable. The following are acceptable alternatives: Nm for J, Js^{-1} or Nms^{-1} for W, Nm^{-2} for Pa, Ns and $kg\,m\,s^{-1}$ are both acceptable for both momentum and impulse. Beware : J NOT acceptable for moments. Condone wrong use of upper and lower-case symbols, e.g. pA for Pa. Annotate with U. For more than one unit error in a question, annotate UU to indicate an error which has not been penalised.
Arithmetic errors	If the **only** error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one-mark lower than the maximum mark. Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error. However, if the power-of-ten error is due to the wrong omission or inclusion of g (= 10 N / kg) this rule does not apply.
Transcription errors	If the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly, one mark of that part question is negated
Fractions	Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.
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. Look to see if it has been replaced on a blank page or another part of the same page.

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.

RM Assessor 3
Please note that 0625 papers are now marked using RM assessor 3. Videos and documents are available by using the the Help icon in the top right-hand corner when logged in or from the RM support site. Familiarisation mode is also available on RM Assessor 3.The tool bar is now located on the left of the screen and you drag items used frequently to the right hand side of the tool bar. **Note:** the tool bar won't be visible until you have scripts to mark rather than just browse.

RM Assessor 3 annotations:

annotation	suggested use	annotation	suggested use
tick	mark awarded (note the ticks are added up next to the tick annotation, check the total you enter agrees)	wavy line (horizontal or vertical)	used to highlight a particular point
cross	no mark awarded	CON	contradiction
SEEN	indicates page seen		
BOD	benefit of doubt given	NAQ	not answered question
NBOD	no benefit of doubt given	PD	poor diagram
on page comment	gives a text box to write comment –much easier to use than in the previous version of RM assessor	SF

SFSF | error in number of significant figures significant figure error not penalized. |
| | | POT | power-of-ten error |
| ECF | error carried forward | large dot (red blob) | used to indicate a point has been seen |

annotation	suggested use
^	omission mark
?	unclear
U UU	unit penalty applied unit penalty not applied because already applied earlier in same question

annotation	suggested use
TV	too vague
I	ignore
SC	special case

Guidance on the expression : words, symbols or numbers
Accept numbers if, in the context of the question, that number can reasonably be a value for the quantity in the equation/formula.
Accept alternative symbols that can reasonably represent the quantity in the equation but not if there is confusion with another quantity that is represented by that symbol in the syllabus, e.g. Q is often acceptable for thermal energy but not if, as has happened, there is confusion with charge.

Linking pages to other questions RM Assessor

It is not unusual for candidates to write all or parts of answers to question outside the normal marking zone for that question. It is absolutely vital that such work is marked. Examiners need to follow up cases where candidates reach the end of the answer zone in the middle of a sentence or cross out all the work that fills the answer zone, or use an asterisk or arrowed line or otherwise to suggest that an answer is completed or replaced elsewhere on the paper.

If all the extra work is clearly visible **in the next marking zone** there is no need to link it.

In all other cases where there is extra work that cannot be seen in the normal marking zone, examiners will need to use full screen mode to find the page which needs linking to a particular question and click 'link to question'. The page is then automatically linked to that question and will appear below the zone for that question when marked.

Blank Pages and Blank AOs

Page 18, 19 and 20 of the answer book is. They are linked to Q1(a).
Annotate with SEEN from toolbar to show that you have seen it.
Additional objects will appear as soon as you start to mark a script containing them. On each page of the additional objects you will see the option to 'flag as seen' or 'link to question'. This must be done for each of the additional objects. Links will appear when the linked question/questions is/are opened for marking.
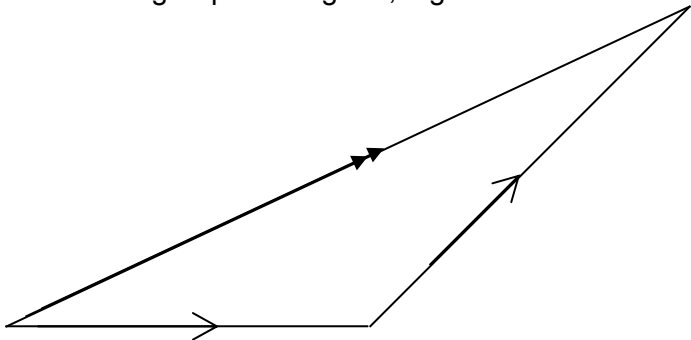
Annotation

To increase marking transparency, reduce the number of enquiries about results and assist team leaders, the following is <u>mandatory</u> :

For **all** questions with two or more marks, examiners should tick to indicate where each credit is awarded.

For questions with one mark, examiners do not need to annotate the script to indicate that credit is awarded.

Any text annotation or annotation in a comment box should never contain -1 or allow a possible misinterpretation that negative marking was applied.

Normally place the ticks close to where the mark is scored.

Question	Answer	Marks
1(a)	($p =$) mv (in any form) **or** 0.16×15	**C1**
	2.4 kg m / s	**A1**
1(b)(i)	3.0 N s **and** at 45° to the original direction	**B1**
1(b)(ii)	vector triangle / parallelogram, e.g.:	**B1**
	scale indicated **or** correct triangle / parallelogram	**B1**
	4.8 kg m / s $\leqslant$ magnitude $\leqslant$ 5.2 kg m / s	**B1**
	22° (to original direction) $\leqslant$ direction $\leqslant$ 28°(to original direction)	**B1**

