Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 40

Published

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

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

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PHYSICS **0625/42**

Paper 4 Extended Theory **May/June 2022**

MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)(i)	(E =) 2 200 000 (J) OR 2.2×10^6 (J)	**A3**
	(E =) Pt in any form	C1
	(E =) 600×3600	C1
1(a)(ii)	chemical	**B1**
1(b)	(t =) 8600 s OR 140 min OR 2.4 h OR 2 h 24 min OR (t =) 8800 s OR 147 min OR 2 h 27 min	**A2**
	(t =) 2.2×10^6 / 250 OR (600×60) / 250 OR 1×600 / 250	C1
1(c)	any **two** from: • less noise OR no noise • less OR no air / gaseous pollution (from the bicycle) OR does not produce acid rain • (the bicycle) uses no / less fossil fuel • does not contribute to greenhouse effect OR does not release CO_2	**B2**

Question	Answer	Marks
2(a)	($F = 2.0 \times 4.0$ =) 8.0 N	**A2**
	(F =) ma in any form	C1

Question	Answer	Marks
2(b)	(F = 30 – 12 =) 18 N	**A3**
	resultant force on 3 kg mass (3 × 4 =) 12 (N)	C1
	(weight of 3 kg mass = 3 × 10) = 30 (N)	C1
2(c)(i)	(Δv =) 4.0 × 0.80 (= 3.2 m / s)	**A2**
	(Δ)v = at in any form	C1
2(c)(ii)	(t = 0.020 / 3.2 =) 0.0063 s OR 6.3×10^{-3} s	**A2**
	(t =) d / v in any form	C1

Question	Answer	Marks
3(a)	scale at least 2 cm : 1 m / s stated	**B1**
	2.5 m / s AND 4.0 m / s vectors correctly drawn by eye **AND** correct resultant	**M1**
	magnitude of resultant velocity = 2.3 – 2.8 m / s inclusive	**A1**
	direction 35° – 40° inclusive (downstream)	**A1**
3(b)	(E = ½ × 65 × 2.5^2 =) 200 J	**A2**
	(E =) ½ mv^2 in any form	C1

Question	Answer	Marks
4(a)	statement: bore of constant (cross sectional) area	**B1**
	explanation: idea of same movement / change in length of liquid / thread AND for same increase in volume / expansion (of liquid)	**B1**
	statement: (liquid has) constant thermal expansion	**B1**
	explanation: liquid moves same distance for each °C temperature rise	**B1**
4(b)	heat capacity / it is small	**B1**
	only uses / needs a small amount of (thermal) energy (to raise its temperature)	**B1**
4(c)	36 J	**A3**
	(E =) $C\Delta T$ in any form	C1
	(E =) $0.11 \times (345 - 20)$ OR (ΔT =) 325 (°C)	C1

Question	Answer	Marks
5(a)(i)	ultrasound OR sound (frequency) above audible range	**B1**
	frequency > 20 kHz OR 20 000 Hz	**B1**
5(a)(ii)	8.7×10^{-4} m	**A3**
	(λ =) v / f OR $v = f\lambda$ in any form	C1
	(λ =) $1.3 \times 10^3 / 1.5 \times 10^6$ OR 8.7×10^n	C1
5(b)	basic description of use e.g. X-rays for detecting broken bones	**B1**
	additional detail e.g. X-rays pass through soft tissue AND not through bone	**B1**

Question	Answer	Marks
6(a)	1.9–2.1 cm	**B1**
6(b)	(circle round) enlarged	**B1**
	(circle round) inverted	**B1**
	(circle round) real	**B1**
6(c)	not an intersection of rays OR cannot be formed on a screen OR cannot be projected on a screen OR light rays do not pass through image OR light rays do not meet OR light rays do not converge	**B1**

Question	Answer	Marks
7(a)	(pole A:) N AND (pole B:) S	**B1**
7(b)	vertical	**B1**
	up	**B1**
7(c)	vertical	**B1**
	down	**B1**

Question	Answer	Marks
8(a)	(t = 1/60 =) 0.017 s OR 1.7×10^{-2} s	**B1**
8(b)(i)	diode	**B1**
8(b)(ii)	(I =) 1.4 A	**A3**
	(I =) Q/t in any form	C1
	(I =) $1.5 \times 10^{17} \times 1.6 \times 10^{-19}$ / 0.017 OR 0.024 / 0.017	C1

Question	Answer	Marks
8(c)	one arrow clockwise AND one arrow anticlockwise	**B1**
	arrow anticlockwise (around circuit) <u>labelled</u> I	**B1**
8(d)	(P = 0.35 × 12 =) 4.2 W	**A2**
	(P =) IV in any form	C1

Question	Answer	Marks
9(a)(i)	0 (A)	**B**1
9(a)(ii)	(I = 12 / 2 =) 6.0 A	**A2**
	(I =) V / R in any form	C1
9(a)(iii)	(I = 12 / 5 =) 2.4 A	**A2**
	($R_s = R_1 + R_2$ = 2 + 3 =) 5 (Ω)	C1
9(b)	(R_p = 6 / 5 =) 1.2 Ω	**A3**
	$1/R_p = 1/R_1 + 1/R_2$ OR (R_p =) $R_1 R_2 / (R_1 + R_2)$	C1
	$1/R_p = 1/2 + 1/3$ OR (R_p =) 2 × 3 / (2 + 3)	C1

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Question	Answer	Marks
10(a)	<table><tr><th>output of X</th><th>output of Y</th></tr><tr><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table>	
	all column X correct **1, 1, 0, 0**	**B1**
	first 2 rows of column Y correct **0, 0**	**B1**
	last 2 rows of column Y correct **1, 0**	**B1**
10(b)	high humidity AND dark(ness)	**B1**
10(c)	relay	**M1**
	low voltage output (of NOR gate/gate Y) OR small current (in relay coil)	**A1**
	large(r) current provided (by relay) OR large(r) voltage provided (by relay)	**A1**

Question	Answer	Marks
11(a)(i)	top: travels to left	**B1**
	middle: deflected down AND still travels to right	**B1**
	bottom: straight on	**B1**

Question	Answer	Marks
11(a)(ii)	plus OR positive OR +	**B1**
11(b)	79 (electrons)	**B1**
	119 (neutrons)	**B1**
	79 (protons)	**B1**

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PHYSICS **0625/62**

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

MARK SCHEME

Maximum Mark: 40

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

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

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

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

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

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

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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 **May/June 2022**

MARK SCHEME

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Question	Answer	Marks
1(a)	negative acceleration **or** decrease in velocity	**B1**
	change in velocity per unit time **or** rate of change of velocity	**B1**
1(b)	delay in applying brakes **or** (human) reaction time **or** foot not removed from accelerator	**B1**
1(c)(i)	gradient **or** slope	**B1**
1(c)(ii)	20.5 m / s ⩽ answer ⩽ 23.5 m / s	**A2**
	the coordinates at one point on curve (e.g. (0.50, 11)) **and** (upper) time coordinate ⩽ 1.0 s	C1
1(d)(i)	air resistance / air friction acts on the car	**B1**
1(d)(ii)	air resistance / resultant / resistive force decreases **and** as speed decreases / car decelerates	**A2**
	air resistance / resultant / resistive force decreases / changes	C1

Question	Answer	Marks
2(a)	gravitational potential energy	**B1**
2(b)(i)	1.6×10^6 Pa	**A3**
	(p =) $h\rho g$ (in any form) **or** $150 \times 1000 \times 10$ **or** 1.5×10^6	C1
	1.5×10^6 **or** $1.0 \times 10^5 + \{150 \times 1000 \times 10\}$ **or** $1.0 \times 10^5 + 1.5 \times 10^6$ **or** 1.6×10^N	C1
2(b)(ii)	5.6×10^6 N	**A2**
	(F =) pA (in any form) **or** $1.6 \times 10^6 \times 3.5$	C1

Question	Answer	Marks
2(c)	speed (of water) remains constant	**B1**
	otherwise density would decrease **or** gaps would appear in the water **or** volume / density does not change **or** liquids incompressible **or** water enters / leaves at constant rate **or** quantity of water remains constant	**B1**

Question	Answer	Marks
3(a)	fast(er) / high(er) speed / (more) energetic molecules escape (into air)	**B1**
	average speed / average kinetic energy of molecules decreases	**B1**
	temperature related to speed / energy of molecules **or** slow(er) / low(er) speed / less energetic molecules remain (in water)	**B1**
3(b)	any **three** from: atoms / ions vibrate (vibrating) atoms / ions hit electrons electrons propelled / travelling through metal / moving through metal electrons hit (distant) atoms free electrons / delocalised electrons mentioned	**B3**

