IGCSE Physics Pastpapers
Year 2021
marking scheme

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

Class:_____
Name:_____

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 40

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

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

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PHYSICS **0625/42**
Paper 4 Extended Theory **May/June 2021**
MARK SCHEME
Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	same (as density of surrounding air)	**B1**
1(b)(i)	falls	**B1**
1(b)(ii)	volume decreases	**B1**
	density increases	**B1**
1(c)(i)	starts at origin	**B1**
	finishes horizontal by eye	**B1**
	gradient decreasing smoothly to 0	**B1**
1(c)(ii)	10 m / s^2 (down)	**B1**
	0 ignore any unit	**B1**

Question	Answer	Marks
2(a)	force × <u>perpendicular</u> distance from pivot / point	**B1**
2(b)	($F_1d_1 = F_2d_2$ =) $500 \times 20 = F \times 12$ numbers substituted in any form	**C1**
	(F = 10 000 / 12 =) 830 N	**A1**

Question	Answer	Marks
2(c)	clear diagram or description (of object) with pivot and <u>vertical</u> forces / weights / masses / cord tension causing moments in each direction	**B1**
	indicate / measure forces and perpendicular distances	**B1**
	calculates a moment or shows / describes how to AND confirms equality of total moment (in each direction) AND statement of equilibrium / balance	**B1**

Question	Answer	Marks
3(a)	(PE loss =) mgh AND (KE gain =) ½ mv^2	**B1**
	PE (loss) = KE (gain)	**B1**
	alternative route 1 for 1st two m.p.s	
	$v^2 = u^2 + 2as$	**(B1)**
	u = 0	**(B1)**
	alternative route 2 for 1st two m.p.s	
	$s = ut + 0.5at^2$ OR $h = 0.5gt^2$	**(B1)**
	u = 0 AND $t = \sqrt{3}$ OR 1.73	**(B1)**
	v^2 (= 2gh) = $2 \times 10 \times 15$ OR $v^2 = 300$ OR $v = 10\sqrt{3}$ OR $v = 10 \times 1.73$	**B1**
	{v = 17 m / s AND $v^2 = 300$ or $v = 10\sqrt{3}$} OR v = 17.3(2) m / s	**B1**

Question	Answer	Marks
3(b)	(F =) change of p / (change of) time OR rate of change of momentum	**C1**
	(F =) 30×17.32	**C1**
	(F =) 520 N	**A1**

Question	Answer	Marks
4(a)(i)	random / haphazard / zig-zag / irregular	**B1**
4(a)(ii)	(liquid / water) molecules move fast OR (pollen) particles massive	**B1**
	collide / bombard	**B1**
	uneven collisions / collisions from different directions (cause random movement) OR (liquid / water) molecules move randomly	**B1**
4(b)(i)	cooling	**B1**
	(thermal) energy used / needed to evaporate (ethanol) / overcome attractive forces(between molecules / particles)	**B1**
	thermal energy taken from skin / patient / person	**B1**
	alternative route for last two m.p.s	
	more / most energetic (liquid) molecules / particles escape OR less / least energetic (liquid) remain	**(B1)**
	less / least energetic molecules / particles linked to lower temp (of skin)	**(B1)**
4(b)(ii)	greater / increases / faster / higher	**B1**

Question	Answer	Marks
5(a)	air good insulator / poor conductor	**B1**
	holder / it stops / reduces conduction OR no / less thermal energy conducted (to hand)	**B1**
	temperature (of outside of holder) lower (than cup) OR less energy to skin / hand / person	**B1**
5(b)	(put a) lid / cover (on cup)	**B1**
	mention of convection	**B1**
	less / no convection (from surface)	**B1**
	alternative route for last 2 m.p.s	
	mention of evaporation	**(B1)**
	less / no evaporation (from surface / container)	**(B1)**
5(c)	radiation	**B1**

Question	Answer	Marks
6(a)	blue ray refracted MORE towards normal at first surface	**B1**
	refraction away from normal at second surface	**B1**
	ray of blue light below ray of green light and diverging throughout path (after entering prism)	**B1**
6(b)	$v = f\lambda$ in any form OR (f=) v / λ	**C1**
	(f =) $3 \times 10^8 \div 4.8 \times 10^{-7}$	**C1**
	(f =) 6.3×10^{14} Hz	**A1**

Question	Answer	Marks
7(a)	3 lines from N face to S face middle line must be straight AND perpendicular to end faces	**B1**
	at least 1 arrow from N to S AND NO arrows from S to N	**B1**
7(b)(i)	needle perpendicular to end faces AND {arrow pointing to S OR correctly labelled N OR S}	**B1**
7(b)(ii)	compass / needle / it aligns with field OR compass / needle / it points in direction of magnetic field OR compass / needle / it points to S(outh)	**B1**
	N pole of needle attracted to S of magnet(s) OR N pole repelled by N of magnets OR unlike poles attract / like poles repel	**B1**
7(c)	heat OR hammer	**B1**
	with magnet lying (magnetically) E – W	**B1**
	OR place in coil / solenoid with a.c.	**(M1)**
	withdraw OR reduce current to 0	**(A1)**

Question	Answer	Marks
8(a)(i)	α in Box 4 / towards bottom of page	**B1**
	γ in Box 3 / no deflection	**B1**
8(a)(ii)	α in Box 1 / into page	**B1**
	γ in Box 3 / no deflection	**B1**

Question	Answer	Marks
8(b)(i)	clockwise accept rotation arrow on diagram	**B1**
	force on L wire up / up arrow on L wire labelled force on diagram	**B1**
	force on RH wire down / down arrow on R wire labelled force on diagram	**B1**
8(b)(ii)	none / zero (moment)	**B1**
8(b)(iii)	current in coil reverses OR changes direction	**B1**
	force(s) (on wires in new positions) still up on L OR down on R owtte	**B1**

Question	Answer	Marks
9(a)	anti-clockwise arrow labelled (conventional) current somewhere in circuit	**B1**
	electron (flow) arrow opposite to (conventional) current	**B1**
9(b)	Q = It in any form or (Q =) It OR 13×1	**C1**
	(Q = It =) 13×1 (= 13 C)	**C1**
	(n = 13 / 1.6×10^{-19} =) 8.1×10^{19}	**A1**

Question	Answer	Marks
10(a)	V = IR in any form or (R =) V / I	**C1**
	(R = 9.2 / 0.004 =) 2300 Ω	**A1**

Question	Answer	Marks
10(b)	(much) greater current in lamp OR lamp activated / lights / glows / gets brighter owtte	**B1**
	resistance of thermistor / component / K reduced (compared to value at (very) low temperature)	**B1**
	voltage / p.d. of point X / across R increases	**M1**
	(larger) current in lamp	**A1**
10(c)	thermistor	**B1**

Question	Answer	Marks
11(a)(i)	(initial CR adjusted for background = 220 – 20 =) 200	**C1**
	(after 1 half-life CR adjusted for background =) 100 OR (detected CR) = 120	**C1**
	2.4 min	**A1**
11(a)(ii)	12 or 13	**C1**
	(12 + 20 =) 32 OR (13 + 20 =) 33	**A1**
11(b)	incorrect	**B1**
	container / (2 mm) plastic does not absorb / stop / block / is penetrated by γ	**B1**
	good extra detail e.g. any **one** of: • container / (2 mm) plastic absorbs / stops α • partially correct as statement • need lead to stop γ • γ is dangerous / harmful owtte	**B1**

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PHYSICS **0625/62**
Paper 6 Alternative to Practical **May/June 2021**
MARK SCHEME
Maximum Mark: 40