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Question	Answer	Marks
2(a)	it / velocity / speed changes / increases (with time)	**C1**
	it / velocity / speed <u>increases</u> at constant rate / steadily	**A1**
2(b)	any **three** from: • (initial) acceleration caused by weight / force of gravity • acceleration decreases • drag / resistance force increases (with speed) • (finally / at terminal velocity) no acceleration / constant speed • (finally / at terminal velocity) no resultant force	**B3**
2(c)(i)	(GPE =) $mg\,(\Delta)\,h$ (in any form) **or** $0.0021 \times 10 \times 0.80$ **or** $2.1 \times 10 \times 0.80$ **or** 17 (J)	**C1**
	0.017 J	**A1**
2(c)(ii)	(KE =) $\dfrac{1}{2}\,mv^2$ (in any form)	**C1**
	$\dfrac{1}{2} \times 0.0021 \times 1.2^2$ **or** $\dfrac{1}{2} \times 2.1 \times 1.2^2$ **or** 1.5 (J)	**C1**
	1.5×10^{-3} J	**A1**
2(c)(iii)	(work done against) friction / drag / resistance **or** thermal energy generated **or** (displaced) liquid gains gravitational potential energy	**B1**

Question	Answer	Marks
3(a)	(p_{liq} =) $h\rho g$ (in any form) **or** $0.400 \times 1000 \times 10$ **or** 2000 **or** 4000 **or** 1.02×10^5 (Pa)	**C1**
	(p =) p_{atm} + $h\rho g$ (in any form) **or** $1.00 \times 10^5 + 0.400 \times 1000 \times 10$ **or** 4000 **or** 1.02×10^5 (Pa)	**C1**
	1.04×10^5 Pa	**A1**
3(b)(i)	(F =) pA (in any form) **or** 4000×0.025	**C1**
	100 N	**A1**
3(b)(ii)	(W.D. =) $F \times x$ (in any form) **or** $1.04 \times 10^5 \times 0.025 \times 0.50$ **or** $4000 \times 0.025 \times 0.50$ **or** 50 (J)	**C1**
	1300 J	**A1**

Question	Answer	Marks
4(a)	molecules close(r)	**B1**
	molecules move only small distances (between collisions) **or** do not move freely	**B1**
	molecules move in clusters **or** slide past each other	**B1**
4(b)	molecules (in liquid) move faster **or** gain energy	**B1**
	molecules move apart (on average)	**B1**
4(c)(i)	molecules overcome forces / gain potential energy as the liquid boils	**B1**
4(c)(ii)	(m =) ρV (in any form) **or** 0.86×50 **or** 43 (g)	**C1**
	(l_v =) $Q \div m$ (in any form) **or** 18 000 / 43 **or** 18 000 / (0.86 × 50)	**C1**
	420 J / g **or** 4.2×10^5 J / kg	**A1**

Question	Answer	Marks
5(a)	electrons mentioned	**B1**
	electrons travel (a great distance) through the metal **or** (vibrating) atoms hit (free) electrons	**B1**
	electrons hit (distant) particles **or** transfer energy (to distant atoms)	**B1**
5(b)	shiny surfaces are poor emitters (of radiation)	**B1**
	infrared / radiation / mentioned	**B1**
	less energy lost **or** lost energy does not need to be supplied	**B1**
5(c)	less thermal energy emitted **or** less space for energy to be lost	**B1**

Question	Answer	Marks
6(a)	speed changes **or** (wave) speed is smaller in right-hand part of tank **or** waves slow down **or** bottom (on the page) section of wave hits the boundary first	**C1**
	(wave) speed is smaller in right-hand part of tank **or** waves slow down **or** bottom (on the page) section of wave hits the boundary first	**C1**
	bottom (on the page) / one part / one side / one section of wave slows down first (and different sections are delayed by different amounts)	**A1**
6(b)(i)	($f =$) $v \div \lambda$ (in any form) **or** $0.39 \div 0.052$ **or** $0.39 \div 0.026$ **or** 15 (Hz) **or** $0.39 \div 5.2$ **or** $0.39 \div 2.6$ **or** 0.15 (Hz) **or** 0.075 (Hz)	**C1**
	$0.39 \div 0.052$ **or** 15 (Hz) **or** $0.39 \div 5.2$ **or** 0.15 (Hz) **or** 0.075 (Hz)	**C1**
	7.5 Hz	**A1**
6(b)(ii)	angle of incidence / i = 45(°) **or** angle of refraction / r = 33(°)	**C1**
	($v_2 =$) $v_1 \times \sin(r) \div \sin (i)$ (in any form) **or** $\lambda_2 = \lambda_1 \times \sin(r) \div \sin (i)$ (in any form) **or** $0.39 \times \sin(33°) \div \sin(45°)$ **or** $0.39 \times \sin(57°) \div \sin(45°)$	**C1**
	0.30 m / s	**A1**

Question	Answer	Marks
7(a)	steel (underlined)	**B1**
7(b)(i)	the direction of the force on a N-pole **and** left to right / N to S	**B1**
7(b)(ii)	beam deflects	**B1**
	beam deflects <u>into</u> the page	**B1**
	moving electrons / charges constitute a current **or** left-hand rule **or** moving electrons / current in a magnetic field experiences a force	**B1**
7(b)	(part of) beam deflects	**B1**
	α-particles deflect in opposite / different direction to β-particles / electrons **or** all α-particles have similar deflections **or** α-particles deflect less	**B1**
	γ-rays do not deflect	**B1**

Question	Answer	Marks
8(a)	(related to) energy supplied in driving charge in a circuit / conductor **or** property of source / battery / cell / power supply	**B1**
	energy supplied per / to unit charge **or** energy transferred to electrical energy **or** from other form of energy **or** energy in driving charge around a complete circuit	**B1**
8(b)(i)	($I = V \div R = 240 \div 30 =$) 8.0 A	**B1**
8(b)(ii)	($P =$) VI **or** 240×8.0	**C1**
	1900 W	**A1**
8(b)(iii)1	half (the size)	**B1**
	(equal voltage / p.d. / e.m.f. and) resistance is twice the size **or** I and R are inversely proportional	**B1**
8(b)(iii)2	(fuse rating =) 13 A / 14 A / 15 A / 16 A / 17 A / 18 A / 19 A	**B1**
	total current is 12.1 A	**B1**

