Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/22**

Paper 2 AS Level Structured Questions **May/June 2022**

MARK SCHEME

Maximum Mark: 60

Published

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[Turn over

Question	Answer	Marks
1(a)	only ampere and kilogram underlined	B1
1(b)(i)	percentage uncertainty = 2.1 + 0.6 + (1.5 × 2)	C1
	= 5.7%	A1
1(b)(ii)	absolute uncertainty = (5.7 / 100) × 8.245 × 10^9 (= 4.7 × 10^8 Pa or 0.47 × 10^9 Pa)	C1
	E = (8.2 ± 0.5) × 10^9 Pa	A1

Question	Answer	Marks
2(a)	T sin 68° + 32 = 280	C1
	T = 270 N	A1
2(b)(i)	$F = \rho g V$ V = 280 / (1.0 × 10^3 × 9.81) = 0.029 m^3	A1
2(b)(ii)	ρ = (32 / 9.81) / 0.029	C1
	= 110 kg m^{-3}	A1

Question	Answer	Marks
2(c)	$(\Delta)E = mg(\Delta)h$ **or** $(\Delta)E = W(\Delta)h$	**C1**
	$(\Delta)h = (-)\ 77 / 32$	**C1**
	$(\Delta)h = (-)\ 2.4$ final height $= 6.2 - 2.4$ $= 3.8$ m	**A1**
2(d)(i)	$T = kx$ where k is a constant **or** $T = (EA / L)x$ where A is (cross-sectional) area, E is Young modulus, L is (original/unstretched) length	**B1**
2(d)(ii)	$E = \frac{1}{2}kx^2$ **or** $E = \frac{1}{2}Fx$ **and** $F = kx$	**C1**
	$E = 0.65 \times 2^2$ $= 2.6$ J	**A1**
	or	
	$E = \frac{1}{2}Fx$ $0.65 = \frac{1}{2} \times 270 \times x$ and so $x = 4.8 \times 10^{-3}$ m $k = F / x = 270 / 4.8 \times 10^{-3}$ $= 5.6 \times 10^4$	**(C1)**

Question	Answer	Marks
2(d)(ii)	final $E = \frac{1}{2} \times 540 \times 9.6 \times 10^{-3}$ **or** $E = \frac{1}{2} \times (270 \times 2) \times (4.8 \times 10^{-3} \times 2)$ **or** $E = \frac{1}{2} \times 5.6 \times 10^{4} \times (9.6 \times 10^{-3})^{2}$ $= 2.6\,\text{J}$	**(A1)**

Question	Answer	Marks
3(a)	$v^2 = u^2 + 2as$ $s = 5.6^2 / (2 \times 9.81)$	**C1**
	(max height =) $3.1 + 5.6^2 / (2 \times 9.81) = 4.7$ (m)	**A1**
3(b)	$s = ut + \frac{1}{2}at^2$ $4.7 = \frac{1}{2} \times 9.81 \times t^2$	**C1**
	$t = 0.98$ s	**A1**
3(c)	line drawn from a non-zero speed at $t = 0$ to a greater speed at $t = T$	**B1**
	a single sloping straight line drawn from $t = 0$ to $t = T$	**B1**
	line starts with a positive non-zero value of v and ends with a negative non-zero value of v	**B1**
3(d)	acceleration (of the ball)	**B1**
3(e)(i)	(magnitudes of accelerations are) equal / same	**B1**
3(e)(ii)	(speeds are) equal / same	**B1**

Question	Answer	Marks
4(a)	sum/total momentum before = sum/total momentum after **or** sum/total momentum (of a system of objects) is constant	**M1**
	if no (resultant) external force/for a closed system	**A1**
4(b)(i)	$(3.0 \times 4.0 \times \cos\theta)$ **or** $(2.5 \times 4.8 \times \cos\theta)$ **or** (5.5×3.7)	**C1**
	$(3.0 \times 4.0 \times \cos\theta) + (2.5 \times 4.8 \times \cos\theta) = (5.5 \times 3.7)$	**C1**
	$\theta = 32°$	**A1**
4(b)(ii)	(initial $E_K = \frac{1}{2} \times 3.0 \times 4.0^2 + \frac{1}{2} \times 2.5 \times 4.8^2$ =) 53 (J) **or** (final $E_K = \frac{1}{2} \times 5.5 \times 3.7^2$ =) 38 (J)	**C1**
	values of initial E_K and final E_K both correct **and** inelastic stated	**A1**

Question	Answer	Marks
5(a)	constant phase difference (between the waves)	**B1**
5(b)(i)	path difference = 1.5×660 $= 990$ nm	**A1**
5(b)(ii)	phase difference = $360° \times 1.5$ $= 540°$	**A1**
5(c)	$\lambda = ax / D$	**C1**
	$x = (660 \times 10^{-9} \times 1.8) / 0.44 \times 10^{-3}$	**C1**
	$= 2.7 \times 10^{-3}$ m	**A1**
5(d)	bright fringes are brighter	**B1**
	no change to dark fringes	**B1**
	no change to (fringe) separation / (fringe) spacing	**B1**
5(e)	(blue light has) shorter wavelength	**M1**
	(so) decrease (slit) separation	**A1**

Question	Answer	Marks
6(a)	$V = V_1 + V_2 + V_3$	B1
	$IR = IR_1 + IR_2 + IR_3$ **or** $(V / I) = (V_1 / I) + (V_2 / I) + (V_3 / I)$ **and** $R = R_1 + R_2 + R_3$	B1
6(b)(i)	$V / 8.0 = 6.0 \times 10^3 / (4.0 \times 10^3 + 6.0 \times 10^3)$ **or** $I = 8.0 / (4.0 \times 10^3 + 6.0 \times 10^3) = 8.0 \times 10^{-4}$ $V = 8.0 \times 10^{-4} \times 6.0 \times 10^3$	C1
	$V = 4.8$ V	A1
6(b)(ii)	total resistance in parallel = 3.0×10^3 (Ω) **or** 3.0 (kΩ)	C1
	current = $8.0 / (3.0 \times 10^3 + 6.0 \times 10^3)$ $= 8.9 \times 10^{-4}$ A	A1
6(c)	thermistor resistance increases	B1
	(thermistor resistance increases so total resistance increases so) current decreases (in battery)	M1
	($P = EI$ and E constant so) power decreases	A1

Question	Answer	Marks
7(a)(i)	P = 0 **and** Q = 137	**A1**
	R = –1 **and** S = 56	**A1**
7(a)(ii)	lepton(s)	**B1**
7(b)(i)	(charge of ddd / Y =) $-\frac{1}{3}(e)\ -\frac{1}{3}(e)\ -\frac{1}{3}(e) = -1(e)$	**B1**
	(charge of $\bar{u}d$ / Z =) $-\frac{1}{3}(e)\ -\frac{2}{3}(e) = -1(e)$	**B1**
7(b)(ii)	meson: Z / $\bar{u}d$ because consists of a quark and an antiquark	**B1**
	baryon: Y / ddd because consists of three quarks	**B1**