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

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

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

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

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

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

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PHYSICS **0625/41**

Paper 4 Extended Theory **May/June 2021**

MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)(i)	any value from 35 to 43 m / s^2	**A2**
	(a =) (v – u) / t in any form **or** gradient (of line) **or** (58 – 50) / 0.20 **or** equivalent values from the graph	**C1**
1(a)(ii)	3800 N	**A3**
	(F =) ma in any form **or** Δp / Δt in any form **or** 76 × candidate's **1(a)(i)** **or** 760 seen	**C1**
	76 × candidate's **1(a)(i)** evaluated **or** 76 × (candidate's **1(a)(i)** + 10) **or** 76 × (candidate's **1(a)(i)**)+ 760	**C1**
1(b)	(deceleration because) upward force greater than weight **or** upward resultant force	**B1**
	air resistance decreases (with decreasing speed / with time) **or** deceleration decreases **or** resultant (upward) force decreases	**B1**
	(until / finally) weight equals air resistance **or** forces balance **or** at terminal / constant velocity / speed	**B1**
1(c)	at zero speed there is no air resistance	**B1**
	weight / downwards force is (still) acting **or** there is (now) a resultant force (downwards at zero speed)	**B1**
	OR forces balance at a speed greater than zero	**(B1)**
	speed cannot decrease / no deceleration once forces balance	**(B1)**

Question	Answer	Marks
2(a)(i)	0.078 N s **or** 0.078 kg m / s	**A2**
	(I =) $m_t(\Delta)v_t$ in any form **or** 1.2×0.065	**C1**
2(a)(ii)	150 m / s	**A2**
	$v_b = (m_t + v_t) / m_b$ in any form **or** initial momentum = final momentum **or** $1.2(0052) \times 0.065 / 0.00052$ **or** $0.078(0338) / 0.00052$	**C1**
2(b)	work done against / due to / because of friction **or** kinetic energy (of trolley) used to do work	**B1**
	kinetic energy decreases (to zero)	**B1**
	thermal energy produced	**B1**

Question	Answer	Marks
3(a)	molecules (already very) close / touching	**B1**
	(repulsive) forces (very) large	**B1**
3(b)(i)	6.5×10^5 Pa	**A3**
	(p =) F / A in any form **or** 8800 / 0.016 **or** (F_{air} =)$1.0 \times 10^5 \times 0.016$	**C1**
	5.5×10^5 **or** 5.5×10^5 (+ 1.0×10^5) **or** (1600 + 8800) / 0.016	**C1**
3(b)(ii)	pressure due to (increased height of) oil in cylinder mentioned **or** pressure (in liquid) increases as depth increases	**B1**
	to keep the upwards force constant **or** to lift the (extra) oil **or** to counteract / oppose the increased pressure / force / weight of the oil	**B1**
3(b)(iii)	(initial) force has to be greater than 8800 N to start the motion **or** the upwards force (just) balances the weight (so no movement) **or** piston / oil has weight **or** friction (between moving parts)	**B1**

Question	Answer	Marks
4(a)	aluminium is a (good) conductor (of heat) **and** plastic is a poor conductor / does not conduct (heat)	**B1**
4(b)(i)	increase in kinetic energy of molecules **or** increase in potential energy of molecules	**B1**
4(b)(ii)	any **three** from: • atoms (touching the hotplate) / lattice vibrate (faster) • atoms pass on energy / vibration to neighbouring atoms / to other atoms by collision • atoms pass on energy to electrons • electrons hit distant atoms **or** electrons move (through lattice)	**B3**
4(b)(iii)	molecules escape from the liquid (as a vapour)	**B1**
	bonds broken / (attractive) forces overcome	**B1**
	molecules gain potential energy **or** work done (to separate molecules / break bonds / overcome forces)	**B1**
4(b)(iv)	840 W	**A3**
	(E =) ml_v in any form **or** $0.11 \times 2.3 \times 10^6$ **or** 2.53×10^5	**C1**
	(rate =) ml_v / t in any form **or** $0.11 \times 2.3 \times 10^6 / 300$ **or** $2.53 \times 10^5 / 300$	**C1**

Question	Answer	Marks
5(a)	molecules / they speed up **or** gain kinetic energy	**B1**
	molecules move further apart **or** push others away	**B1**
5(b)	forces between liquid molecules weak(er than in solids)	**B1**
	less energy / work done to separate molecules **or** greater separation for same work done / same increase in energy	**B1**
5(c)(i)	greater sensitivity	**B1**
	volume increase (of liquid in second thermometer) is greater **or** liquid moves a greater distance (for the same temperature increase)	**B1**
5(c)(ii)	smaller range **and** either of: • smaller temperature increase for liquid / meniscus to reach end of tube • expands more / greater sensitivity **and** tube of same length	**B1**
5(d)(i)	statement of <u>problem</u> (e.g. bridges buckle (in hot weather))	**B1**
5(d)(ii)	suggested solution to problem stated in **5(d)(i)** (e.g. allow gaps at the ends of the bridge)	**B1**
	more detail (e.g. as the bridge expands the gaps close)	**B1**

Question	Answer	Marks
6(a)	two points labelled C at the centre of the two compressions	**B1**
6(b)	6200−6500 Hz	**A3**
	(λ =) value from 0.051 to 0.053 (m) seen anywhere	**C1**
	(f =) v / λ in any form **or** 330 / 0.052 **or** 330 / 5.2 **or** 63	**C1**
6(c)	compressions / rarefactions closer **or** more compressions / rarefactions (in same distance)	**B1**
	less diffraction / spreading out	**B1**
	(because of) smaller wavelength **or** ratio wavelength / gap width smaller	**B1**

Question	Answer	Marks
7(a)(i)	any **three** from: • *y*-axis labelled *e.m.f.* **and** *x*-axis labelled *time* • at least one cycle of a sinusoidal wave • <u>only **two**</u> complete cycles of a sinusoidal wave • constant amplitude **and** constant period for first two periods of a sinusoidal wave	**B3**
7(a)(ii)	peak **or** trough **or** corresponding time labelled P	**B1**
7(a)(iii)	(amplitude / maximum e.m.f.) increases	**B1**
	(e.m.f.) changes direction more often **or** greater frequency	**B1**
7(b)	alternating current in primary coil	**B1**
	alternating / changing magnetic field **or** magnetic field cuts secondary coil (continuously)	**B1**
	(alternating) e.m.f. <u>induced</u> in the secondary coil	**B1**

Question	Answer	Marks
7(c)	smaller current (and same resistance when the power is transmitted and an equal rate)	B1
	less thermal energy loss / produced (in cables)	B1

Question	Answer	Marks
8(a)	 **and** between P and Q	B1
8(b)	1.5 V **c.a.o.**	B1
8(c)(i)	1600 Ω	A3
	($V_{800\,\Omega}$ =) 4.0 (V)	C1
	(I =) V / R in any form or 4.0 / 800 or 0.0050 (A) **or** (R =) V / I or 8.0 / 0.0050	C1
	OR 1600 Ω	(A3)
	($V_{800\,\Omega}$ =) 4.0 (V)	(C1)
	(R_{Th} =) $R_{800\,\Omega} \times V_{Th} / V_{800\,\Omega}$ in any form **or** (R_{Th} =) $800 \times 8.0 / 4.0$ in any form	(C1)
	OR 1600 Ω	(A3)
	$\frac{12}{800+R_{Th}}$ **or** $\frac{8.0}{R_{Th}}$ **or** $\frac{R_{Th}}{800+R_{Th}}$	(C1)
	$\frac{12}{800+R_{Th}} = \frac{8.0}{R_{Th}}$ in any form	(C1)

Question	Answer	Marks
8(c)(ii)	larger proportion of the e.m.f. (across thermistor) **or** smaller voltage across 800 Ω	B1
	temperature (of thermistor) is smaller / has decreased	B1
	resistance of thermistor / circuit is large(r)	B1

