Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/42**

Paper 4 Extended Theory **May/June 2023**

MARK SCHEME

Maximum Mark: 80

Published

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[Turn over

Question	Answer	Marks
1(a)(i)	no resultant / net force	**B1**
	no resultant/net moment	**B1**
1(a)(ii)	4.7×10^7 J or 47 MJ	**A2**
	$(\Delta)E_p = mg(\Delta)h$ **OR** $(\Delta E_p =)\ mg(\Delta)h$ **OR** $(\Delta E_p =)\ 3200 \times 9.8 \times 1500$	C1
1(b)(i)	point, labelled 1, on either of the horizontal sections of the graph (to the left of A or to the left of B)	**B1**
	point, labelled 2, on the graph between A and the start of the horizontal section of the graph to the left of B	**B1**
	point, labelled 3, on the graph between the start of the curved section to the right of the origin and the start of the horizontal section of the graph to the left of A	**B1**
1(b)(ii)	(initially there is acceleration due to) weight **OR** gravitational force **OR** unbalanced force / resultant force / downward force	**B1**
	(then) air resistance increases as speed or velocity increases	**B1**
	(as air resistance increases) resultant force downwards decreases **OR** acceleration decreases	**B1**
	constant speed when air resistance = weight / gravitational force	**B1**

Question	Answer	Marks
2(a)	26 J	**A3**
	$E_K = ½mv^2$ **OR** $(E_K =)\ ½mv^2$ **OR** $(E_K =)\ ½ \times 0.16 \times (18)^2$	C1
	$(E_K =)\ ½ \times 0.16 \times (18)^2$ **OR** $(E_K =)\ ½ \times 0.16 \times 324$ **OR** $(E_K =)\ 2.6 \times 10^N$	C1

Question	Answer	Marks
2(b)	24 N	**A2**
	$Ft = \Delta mv$ **OR** $F = ma$ **OR** (F =) (0.16 × 18) / 0.12	C1
2(c)	longer time (of impact / contact) **AND** smaller force (on them) **OR** longer time (of impact / contact) **AND** does not hurt as much	**B1**

Question	Answer	Marks
3(a)	(force of gravity / weight of person is spread over a much) greater <u>area</u>	**B1**
	$p = F/A$ **OR** $p \propto 1/A$	**B1**
	(force is same so) pressure is lower (so ice is less likely to crack)	**B1**
3(b)	5.8×10^3 Pa	**A4**
	p (due to water) = ρgh **OR** (p =) ρgh **OR** (p =) 1000 × 9.8 × 0.45 **OR** (p =) 4410	C1
	$W = mg$ **OR** (W =) mg **OR** (W =) (690 × 9.8) **OR** (W =) 6762 **OR** (p (due to ice) =) 1352.4	C1
	(pressure =) candidate's calculated pressure due to water + candidate's calculated pressure due to ice **OR** total pressure = [1000 × 9.8 × 0.45] + [(690 × 9.8) / 5.0] **OR** total pressure = 4410 + 1352.4	C1

Question	Answer	Marks
4(a)	pressure decreases **AND** particles have smaller velocity / momentum / smaller E_K / kinetic energy (when temperature is lower)	**B1**
	lower rate / frequency of collision of particles	**B1**
	particles collide with smaller force **OR** smaller impulse change	**B1**

Question	Answer	Marks
4(b)(i)	–273 (°C)	**B1**
4(b)(ii)	(temperature at which) particles have least E_K / kinetic energy	**B1**
	lowest possible temperature	**B1**
4(c)	200 cm^3	**A3**
	pV = constant **OR** $9.0 \times 10^4 \times 350 = 1.6 \times 10^5 \times V_2$	C1
	$V_2 = [9.0 \times 10^4 \times 350] / 1.6 \times 10^5$ **OR** $V_2 = 2.0 \times 10^N$ **OR** 1.97×10^N	C1