Question	Answer	Marks
4(a)(i)	two / three wires of at least two different metals	**B1**
	one junction in sulfur	**B1**
	the other junction in ice-water mixture / at room temperature **and** one of the wires must be from the first junction	**B1**
	labelled voltmeter / voltmeter symbol correctly connected	**B1**

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Question	Answer	Marks
4(a)(ii)	measure e.m.f.	**B1**
	how to find temperature from e.m.f. (e.g. use calibration graph **or** calculation **or** table)	**B1**
4(b)	measures high temperatures / wires do not melt / rapid response / robust / small heat capacity / electrical output / (can be) remote from observer / direct input to computer	**B1**

Question	Answer			Marks
5(a)	<u>temperature</u>			**B1**
	at which liquid becomes a gas **or** liquid and gas exist together			**B1**
5(b)(i)	1.8×10^5 J			**A2**
	(E =) VIt (in any form) **or** $230 \times 13 \times 60$ **or** 230×13 **or** 3000			C1
5(b)(ii)	9.1×10^{-3} kg / s		9.1×10^{-3} kg / s	**A4**
	(ΔT =) 100 – 22 **or** 78	**or**	(ΔT =) 100 – 22 **or** 78	C1
	$m = E / c\Delta T$ (in any form) **or** $1.8 \times 10^5 / (4200 \times 78)$	**or**	(rate =) $P / c\Delta T$ (in any form) **or** $m = E / c\Delta T$ **and** $E = Pt$	C1
	$1.8 \times 10^5 / (4200 \times 78 \times 60)$ **or** 5.5×10^N **or** $9.1/9.2 \times 10^N$	**or**	$3000 / (4200 \times 78)$ **or** $230 \times 13 / (4200 \times 78)$ **or** $9.1 / 9.2 \times 10^N$	C1
5(c)	1 if the tap becomes live **or** if the (live) cable touches the (metal) tap			**B1**
	there is a current to earth / in the earth wire (which blows the fuse)			**B1**
	2 the current (in earth wire) is large **and** fuse melts / blows / stops current / breaks circuit			**B1**

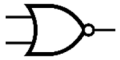
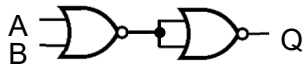
Question	Answer	Marks
6(a)	any **three** from: radiation light / infrared / electromagnetic (radiation) travel through space / vacuum absorbed by road	**B3**
6(b)	road / black surfaces are good absorbers (of radiation) **or** sea is a poor absorber (of radiation)	**B1**
6(c)(i)	they / molecules speed up **or** gain kinetic energy	**B1**
	they / molecules move further apart	**B1**
6(c)(ii)	density (of air above road) decreases **or** density (of hot air) decreases	**B1**
	air (above land / road) rises **or** air (that is hot) rises	**B1**
	air (above road) replaced by cool air / air from above sea	**B1**

Question	Answer	Marks
7(a)	(all the light) meets (at a point) **or** is focused **or** intersects	**A2**
	(all the light) travels towards a point	C1
	it then diverges or spreads out (from that point) **or** point of convergence is on XY / at F / the focal point / principal focus / 3.0 cm from lens	**B1**
7(b)	**two** marked points on XY 3.0 cm from centre of lens **and** one on left and one on right **and** each labelled F	**B1**

Question	Answer	Marks
7(c)(i)	**two** of these rays from tip of N drawn: ray (that seems to come) from left-hand principal focus **and** emerges from lens paraxially paraxial ray to lens **and** then towards right-hand principal focus ray towards / through centre of lens	**M2**
	two rays traced back to intersection **and** line from intersection to axis **and** line labelled I	**A1**
7(c)(ii)	virtual **and** light / rays do not pass through I **or** virtual **and** light / rays only seem to come from I **or** virtual **and** produced by diverging rays virtual **and** (real) rays do not meet	**B1**
7(c)(iii)	magnifying glass	**B1**

Question	Answer	Marks
8(a)	0.27 J	**A4**
	(v =) at (in any form) **or** 10 × 0.67 **or** 6.7 (m / s)	C1
	6.7 (m / s)	C1
	(KE =) ½mv^2 (in any form) **or** ½ × 0.012 × (10 × 0.67)^2 **or** ½ × 0.012 × 6.7^2	C1
8(b)(i)	magnetic field / magnetic field lines cut the copper / tube / it (**or** vv.)	**B1**
	electromagnetic induction occurs **or** e.m.f. induced	**B1**

Question	Answer	Marks
8(b)(ii)	(upwards / opposing) force on magnet	**B1**
	force / magnetic field / e.m.f. / current opposes the change (producing it) / opposes motion **or** force on magnet due to magnetic field caused by current in tube	**B1**

Question	Answer	Marks
9(a)	digital (signal) consists of 1(s) and 0(s) / high value and low	**B1**
	analogue (signal) is (continuously) variable (in magnitude)	**B1**
9(b)	NOR (gate) **and** 	**B1**
9(c)		**A2**
	 (i.e. NOR gate symbol with two inputs joined seen)	C1

Question	Answer	Marks
10(a)(i)	same number of protons / both have one proton	**B1**
10(a)(ii)	it / hydrogen-3 / $_{(1)}^{3}H$ has one more neutron	**A2**
	different number of neutrons / nucleons	C1

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Question	Answer	Marks
10(b)(i)	(high temperature produces) high (kinetic) energy / momentum / speed / ability to do large quantity of work	**B1**
	they repel each other	**B1**
	are positively charged / have like charges **or** need to come close together	**B1**
10(b)(ii)	$^{4}_{2}X$ **or** $^{4}_{2}He$ **or** $^{4}_{2}\alpha$	**B1**
	$^{1}_{0}n$ **and** no other particle	**B1**

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PHYSICS **0625/43**

Paper 4 Extended Theory **May/June 2022**

MARK SCHEME

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Question	Answer	Marks
1(a)(i)	9.7 s	**A2**
	(a =) $\Delta v \div t$ in any form OR 28 (–0)/2.9	C1
1(a)(ii)	4600 N	**A2**
	(F =) ma in any form OR 1600 × 2.9	C1
1(a)(iii)	630 000 J / 6.3×10^5 J	**A2**
	(KE =) ½ mv^2 in any form OR $\frac{1600 \times 28^2}{2}$	C1
1(b)	960 000 C / 9.6×10^5 C	**A3**
	(Q =) It in any form OR 32 × 8.3 × 60 × 60	C1
	(t s =) 8.3 × 60 × 60	C1
1(c)	any **one** explicit example of a variation from *ideal conditions* such as: (repeated) acceleration / deceleration / use of brakes / varying speed motion uphill / uneven road surface cold weather / headwind	**B1**

Question	Answer	Marks
2(a)	gravitational potential (energy)	**B1**
2(b)(i)	2.0×10^6 J / s	**A3**
	(P =) E/t in any form OR (480 × 10 × 410)/1	C1
	(ΔGPE =) mgh in any form OR 480 × 10 × 410	C1

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Question	Answer	Marks
2(b)(ii)	81 (%) OR 82 (%)	**A3**
	$P = V I$ in any form OR 6000 × 270 OR 1 620 000	C1
	(efficiency =) (useful) power out / (total) power in (× 100%) in any form	C1
2(c)(i)	damage to habitats (for fish) / construction is expensive / droughts / flood risk if dam bursts	**B1**
2(c)(ii)	biofuel / wind / geothermal / tidal / solar / wave	**B1**

Question	Answer	Marks
3(a)(i)	suitable scale recorded (e.g. 2 cm : 25 N)	**B1**
	two vectors correctly drawn by eye **AND** correct resultant	**M1**
	130 N	**A1**
	(vertically) upwards	**A1**
3(a)(ii)	13 kg	**B1**
3(b)	acceleration	**B1**
	momentum	**B1**

Question	Answer	Marks
4(a)(i)	zig zag motion / random changes of direction	**B1**
	random length of path in each direction	**B1**

Question	Answer	Marks
4(a)(ii)	any **four** from: • air <u>molecules</u> bombard smoke <u>particles</u> • air molecules are small (compared to smoke particles) / have small(er) mass • air molecules are very fast moving • air molecules move in random directions • (collisions exert unbalanced) forces on smoke particles	**B4**
4(b)(i)	kinetic energy (and potential energy) of molecules increase (hence internal energy increases)	**B1**
4(b)(ii)	bigger change in momentum of molecules OR molecules hit (the walls) harder	**B1**
	(molecules hit) more often / more frequently	**B1**