Question	Answer	Marks
9(a)	$^{2}_{1}H$ **and** $^{3}_{1}H$ **and** in this order	B1
9(b)(i)	joining together of (small / H) nuclei	B1
	to produce a bigger nucleus / He nucleus **or** with the release of energy	B1
9(b)(ii)	($^{2}_{1}H + ^{3}_{1}H \rightarrow$) $^{1}_{0}n$	B1
	(+) $^{4}_{2}(....)$	B1
	He **or** α seen	B1
9(c)	any **two** from: • geothermal (energy) • tidal (energy) • nuclear (energy)	B2

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PHYSICS **0625/43**

Paper 4 Extended Theory **May/June 2021**

MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)	(extension =) 15 cm	A2
	$F = kx$ **OR** $x = F/k$ **OR** 3.0/0.2	C1
1(b)	extension is proportional to load	B1
	up to the limit of proportionality, extension proportional to load	B1
1(c)	graph initially straight line with positive gradient that passes through the origin	B1
	point labelled, increasing gradient to the right	B1
1(d)	• from elastic / strain energy • to gravitational potential energy EITHER: • to kinetic energy, when moving from A to equilibrium OR from kinetic energy, when moving from equilibrium to B	B3

Question	Answer	Marks
2(a)(i)	pressure = force/area accept P inversely proportional to area	B1
	same force exerted by each group of books	B1
	area (in contact with bookshelf) in group B is greater OR area (in contact with bookshelf) in group A is smaller	B1
2(a)(ii)	(pressure =) 1900 Pa	A3
	force = $6 \times 0.52 \times 10$ OR 31(.2) seen	C1
	area = $6 \times 0.013 \times 0.21$ OR 0.016(38) seen OR 163.8 (cm^2)	C1

Question	Answer	Marks
2(b)	(depth =) 19 m	**A3**
	$p = \rho gh$ OR $(3.0 - 1.0) \times 10^5 = 1030 \times 10 \times h$ in any form	**C1**
	$h = (3.0 - 1.0) \times 10^5/1030 \times 10$ OR $h = 2.0 \times 10^5/1030 \times 10$	**C1**

Question	Answer	Marks
3(a)	thinking time is constant	**B1**
3(b)	kinetic energy	**B1**
	kinetic energy = ½ mv^2	**B1**
	work done (to lose KE) = Fd (so stopping distance is proportional to v^2)	**B1**
	OR (alternative route)	
	time to decelerate is proportional to v	**(B1)**
	d = average $v \times t$ = ½ $v \times t$	**(B1)**
	d is proportional to v^2	**(B1)**
3(c)(i)	0.68 s	**A2**
	$t = d/v$ OR 15/22 in any form	**C1**
3(c)(ii)	15 000 N	**A2**
	Ft = change in momentum OR $F \times 2.1 = 1400 \times 22$ in any form OR $F = ma$ OR (F =)$(1400 \times 22)/2.1$)	**C1**

Question	Answer	Marks
4(a)(i)	Energy transferred when 1 kg / unit mass of a substance freezes or melts	**A2**
	Energy transferred when a substance freezes/melts/changes state	**C1**
4(a)(ii)	cup containing mixture of ice and water	**M1**
	mixture of ice and water will remain at 0 °C until all ice is melted (but temperature of water at 0 °C rises) or reverse argument OR energy needed for change of state so temperature doesn't rise until this has taken place	**A1**
4(b)(i)	in evaporation more – energetic / faster moving molecules / molecules with high(er) kinetic energy escape (from surface)	**B1**
	low(er) energy / slow molecules remain OR so remaining liquid is cooler	**B1**
	thermal energy is taken from person to liquid (so person cools down)	**B1**
4(b)(ii)	(great(er) / fast(er) evaporation of sweat as) wind blows fast moving molecules away OR molecules do not re-enter the liquid	**B1**

Question	Answer	Marks
5(a)(i)	part of a circle, at least quarter of a circle, centred on centre of gap	**B1**
	waves same wavelength as incident waves	**B1**
5(a)(ii)	waves pass through gap remaining straight	**B1**
	less / no diffraction occurs	**B1**
5(b)	1.8 m	**A2**
	$\lambda = v/f$ OR 1500/850 in any form	**C1**

Question	Answer	Marks
6(a)	principal focuses marked in correct position	**B1**
6(b)	1 mark for each of: • 1 correct ray • 2nd correct ray • 3rd correct ray and image, labelled I, in correct position with arrow at bottom	**B3**
6(c)	real	**B1**
	inverted and enlarged	**B1**
6(d)(i)	(image produced by a magnifying glass is) upright OR NOT inverted OR virtual	**B1**
6(d)(ii)	position marked between principal focus and lens	**B1**

Question	Answer	Marks
7(a)	energy supplied	**M1**
	to drive a unit charge / 1 C round a complete circuit	**A1**
7(b)(i)	(R =) 2.3 Ω OR 2.2 Ω	**A3**
	$R = V/I$ in any form	**C1**
	current in R = 4 (A) OR p.d. across R = 9 (V)	**C1**
7(b)(ii)	1.1 Ω	**A3**
	resistance proportional to length (so twice length twice resistance)	**C1**
	resistance inversely proportional to area (so twice diameter decreases resistance by factor of 4)	**C1**

Question	Answer	Marks
8(a)	digital signal only two states – low or high OR 0 or 1	**B1**
	analogue signal any value	**B1**
8(b)	 correct symbol for NOR gate	**B1**
8(c)(i)	AND	**B1**
	OR	**B1**
8(c)(ii)	rows 1, 2, 5, 6 all 1	**B1**
	rows 3, 4, 7, 8 all 0	**B1**

Question	Answer	Marks
9(a)	(N_S =) 24 000	**A2**
	$N_S = N_P \times V_S / V_P$ OR $50 \times 110 \times 10^3$ / 230 in any form	**C1**
9(b)	labelled diagram showing: • (soft)-iron core • copper coils • fewer coils on secondary than primary	**B3**
9(c)	alternating voltage in primary	**B1**
	alternating / varying / changing magnetic field (in iron core)	**B1**
	voltage is induced in the secondary coil	**B1**

Question	Answer	Marks
10(a)(i)	curve bending downwards while in magnetic field (and labelled α)	**B1**
10(a)(ii)	curve bending in opposite direction from α while in magnetic field **OR** up the page if no curve shown for α in **(a)(i)** (and labelled β)	**B1**
	greater curvature for β than for α	**B1**
10(a)(iii)	line passing straight through magnetic field (and labelled γ)	**B1**
10(b)	any **two** from: • stand behind shielding provided / wall / as far away as possible • store in lead-lined boxes • limit exposure time / (monitoring exposure) with film badge • do not allow pregnant staff to work	**B2**
10(c)(i)	$^{131}_{53}\mathrm{I}$	**B1**
10(c)(ii)	any **two** from: • γ can be detected outside body • needs long enough half-life to be detected / reach part of the body required • needs short enough half-life to soon have very little activity • gamma weakly ionising or pass out of body without harm	**B2**

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PHYSICS **0625/61**

Paper 6 Alternative to Practical **May/June 2021**

MARK SCHEME

Maximum Mark: 40

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Question	Answer	Marks
1(a)	x = 50.0 (cm)	**1**
1(b)(i)	T = 1.67	**1**
1(b)(ii)	T^2 = 2.79 (or 2.789 or 2.7889)	**1**
	T^2 given to 3 significant figures	**1**
1(b)(iii)	cm, s, s, s^2	**1**
1(c)	Graph: Axes correctly labelled with quantity and unit and right way round	**1**
	Suitable scales	**1**
	All the plots from their table correct to better than ½ small square	**1**
	Good line judgement, thin, continuous line	**1**
1(d)	No. Not through origin	**1**
1(e)	(Timing) errors less significant / have a smaller <u>percentage</u> uncertainty / the error is spread over 10 periods / is divided by 10	**1**