Question	Answer	Marks
9(a)(i)	wave / light / energy / ray is completely / entirely reflected (at the boundary between two mediums) **or** no refraction **or** no wave / light / energy / ray passes into second medium / across boundary **or** only reflection occurs	**B1**
9(a)(ii)	light (must pass) from medium where it travels slower **or** to medium where it is faster **or** from medium with larger refractive index **or** to medium with smaller refractive index	**B1**
	angle of incidence (must be) greater than the critical angle / $\sin^{-1}(1 \div n)$	**B1**
9(b)	light / infrared travels in fibre	**B1**
	total internal reflection at <u>inner</u> surface **or** <u>within</u> (graded-index) fibre	**B1**
	light carries information / signal / data / message or signal / light encoded	**B1**

Question	Answer	Marks
10(a)	radiation that is always present **or** due to environment **or** in everyday life	**B1**
	soil / rocks / earth / cosmic rays / space / Sun / weapons testing / radon / nuclear waste	**B1**
10(b)(i)	alpha-emission (only)	**B1**
	alpha-particles do not penetrate (two sheets of) paper **or** β-particles **and** γ-rays pass through (two sheets of) paper	**B1**
10(b)(ii)	$^{208}_{84}Po \rightarrow$ $^{4}_{2}\alpha$ / $^{4}_{2}He$	**B1**
	$^{204}Pb...$ **or** $_{82}Pb$	**C1**
	$^{204}_{82}Pb$	**A1**

This document consists of **16** printed pages.

Generic Marking Principles

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Marks must be awarded in line with:

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

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- 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).
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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.
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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.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. However, an A mark following an M mark is a dependent mark and is only awarded if the M mark has been awarded.
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. **<u>Always annotate ecf if applied.</u>**
cao	correct answer only
Significant Figures	Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this this general rule will be specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. $kg\,m\,s^{-2}$ for N is NOT acceptable. The following are acceptable alternatives: Nm for J, Js^{-1} or Nms^{-1} for W, Nm^{-2} for Pa, Ns and $kg\,m\,s^{-1}$ are both acceptable for both momentum and impulse.. Beware : J NOT acceptable for moments. Condone wrong use of upper and lower case symbols, e.g. pA for Pa. Annotate with U. For more than one unit error in a question, annotate UU to indicate an error which has not been penalised.
Arithmetic errors	If the **only** error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one mark lower than the maximum mark. Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error. However if the power-of-ten error is due to the wrong omission or inclusion of g (= 10 N / kg) this rule does not apply.
Transcription errors	If the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly, one mark of that part question is negated
Fractions	Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.

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. Look to see if it has been replaced on a blank page or another part of the same page.
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.

RM Assessor 3

Please note that 0625 papers are now marked using RM assessor 3. Videos and documents are available by using the Help icon in the top right
hand cornet when logged in or from the RM support site. Familiarisation mode is also available on RM Assessor 3.
The tool bar is now located on the left of the screen and you drag items used frequently to the right hand side of the tool bar. Note – the tool bar
won't be visible until you have scripts to mark rather than just browse.

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

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	power-of-ten error

annotation	suggested use	annotation	suggested use
ECF	error carried forward	large dot (red blob)	used to indicate a point has been seen
^	omission mark	TV	too vague
?	unclear	I	ignore
U UU	unit penalty applied unit penalty not applied because already applied earlier in same question	SC	special case

Guidance on the expression : words, symbols or numbers
Accept numbers if, in the context of the question, that number can reasonably be a value for the quantity in the equation/formula.
Accept alternative symbols that can reasonably represent the quantity in the equation but not if there is confusion with another quantity that is represented by that symbol in the syllabus e.g. Q is often acceptable for thermal energy but not if, as has happened, there is confusion with charge.

Linking pages to other questions RM Assessor
It is not unusual for candidates to write all or parts of answers to question outside the normal marking zone for that question. It is absolutely vital that such work is marked. Examiners need to follow up cases where candidates reach the end of the answer zone in the middle of a sentence or cross out all the work that fills the answer zone, or use an asterisk or arrowed line or otherwise to suggest that an answer is completed or replaced elsewhere on the paper.
If all the extra work is clearly visible **in the next marking zone** there is no need to link it.
In all other cases where there is extra work that cannot be seen in the normal marking zone, examiners will need to use full screen mode to find the page which needs linking to a particular question and click 'link to question'. The page is then automatically linked to that question and will appear below the zone for that question when marked.

Blank Pages and Blank AOs

Page 18, 19 and 20 of the answer book is. They are linked to Q1(a).
Annotate with SEEN from toolbar to show that you have seen it.
Additional objects will appear as soon as you start to mark a script containing them. On each page of the additional objects you will see the option to 'flag as seen' or 'link to question'. This must be done for each of the additional objects. Links will appear when the linked question/questions is/are opened for marking.

PUBLISHED

<u>**Annotation**</u>

To increase marking transparency, reduce the number of enquiries about results and assist team leaders, the following is <u>mandatory :</u>

For **all** questions with two or more marks, examiners should tick to indicate where each credit is awarded.

For questions with one mark, examiners do not need to annotate the script to indicate that credit is awarded.

Any text annotation or annotation in a comment box should never contain –1 or allow a possible misinterpretation that negative marking was applied.

Normally place the ticks close to where the mark is scored.