Question	Answer	Marks
5(a)	energy required to raise the temperature of 1 kg / 1 g / unit mass of a substance by 1 °C / unit temperature	**A2**
	energy required to raise the temperature of a substance by 1 °C	C1
5(b)(i)	0.50 kg	**A2**
	$\rho = m/V$ in any form	C1
5(b)(ii)	190 000J / 1.9×10^5 J / 190 kJ	**A5**
	(E=) $mc\Delta T$ in any form	C1
	(E=) mL in any form	C1
	Use of c = 4200 (J / kg °C) AND ΔT = 5	C1
	Use of c = 2100 AND ΔT = 18	C1

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Question	Answer	Marks
6(a)(i)	wavefronts semicircles or part semicircles centred on gap	**B1**
	wavelength of waves to right of barrier same as wavelength of incident wave	**B1**
6(a)(ii)	1 wavelength shorter	**B1**
	correct refraction	**B1**
	2 direction of travel perpendicular to wavefronts	**B1**
6(b)	any **two** from: • particles (in transverse waves) vibrate perpendicular to the direction of travel (of the wave) OR particles in longitudinal waves vibrate parallel to the direction of travel of the wave • longitudinal waves have compressions and rarefactions • transverse waves have troughs and crests	**B2**
6(c)(i)	1000 m / s ⩽ value ⩽ 2000 m / s	**B1**
6(c)(ii)	molecules closer together / water has greater density	**B1**

Question	Answer	Marks
7(a)	ray from left hand corner of the mirror to the eye	**B1**
	angle of incidence = angle of reflection	**B1**
7(b)	any **two** from: virtual upright same size as object laterally inverted	**B2**
7(c)(i)	ultraviolet / X-rays / gamma rays	**B1**
7(c)(ii)	infrared / microwaves / radio (waves)	**B1**

30

Question	Answer	Marks
8(a)(i)	light-dependent resistor / LDR	**B1**
8(a)(ii)	voltmeter connected in parallel with component Y	**B1**
8(a)(iii)	1 0.016 A	**A2**
	(I =) V/R in any form **or** 12/400 **or** 12/350 **or** 12/750 OR ($R_{total} = R_1 + R_2$ =) 750 (Ω)	C1
	2 6.4 V	**A1**
8(a)(iv)	(in a dark room the p.d. across component Y) decreases	**B1**
8(b)	one named practical application of LDR e.g. switch on street lights (at night) / turn on security light (at night)	**B1**

Question	Answer	Marks
9(a)(i)	any **four** from: • needle oscillates (as magnet moves up and down) • coil cuts magnetic field / magnetic field changes (as magnet moves) • changing (magnetic) field induces voltage/current • induced voltage/current opposes the motion/change causing it • force, magnetic field and induced current are mutually perpendicular	**B4**
9(a)(ii)	larger (maximum) deflection	**B1**
9(b)	2300	**A2**
	(N_P =) $V_P N_S / V_S$ in any form OR (N_P =) $\frac{25\,000 \times 36\,000}{400\,000}$	C1

Question	Answer	Marks
10(a)	background radiation (present in values in Table 10.1)	**B1**
	(background radiation) is removed (before plotting) OR (background radiation) not present in the graph values	**B1**
10(b)	$70 \leqslant$ half-life $\leqslant 76$ (s)	**A2**
	evidence of at least one pair of values for count rate halving taken from graph	C1
10(c)	$^{234}_{91}Pa \rightarrow {}^{234}_{92}U + {}^{0}_{-1}\beta$	
	$_{92}U$ on RHS	**B1**
	^{234}U	**B1**
	$+ {}^{0}_{-1}\beta$ on RHS	**B1**

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Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/61**

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

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	21.3 (cm)	**1**
	22.8 (cm) (or the other way round)	**1**
	l_0 = 1.5 (cm)	**1**
1(a)(ii)	set square method clearly shown	**1**
1(b)	correct calculation of *k*; P divided by candidate's e_1 quoted to 2 or more significant figures	**1**
	N / cm	**1**
1(c)	e_5 = 4.8 (cm)	**1**
	k given to 2 significant figures	**1**
1(d)	statement to match results and explanation to match statement	**1**
1(e)(i)	additional load(s)	**1**
1(e)(ii)	plot a graph OR take an average	**1**

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Question	Answer	Marks
2(a)	23 (°C)	**1**
2(b)	s, °C	**1**
2(c)(i)	view scale / value / water level at right angles / perpendicularly	**1**
	to bottom of meniscus	**1**
2(c)(ii)	measuring cylinder can only be read to nearest 1 or 2 cm^3. OR to nearest cm^3 means you are measuring the volume to 3 significant figures (which is sufficient)	**1**
2(d)(i)	$R_1 = 0.15$	**1**
	with unit °C / s	**1**
2(d)(ii)	$R_2 = 0.05$	**1**
2(e)	yes; with numbers given, starting from a higher temperature the cooling rate is 0.15 °C / s but starting from a lower temperature the cooling rate is 0.05 °C / s	**1**
2(f)	lid	**1**
	insulation	**1**

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Question	Answer	Marks
3(a)	a position in series with power supply, ammeter and **BC**	**1**
3(b)	I = 0.38 (A)	**1**
3(c)	V = 2.6	**1**
3(d)(i)	R = 6.84	**1**
3(d)(ii)	V, Ω	**1**
3(e)	graph: axes correctly labelled with quantity and unit and right way round	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
3(f)	method shown clearly on graph	**1**
	R value correct to nearest ½ small square	**1**

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Question	Answer	Marks
4	**MP1** **identify variable under test** either distance between supports / length of beam OR composition of beam (proportion of sand / cement)	**1**
	MP2 increase load until beam breaks (and record load)	**1**
	MP3 repeat for (at least 2 more) different beams or (2 more) different lengths	**1**
	MP4 **constant variable** identified (in relation to variable under test) distance between supports position of load composition of beam (if not independent variable) same length of beam (if not independent variable)	**1**
	MP5 **table** with columns for distance / length or composition, and (maximum) load with units required for load and distance / length	**1**
	MP6 **conclusion** compare breaking load with variable under test OR plot a graph of load against length	**1**
	MP7 **additional point** any **one** from: at least 5 sets of results repeats of individual tests and average (rough initial test then) adding small loads near breaking load carefully place loads on beam	**1**

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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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Question	Answer	Marks
1(a)	any valid method e.g. check equal distance between rule and bench at two places OR use set square/protractor between stand and rule OR line up with suitable (named) surface	**1**
1(b)(i)	d = 15.2 (cm)	**1**
1(b)(ii)	F_P = 1.05 (N) and F_Q = 1.95 (N)	**1**
1(c)	graph: • x-axis labelled with quantity and unit	**1**
	• suitable scales (plots occupying at least 3 large squares in both directions)	**1**
	• plots all correct to ½ small square and precise plots	**1**
	• 2 well judged lines and thin lines	**1**
	• intersection at d = 50.0 cm to ±1 small square	**1**
1(d)	F_0 present and W_R in range 1.8 (N) to 2.2 (N)	**1**
	W_R expressed to 2 or 3 significant figures and with unit of N	**1**
1(e)	forcemeter Q has zero error OR has not been set to 0 at start	**1**

Question	Answer	Marks
2(a)(i)	θ_R = 19 (°C)	**1**
2(a)(ii)	suitable precaution e.g. line of sight perpendicular to scale OR wait until reading stops rising (at start)	**1**
2(b)	s, °C both correct	**1**

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Question	Answer	Marks
2(c)	statement matching readings in table	1
	comparison of temperature changes over 180 s, matching statement	1
2(d)(i)	x = 0.106	1
	unit °C / s	1
2(d)(ii)	value of x will be less/lower	1
	temperature difference between beaker and room is less and values from table referred to	1
2(e)	repeat experiment with a lid	1
	(calculate cooling rate) subtract from x to find cooling rate without transfer from sides OR a comparison of cooling rates	1

Question	Answer	Marks
3(a)(i)	f_1 = 3.1 (cm)	1
	F_1 = 15.5 (cm)	1
3(a)(ii)	move lens backwards and forwards slowly OR move lens slowly	1
3(b)(i)	h_O = 1.2 (cm) and h_I = 5.1 (cm)	1
3(b)(ii)	hand gets in way of light	1
	mark on screen and measure later OR use screen with scale OR use translucent screen and measure at rear	1