Question	Answer	Marks
2(a)(i)	V_1 = 2.4	**1**
	I_1 = 0.50	**1**
	V, A	**1**
2(a)(ii)	R_1 = (4.8) in Ω	**1**
2(b)	R_S = 9.29 or 9.3 stated to 2 / 3 sf	**1**
2(c)	R_P = 2.42	**1**
2(d)	Resistors in parallel	**1**
	Voltmeter and ammeter correctly placed, all symbols correct	**1**
2(e)	Use another resistor	**1**
	Add at least three more resistors (one at a time)	**1**
2(f)	Correct symbol for variable resistor	**1**

Question	Answer	Marks
3(a)	Normal at centre of AB	1
3(b)	EF and GH at 2.0 cm and 5.0 cm	1
3(c)(i)	$i = 30° \pm 2°$ to the left of normal and above the block	1
3(c)(ii)	P_1P_2 distance at least 5.0 cm but not greater than 15 cm	1
3(d)(i)	*a* between 2.2 and 2.6 (cm) or 22 and 26 (mm)	1
3(d)(ii)	*b* between 5.2 and 5.6 cm or 52 and 56 mm, and correct unit seen in **(i)** or **(ii)** and not contradicted	1
3(d)(iii)	*b* / *a* value quoted with no unit	1
	b / *a* lies within range 2.00 to 2.50	1
3(e)	One from: View bases of pins Pins at least 5cm apart Ensure pins are vertical	1
3(f)	At least 4 additional values, all < 90°	1
	Range at least 30°	1

Question	Answer	Marks
4	**MP1** Apparatus: timer	1
	MP2 Remove block from water	1
	MP3 Record temperatures and times OR record temperatures over a fixed time OR record time for a fixed temperature drop	1
	MP4 Other block(s) used	1
	MP5 Key variable: One from: Starting temperature of block Room temperature Water temperature Size of block Mass of block	1
	MP6 Table with columns for metal / block / material (owtte), temperature OR time OR temperature and time as appropriate to the method. Correct quantity and units required	1
	MP7 Plot graph of temperature against time (for each material) OR Compare rates of cooling OR Compare temperature drops (if fixed time used) OR Compare times (if fixed temperature drop used) OR Equate large temp. drop / short time to a high rate of cooling (or the converse)	1

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PHYSICS **0625/63**

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Question	Answer	Marks
1(a)	any 2 valid precautions e.g: rule close rule parallel to spring eye perpendicular to reading use set square clamp rule	2
1(b)(i)	l = 10.7 (cm)	1
1(b)(ii)	e = 8.4 / ecf (cm)	1
1(c)	e_U present	1
	W_R = 1.2 and unit (N) correct working shown	1
1(d)	l_W and e_w present	1
	ρ = 1.5 (g / cm^3) given to 2/3 significant figures	1
1(e)	any valid source of inaccuracy e.g: part of load U is metal hanger immersed too clay wet when weight measured air holes in clay air bubbles on immersed clay	1
1(f)	straight line	1
	stated as going through origin	1

Question	Answer	Marks
2(a)	correct voltmeter symbol in parallel with resistor and cell	1
2(b)	I_A = 0.64 (A)	1
2(c)	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 and thin line	1
2(d)	*E* in range 1.3 to 1.7 (V)	1
2(e)(i)	*G* present and triangle method seen on graph	1
2(e)(ii)	*r* in range 0.9 (Ω) to 2.0 (Ω)	1
2(f)	obtain more values at other potential differences	1
	start V axis at 3.0 (V) to expand scale	1

Question	Answer	Marks
3(a)(i)	normal correct	1
3(a)(ii)	θ = 20° ± 1°	1
3(b)	not suitable should be as far apart as possible	1
3(c)	all lines present and neat	1
3(d)(i)	*a* = 6.2 (cm) and *b* = 4.3 (cm) both ± 1 mm	1
3(d)(ii)	*n* = 1.4(1)	1
	expressed to 2/3 significant figures and no unit	1
3(e)(i)	α = 21° ± 2°	1
3(e)(ii)	statement matching results and justification matching statement ('within limits of experimental accuracy' / owtte)	1
3(f)	any suitable precaution e.g. look at base of pins/keep pins vertical use thin pins thin lines	1
3(g)	any one of: difficult to align pins/place pins accurately pins (too) thick lines too thick	1

Question	Answer	Marks
4	MP1 **apparatus:** rule or equivalent	**1**
	MP2 **method:** identify independent variable detail of deflection measurement and how it is measured	**1**
	MP3 repeat for new independent variable	**1**
	MP4 **control variable:** any variable appropriate to independent variable e.g. width of strip if thickness is the factor	**1**
	MP5 **table:** columns, with units, for independent variable, deflection	**1**
	MP6 **analysis:** compare readings in the table to see if change in factor produces change in deflection plot line graph (with axes specified)	**1**
	MP7 **additional point** (one from)**:** at least 5 sets of data taken repeat each measurement and take average 2nd appropriate control variable stated repeat experiment for different variation (e.g. different mass if thickness is factor) use of fiducial aid	**1**

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **October/November 2021**

MARK SCHEME

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

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

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PHYSICS **0625/42**

Paper 4 Extended Theory **October/November 2021**

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Question	Answer	Marks
1(a)	(acceleration) increases	B1
1(b)	tangent drawn at 25 s	M1
	78 to 82 m / s^2	A1
1(c)	(distance =) area under graph (stated or correct area clearly shown on graph) OR (400 x 10) / 2 OR (b x h) ÷ 2	C1
	2000 m	A1

Question	Answer	Marks
2(a)	extension is (directly) proportional to load (if elastic limit is not exceeded)	B1
2(b)(i)	0 to 20.5 + / – 0.5 N	B1
2(b)(ii)	(k =) F / x OR (k =) 1 / gradient	C1
	140 N / m OR 0.14 N / mm	A1
2(b)(iii)	60 OR 61 OR 62 OR 63 (mm) seen	C1
	180 mm OR 0.18 m	A1
2(c)	W = mg in any form OR (m =) W / g OR (m) = 4 / 8.7	C1
	0.46 kg	A1

Question	Answer	Marks
3(a)	momentum before collision = momentum after collision	**B1**
	(initial momentum (*p*) =) 800 × 2 OR 1600 (kg m / s)	**B1**
	(v =) (1600 – 1300) / 800 OR 300 / 800 OR 0.38 (m / s)	**B1**
3(b)(i)	(impulse =) change in momentum	**C1**
	1300 Ns	**A1**
3(b)(ii)	same value as **(b)(i)** OR 1300 (Ns)	**B1**

Question	Answer	Marks
4(a)	(statement) renewable	**B1**
	(explanation) (wind) is) replaced / replenished OR does not run out OR is not used up OR is an infinite energy resource	**B1**
4(b)	any **two** from: geothermal nuclear tidal	**B2**
4(c)	chemical	**B1**
	gravitational potential	**B1**

Question	Answer	Marks
5(a)	wires of 2 different metals	**B1**
	one junction clearly in each liquid	**B1**
	voltmeter / ammeter / galvanometer correctly connected	**B1**
5(b)	any **two** from • expansion of liquid • expansion of solid • expansion of gas • density (of liquid) • (electrical) resistance	**B2**
5(c)	any **two** from • large range • (measure) high temperatures • remote sensing • small size OR small mass • small thermal capacity • suitable for data logging • responds quickly OR measures rapidly varying temperatures OR temperature changing continuously	**B2**