Question	Answer	Marks
1(a)(i)	same distance travelled in same time / 0.02 s / dots equally spaced	**B1**
1(a)(ii)	trolley accelerates OR trolley increases speed / velocity	**B1**
	a resultant force is acting on the trolley	**B1**
1(b)	distance = area under graph, in any form	**C1**
	(distance = $\dfrac{0.5 \times 0.75}{2}$ =) 0.19 m	**A1**
1(c)	any **three** from • initially velocity increases or the metal ball is accelerating OR (downwards) resultant force • resistance (of liquid) has increased (as velocity increases) • downwards force (on metal ball) = upwards force (on metal ball) (at point X) • (metal ball) travels at constant velocity / speed	**B3**

Question	Answer	Marks
2(a)	PE lost = KE gained, in any form	**C1**
	$v^2 = 2gh$ or $0.16 \times 10 \times 115 = 0.5 \times 0.16 \times v^2$	**C1**
	(speed =) 48 m / s	**A1**
2(b)	momentum = mv	**C1**
	(momentum=) 7.7 kg m / s or 7.7 N s	**A1**

Question	Answer	Marks
3(a)(i)	One other scalar quantity	**B1**
3(a)(ii)	One other vector quantity	**B1**
3(b)(i)	$v = d \div t$ in any form OR $(t =) d \div v$ OR $3.9 \div 0.3$	**C1**
	$(t =)$ 13 s	**A1**
3(b)(ii)	inward arrow labelled F towards centre of circle	**B1**
3(b)(iii)	**1** frictional / inward force / resultant force insufficient (at higher speed)	**B1**
	2 tangential arrow at P in either direction, labelled S	**B1**

Question	Answer	Marks
4(a)	A liquid B solid C gas	**B2**
4(b)	average distance between molecules greater (in gas)	**B1**
	(attractive) forces between molecules lower or zero in gas	**B1**
4(c)(i)	$p_1V_1 = p_2V_2$ in any form OR $0.9 \times 10^5 \times 3400 = 2.5 \times 10^5 \times V_2$	**C1**
	$(V_2 =) \, p_1V_1 \div p_2$ OR $(V_2 =) \, 0.9 \times 3400 \div 2.5$	**C1**
	1200 cm^3	**A1**

Question	Answer	Marks
4(c)(ii)	pressure increases	**B1**
	molecules move / collide faster OR have greater momentum	**B1**
	molecules collide more frequently (with piston) OR with greater change in momentum	**B1**

Question	Answer	Marks
5(a)	cork on black plate / side B falls off (before cork on shiny plate / side A)	**B1**
	black surface are better absorbers than shiny surfaces **or** shiny surfaces are better reflectors than black surfaces	**B1**
	black surface are better absorbers than shiny surfaces **or** shiny surfaces are better reflectors than black surfaces **AND** of (infrared) radiation	**B1**
	wax on black plate / plate B melts before wax on shiny plate / plate A	**B1**
5(b)	conduction	**B1**

Question	Answer	Marks
6(a)	molecules closer together than normal in a compression	**B1**
	molecules further apart than normal in a rarefaction	**B1**
	pressure higher (than normal) in a compression AND pressure lower (than normal) in a rarefaction	**B1**

Question	Answer	Marks
6(b)(i)	4400 (Hz) seen	C1
	($\lambda =$)$v \div f$ in any form OR $340 \div 4400$ OR $340 \div 4.4$ OR 77	C1
	($\lambda = v \div f =$) 0.077 m	A1
6(b)(ii)	**1** speed stays the same	B1
	2 wavelength decreases	B1

Question	Answer	Marks
7(a)	any **two** from: remote controls (infrared) sensors / alarms specific electrical appliances thermal imaging	B2
7(b)	Any **three** from • shielding of operator behind screen / lead apron / out of room AND to absorb radiation • shielding of other parts of patient with lead / shielding of other parts of patient AND to absorb radiation • distance from source AND reduces intensity / amount of radiation / exposure • limit time of exposure / not too frequent / max number of X-rays per year AND to limit dose • limit strength / intensity of X-ray beam AND to limit dose	B3
7(c)(i)	**1** 3×10^8 m / s	B1
	2 3×10^8 m / s	B1
7(c)(ii)	> 20 000 Hz	B1

Question	Answer	Marks
8(a)(i)	$V = IR$ in any form OR ($I =$) $V \div R$ OR ($I =$) $3 \div 4$	**C1**
	($I =$) 0.75 A	**A1**
8(a)(ii)	0 (V) OR nothing OR no reading	**M1**
	diode does not pass current (in reverse direction)	**A1**
8(b)	AND gate	**B1**
8(c)(i)	C and D both 1 0 0 0	**B1**
	first line of E 0	**B1**
	2nd, 3rd and 4th lines of E 1	**B1**
8(c)(ii)	OR	**B1**

Question	Answer	Marks
9(a)	high voltage results in low current (for same power)	**B1**
	Any **two** from: • heat loss depends on current • less power / energy loss (in transmission) • thinner wires can be used	**B2**

Question	Answer	Marks
9(b)	Efficiency = $\dfrac{\text{(useful) power output}}{\text{(total) power input}}$	**C1**
	$P = VI$ in any form	**C1**
	power output = (20×2.3) = 46 (W)	**C1**
	power input = 46 ÷ 0.9 = 51 (W)	**C1**
	input current = (51 ÷ 240=) 0.21 A	**A1**

Question	Answer	Marks
10(a)	iron core / coil / solenoid becomes a magnet	**B1**
	iron core / coil / solenoid <u>attracts</u> iron armature	**B1**
	armature pivots/moves **and** contacts touch / there is a current in circuit B	**B1**
10(b)	current in circuit B does not stop when switch in circuit A is opened	**B1**
	steel remains magnetised when there is no current in the coil	**B1**

Question	Answer	Marks
11(a)	α deflected in smooth curve away from plate P / towards plate Q	B1
	α continues in straight line beyond plates OR multiple paths for β and no more than a single α path	B1
	β deflected in smooth curve towards plate P / away from plate Q	B1
	β deflected more than α	B1
	γ passes straight through without deviation **and** continues in straight line beyond plates	B1
11(b)	suitable application e.g. sterilisation of equipment, medical diagnosis / treatment, thickness control, detecting leaks / cracks, food preservation	B1
	explanation e.g. destroys bacteria, destroys cancer cells, lower amount of radiation detected if thickness too large, radiation detected at site of leak, destroys microbes in food	B1

Cambridge IGCSE™

PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2020**

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 2020 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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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.