Question	Answer	Marks
5(a)(i)	$\rho = m / V$ **OR** $m = \rho V$	**B1**
	(m =) 1.2 × 4.5 × 6.1 × 2.4 (= 79 kg) **OR** (m =) 79.056 (kg)	**B1**
5(a)(ii)	290 s	**A4**
	$c = (\Delta)E / m\Delta\theta$ **OR** (ΔE =) $mc\Delta\theta$ **OR** (ΔE =) 79 × 1000 × 4(.0) **OR** (ΔE =) 316 000 **OR** ($\Delta\theta$ =) 4(.0)	C1
	$P = (\Delta)E / t$ **OR** (ΔE =) Pt **OR** (ΔE =) 1100 × t	C1
	(t =) $mc\Delta\theta / P$ **OR** (t =) 79 × 1000 × 4(.0) / 1100 **OR** (t =) 316 000 / 1100	C1
5(a)(iii)	any **one** from: • (thermal) energy is transferred to furniture / walls / objects (in the room) • (thermal) energy is transferred through windows / doors / floor / ceiling / from the room	**B1**
5(b)	conduction **AND** convection	**B1**

Question	Answer	Marks
6(a)	P-waves: longitudinal	**B1**
	S-waves: transverse	**B1**
6(b)	1600 m **OR** 1.6 km	**A3**
	$v = f\lambda$ **OR** (λ =) v / f	C1
	(λ =) [7.2 × 1000] / 4.5 **OR** (λ =) 1.6×10^{N} **OR** (λ =) 7.2 / 4.5	C1

Question	Answer	Marks
7(a)	normal drawn in correct position and at right angles to the surface	**B1**
7(b)	22°	**A3**
	i = 34(°)	C1
	$n = \sin i / \sin r$ **OR** (r =) $\sin^{-1}\{\sin i / n\}$ **OR** $\sin r = \sin 34 / 1.47$ **OR** $\sin r = 0.38$	C1
7(c)	3.0×10^{8} m / s	**B1**
7(d)	2.04×10^{8} m / s	**A2**
	n = speed of light in air / speed of light in oil **OR** (speed of light in oil =) speed of light in air / n **OR** (speed of light in oil =) $3.0 \times 10^{8} / 1.47$	C1

Question	Answer	Marks
8(a)(i)	region in which a (magnetic) pole experiences a force	**B1**
8(a)(ii)	in the direction of the force on the N pole	**B1**

Question	Answer	Marks
8(b)	4 radial lines outside sphere, touching the sphere and equally spaced all around sphere	**B1**
	direction of arrows towards the sphere	**B1**
8(c)(i)	2.0 V	**A1**
8(c)(ii)	(ratio of p.d. across $R_2 : R_3$ =) 1 : 2	**B1**
8(c)(iii)1.	current is zero in R_1 **AND** diode is in wrong direction (to allow current) owtte	**B1**
8(c)(iii)2.	(ratio of p.d. across $R_2 : R_3$ =) 1 : 1	**B1**

Question	Answer	Marks
9(a)	α – no. of neutrons 2	**B1**
	β – no. of protons 0 **and** charge -1.6×10^{-19}	**B1**
	γ – no. of neutrons 0 **and** charge 0 **and** (very) thick concrete / thick lead	**B1**
9(b)	(the nucleus has) one less neutron and one more proton	**B1**
9(c)	95 (counts / min)	**A4**
	initial count rate due to source = 550 – 30 (counts / min) **OR** 520 seen	C1
	(75 min =) 3 half-lives **OR** (count rate =) 1 / 8 (of initial count rate)	C1
	final count rate due to source = (520 / 8 =) 65	C1
9(d)	any **two** from: • limit time of exposure • store sources in lead boxes • keep distance from sources • avoid contact **OR** use tongs **OR** wear gloves	**B2**

Question	Answer	Marks
10(a)	$v = 2\pi r / T$	**B1**
	r = (average) radius of the orbit **AND** T = (orbital) period	**B1**
10(b)	rays from Sun strike the country at different angles through the year **OR** rays from Sun strike the country for different number of hours per day through the year	**B1**
10(c)	(first space:) red supergiant	**B1**
	(second space:) nebula	**B1**
	(3rd and 4th spaces:) neutron star	**B1**
	black hole	**B1**
10(d)	1.6×10^9 (light-years)	**A2**
	$H_0 = v/d$ **OR** (d =) v / H_0 **OR** (d =) $[33\,000 \times 10^3] / [\,2.2 \times 10^{-18} \times 9.5 \times 10^{15}]$	C1