Question	Answer	Marks
6(a)(i)	C in line with smallest gap between dots	**B1**
6(a)(ii)	R in line with largest gap between dots	**B1**
6(a)(iii)	arrow corresponds to wavelength	**B1**
6(b)	1500 m / s	**B1**
6(c)	$v = f\lambda$ in any form OR (f =) v / λ	**C1**
	(f =) 1500 / 0.12	**C1**
	(f =) 13 kHz OR 13 000 Hz	**A1**
6(d)	statement consistent with candidate's answer to 6c	**M1**
	ultrasound is above 20 000 Hz	**A1**

Question	Answer	Marks
7(a)(i)	i = 60° used or seen	**C1**
	sin i / sin r = n in any form	**C1**
	ray refracted toward normal and toward AC	**C1**
	ray clearly refracted down in prism reaching AC with r = 35(°)	**A1**
7(a)(ii)	10°	**B1**
7(b)	refracted away from normal	**B1**
7(c)(i)	(total internal) reflection at X NOT refraction at X or anywhere else	**B1**
	reaches end of fibre with <u>only one</u> additional reflection (off lower internal edge of fibre)	**B1**
7(c)(ii)	total internal reflection	**B1**

Question	Answer	Marks
8(a)(i)	clearly more –ve (than +ve) on left AND more +ve (than –ve) on right	**B1**
	same number of +ve and - ve	**B1**
8(a)(ii)	-ve charges (flow) from earth OR -ve charges flow to object	**B1**
	electrons flow to balance (excess) +ve charge on the object	**B1**
8(b)	$I = Q / t$ in any form OR (Q =) It	**C1**
	(Q =) $0.65 \times 10^{-3} \times 2.2 \times 60$	**C1**
	(Q =) 0.086 C	**A1**

Question	Answer	Marks
9(a)	7.5 V	**B1**
9(b)(i)	$1 / R_p = 1 / R_1 + 1 / R_2$ OR (R_p =) $R_1R_2 / (R_1 + R_2)$ in any form	**C1**
	(R_p =) 1.2 (Ω)	**C1**
	3.2 Ω	**A1**
9(b)(ii)	(V =) IR in any form	**C1**
	4.1 V	**A1**

Question	Answer	Marks
10(a)	OR (gate)	**B1**
10(b)	0	**B1**
	1	**B1**
10(c)	prevents electrocution OR metal case cannot become live OR metal case always at earth potential / voltage	**B1**
	(if) live wire touches metal case	**B1**
10(d)(i)	if current too high	**B1**
	fuse melts	**B1**
10(d)(ii)	13 A (circled)	**B1**
	fuse rating/value above but near (to) normal operating current/ 10 A OR fuse rating/value slightly higher (than) normal operating current /10A OWTTE	**B1**

Question	Answer	Marks
11(a)	(very small) nucleus **AND** (surrounded by) electrons (in orbit / shells)	**B1**
	neutrons and protons in nucleus	**B1**
	4 electrons (in atom) OR number of electrons = number of protons	**B1**
	4 neutrons (in nucleus)	**B1**
11(b)	$^{135}_{55}$ on left	**B1**
	Cs on left	**B1**
	$^{135}_{56}$Ba on right	**B1**
	+β on right OR –β on left	**B1**

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2021**

MARK SCHEME

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

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

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

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

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

Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.
NOTE: – If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only mark available in this case is the first (axes right way round and labelled) So maximum 1.
– If axes are wrong way round, the other 3 marks are still available.

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PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2021**

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Question	Answer	Marks
1(a)	it / a vector has a direction	**B1**
1(b)	two / three vectors **and** no more than one other quantity underlined	**C1**
	acceleration **and** momentum **and** velocity underlined **and** no others	**A1**
1(c)(i)	5.5 N	**B1**
1(c)(ii)	correct right-angled triangle / rectangle / intersecting arcs seen e.g.	**B1**
	(magnitude from) 9.6 to 10.0 N	**B1**
	(angle to vertical from) 54.0 to 57.5°	**B1**
1(c)(iii)	any **two** of: equal (in magnitude) opposite (in direction) the ring is in equilibrium **or** no resultant force on ring **or** forces on ring balance	**B2**

Question	Answer	Marks
2(a)	(quantity of thermal) energy **or** energy (to increase temperature) **or** energy (transferred by heating)	**C1**
	energy to increase temperature (of an object) per degree Celsius 1 °C	**A1**
2(b)(i)	(internal energy) depends on kinetic energy (of molecules)	**B1**
	kinetic energy (of molecules) decreases **or** potential energy (of molecules) decreases	**B1**
2(b)(ii)	(ΔE =) $mc\Delta T$ in any form **or** $0.24 \times 4200 \times 17$	**C1**
	1.7×10^4 J	**A1**
2(c)(i)	k.e. of molecules / (thermal) energy absorbed (from water / surroundings) **or** energy absorbed from (cooling) water	**B1**
	supplies latent heat **or** energy used to overcome intermolecular forces / to break bonds	**B1**
2(c)(ii)	any determination of mass	**B1**
	determine change in mass (of ice) / increase in mass of water **or** dry the ice **or** ensure water is at 0 °C / equilibrium is established **or** insulate the beaker	**B1**
	use (l_f =) E / m in any form	**B1**

Question	Answer	Marks
3(a)	any **three** of: they / molecules collide with inner surface momentum (of a molecule) changes / reverses force exerted / impulse force spread over area / surface **or** $p = F / A$	**B3**
3(b)(i)	(V_2 =) p_1V_1 / p_2 in any form **or** $630 \times 1.0 \times 10^5 / 1.4 \times 10^5$	**C1**
	450 cm^3 **or** 4.5×10^{-4} cm^3 **or** 0.45 dm^3	**A1**
3(b)(ii)	any **two** of: molecules move more slowly / have less kinetic energy pressure (inside balloon) decreases **or** pressure is directly proportional to temperature **or** $p \propto T$ volume is directly proportional to temperature **or** $V \propto T$ molecular collisions less frequent molecular collisions less violent / hard / exert smaller impulse water / external pressure compresses balloon **or** water pressure greater (and balloon compressed)	**B2**

Question	Answer	Marks
4(a)(i)	straight line begins at (15 s, 120 m) **and** continues to end of given line	**B1**
4(a)(ii)	curve with increasing gradient from origin to beginning of candidate's **(a)(i)**	**B1**
4(b)	(E_k =) $\frac{1}{2}mv^2$ in any form	**C1**
	$\frac{1}{2} \times 1.8 \times 10^5 \times 20^2$	**C1**
	3.6×10^7 J	**A1**
4(c)(i)	(work done =) force × distance (moved in the direction of the force)	**C1**
	(work done =) force × distance moved in the direction of the force	**A1**
4(c)(ii)	240 m **c.a.o.**	**B1**
4(c)(iii)	3.6×10^7 / 240 **or** kinetic energy / distance **or** (*a* =) 20 / 24 **or** $\Delta v / t$ in any form **or** 0.83 **or** (*F* =) *ma* in any form	**C1**
	1.5×10^5 N	**A1**

Question	Answer	Marks
5(a)	(point) where (parallel) rays (of light) meet (after passing through lens)	**C1**
	point) where parallel rays (of light) meet / are focussed (after passing through lens) **or** (point) through which rays (of light) that emerge parallel pass (before reaching lens)	**A1**
5(b)	distance between principal focus / focal point and optical centre / lens	**B1**
5(c)(i)	vertical line labelled L 4.0 (± 0.2) cm to the right of O	**B1**
5(c)(ii)	paraxial ray from tip of O to candidate's lens **and** from lens to tip of I **or** paraxial ray from lens to tip of I **and** from tip of O to candidate's lens	**C1**
	3.0 (± 0.2) cm	**A1**
5(c)(iii)	fourth box ticked i.e: 	**B1**
	reversed / inverted	**B1**