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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)(i)	l = 3.1(cm) and w = 2.7(cm)	1
1(a)(ii)	V = 27, 26.8, 26.78, 26.784	1
1(a)(iii)	m_A =51 g	1
1(a)(iv)	ρ_A = 1.9(0) or 1.89	1
	g/cm^3	1
1(b)(i)	V = 32(cm^3)	1
1(b)(ii)	ρ_B = 1.88 to 2 or 3 significant figures	1
1(c)	Statement to match results.	1
	Justification to match results and to include the idea of within (or beyond) the limits of experimental accuracy.	1
1(d)	3rd box ticked	1
	5th box ticked	1

Question	Answer	Marks
2(a)	21 (°C)	**1**
2(b)(i)	Table 2.1 times 0 and 180; units s and °C	**1**
2(b)(ii)	$\Delta\theta_1$ = 16 (°C)	**1**
2(b)(iii)	R_1 = 0.089 or 0.09	**1**
2(c)(i)	Table 2.2 completed ecf from (b)(i) allowed	**1**
2(c)(ii)	$\Delta\theta_2$ present and R_2 present with unit °C/s	**1**
2(d)(i)	D_1 = 64 D_2 = 48	**1**
2(d)(ii)	Conclusion to match results	**1**
	Justification to match conclusion with correct evidence given from results	**1**
2(e)(i)	Prevent parallax error owtte	**1**
2(e)(ii)	To obtain even temperature throughout owtte	**1**

Question	Answer	Marks
3(a)	h_0 = 1.5 cm OR 15 mm	1
3(b)	m values 3.55, 1.66, 1.08, 0.80, 0.64	1
3(c)	Graph: Axes correctly labelled and right way round	1
	Suitable scales	1
	All plots correct to ½ small square	1
	Good line judgement, thin, continuous line	1
3(d)	Method clearly shown on graph	1
	u_1 correct to ½ small square	1
3(e)	f values from 13.5 to 16.4 cm	1
3(f)	Any two from: Use dark room / bright object Move <u>screen</u> slowly to find best image Mark centre of lens position on lens holder Place metre rule on bench / clamp rule in position Ensure object, lens and screen are vertical Ensure object and lens at same height from bench	2

Question	Answer	Marks
4	**MP1** Correct circuit diagram to include test wire, power source, ammeter and voltmeter	1
	MP2 Correct symbols used for ammeter and voltmeter.	1
	MP3 At least 3 different metals (or alloys) suggested	1
	MP4 Measure potential difference and current. Work out resistance	1
	MP5 Repeat with at least two more wires of different material.	1
	MP6 Key variables: Any one from: Length of wire Diameter / thickness / cross-sectional area of wire	1
	MP7 Table with columns for material, potential difference, current and resistance with units V, A, Ω.	1

Additional graph notes:

Note: The principle to apply here is 'could I draw a significantly better line, using these points, <u>under examination conditions?</u>' 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 IGCSE™

PHYSICS **0625/63**

Paper 6 Alternative to Practical **October/November 2020**

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 2020 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 **8** printed pages.

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)	24(.0) (°C)	**1**
1(b)	units all correct: s, °C, °C	**1**
	t values all present (30, 60, 90, 120, 150 & 180)	**1**
1(c)	suitable precaution, e.g. • take reading at 90° / perpendicularly to scale • stir (before reading / throughout experiment)	**1**
1(d)(i)	conclusion matching results, e.g. beaker B cools more slowly / owtte	**1**
1(d)(ii)	cooling rate decreases as temperature falls / owtte	**1**
1(e)(i)	°C / s	**1**
1(e)(ii)	$x_A = 0.158$ <u>and</u> $x_B = 0.0556$	**1**
1(e)(iii)	statement matching results	**1**
	$x_B <$ <u>half</u> of x_A / owtte	**1**
1(f)	any suitable suggestion, e.g. • thicker / more insulated lid ; • higher <u>initial</u> temperature	**1**

Question	Answer	Marks
2(a)	either correct voltmeter symbol in parallel with X or correct ammeter symbol in series	1
	second correct meter and circuit completed	1
2(b)	V = 3.3 (V) and I = 0.82 (A)	1
2(c)(i)	V, A	1
2(c)(ii)	correct calculations of R (4.02 / ecf, 3.89, 4.10)	1
	consistent 2 or consistent 3 sig figs	1
2(d)	statement matching results	1
	within limits of experimental accuracy / owtte <u>with</u> values or comparative values seen	1
2(e)	any parallel or series and parallel arrangement of <u>three</u> resistors	1
2(f)(i)	rectangle with strike-through arrow only	1
2(f)(ii)	any suitable advantage, e.g. • can obtain continuous set of values • more straightforward to change current • can obtain more values easily	1

Question	Answer	Marks
3(a)	h_O = 2.0 (cm)	**1**
3(b)(i)	h_I = 3.7 (cm)	**1**
3(b)(ii)	W = 0.54 / ecf	**1**
3(c)	graph:	
	axes labelled correct orientation, with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to less than ½ small square and precise plots	**1**
	well-judged line <u>and</u> thin line	**1**
3(d)	triangle method seen on graph	**1**
	f in range 12.0 (cm) to 15.4 (cm)	**1**
3(e)	any suitable explanation, e.g. • values of h_I become very small / difficult to measure • greater % uncertainty	**1**
	any suitable improvement, e.g. • use a larger object • use graph paper on screen • mark top and bottom of image and measure after	**1**

Question	Answer	Marks
4	**MP1 Factor** diameter / mass of ball	**1**
	MP2 Apparatus stop-watch (or similar)	**1**
	MP3 Control variable any suitable control variable, e.g. • mass of ball (if diameter is the factor) • diameter of ball (if mass is the factor) • distance (timed over)	**1**
	MP4 Method any **one** from: • measure the chosen factor (i.e. mass / diameter) ; • apparatus used to measure mass / diameter ; • precaution: repeat (procedure) <u>and</u> average	**1**
	MP5 Method drop ball in tube of water <u>and</u> time (over fixed distance)	**1**
	MP6 Method repeat for different value of chosen factor (i.e. mass / diameter)	**1**
	MP7 Analysis any **one** from: • comparison of time / speed with chosen factor • graph of time / speed vs chosen factor	**1**

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PHYSICS	0625/22
Paper 2 Multiple Choice (Extended)	**March 2020**
MARK SCHEME	
Maximum Mark: 40	

Published

This document consists of **3** printed pages.