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Question	Answer	Marks
3(b)(iii)	F_2 = 16.1 or 16.2 (cm)	**1**
	F_2 expressed to 2 or 3 significant figures with matching unit	**1**
3(c)	statement matching results	**1**
	values within limits of experimental accuracy/owtte and values quoted in justification	**1**
3(d)	any **one** from: mark position of lens on holder clamp/place rule on bench ensure screen, lens and object all perpendicular view rule perpendicularly repeat and take average use darkened room/brighter light	**1**

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Question	Answer		Marks
4	MP1	**apparatus:** voltmeter – correct symbol in parallel with LDR	**1**
	MP2	**independent variable:** statement identifying the independent variable e.g. light intensity, distance, current, voltage	**1**
	MP3	**method:** measure independent variable (e.g. metre rule to measure distance between lamp and LDR) measure p.d. and current calculate resistance of LDR	**1**
	MP4	repeat for new value of independent variable	**1**
	MP5	**control variable:** any variable appropriate to independent variable (e.g. distance from lamp to LDR if current through lamp is the independent variable, p.d., power, intensity)	**1**
	MP6	**table:** columns, with units, for independent variable, measured dependent variable and resistance (not just resistance without raw measurements)	**1**
	MP7	**analysis:** compare resistance values (in table) to see if change in independent variable produces change in resistance plot line graph (with axes specified)	**1**

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **October/November 2022**

MARK SCHEME

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

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

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PHYSICS **0625/42**

Paper 4 Theory (Extended) **October/November 2022**

MARK SCHEME

Maximum Mark: 80

Published

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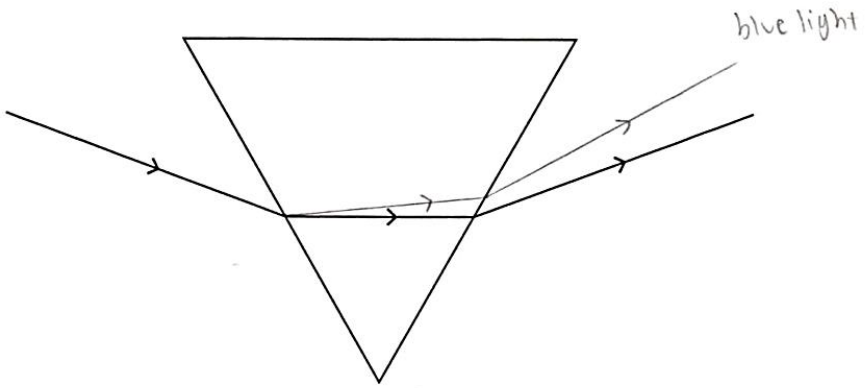
Question	Answer	Marks
1(a)	(depth =) 0.211 m	**A3**
	$\rho = m / V$ **OR** (V =) m / ρ **OR** 800 / 1020	C1
	$V = l \times w \times d$ **OR** (d =) $V / (l \times w)$ **OR** $V \div 3.72$	C1
1(b)	(ΔGPE =) 56(.0) J	**A3**
	GPE = $mg\Delta h$ **OR** (GPE =) $mg\Delta h$ **OR** (800 / 60) $\times$ 10 $\times$ 0.42(0)	C1
	(mass per second =) 800 / 60 (kg) **OR** their GPE per minute $\div$ 60	C1
1(c)	(P =) 8200 Pa	**A3**
	(P =) $h\rho g$	C1
	(P =) 1020 $\times$ 10 $\times$ 0.8(00) (Pa)	C1
	OR	
	(P =) F / A	(C1)
	$F = mg$ **OR** F = 1020 $\times$ 0.8(00) $\times$ 3.72 $\times$ 10	(C1)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="3">2(a)</td><td>(use stop-watch to) time oscillations</td><td>B1</td></tr>
<tr><td>(use of fiduciary) aid to determine a complete cycle</td><td>B1</td></tr>
<tr><td>(use of) multiple oscillations AND division (to determine period)</td><td>B1</td></tr>
<tr><td>2(b)</td><td>
<table>
<tr><td>quantity</td><td>device</td></tr>
<tr><td>volume of water in a glass</td><td>measuring cylinder</td></tr>
<tr><td>width of a small swimming pool</td><td>metre rule</td></tr>
<tr><td>thickness of a piece of aluminium foil</td><td>micrometer screw gauge</td></tr>
</table>
1 mark for each correct response
</td><td>B3</td></tr>
</table>

Question	Answer	Marks
3(a)(i)	*any one from*: • fossil fuel / named fossil fuel • biofuel / wood / crops • hydro • wave • wind • solar cell / panel.	**B1**
3(a)(ii)	geothermal **OR** nuclear	**B1**
3(b)(i)	yes **OR** it is renewable	**B1**
	tides are continuous / regular / happen every day / always there / owtte **OR** Moon / Sun always there **OR** nothing is consumed / used up **OR** tides are an unlimited resource	**B1**
3(b)(ii)	(power =) 4800 W	**A4**
	KE = $\frac{1}{2}mv^2$	C1
	$(P =) E / t$ **OR** $(P =)$ KE / s **OR** (KE / s =) $\frac{1}{2} \times 6(.0) \times 10^3 \times 2(.0)^2$	C1
	electrical (output) power = 40% of KE / s **OR** $0.4 \times 12\,000$	C1

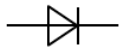
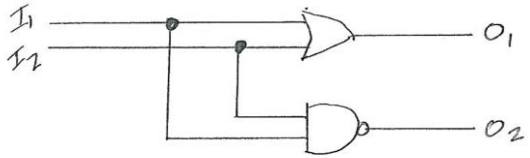
Question	Answer	Marks
4(a)	*any three from*: • moving particles have momentum **OR** particles hit walls • momentum changes when particles hit walls • force exerted (by particles) due to (rate of) change of momentum • pressure is (total) force (of particles) per unit area (of wall).	**B3**
4(b)	pressure increases	**M1**
	(there is a) greater change of momentum **OR** (particles exert) greater force (on same area) **OR** particles move faster **OR** particles have more KE	**A1**
4(c)	(pressure =) 1.5×10^5 Pa	**A3**
	$p_1 V_1 = p_2 V_2$ **OR** (p_2 =) $p_1 V_1 / V_2$ **OR** pV = constant (for fixed m, fixed T)	C1
	(p_2 =) $9(.0) \times 10^4 \times 170 / 100$	C1

Question	Answer	Marks
5(a)	(E =) 410 000 000 J **OR** 410 MJ **OR** 4.1×10^8 J	**A3**
	$\Delta E = mc\Delta T$ **OR** (ΔE =) $mc\Delta T$ **OR** $1200 \times 960 \times 360$	C1
	(ΔT =) 360 (°C)	C1
5(b)	(thermal) radiation	**M1**
	electromagnetic / e-m / infrared / IR (radiation emitted from block)	**A1**
	travels to worker **OR** is absorbed by worker **OR** travels without needing a medium	**A1**
5(c)	conduction	**B1**
	delocalised / free / moving electrons	**B1**
	any one from: • (electrons) move (from outer surface) to interior (of rollers) • (electrons) travel through(out) the solid / large distances • (electrons) collide with <u>distant</u> particles • lattice vibrations transfer thermal energy to neighbouring particles **OR** particles vibrate and cause nearby / adjacent particles to vibrate **OR** vibrating particles collide with particles transferring energy.	**B1**

Question	Answer	Marks
6(a)(i)	*two correct rays from*: • ray from X through centre of lens • ray from X to lens, parallel to principal axis, refracted through RH focus F • ray from X (that would pass through LH focus) refracted parallel to principal axis.	**M2**
	two rays correctly extended back, intersecting to left of object and image labelled	**A1**
	IY drawn **AND** 36 mm ≤ distance ≤ 44 mm	**A1**
6(a)(ii)	*any two from:* • object closer to lens than (one) focal length • (actual) rays do not meet (at image) • image cannot be formed on a screen **OR** image only visible through lens • object and image on same side (of lens) **OR** image on LHS of lens/object.	**B2**
6(b)		**A3**
	blue ray refracted <u>closer</u> to the normal than the green ray as it enters the prism	C1
	blue ray refracted away from the normal as it leaves the prism	C1

Question	Answer	Marks
7(a)	(minimum of) one complete loop above magnet **AND** one complete loop below magnet	**M1**
	additional field lines leaving both poles **OR** additional loops above and below	**A1**
	(minimum of) <u>two</u> correct arrows (from N to S)	**B1**
7(b)	line with arrow to the left	**B1**
7(c)(i)	(force to the) left **OR** (force) away from magnet 2 / towards magnet 1	**B1**
7(c)(ii)	force (on N pole) is in direction of the (magnetic) field / owtte	**B1**