Question	Answer	Marks
6(a)(i)	(J) ultraviolet (radiation) (K) infrared (radiation) (L) radio (waves)	
	two correct	**C1**
	all three correct	**A1**
6(a)(ii)	L **or** radio (waves)	**B1**
6(b)	(c =) 3.0×10^8 (m / s) seen	**C1**
	(f =) v / λ in any form **or** $3.0 \times 10^8 / 1.2 \times 10^{-9}$	**C1**
	2.5×10^{17} Hz	**A1**
6(c)(i)	stated medical use (e.g. treating cancer / X-ray shadowgraph / sterilising equipment)	**B1**
	statement of what happens to the X-rays (e.g. absorbed by tumour / bones / bacteria)	**B1**
	stated consequence (e.g. tumour killed **or** image / picture / shadow / photograph produced)	**B1**
6(c)(ii)	can cause burns / (cell) mutation / cell damage / tumours / cancer / damages DNA etc.	**B1**

Question	Answer	Marks
7(a)	electrons mentioned	**B1**
	negative charges / electrons move from cloth **or** move to rod	**B1**
7(b)(i)	electrons / negative charge(s) repelled to earth **or** ball charged by induction	**B1**
	ball positively charged	**B1**
	opposite charges attract	**B1**
7(b)(ii)	negatively charged (by rod) **or** ball discharges / becomes neutral	**B1**
	repelled by rod **or** pulled down by gravity / its weight	**B1**

Question	Answer	Marks
8(a)	Q / t **or** (rate of) flow of (electric) charge / electrons	**B1**
8(b)	(current in the 450 Ω resistor =) $I_2 - I_1$	**B1**
8(c)	($V_{450\,\Omega}$ =) IR **or** 0.012×450 **or** 5.4 (V) **or** 9.0 – 5.4 **or** 3.6 (V) seen	**C1**
	(I =) 3.6 / 800 **or** 0.0045 (A)	**C1**
	(P =) VI **or** 3.6×0.0045 **or** $3.6^2 / 800$	**C1**
	1.6×10^{-2} W **or** 16 mW	**A1**
8(d)	resistance (of LDR) decreases	**B1**
	current (in circuit) increases **or** resistance of parallel pair decreases	**C1**
	p.d. across 800 Ω resistor increases **and** p.d. across 450 Ω resistor decreases **or** resistance of parallel pair a smaller fraction of total resistance **and** p.d. across 450 Ω resistor decreases	**A1**

Question	Answer	Marks
9(a)	(very small) nucleus **and** surrounded by electrons (in orbit / shells)	**B1**
	92 protons **or** 92 electrons **or** number of protons = number of electrons	**B1**
	protons and neutrons in nucleus	**B1**
	143 neutrons	**B1**
9(b)	(uranium-238 has) three more neutrons (in nucleus)	**B1**
9(c)	$^{94}_{(38)}$(E)	**B1**
	$^{(94)}_{38}$(E)	**B1**
9(d)(i)	55	**B1**
9(d)(ii)	140	**B1**

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Cambridge IGCSE™

PHYSICS **0625/43**

Paper 4 Extended Theory **October/November 2021**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	0.0069 m / s^2	**A2**
	(acceleration =) gradient of graph or $\Delta v / \Delta t$ in any form OR $\frac{15-7.5}{(60-42)60}$	C1
1(b)	48 000 m or 48 km	**A3**
	area under graph	C1
	$\frac{1}{2}(18\times7.5\times60)+(7.5\times18\times60)+(15\times40\times60)$	C1
1(c)(i)	(force =) 2.0×10^5 N	**A2**
	(F =) ma OR $2.3\times10^7\times0.0087$ in any form	C1
1(c)(ii)	there is a backward / drag force OR water resistance	**B1**

Question	Answer	Marks
2(a)	(rate of transfer of gravitational potential energy =) 0.17 W	**A4**
	(gravitational PE lost =) mgh in any form OR $12\times10\times1.7$	C1
	(gravitational PE lost =) 204 (J)	C1
	(gravitational PE lost / s =) 204 / 1200	C1
2(b)	59% OR 0.59	**A2**
	efficiency = useful power output / power input ($\times$ 100%) in any form OR $0.10/0.17\times100\%$	C1
2(c)	any sensible advantage, e.g. no use of (fossil) fuel, no cost to run, can be used in remote areas, no CO_2 / air pollution, no greenhouse gases, does not contribute to global warming	**B1**

Question	Answer	Marks
3(a)(i)		**B2**
	pressure in a liquid increases with depth OR pressure decreases (as bubble rises)	B1
	pressure (of gas) is inversely proportional to volume OR internal pressure greater than external pressure (momentarily) OR (air) molecules do not have to hit surface of bubble as frequently (to stop the bubble collapsing) OR the bubble is not as strongly compressed	B1
3(a)(ii)	0.50 cm^3	**A4**
	PV = constant, in any form	C1
	P (due to water) = ρgh, in any form	C1
	$[1.0 \times 10^5 + (1000 \times 10 \times 3.0)] \times 0.40 = [1.0 \times 10^5 + (1000 \times 10 \times 0.5)] \times V_2$	C1
3(b)		**B2**
	paper is not compressed as much / less force on piston B	B1
	air can be compressed OR some of the energy is used to compress the air (instead of the paper)	B1

Question	Answer	Marks
4		**B4**
	(temperature of air increases) so molecules move faster / their KE increases	B1
	molecules collide with walls of container and change momentum	B1
	greater change of momentum when temperature is higher OR collisions more frequent OR harder collisions OR force = rate of change of momentum	B1
	(higher force and hence) higher pressure	B1

Question	Answer	Marks
5(a)(i)	1.2 kg	**A2**
	$(m =) \frac{7600 \times 0.41}{2600}$ volume constant so mass directly proportional to density	C1
5(a)(ii)	0.37 J / °C	**A2**
	(thermal capacity =) mass × specific heat capacity	C1
5(a)(iii)	48 J	**A2**
	(E =) $mc\Delta T$ OR $1.2 \times 0.50 \times (100 - 20)$ in any form	C1
5(b)	electrons mentioned	**B1**
	(metals have) electrons free to move / delocalised (which transfer thermal energy)	**B1**

Question	Answer	Marks
6(a)		**B5**
	method of producing sound, e.g. clap for echo method or gun for direct measurement, sig gen or loudspeaker, hammer on block	B1
	apparatus used, e.g. stopwatch, long tape, trundle wheel, wall if using echo method, metre rule, microphones and timer or microphones and oscilloscope	B1
	detail of measurement of (long) distance, e.g. measure distance between person and the wall, measure distance between loudspeaker and microphone or measure distance between two microphones	B1
	detail of measurement of time OR appropriate time measured, e.g. at one end start stopwatch when smoke seen from gun and stop it when sound heard, start stopwatch when gun heard / clap heard and stop when echo heard, measure time taken between clap and hearing echo, timer starts when first microphone receives signal and stops when second receives signal OR measurement of wavelength, e.g. move one microphone away until two waves on oscilloscope have moved one wavelength apart	B1
	speed = measured distance / time for direct method OR speed = 2 × distance from student clapping to wall / time for echo method OR distance between microphones = wavelength AND $v = f \times \lambda$	B1
6(b)		**B2**
	wavelength of light is (much) smaller than width of doorway or wavelength of sound	B1
	wavelength of sound is similar to width of doorway OR $\lambda \simeq$ width of gap for diffraction to occur OR larger wavelength results in greater diffraction ORA	B1