Question	Answer	Marks
1	A	1
2	A	1
3	D	1
4	D	1
5	C	1
6	D	1
7	A	1
8	C	1
9	C	1
10	B	1
11	C	1
12	C	1
13	C	1
14	D	1
15	B	1
16	C	1
17	A	1
18	C	1
19	A	1
20	C	1
21	D	1
22	A	1
23	A	1
24	D	1
25	A	1
26	D	1
27	C	1
28	C	1

Question	Answer	Marks
29	A	1
30	C	1
31	B	1
32	D	1
33	D	1
34	D	1
35	B	1
36	C	1
37	C	1
38	B	1
39	B	1
40	B	1

Cambridge IGCSE™

PHYSICS	**0625/42**
Paper 4 Extended Theory	**March 2020**
MARK SCHEME	
Maximum Mark: 80	

Published

This document consists of **15** printed pages.

Generic Marking Principles

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- 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.

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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).
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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.
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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> (see examples below)

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	<u>Calculation specific guidance</u>

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	<u>Guidance for chemical equations</u>

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.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. However, an A mark following an M mark is a dependent mark and is only awarded if the M mark has been awarded.
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.
<u>Underlining</u>	Underlining indicates that this **<u>must</u>** 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
Significant Figures	Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Annotate with U. For more than one unit error in a question, annotate UU to indicate an error which has not been penalised. Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. kg m s^{-2} for N is NOT acceptable. The following are acceptable alternatives: N m for J, J s^{-1} or N ms^{-1} for W, N m^{-2} for Pa, N s and kg m s^{-1} are both acceptable for both momentum and impulse. Beware: J NOT acceptable for moments. Condone wrong use of upper and lower case symbols, e.g. pA for Pa.
Arithmetic errors	If the **only** error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one mark lower than the maximum mark. Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. Do not penalise the same POT error more than once. Annotate POT POT. However if the power-of-ten error is due to the wrong omission or inclusion of g (= 10 N / kg) this rule does not apply. The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error.

Transcription errors	If the only error in arriving at a final answer is because previously calculated data has clearly been misread, but used correctly, then for that part question the mark will be one less than the maximum mark.
Fractions	Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.
Crossed out	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. Look to see if it has been replaced on a blank page or another part of the same page.
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.

RM Assessor 3

Please note that 0625 papers are now marked using RM assessor3. Videos and documents are available by using the Help icon in the top right hand corner when logged in or from the RM support site. Familiarisation mode is also available on RM Assessor 3.
The tool bar is now located on the left of the screen and you drag items used frequently to the right hand side of the tool bar. Note – the tool bar won't be visible until you have scripts to mark rather than just browse.

RM Assessor3 annotations:

annotation	suggested use		annotation	suggested use
tick	mark awarded (note the ticks are added up next to the tick annotation, check the total you enter agrees)		wavy line (horizontal or vertical)	used to highlight a particular point
cross	no mark awarded		CON	contradiction
SEEN	indicates page seen			
BOD	benefit of doubt given		NAQ	not answered question
NBOD	no benefit of doubt given		PD	poor diagram

annotation	suggested use
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
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

Guidance on the expression: words, symbols or numbers
Accept numbers if, in the context of the question, that number can reasonably be a value for the quantity in the equation / formula.
Accept alternative symbols that can reasonably represent the quantity in the equation but not if there is confusion with another quantity that is represented by that symbol in the syllabus e.g. Q is often acceptable for thermal energy but not if, as has happened, if there is confusion with charge.

<u>Linking pages to other questions RM Assessor3</u>
It is not unusual for candidates to write all or parts of answers to question outside the normal marking zone for that question. It is absolutely vital that such work is marked. Examiners need to follow up cases where candidates reach the end of the answer zone in the middle of a sentence or cross out all the work that fills the answer zone, or use an asterisk or arrowed line or otherwise to suggest that an answer is completed or replaced elsewhere on the paper.

If all the extra work is clearly visible **in the next marking zone** there is no need to link it.

In all other cases where there is extra work that cannot be seen in the normal marking zone, examiners will need to use full screen mode to find the page which needs linking to a particular question and click 'link to question'. The page is then automatically linked to that question and will appear below the zone for that question when marked.

Blank Pages and Blank AOs

There are no blank pages.
Annotate with 'seen' from toolbar that you have seen any blank Additional Objects.

Annotation

To increase marking transparency, reduce the number of enquiries about results and assist team leaders, the following is mandatory:

- For **all** questions with two or more marks, examiners should tick to indicate where each credit is awarded.
- For questions with one mark, examiners do not need to annotate the script to indicate that credit is awarded.
- Any text annotation or annotation in a comment box should never contain –1 or allow a possible misinterpretation that negative marking was applied.

Normally place the ticks close to where the mark is scored.