Question	Answer	Marks
8(a)	(R_Y) decreases	**B1**
	change in V consistent with stated effect on R_Y	**B1**
	change in R_Y / R_{total} consistent with their stated effect on R_Y **OR** change in proportion of the total p.d. across Y (or proportion of total p.d. across fixed resistor) consistent with their stated effect on R_Y	**B1**
8(b)(i)	(n =) 1.9×10^{19}	**A3**
	$I = Q / t$	C1
	(n =) 3(.0) / 1.6×10^{-19} **OR** (n =) Q / 1.6×10^{-19}	C1
8(b)(ii)	(P =) 36 W	**A2**
	$P = IV$ **OR** (P =) IV **OR** 3(.0) × 12	C1

Question	Answer	Marks
9(a)(i)		**B1**
9(a)(ii)		**B1**
9(b)(i)	I_1 | I_2 | Z | O 0 | 0 | 1 | 0 0 | 1 | 1 | 0 1 | 0 | 0 | 1 1 | 1 | 0 | 0	
	all Z correct	**B1**
	all O correct	**B1**
9(b)(ii)	NOT	
9(c)		**A4**
	OR gate / box labelled OR	C1
	NAND gate / box labelled NAND	C1
	OR gate with inputs I_1 and I_2 labelled **AND** NAND gate with inputs I_1 and I_2 labelled	C1

Question	Answer	Marks
10(a)(i)	(proton number) 2	**B1**
	(nucleon number) 4	**B1**
10(a)(ii)	3.2×10^{-19} (C)	**B1**
10(b)	${}^{230}_{88}Ra \rightarrow {}^{230}_{89}Ac + {}^{0}_{-1}\beta$	**A3**
	any two from: • nucleon numbers 230 on left **AND** 230 on right • Ra and proton number 88 on left **AND** Ac and proton number 89 on right • ${}^{0}_{-1}\beta$.	C2
10(c)	(mass =) 1.2×10^{-12} g	**A2**
	3 half-lives **OR** $9.6 \times 10^{-12} / 8$ **OR** $9.6 \times 10^{-12} / 2^3$	C1

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

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

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

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

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

Additional graph notes:

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

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

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PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2022**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	2.3 J	**A2**
	Δg.p.e. = $mg\Delta h$ in any form **or** $0.50 \times 10 \times 0.45$	C1
1(b)(i)	1.2 N s	**A3**
	impulse = change in momentum **or** 2.0×0.60	C1
	$I = m\Delta v$ in any form **or** 2.0×0.60	C1
1(b)(ii)		**B3**
	kinetic energy (of block A) decreases	B1
	thermal / internal energy produced / increases (due to friction)	B1
	friction mentioned **or** block slows down / decelerates	B1

Question	Answer	Marks
2(a)(i)		**B2**
	magnitude **or** size	B1
	direction	B1
2(a)(ii)		**B2**
	any **two** from: acceleration / deceleration, gravitational field strength, impulse, momentum, velocity, weight	B2
2(b)(i)	0.12 m	**B1**
2(b)(ii)		**B2**
	beyond where the extension is not directly proportional to the load **or** (point) where extension stops being directly proportional to the load **or** point up to which extension is directly proportional to the load	B1
	10.4 N $\leqslant$ weight $\leqslant$ 10.9 N	B1
2(b)(iii)	22 N / m $\leqslant k \leqslant$ 25 N / m	**A3**
	clear subtraction of 0.12 from a length that is in Hooke's law region e.g. 0.54 – 0.12	C1
	$k = F / x$ in any form **or** $k = W / x$ in any form **or** k = 1 / gradient	C1

Question	Answer	Marks
3(a)	620 N	**B1**
3(b)		**B2**
	no resultant force (on object in equilibrium)	B1
	no resultant moment (on object in equilibrium)	B1
3(c)(i)	560 N m	**A2**
	(Γ =) $Fx_{\perp r}$ **or** 620 × 0.90	C1
3(c)(ii)	540 N	**A3**
	use of any moment	C1
	T × 1.2 sin 60° (= 560) **or** (T =) 560 / (1.2 × sin 60°)	C1

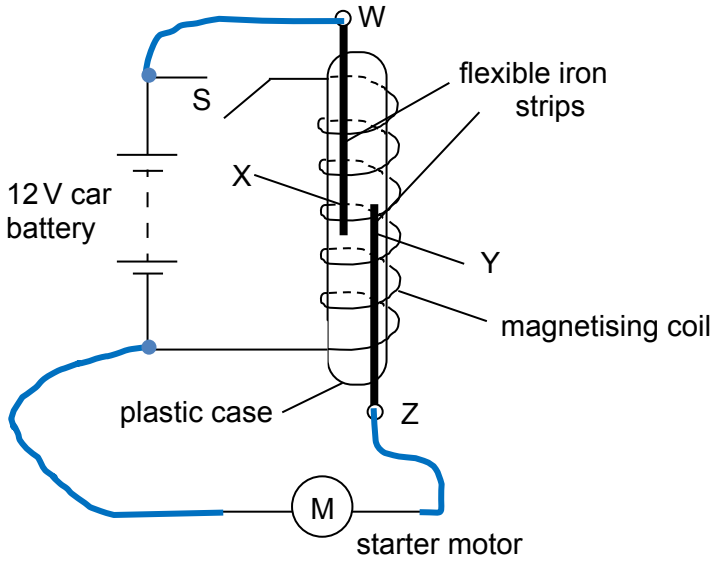
Question	Answer	Marks
4(a)(i)	240 N	**A2**
	$F = pA$ in any form **or** $1.0 \times 10^5 \times 2.4 \times 10^{-3}$	C1
4(a)(ii)	5.0 J	**A2**
	WD = $Fx_{\parallel}$ **or** 240×0.021	C1
4(b)	$(-)3.5 \times 10^3$ J	**A2**
	$E = CDT$ in any form **or** $89 \times (21 - (-18)$ **or** $89 \times (3)$ **or** 89×39	C1
4(c)		**B3**
	(as the volume decreases) the particles collide more often	B1
	(as the temperature decreases) the particles collide less violently	B1
	two effects cancel (to leave the pressure unchanged) **or** particles collide with walls / piston / cylinder	B1
4(d)		**B2**
	(attractive) forces between (any two) particles large(r than in gases)	B1
	particles close(r) together (than gas particles) **or** particles already touching	B1

Question	Answer	Marks
5(a)	infrared	**B1**
5(b)(i)	(both) transverse / electromagnetic / travel in a vacuum / have the same (high) speed (in a vacuum)	**B1**
5(b)(ii)	(it / visible light) compared with an e.m. radiation stated by candidate in **5(a)** in terms of frequency / wavelength	**B1**
5(c)(i)		**B3**
	equipment e.g. black container, white container, thermometers **or** Leslie's cube and detector	B1
	measurements made warm / hot water in container **and** temperature decreases recorded **or** time to reach a given temperature / to cool **or** warm / hot water in cube **and** meter readings recorded	B1
	how a conclusion is reached better emitter surface cools quicker **or** greater reading from better emitter surface	B1

Question	Answer	Marks
5(c)(ii)	any **two** appropriate quantities e.g. initial temperature of water mass / volume of water dimensions / surface area of container time of cooling mass of container shape of container smoothness of surface **or** surface area of face (of cube) distance of detector temperature of water at time of measurement smoothness of surface	**B2**

Question	Answer	Marks
6(a)	(light of a) single frequency	**B1**
6(b)(i)		**B2**
	angle of incidence is 0° (hence) angle of refraction is 0°	B1
	or all the wavefront hits the plastic at the same time all slows down at the same time	B1
6(b)(ii)	1.8×10^8 m / s	**A4**
	$n = 1 / \sin c$ in any form **or** $n = 1 / \sin 37°$	C1
	(n =) 1.7	C1
	$v_{pl} = v_0 / n$ in any form **or** $3.0 \times 10^8 / 1.7$ **or** $3.0 \times 10^8 \times \sin 37°$	C1
6(b)(iii)		**B3**
	critical angle (for blue light) < 37° **or** critical angle for red (light) is 37°	B1
	angle of incidence (of blue light) greater than its critical angle (in plastic)	B1
	total internal reflection **or** all the (blue) light reflects **or** no (blue) light leaves the glass / refracts / travels in air along the straight edge	B1