Question	Answer	Marks
7(a)(i)		**B2**
	ray approaching left hand face of prism closer to normal than emerging ray	B1
	ray entering right hand face of prism showing refraction towards normal for ray already drawn	B1
7(a)(ii)	light of single frequency	**B1**
7(b)(i)	$3(.0) \times 10^8$ m / s	**B1**
7(b)(ii)	5.8×10^{14} Hz	**A2**
	(f =) v / λ in any form OR $3.0 \times 10^8 / 5.2 \times 10^{-7}$	C1
7(b)(iii)	2.0×10^8 m / s	**A2**
	refractive index = speed of light in air / speed of light in glass in any form	C1

Question	Answer	Marks
8(a)		**B2**
	five straight, parallel vertical lines, equally spaced by eye, between plates	B1
	arrow head pointing upwards on at least one line and none wrong	B1
8(b)(i)	11 A	**A2**
	(I =) P / V in any form OR 2400 = I220	C1
8(b)(ii)	9900 C OR 9800 C	**A2**
	(Q =) It in any form OR (Q =) $11 \times 15 \times 60$	C1
8(b)(iii)	13 A	**B1**

Question	Answer	Marks
9(a)(i)		**B2**
	four components joined in series	B1
	all circuit symbols correct for resistor, thermistor, a filament lamp and a power supply	B1
9(a)(ii)	voltmeter connected in parallel to the resistor	**B1**
9(a)(iii)	(p.d. across terminals of power supply) = 18 V	**A4**
	(current through resistor when p.d. across it is 6.0 V =) 0.4 A	C1
	current same through all components in series circuit OR horizontal line through 0.4 A on graph through all three curves OR p.d. across filament lamp = 3.0 V OR p.d. across thermistor = 9.0 V	C1
	p.d. across filament lamp = 3.0 V AND p.d, across thermistor = 9.0 V	C1
9(b)	any sensible use requiring temperature control or depending on temperature, e.g. fire alarms, to keep computers cool (by operating fan), in incubators, electronic thermometer, electronic thermostat in kettle / car engine	**B1**

Question	Answer	Marks
10(a)(i)	6.0 V	**A2**
	(V_S =) $N_S V_P$ / N_P in any form or (V_S =) (25 × 120) / 500	C1
10(a)(ii)	2.5 A OR 2500 mA	**A2**
	(I_S =) I_P V_P / V_S in any form OR (0.125 × 120) / 6.0	C1
10(b)(i)	arrow right to left along loose part of wire or any other correct position	**B1**
10(b)(ii)		**B2**
	wire moves up	B1
	(reversing direction of the current) reverses the direction of force	B1
10(c)	coil does not continue to rotate in the same direction	**B1**

Question	Answer	Marks
11(a)(i)	background radiation OR any reasonable specific source of background radiation e.g. cosmic rays, the sun, space, building materials, earth, rocks, radon gas, student etc.	**B1**
11(a)(ii)	(radioactive decay is a) random (process)	**B1**
11(b)		**B3**
	U: proton no 92 and nucleon number 238	B1
	Th: proton number 90 and nucleon number 234	B1
	α: proton number 2 and nucleon number 4	B1
11(c)	11	**A2**
	three half lives or evidence of multiplying half-life by 3	C1

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PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2021**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	439 / 43.9	1
	454 / 45.4 and both answers with correct unit	1
1(a)(ii)	l_0 = top - bottom	1
1(b)(i)	439 / 43.9	1
1(b)(ii)	454 / 45.4 and both answers with correct unit	1
1(c)	Graph: Axes correctly labelled with quantity and unit and right way round	1
	Suitable scales	1
	All SIX plots (including 0, 0) correct to ½ small square	1
	Good line judgement, thin, continuous line	1
1(d)	l and l_0 clear and correct	1
	e clear and correct	1

Question	Answer	Marks
2(a)(i)	$V_X = 1.2$	1
	$I_X = 0.26$	1
2(a)(ii)	$R_X = 4.62$	1
	units A, V and Ω seen correctly	1
2(b)	(No) – <u>too</u> different (owtte)	1
2(c)(i)	Resistors Z and X in parallel and named	1
	Voltmeter correctly placed	1
	Ammeter correctly placed, correct circuit and all symbols correct.	1
2(d)	2.2 (given to 2 significant figures)	1
2(e)	At least 4 additional values suggested	1
	All values within 1(Ω) to 20(Ω)	1

Question	Answer	Marks
3(a)	Normal at 90°	1
	Correctly placed lines at 40° ± 2° and 70° ± 2°	1
	Both 7.0 ± 0.2 cm	1
3(b)	P_1P_2 distance at least 50 mm on AB	1
3(c)	α 70 ± 2°	1
3(d)	Correct unit	1
3(e)	At least 3 extra angles suggested	1
	Range of at least 30°	1
3(f)	One of: Difficulty in lining up pins Thickness of mirror Thickness of pins / size of pin holes	1
3(g)	Any two from: Box 2 ticked Box 3 ticked Box 5 ticked	2

Question	Answer	Marks
4	**MP1** Apparatus: (stop)watch / clock / timer	1
	MP2 Method: Heat water in a container to a specified temperature or to boiling point	1
	MP3 Method: Repeat for at least two additional containers	1
	MP4 Constant Variable: Volume of water	1
	MP5 Constant Variable: Starting temperature (of water) OR room temperature OR power of heater	1
	MP6 Table with columns to match their method. If MP2 correct, this needs type of container and time with unit (s)	1
	MP7 Compare times / durations (for the various containers) OR see which takes longer.	1

Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.
NOTE: If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only mark available in this case is the first (axes right way round and labelled) So maximum 1.
If axes are wrong way round, the other 3 marks are still available.

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PHYSICS **0625/63**
Paper 6 Alternative to Practical **October/November 2021**
MARK SCHEME
Maximum Mark: 40

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Question	Answer	Marks
1(a)	θ_R = 21 (°C)	1
1(b)	s, °C both correct	1
1(c)	2 suitable precautions e.g.: view scale reading perpendicularly, wait until readings stops rising (at start), avoid thermometer touching beaker	2
1(d)	statement matching readings in table	1
	comparison of temperature changes over 180 s, matching statement (need to see values used in justification)	1
1(e)(i)	correct calculation of x_1	1
1(e)(ii)	Correct unit °C / s	1
1(f)(i)	beaker B without lid	1
1(f)(ii)	statement matching data for beaker B with values quoted	1
	statement with comparison of data or cooling rates	1

Question	Answer	Marks
2(a)	ammeter in series connection or voltmeter in parallel connection	1
	second meter shown connected correctly and circuit complete	1
2(b)(i)	V = 2.8	1
	I = 0.32	1
2(b)(ii)	R = 8.75 / ecf, 5.78, 5.00, 3.19	1
	R consistent to 2 or 3 significant figures	1
2(b)(iii)	V, A, Ω all correct	1
2(c)(i)	P = 1.51 / ecf and Q = 1.57 / ecf	1
2(c)(ii)	statement matching results and values used	1
	justification matching statement e.g. within limits of experimental accuracy / owtte	1
2(d)	valid inherent source of inaccuracy e.g.: crocodile clip connection not even / difficult to connect at exactly the correct length / resistance wires not uniform	1

Question	Answer	Marks
3(a)	hO = 2.0 (cm)	1
3(b)	move screen backwards and forwards / move screen slowly	1
3(c)	1 / h_I = 0.18	1
3(d)	graph: • axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least ½ grid)	1
	• plots all correct to ½ small square, precise plots	1
	• well judged line and thin line	1
3(e)(i)	triangle method seen on graph	1
3(e)(ii)	f in range 14.0cm to 16.0cm	1
3(f)	any difficulty in measuring h_I e.g.: ruler in way of light / difficult to see top and bottom of image / edges of image blurred / difficult not to move screen when placing ruler to measure image	1
	matching solution e.g.: use graph paper on screen / mark top and bottom of image and measure later / use translucent screen and measure at back / use larger object / clamp screen (after obtaining focus)	1