Question	Answer	Marks
1(a)	(a=)$\Delta v / \Delta t$ in any form OR (a=)$\Delta v / \Delta t$ OR (a)=120 / 8	C1
	(a) = 15 m / s^2	A1
1(b)(i)	straight line from (0,0) to (8,120)	B1
1(b)(ii)	(h = A =) ½ × 120 × 8	C1
	(h=) 480 m	A1
1(b)(iii)	rising <u>curve</u> from 8 s to 20 s	B1
	decreasing gradient from 8 s to 20 s	B1
	horizontal from 20 s to 25 s AND below 200 m / s, AND above 120 m / s	B1

Question	Answer	Marks
2(a)	(impulse =) <u>change of</u> momentum	C1
	(impulse =) 71(10 – 4)	C1
	(impulse =) 430 N s	A1
2(b)(i)	(impulse =) force × time	B1
2(b)(ii)	(av F =) impulse / time (= 430 / 1.2)	C1
	(av F =) 360 N	A1
2(c)	F= ma in any form OR (F =) ma OR 71 × 6.4	C1
	(F=) 450 N	A1

Question	Answer	Marks
3(a)(i)	KE = ½ mv² in any form OR v² = 2 × KE / m OR 240 = ½ × 7.5 v²	**C1**
	v² = 2 × 240 / 7.5 OR (v=) √{2 × 240 / 7.5 } OR (v=) √{2KE / m }	**C1**
	= 8.0 m / s	**A1**
3(a)(ii)	240 W	**B1**
3(b)(i)	P = VI in any form OR 11 × 2	**C1**
	22 W	**A1**
3(b)(ii)	(efficiency =) P_o / P_i OR (efficiency =) P_o / P_i OR (efficiency =) (11 × 2 / 240) × 100	**C1**
	{efficiency = (11 × 2 / 240) × 100 =} 9.2 (%)	**A1**
3(c)	ρ = m / V in any form OR (V =) m / ρ OR (V =)7.5 / 1.3	**C1**
	(V = 7.5 / 1.3 =) 5.8 m³	**A1**

Question	Answer	Marks
4(a)	(thermal) energy to change state o.w.t.t.e.	**M1**
	to melt (solid) per kg / unit mass NOT per °C	**A1**
4(b)(i)	E = mc(Δ)T in any form OR (c =) E / m(Δ)T OR (c =) 35 000 / (0.35 × 24.5)	**C1**
	(c =) 4 100 J / (kg °C)	**A1**
4(b)(ii)	use of 35 000	**B1**
	E = ml in any form OR (m =) E / l OR 35000 / 3.3 × 10^5	**C1**
	(m =) 0.11 kg	**A1**

Question	Answer	Marks
5(a)	conduction	**B1**
	conduction	**B1**
	radiation	**B1**
5(b)	electrons <u>move</u>	**B1**
	lattice / molecular / particle <u>vibration</u> or w.t.t.e. OR free / delocalised electrons	**B1**
5(c)	shiny white	**M1**
	best reflector	**A1**

Question	Answer	Marks
6(a)(i)	3 straight crests, to the right of A parallel to incident crests AND same λ by eye	**B1**
	curving round correct way below A	**B1**
6(a)(ii)	diffraction	**B1**
6(b)(i)	correct arrow perpendicular to wave fronts	**B1**
6(b)(ii)	refraction	**B1**
6(b)(iii)	wavelength – decreases	**B1**
	frequency – stays same	**B1**
	speed of wave – decreases	**B1**

Question	Answer	Marks
7(a)(i)	one correct ray	**B1**
	second correct ray	**B1**
	rays intersect above axis to left of A AND object drawn from axis to intersection	**B1**
7(a)(ii)	AC	**B1**
	CB	**B1**
7(b)(i)	ray in prism refracted down less than green ray	**B1**
7(b)(ii)	ray in rectangular block refracted down less than green ray	**B1**
7(b)(iii)	ray leaving rectangular block parallel to incident ray	**B1**

Question	Answer	Marks
8(a)	{$R_s = R_1 + R_2 + R_3$ in any form OR (R_s)= $R_1 + R_2 + R_3$ OR (R_s) = 3 + 2 + 6 (Ω) OR (R_s) = 11 (Ω)} AND {V= IR in any form OR (I=)V / R OR (I=) 12 / 11 (A)}	**C1**
	(I=) 1.1 A	**A1**
8(b)	uses resistance of wire proportional to length OR (resistance XQ =) 6 Ω 0.6 / 2.0 (Ω) OR 1.8 (Ω)	**B1**
	$1 / R_p = 1 / R_1 + 1 / R_2$ OR (R_p=) $R_1 R_2 / (R_1 + R_2)$	**C1**
	$1 / R_p = 1 / 1.5 + 1 / (6 \times 0.6 / 2)$ OR (R_p=) $1.5 \times (6 \times 0.6 / 2) / (1.5 + 6 \times 0.6 / 2)$ OR (R_p= $1.5 \times 1.8 / \{1.5 + 1.8\}$) = 0.82 ($\Omega$)	**C1**
	(R = 3 + 2 + 0.82 =) 5.8 Ω	**A1**

Question	Answer	Marks
9(a)	NAND	**B1**
9(b)	NOT	**B1**
9(c)	AB 1st row 11 AND 4th row 00	**B1**
	AB 2nd and 3rd row 01 AND 10 in any order	**B1**
	E 1st two rows 0 1	**B1**
	E last two rows 1 1	**B1**

Question	Answer	Marks
10(a)	magnetic field (produced)	B1
	(magnetic field / magnetic flux / magnetic effect / magnetism) (it) alternates / changes direction / reverses	B1
10(b)	e.m.f. / p.d. / voltage	B1
10(c)	(temperature) increased	B1
	current in <u>base of pan</u> o.w.t.t.e.	B1
	thermal energy (produced in base of pan)	B1

Question	Answer	Marks
11(a)	neutrons 1 2	B1
	electrons 2 2	B1
	mass 3 4 OR 2 more 3 more	B1
11(b)	β	B1
	β – (would be) stopped by 5 mm / thick Al	B1
	α – (would be) stopped by 0.1 mm Al / Al foil AND γ – (would) not (be) stopped by 5 mm / thick Al	B1

Cambridge IGCSE™

PHYSICS	**0625/62**
Paper 6 Alternative to Practical	**March 2020**
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 March 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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

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> (see examples below) 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	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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.