Question	Answer	Marks
7(a)		**B3**
	X and Y / they become magnetised **or** they / strips have poles	B1
	strips in the centre have opposite (magnetic) poles **or** X and Y attract	B1
	X and Y touch / close switch / activate relay / complete circuit	B1
7(b)(i)	150 A	**A2**
	$I = P / V$ in any form **or** 1.8 / 12 **or** 1800 / 12 **or** 1800 / 12 **or** 0.15	C1
7(b)(ii)		**B2**
	small(er) resistance mentioned	B1
	less thermal energy produced **or** wires do not melt **or** large current mentioned	B1

Question	Answer	Marks
7(c)		**B2**
	flexible strips in series with motor	B1
	power supply in series with motor	B1
	expected answer:  	

Question	Answer	Marks
8(a)	both relate to energy per unit charge	**B1**
8(b)	e.m.f. applies to the whole circuit / source **or** p.d. to one (or more) component **or** energy conversion to electrical for e.m.f. **or** from electrical for p.d.	**B1**
8(c)(i)	4.8 V	**B1**
8(c)(ii)	20 Ω	**A3**
	$1 / R_T = 1 / R_1 + 1 / R_2$ **or** (R_T =) $R_1 R_2 / (R_1 + R_2)$ **or** $1 / R_T = 1 / 24 + 1 / 12$ **or** $1 / R_T = 3 / 24$ **or** (R_T =) $24 \times 12 / (24 + 12)$	C1
	8.0 (Ω)	C1
8(c)(iii)	2.9 V	**A2**
	$V = ER / R_T$ in any form **or** $4.8 \times 12 / 20$ **or** $I = E / R$ in any form **or** 0.24 seen	C1

Question	Answer	Marks
9(a)	they all have the same number of neutrons / nucleons **or** they are all identical	**B1**
9(b)(i)		**B2**
	(number of protons =) 80	B1
	(number of neutrons =) 118	B1
9(b)(ii)	19 counts / minute $\leqslant$ count rate $\leqslant$ 21counts / minute	**B1**
9(b)(iii)	2.4 days $\leqslant \tau \leqslant$ 2.9 days	**A4**
	count rate from line – background count e.g. 390 – 20	C1
	answer from first C1 mark divided by 2 e.g. 370 / 2 **or** 185	C1
	background count + answer from second C1 mark e.g. 20 + 370 / 2 **or** 20 + 185 **or** 205	C1

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PHYSICS **0625/43**

Paper 4 Theory (Extended) **October/November 2022**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	change of velocity per unit time or $\frac{v-u}{t}$	**B1**
1(b)(i)	(72 / 35 =) 2.1 m / s^2	**A1**
1(b)(ii)	230 000 N OR 230 kN	**A2**
	$F = ma$ **OR** (F =) ma **OR** 110 000 × 2.1	C1
1(b)(iii)	any **one** from: • (increase / change in) air resistance • (increase / change in) wind	**B1**
1(b)(iv)	any **three** from: • initial acceleration highest value **AND** horizontal line • curved or straight line downwards • curved or straight line downwards **AND** line not reaching zero by 35 s • horizontal line before and up to 35 s.	**B3**

Question	Answer	Marks
2(a)(i)	4.5 kg m / s	**A3**
	$p = mv$ **OR** (change in momentum =) $mv - mu$	C1
	(change in momentum =) $(0.058\times52)-(-0.058\times26)$ **OR** $(0.058\times52)+(0.058\times26)$ **OR** $(0.058\times-26)-(0.058\times52)$	C1
2(a)(ii)	(impulse =) force × time **OR** (impulse =) Ft	**B1**
2(a)(iii)	0.013 s	**A2**
	(t =) change in momentum / F **OR** (t =) $m(v–u)$ / F **OR** (t =) Δp / F **OR** 4.5 / 350	C1
2(b)	59 J	**A3**
	KE = $\frac{1}{2}mv^2$ **OR** (KE =) $\frac{1}{2}mv^2$	C1
	(change in KE) = ½ 0.058 × 52^2 – ½ 0.058 × 26^2 **OR** ½ 0.058 × 26^2 – ½ 0.058 × 52^2	C1

Question	Answer	Marks
3(a)	5 correct: 3 marks, 3 or 4 correct: 2 marks, 2 correct: 1 mark gravitational potential water (tidal) bay kinetic turbines	**B3**
3(b)	any **one** advantage from: • renewable • reliable or predictable • running cost low • does not produce (harmful) pollution. any **one** disadvantage from: • (high) cost of construction • possible effects on (marine) life • not available all day • power produced doesn't always match with peak demand • limited number of sites • maintenance difficult / increased corrosion (because underwater).	**B2**
3(c)	Moon	**B1**

Question	Answer	Marks
4(a)(i)	any **one** from: • volume (of liquid) • length (of thread / liquid in tube).	**B1**
4(a)(ii)	more **OR** greater (sensitivity)	**M1**
	volume of liquid / length of thread increases more per °C / unit temperature (because greater volume of liquid present) **OR** (more liquid to expand so) gives a larger change in the level of the liquid per °C / unit temperature	**A1**
4(a)(iii)	longer (capillary) tube	**M1**
	liquid can expand further so to a higher temperature	**A1**
	OR	
	smaller (volume) bulb	**(M1)**
	less liquid so liquid expands less / lower rise per °C	**(A1)**
	OR	
	larger diameter / wider capillary tube	**(M1)**
	lower increase in level for each °C	**(A1)**
	OR	
	replace liquid with a liquid with lower expansivity	**(M1)**
	liquid expands less for each °C	**(A1)**
4(b)	e.m.f.	**B1**

Question	Answer	Marks
5(a)	energy from the Sun transfers to / is absorbed by (water) molecules, (so KE of (water) molecules increases)	**B1**
	molecules with high(er) energy / KE / fast(er) moving molecules escape (from the surface)	**B1**
	wind removes molecules when they have left the surface (so they do not re-enter the liquid)	**B1**
	any **one** from: • wind increases the rate of evaporation • (absorption of) energy from the Sun increases the rate of evaporation • least / less water evaporates / lower rate of evaporation from dish C • most / more water evaporates / higher rate of evaporation from dish B	**B1**
5(b)	energy to change 1 kg / unit mass from liquid to gas / gas to liquid (without changing its temperature)	**A2**
	energy to change from liquid to gas / gas to liquid **OR** energy to change state of 1 kg	C1
5(c)	A: temperature (of solid / ice) increases **AND** C: temperature (of liquid / water) increases	**B1**
	B: solid / ice changes to liquid / water **OR** solid / ice melts (at constant temperature)	**B1**
	D: liquid / water changes to gas / steam **OR** liquid / water boils (at constant temperature)	**B1**

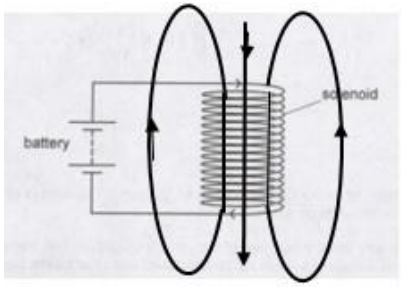
Question	Answer	Marks
6(a)(i)	correct direction, with angle made with surface correct	**B1**
6(a)(ii)	three wavefronts perpendicular to their answer to **(a)(i)**	**B1**
	wavelength 1.6 cm / same as incident wave	**B1**
6(b)	at least two correct arcs (after the gap in the barrier)	**B1**
	three circular arcs (after the gap on the barrier) centred on gap	**B1**
	wavelength same as wavelength of incident wavefronts	**B1**
6(c)	6.4 cm / s **OR** 0.064 m / s	**A2**
	$v = f\lambda$ **OR** (v =) $f\lambda$ **OR** 4.0×1.6 **OR** 4.0×0.016	C1

Question	Answer	Marks
7(a)	any **two** from: • all light is reflected • no light is refracted • (occurs) when light travels in a more dense medium towards a (boundary with a) less dense medium	**B2**
7(b)(i)	(x =) 48°	**A3**
	n = 1 / sin c **OR** c = $\sin^{-1}$ (1 / n) **OR** sin c = 1 / 1.5 **OR** c = $\sin^{-1}$ (1 / 1.5)	C1
	c = 42(°)	C1
7(b)(ii)	(speed =) 2.0×10^8 m / s	**A2**
	$n = \frac{\text{speed of light in vacuum}}{\text{speed of light in liquid}}$ **OR** $n = \frac{\text{(approx.) speed of light in air}}{\text{speed of light in liquid}}$ **OR** $n = c / v$ **OR** (v =) c / n **OR** $1.5 = \frac{3 \times 10^8}{\text{speed of light in liquid}}$	C1