Question	Answer	Marks
4	MP1 **apparatus:** factor stated and apparatus appropriate to its measurement e.g. ammeter, voltmeter, coils (no apparatus for measuring required)	1
	MP2 **control variable:** any variable appropriate to independent variable (e.g. current if number of coils is the independent variable, number of coils if current is the independent variable. Same size / mass of paper clips)	1
	MP3 **method:** measure independent variable check number of paper clips supported	1
	MP4 repeat for new value of independent variable	1
	MP5 **table:** columns, with units, for independent variable and number of paper clips	1
	MP6 **analysis:** compare readings in the table to see if change in factor produces change in strength, plot line graph (with axes specified)	1
	MP7 **additional point** (one from)**:** at least 5 sets of data taken, repeat each measurement and take average, 2nd appropriate control variable stated, repeat experiment for different variation (e.g. different no of coils if current is factor) arrangement of paper clips	1

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **March 2021**

MARK SCHEME

Maximum Mark: 40

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

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

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PHYSICS **0625/42**
Paper 4 Theory (Extended) **March 2021**
MARK SCHEME
Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	78 N	**A3**
	(m=) ρV OR $\rho = m / V$ in any form	C1
	$W = mg$	C1
1(b)	4.5×10^3 N	**A3**
	(F=) (Δ)PA OR $P = F / A$ in any form	C1
	($\Delta P = 1.3 \times 10^5 - 1.0 \times 10^5 =) 3 \times 10^4$	C1
	outwards	**B1**
1(c)	(ρ=) 800 kg / m^3	**A3**
	(ρ=) P / gh OR $P = \rho gh$ in any form	C1
	(ρ=) $9.6 \times 10^4 / (10 \times 12)$	C1

Question	Answer	Marks
2(a)(i)	(moment of a force) is the turning effect (about a point / pivot)	**B1**
2(a)(ii)	2.8×10^6 N m	**A2**
	(moment =) Fd in any form	C1
2(b)(i)	scalar / speed has magnitude only OR scalar / speed has no direction	**B1**
	vector / velocity has magnitude and direction	**B1**
2(b)(ii)	any scalar quantity	**B1**
	any vector quantity	**B1**

Question	Answer	Marks
2(c)	correct triangle or parallelogram drawn	**B1**
	resultant force (including correct arrow)	**B1**
	scale 1 cm = 4 N or 1 cm = 5 N	**B1**
	40 – 47 N **AND** 33° – 40° (anticlockwise from 20 N)	**B1**

Question	Answer	Marks
3(a)	renewable / yes	**B1**
	crops can be regrown (to replace resource) / waste materials don't run out	**B1**
3(b)	water will cool (too much) / thermal energy lost (during transfer)	**B1**
	lag/insulate (pipes) OR transport in a poor conductor of thermal energy	**B1**
3(c)	any two from: • air pollution / harmful gases / acid rain • CO_2 / greenhouse gases / contribution to global warming • not renewable • damage from mining / drilling or any valid environmental consequence of transport of coal	**B2**

Question	Answer	Marks
4(a)	molecules strike walls	**B1**
	momentum (of molecules) changes / momentum = mass × velocity	**B1**
	force = rate of change of momentum	**B1**
	pressure = (sum of) force(s) / area / pressure = rate of change of momentum / area	**B1**

Question	Answer	Marks
4(b)(i)	(p_2=) p_1V_1 / V_2	**A2**
	$p_1V_1 = p_2V_2$	C1
4(b)(ii)	greater	**B1**
	molecules move faster / have greater KE / molecules have greater momentum	**B1**
	(leads to) more frequent / harder collisions (with walls) / great rate of change of momentum	**B1**

Question	Answer	Marks
5(a)	echo	**B1**
5(b)	(λ=) 7.5×10^{-4} m	**A3**
	(λ=) v / f OR $v = f\lambda$ in any form	C1
	(λ=) $1.5 \times 10^3 / 2 \times 10^6$	C1
5(c)(i),(ii)	labelled wavelength of incident wave	**B1**
	3 part circles to the left of the barrier and centred to right of the barrier	**B1**
	wavelengths of reflected and incident waves same	**B1**

Question	Answer	Marks
6(a)	Any two correct rays from • from O through optical centre (and beyond) • from O parallel to principal axis to centre line of lens then through F_1 • from F_2 through O to centreline of lens then parallel to principal axis	**M2**
	rays traced back to intersect **AND** 2.4 – 3.6 cm	**A1**
6(b)	magnified	**B1**
	same way up as object	**B1**
	virtual	**B1**
6(c)	one ray from each prism refracted towards principal axis	**B1**
	(rays) converge to the right of original convergence on the principal axis	**B1**

Question	Answer	Marks
7(a)	no cutting of (magnetic) flux / magnetic field	**B1**
7(b)	to the top of the page / RH box	**B1**
	current, motion and (magnetic) field mutually at right angles	**B1**
	(magnetic) field from left to right	**B1**
7(c)(i)	opposite current (direction) / opposite deflection (on ammeter)	**B1**
7(c)(ii)	greater current / deflection	**B1**

Question	Answer	Marks
8(a)	energy supplied by a source in driving charge around a complete circuit / energy needed to drive unit charge / 1 coulomb round circuit	**B1**
8(b)(i)	(P=) 90 W	**A3**
	(P=) V I in any form	C1
	(V / R OR I =) 2	C1
8(b)(ii)	(p.d. =) 15 V	**A2**
	(p.d. =) 60 – 45	C1
8(b)(iii)	(I = 15 / 10 =) 1.5 A	**A2**
	(I =) V / R OR V = IR in any form	**C1**

Question	Answer	Marks
9(a)	I / P I / P O / P 0 0 0 1 1 0 1 1	**B1**
	I / P I / P O / P 0 0 **0** 0 1 **1** 1 0 **1** 1 1 **1**	**B1**
9(b)	two inputs to curved face, sharp end with small circle and one output	**B1**

Question	Answer	Marks
9(c)(i)	1 0 1 0	
9(c)(ii)	AND	**B1**
	input 1 and 1 gives output 1	**B1**
	any 0 input gives 0 output	**B1**

Question	Answer	Marks
10(a)	2	**B1**
	4	**B1**
	+2	**B1**
10(b)	$^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{0}_{-1}\beta$	
	nucleon numbers 90 on both sides of equation	**B1**
	Sr and proton number 38 on left AND Y and proton number 39 on right	**B1**
	$^{0}_{-1}\beta$ (to right of arrow)	**B1**
10(c)	(original mass = 4 / 9.2 =) 37 mg	**A2**
	2 half-lives	C1

Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/62**

Paper 6 Alternative to Practical **March 2021**

MARK SCHEME

Maximum Mark: 40

Published

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[Turn over

Question	Answer	Marks
1(a)	method outlined e.g. measure distance of rule from bench at two places <u>and</u> horizontal if equal	1
1(b)	d = 96.0 (cm)	1
1(c)	any suggestion with reference to checking if t measurable / checking if d value appropriate / establishing a range of d and t values	1
1(d)	$1 / T = 0.28$ (1 / s)	1
1(e)	graph: • axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least ½ grid)	1
	• plots all correct to ½ small square <u>and</u> precise plots	1
	• well-judged line <u>and</u> thin line	1
1(f)	G present and triangle method seen <u>on graph</u>	1
1(g)(i)	timing errors have less effect / smaller % uncertainty	1
1(g)(ii)	repeat each reading and calculate average value	1

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

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

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