ANNOTATION

Please annotate as you would normally do to explain marks.

Where items have 2 marks or more, overlays have been published. The overlay points correspond to mark scheme order. Please enter ticks for correct responses on the appropriate point of the overlay. The other points can be left blank if a mark has not been awarded but you may wish to add a cross or other annotation if you think it would be helpful.

You should add ticks <u>and</u> crosses please, as you would normally do, for **Question 3(c)** (the graph) and **Question 4**.

In order to avoid confusion, if a marking frame contains the answers to more than one question, the appropriate answer has been overlaid with a box.

The overlay for **Q4** marks has been divided between 2 pages to minimise scrolling.

BLANK PAGES

There is **one** blank page on this paper which has been attached at the front. Please check before starting marking as answers to **Question 4** may be continued here. Please mark as 'SEEN' and check nothing has been added to Fig.1.1 or Fig.1.2 as you scroll past them.

The LINK device can be used to refer the answer to the correct question if necessary.

Please ensure that nothing has been written in the blank spaces below the Questions on pages 3, 7, 8, 10 and 13.

IGNORE / NOT

Where more answers than required have been given for a question:

- if an answer is shown as IGNORE in Additional Guidance, another correct answer can be accepted,
- if an answer is shown as NOT, it negates any other correct answer.

Cambridge IGCSE – Mark Scheme
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Question	Answer	Marks
1(a)(i)	l = 4.5 (cm) and d = 2.0 (cm)	**1**
	both to 1 decimal place	**1**
1(a)(ii)	method outlined /	**1**
	how diameter determined accurately e.g. use of string wrapped round rod <u>and</u> measured / several turns <u>and</u> calculate diameter from circumference, OR use of rod between two blocks and measure gap / in at least 2 places and <u>take average</u>, OR means of measuring diameter across ends / at several places and <u>take average</u>, OR use of micrometer, (vernier) callipers / at various points (along length or across ends) and <u>take average</u>	**1**
1(b)	m present <u>and</u> ρ_1 = 0.55 / ecf	**1**
	correct unit (g / cm³)	**1**
1(c)	V_1 = 144 (cm³) <u>and</u> V_2 = 152 (cm³)	**1**
1(d)	ρ_2 = 0.57 / ecf	**1**
	ρ_1 and ρ_2 to consistent 2 or consistent 3 significant figures	**1**
1(e)	straight arrow perpendicular to measuring cylinder	**1**

Question	Answer	Marks
1(f)	suitable source of inaccuracy e.g.: measuring cylinder scales less precise / accurate, water lost on transfer / droplets on clay, wood might absorb water	1

Question	Answer	Marks
2(a)	θ_R = 21 (°C)	1
2(b)(i)	s, °C both correct in heading	1
2(b)(ii)	suitable precaution e.g.: line of sight perpendicular to scale wait until reading stops rising (at start) stir before reading keep thermometer at same depth	1
2(c)(i)	x_1 = 0.18	1
2(c)(ii)	unit °C / s, seen in **(c)** and not contradicted	1
2(c)(iii)	x_3 = 0.07 <u>and</u> x_2 = 0.12	1
2(d)(i)	cooling rate decreases (over time) <u>and</u> justified by comparative <u>values</u> of cooling rate over suitable periods of time	1
2(d)(ii)	$\theta_F = \theta_R$	1

Question	Answer	Marks
2(e)(i)	suggestion matching results	1
	explanation matching suggestion: EITHER: SUGGESTION: smaller cooling rate<u>s</u> (at equivalent times) EXPLANATION: reference to cooling rate being smaller at <u>lower temperatures</u> <u>and</u> <u>values stated</u> OR SUGGESTION: smaller difference(s) in cooling rates (between equivalent times) EXPLANATION: clear reference to $(x_2 - x_3)$ being smaller than $(x_1 - x_2)$	1
2(e)(ii)	suitable control: (same) volume of water, (same) material of beaker, (same) duration of experiment, (same) room temp / named appropriate environmental condition	1

Question	Answer	Marks
3(a)(i)	V = 2.1 (V) <u>and</u> I = 0.26 (A)	1
3(a)(ii)	R_0 = 8.1 / ecf	1
3(b)	$1 / I$ = 2.86	1

Question	Answer	Marks
3(c)	graph:	
	• axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least ½ grid)	1
	• plots all correct to ½ small square <u>and</u> precise plots	1
	• well judged line <u>and</u> thin line	1
3(d)(i)	*G* present and triangle method seen <u>on graph line</u>	1
3(d)(ii)	*E* in range 2.0 (V) to 2.9 (V)	1
3(e)	*l* = 30(.0) cm	1
	reference to ammeter forming greater proportion of total resistance	1

Question	Answer	Marks
4	**MP1** **circuit diagram:** ammeter in series with resistor <u>and</u> circuit correct	1
	MP2 **apparatus:** <u>ammeter</u> <u>and</u> <u>means of measuring candidate's independent variable if other than air speed</u> e.g. (metre) rule if distance is independent variable, protractor if angle of air flow is independent variable	1

Question	Answer	Marks
4	**MP3** **control variable** (one from)**:** speed of fan (if distance / angle varied) <u>or</u> distance / angle between fan and turbine (if fan speed varied), height of fan / turbine, angle of air flow	1
	MP4 **method:** measure / record independent variable (allow turbine to turn and) measure / record current,	1
	MP5 repeat for different value of independent variable	1
	MP6 **analysis:** compare readings (in a table) to see if change in independent variable produces change in current / plot line graph (with correct axes specified)	1
	MP7 **additional point** (one from)**:** at least 5 sets of data taken, repeat each measurement <u>and</u> take average, 2nd valid control variable stated, repeat for different resistor <u>and</u> compare pattern preliminary experiment to determine suitable range for independent variable measure air speed at same point each time	1