Question	Answer	Marks
8(a)	positively charged / plastic rod is brought close to metal plate	**B1**
	negative charges / electrons (from metal plate) move to top of metal plate / close(r) to rod	**B1**
	earth lead connected to (metal) plate **AND** negative charges / electrons move on to plate	**B1**
	(at the end of the process) earth lead removed (before charged rod removed) **OR** (at the end of the process) metal plate has (net) negative charge	**B1**
8(b)	correct direction – pointing away from negative terminal / clockwise arrow **AND** current flow in opposite direction to flow of electrons	**B1**

Question	Answer	Marks
9(a)	0.02 s	**A2**
	$t = 1 / f$ **OR** ($t =$)$1 / f$ OR $1 / 50$	C1
9(b)(i)	correct shape shown with rectification for two cycles	**A2**
	sine shape shown (without rectification for two cycles)	C1
9(b)(ii)	340 marked	**A1**
9(b)(iii)	one correct time value marked on time axis	**B1**
	a second correct time value marked on time axis	**B1**

Question	Answer	Marks
10(a)	α-particles are short and thick / β-particles are long and thin	**B1**
	any **two** from: • α-particles are more ionising / β-particles are less ionising • α-particles are less penetrating or have shorter range / β-particles are more penetrating or have longer range • α-particles have more energy / β-particles have less energy	**B2**
10(b)(i)	(element with) same number of protons	**B1**
	(element with) different number of neutrons	**B1**
10(b)(ii)	$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\beta$	
	Na on left with correct proton and nucleon number	**B1**
	β on right with correct proton and nucleon number	**B1**
	Mg on right with correct proton and nucleon number	**B1**
10(b)(iii)	half life (of Na 24) long enough (to allow detection of leaks)	**B1**
	negligible amount (of Na 24) remains in liquid after a few days (so) less hazardous (to human health) **OR** decays to something stable/magnesium (is stable) **AND** (so) less hazardous (to human health)	**B1**

Question	Answer	Marks
11(a)	at least one line on the left and one line on the right, outside coil **AND** curved back over the top and under the base of the coil, towards the central core of the coil	**B1**
	at least two (straight vertical) lines inside coil	**B1**
	direction of arrow correct on at least one line and none wrong  	**B1**
11(b)	910	**A2**
	$N_P / N_S = V_P / V_S$ **OR** (N_S =) (V_S / V_P) × N_P **OR** (N_S =) $\frac{11000 \times 33\,000}{400\,000}$ **OR** (N_S =) $\frac{11000 \times 33}{400}$	C1

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PHYSICS **0625/61**

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

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)	Clear use of horizontal aid OR bob touching rule	**1**
1(b)(i)	T = 1.41	**1**
1(b)(ii)	T^2 = 1.99 (to 2 decimal places only, correctly rounded)	**1**
1(c)	Axes of graph correctly labelled with quantity and unit and right way round	**1**
	Suitable scales	**1**
	All plots correct to ½ small square	**1**
	Good line judgement, thin, continuous line	**1**
1(d)	Triangle method clear on graph	**1**
	Triangle at least half the length of the line between extreme plots used	**1**
	G value in range 0.038 – 0.044	**1**
1(e)	Reaction time / human error a smaller part of time measured	**1**

Question	Answer	Marks
2(a)	Correct voltmeter symbol across lamp	**1**
2(b)(i)	V_1 = 2.4(0)	**1**
	I_1 = 0.32(0)	**1**
2(b)(ii)	R_1 = 7.5	**1**
2(c)	R_2 = 5.8 / 5.83 to 2 or 3 significant figures	**1**
2(d)	R_3 = 5(.0) with unit Ω (here or seen in **(a)** or **(b)(ii)** and not contradicted)	**1**
2(e)	1 decreases	**1**
	2 decreases	**1**
2(f)	Correct symbol for variable resistor	**1**
	Variable resistor in series with power source and ammeter	**1**
	Ammeter and lamp with correct symbols and no flying lead at all	**1**

Question	Answer	Marks
3(a)	23 (°C)	**1**
3(b)	30, 60, 90, 120, 150, 180	**1**
3(c)	$\Delta\theta_1$ = 21 (°C) and $\Delta\theta_1 / \Delta t$ = 0.12 (0.117)	**1**
	°C / s in **(c)** or **(d)** and not contradicted	**1**
3(d)	$\Delta\theta_2$ = 6(°C) and R_2 = 0.067	**1**
3(e)	Conclusion that matches results	**1**
	Justification that matches conclusion and results	**1**
3(f)	View scale / value / reading / water level at right angles / perpendicularly	**1**
	To bottom of meniscus	**1**
3(g)	Any two from: Volume / amount / mass <u>of water</u> Room temperature Time interval / duration of experiment	**2**

Question	Answer	Marks
4	**MP1** (Metre) rule / tape measure	**1**
	MP2 Release ball to roll down track, measure how far it travels.	**1**
	MP3 Repeat for at least 2 more different angles of right-hand side of track	**1**
	MP4 Clear identification of the correct distance to be measured (e.g. from table leg or other point identified on floor to point of impact with track) OR clear explanation of how to identify point of impact (e.g. using a sand tray)	**1**
	MP5 Constant variable identified Release height for ball Or same ball every time / same weight / mass / size of ball	**1**
	MP6 Table consistent with their method (if method correct with columns for distance travelled and angle of track, with units)	**1**
	MP7 Analysis based on their table Graph of angle against distance travelled, or compare angle with distance travelled (or the equivalents for their method)	**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.
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Paper 6 Alternative to Practical **October/November 2022**

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Question	Answer	Marks
1(a)	precaution for reading water level e.g.: view scale perpendicularly rule close to boiling tube use of set square	**1**
1(b)	h = 4.0	**1**
1(c)	H = 1.4 / ecf from **(b)**	**1**
1(d)	axes labelled with quantity and unit	**1**
	appropriate scales (occupying at least ½ grid)	**1**
	plots all correct to ½ small square and precise plots	**1**
	well-judged line and thin line	**1**
1(e)(i)	G present and triangle method shown on graph grid	**1**
1(e)(ii)	D in range 1.9 cm to 2.4 cm	**1**
1(f)	inside diameter near base not uniform / owtte	**1**
1(g)	valid critical comment e.g.: water volumes small – large uncertainty in measuring cylinder test-tube diameter small – large uncertainty in answer / owtte height changes small so unreliable	**1**

Question	Answer	Marks
2(a)	θ_R = 22 (°C)	**1**
2(b)(i)	suitable precaution e.g.: view scale reading perpendicularly wait until reading stops rising avoid thermometer touching beaker	**1**
2(b)(ii)	s, °C, °C all correct	**1**
2(c)	statement matching readings in table – 'beaker B cools more slowly' / owtte	**1**
	comparison of temperature changes <u>over 180 s</u>, matching statement (need to see <u>values</u> used in justification)	**1**
2(d)(i)	unit °C / s	**1**
2(d)(ii)	x_A = 0.097 <u>and</u> x_B = 0.039	**1**
2(e)(i)	paint surfaces black OR other appropriate suggestion	**1**
2(e)(ii)	any **two** suitable control variables e.g.: starting / initial temperature same volume of water same room temperature	**2**
2(e)(iii)	beaker A cooling rate > x_A <u>and</u> suitable explanation cooling rate of A greater than x_A	**1**

Question	Answer	Marks
3(a)	correct voltmeter symbol in parallel with P and Q combination	**1**
3(b)(i)	V = 1.4 (V)	**1**
	I_T = 0.76 (A)	**1**
3(b)(ii)	R_{PQ} = 1.8 / ecf (Ω)	**1**
	all units correct A, V, Ω	**1**
3(c)	V_S present and both R_S and R_{PQ} to either 2 or 3 significant figures	**1**
3(d)(i)	both ammeter readings present and to 2 decimal places	**1**
3(d)(ii)	statement matching results with values / comparative values seen	**1**
	justification – 'within limits of experimental accuracy' / owtte	**1**
3(e)(i)	rectangle with strike-through arrow only and X on series part of circuit	**1**
3(e)(ii)	any **one** from: cannot obtain continuous set of values less straightforward to change current more difficult to obtain a greater number of values	**1**

Question	Answer	Marks
4	**apparatus** **MP1** thermometer, metre rule	**1**
	method **MP2** valid procedure: heat ball in water <u>and</u> measure temperature <u>drop</u> ball measure height ball bounces to	**1**
	MP3 repeat for at least 2 new temperatures	**1**
	control variable **MP4** height of drop	**1**
	table **MP5** columns with units for temperature and bounce height	**1**
	analysis **MP6** **compare** readings in the table to see if change in temperature produces change in dependent variable OR plot line graph of temperature vs bounce height	**1**
	additional point **MP7** any **one** from: keep in water until sure whole ball at same temp as water use of water bath at least 5 sets of data taken repeat each measurement <u>and</u> take average repeat experiment for different variation (e.g. different bounce surface / height of drop) same ball / diameter of ball, bounce surface / type of floor	**1**

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **February/March 2022**

MARK SCHEME

Maximum Mark: 40

Published

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

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

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

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PHYSICS **0625/42**

Paper 4 Extended Theory **February/March 2022**

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.

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Question	Answer	Marks
1(a)	2.2 s	**B1**
1(b)	*Any two from:* • Line on graph is horizontal / gradient is zero • (therefore) no acceleration / speed is constant • (resultant) force causes / is proportional to acceleration	**B2**
1(c)	8.5 ms^{-2}	**A3**
	(a =) Δv / t in any form OR gradient of graph OR 12.8 / 1.5 OR other suitable values from graph	**(C1)**
	(1.5, 12.8) both seen OR alternative suitable points on the line identified	**(C1)**
1(d)	0.5 × 12.8 × 1.5 (= 9.56 / 9.6 m) OR 6.4 × 1.5 (= 9.6)	**A2**
	(length of ramp) = area under graph (between 0–1.5 s) OR average velocity × time	**(C1)**

Question	Answer	Marks
2(a)(i)	extension (of the spring) is (directly) proportional to the force / load (applied to the spring, up to the limit of proportionality)	**B1**
2(a)(ii)	W=mg in any form OR force is (directly) proportional to mass	**B1**
2(a)(iii)	80 N	**B1**
2(b)	straight line through / from origin with positive gradient up to 175 N	**B1**
	smooth curve after 175 N with increasing positive gradient	**B1**
2(c)	(80 N × 3.5 m =) 280 J	**A2**
	ΔE = Fxd in any form OR GPE= mgh in any form	**(C1)**

Question	Answer	Marks
3(a)	*Any two from:* • (Amount of water in the pool decreases) as water evaporates / becomes water vapour / gas • The (more) energetic molecules escape OR fast(er) molecules escape OR molecules with more (kinetic) energy escape • From the surface of the water	**B2**
3(b)	lower temperatures / cold(er) day **OR** less windy weather	**B1**
	produces smaller pool more slowly because rate of evaporation decreases with decreasing temperature **OR** produces smaller pool more slowly as a draught over surface removes water vapour enabling faster rate of evaporation	**B1**
3(c)	*Any three from:* • (thermal) energy in the skin / body transferred to (molecules of) sweat • These molecules (have enough KE to) escape from the skin / become water vapour • Leaving behind molecules with lower energy • Which leaves the skin / body at a lower temperature	**B3**

Question	Answer	Marks
4(a)(i)	(mass = 1900×0.05) = 95 kg	**A2**
	(m =) ρV in any form OR 1900×0.05	**(C1)**
4(a)(ii)	(= 95×1500) = 140 000 J / °C / 1.4×10^5 J / °C	**A2**
	(C =) $m \times c$	**(C1)**

Question	Answer	Marks
4(a)(iii)	34 000 s / 560 min / 9 h 20 min	**A3**
	Temperature rise = 12(°C) / 19–7 OR $E = C \times \Delta\ \theta$ in any form	**(C1)**
	(t =) E / P in any form OR (thermal capacity × 12) / 50	**(C1)**
4(b)(i)	sand molecules gain KE OR vibrate more OR hit (other) molecules (when heated) OR (thermal energy is transferred by) conduction	**B1**
	Energy is transferred to molecules of plastic pot in contact with sand (through collisions) OR Energy OR (lattice) vibrations transferred to neighbouring molecules	**B1**
4(b)(ii)	(sand is warmer than surroundings and so thermal) energy (constantly) is lost from the sand	**B1**
	(at a constant temperature) rate of (thermal) energy supplied to the sand is equal to rate of (thermal) energy lost from sand	**B1**

Question	Answer	Marks
5(a)(i)	straight line from clock to mirror AND from mirror to eye with correct arrows	**B1**
	Angle of incidence = angle of reflection	**B1**
5(a)(ii)	Correct position of image	**B1**
5(a)(iii)	Virtual (no mark) And Cannot be projected on a screen / light doesn't pass through image / AW	**B1**

Question	Answer	Marks
5(a)(iv)		**B1**
5(b)(i)	(monochromatic light) is light of a single frequency	**B1**
5(b)(ii)	5.4×10^{14} Hz	**A3**
	(speed of light =) 3×10^{8} (m / s)	**(C1)**
	(f =) v / λ in any form OR $3.0 \times 10^{8} / 5.6 \times 10^{-7}$	**(C1)**

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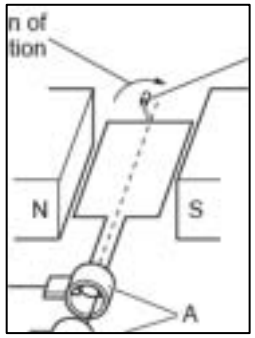
Question	Answer	Marks
6(a)	Minimum of one arrow on a field line pointing N → S and not contradicted	**B1**
	central line perpendicular to poles of magnets AND at least two other correct field lines	**B1**
6(b)(i)	(A are) slip rings	**B1**

Question	Answer	Marks
6(b)(ii)	 Minimum of one arrow, pointing clockwise, on the wire, not contradicted	**B1**
	Field direction, motion of wire and induced current are mutually perpendicular OWTTE	**B1**
6(b)(iii)	(as coil rotates) it cuts (magnetic) field between the magnets	**B1**
	This <u>induces</u> an e.m.f. / voltage / p.d. (in the coil)	**B1**
	This produces a current in the (coil transferred to the) galvanometer (via the slip rings and carbon brushes)	**B1**
	Direction of current flow changes with each 180 degree rotation of coil	**B1**

Question	Answer	Marks
7(a)	8 (cells)	**B1**
7(b)(i)	(12 / 2.4 =) 5.0 Ω	**A2**
	R = V / I in any form	**(C1)**
7(b)(ii)	(Resistance of Q = 5–1.5) = 3.5 Ω	**A2**
	$1 / R = 1 / R_1 + 1 / R_2$ OR $R = R_1R_2 / (R_1+R_2)$	**(C1)**

Question	Answer	Marks
7(c)(i)	correct voltmeter symbol connected correctly across both lamps	**B1**
7(c)(ii)	4.3 W	**A3**
	(P =) IV in any form OR 1.2 × 3.6	**(C1)**
	3.6 V **OR** 1.2 A	**(C1)**

Question	Answer	Marks
8(a)	Labelled diagram showing • labelled Iron (core) • two coils, labelled primary and secondary, (around core and connected to separate circuits) • Fewer turns on labelled secondary coil	**B3**
8(b)	(Primary voltage causes) an alternating current in primary coil	**B1**
	produces a changing magnetic field	**B1**
	(changing) field induces pd / e.m.f. (in secondary coil)	**B1**
8(c)	0.026	**A2**
	(Ns / Np =) Vs / Vp in any form	**(C1)**

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Question	Answer	Marks
9(a)(i)	(A signal that has one of) two possible states	**B1**
9(a)(ii)	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table> C all correct ; D all correct ;	**B2**
9(b)	NAND	**B1**

Question	Answer	Marks
10(a)	$^{241}_{95}Am \rightarrow {}^{237}_{93}Np + {}^{4}_{2}\propto$	
	^{237}Np nucleon number correct for Np	**B1**
	$_{93}Np$ proton number correct for Np	**B1**
	$+ {}^{4}_{2}\propto$ alpha notation correct	**B1**
10(b)(i)	alpha (particles emitted from americium)	**B1**
	move close to / hit molecules in the air (between the metal plates)	**B1**
	removing electrons (out of the molecules)	**B1**

Question	Answer	Marks
10(b)(ii)	*Any two from:* • alpha not penetrating / short range AND alpha (particles) stopped by smoke particles • alpha (particles) more highly ionising (than gamma) AND ionise air more easily • range of alpha particles is short / alpha is not penetrating AND alpha less harmful (to humans)	**B2**

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PHYSICS **0625/62**

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

MARK SCHEME

Maximum Mark: 40

Published

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

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

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

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

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