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PHYSICS	**9702/22**
Paper 2 AS Level Structured Questions	**October/November 2019**
MARK SCHEME	
Maximum Mark: 60	

Published

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

Question	Answer	Marks
2(b)(iii)	total distance fallen = 0.280 + 0.080 = 0.360 $0.360 = ½ \times 9.81 \times t^2$ $t = 0.27$ s	**C1**
	time taken = 0.27 – 0.24 = 0.03 s	**A1**
	or	
	v = 9.81 × 0.239 **or** $(2 \times 9.81 \times 0.280)^{0.5}$ **or** (2 × 0.280) / 0.239 = 2.34 ($m\,s^{-1}$)	**(C1)**
	$0.080 = 2.34t + ½ \times 9.81 \times t^2$ solving quadratic equation gives $t = 0.03$ s *allow any correct method using equations of uniform accelerated motion*	**(A1)**
2(c)	(average) resultant force/acceleration/speed/velocity (of low-density ball) is less	**B1**
	(so) time interval is longer	**B1**

Question	Answer	Marks
3(a)	force on body A (by body B) is equal (in magnitude) to force on body B (by body A)	**B1**
	force on body A (by body B) is opposite (in direction) to force on body B (by body A)	**B1**
3(b)(i)	$m_X \times 5v$ **or** $(m_X + m_Y) \times v$	**C1**
	$m_X \times 5v = (m_X + m_Y) \times v$ (so) $m_Y / m_X = 4$	**A1**
3(b)(ii)	$(E =)\ ½mv^2$	**C1**
	ratio $= [½ \times (m_X + m_Y) \times v^2] / [½ \times m_X \times (5v)^2]$	**C1**
	$= 0.2$	**A1**
3(b)(iii)	ratio = 1	**A1**
3(c)(i)	**1.** (magnitude of resultant force is) zero	**B1**
	2. (magnitude of resultant force is) constant	**B1**
	(direction of resultant force is) opposite to the momentum	**B1**
3(c)(ii)	horizontal line from (0 ms, 0 squares) ending at (20 ms, 0 squares)	**B1**
	straight line from (20 ms, 0 squares) ending at (40 ms, 4.0 squares [= 4.0 cm vertically])	**B1**
	horizontal line from (40 ms, 4.0 squares) ending at (60 ms, 4.0 squares)	**B1**

Question	Answer	Marks
4(a)(i)	(vertically) upwards/up	**B1**
4(a)(ii)	increases (with time/velocity/depth)	**B1**
4(b)(i)	for a body in (rotational) equilibrium	**B1**
	<u>sum/total</u> of clockwise moments about a point = <u>sum/total</u> of anticlockwise moments about the (same) point	**B1**
4(b)(ii)	$(F_B \times 5.0)$ **or** (380×2.5) **or** (750×1.6)	**C1**
	$(F_B \times 5.0) = (380 \times 2.5) + (750 \times 1.6)$ $F_B = 430$ N	**A1**
4(b)(iii)	taking moments about C: $(380 \times 2.5) = 750 \times (2.0 - x)$	**C1**
	$(2.0 - x) = 1.3$ $x = 0.7$ m	**A1**
	or	
	moments may be taken about other points, e.g. about D: $(380 \times 4.5) + (750 \times x) = 1130 \times 2.0$	**(C1)**
	$x = 0.7$ m	**(A1)**

Question	Answer	Marks
5(a)	distance moved by wavefront/energy during one cycle/oscillation/period (of source) **or** <u>minimum</u> distance between two wavefronts **or** distance between two <u>adjacent</u> wavefronts	**B1**
5(b)	(T =) 2.0×2.5 (= 5.0 ms) **or** $2.0 \times 2.5 \times 10^{-3}$ (= 5.0×10^{-3} s)	**C1**
	$f = 1 / (5.0 \times 10^{-3})$ = 200 Hz	**A1**
5(c)(i)	(path difference =) $8.0 + (20.8^2 - 8.0^2)^{0.5} - 20.8 = 6.4$ (m)	**A1**
5(c)(ii)	• <u>path difference</u> = 4λ • waves (meet at C) in phase • constructive interference (of waves) *any two points, one mark each*	**B2**
5(c)(iii)	$v = 200 \times 1.6$ = 320 (m s^{-1})	**C1**
	$\Delta t = 6.4 / 320$ **or** $27.2 / 320 - 20.8 / 320$ = 0.020 s	**A1**
5(c)(iv)	$3\lambda = 6.4$ $\lambda = 2.1$ m	**A1**

Question	Answer	Marks
6(a)	<u>sum of</u> current(s) into junction = <u>sum of</u> current(s) out of junction **or** (algebraic) sum of current(s) at a junction is zero	**B1**
6(b)(i)	$R = V / I$	**C1**
	$= 0.60 / 7.5 \times 10^{-3}$	**C1**
	$= 80\ \Omega$	**A1**
6(b)(ii)	resistance decreases	**B1**
6(c)(i)	$E = 0.60 + 0.30$ $= 0.90$ V	**A1**
6(c)(ii)	(I =) 9.3 – 7.5	**C1**
	I = 1.8 (mA) **or** 1.8×10^{-3} (A) $R = 0.90 / 1.8 \times 10^{-3}$ $= 500\ \Omega$	**A1**
	or	
	total resistance = $0.90 / 9.3 \times 10^{-3} = 96.8$ (Ω) total resistance of diode and X = $0.90 / 7.5 \times 10^{-3} = 120$ (Ω) $1 / 96.8 = 1 / R + 1 / 120$	**(C1)**
	$R = 500\ \Omega$	**(A1)**

Question	Answer	Marks
6(c)(iii)	$P = VI$ **or** I^2R **or** V^2 / R	**C1**
	$= 0.60 \times 7.5 \times 10^{-3}$ **or** $(7.5 \times 10^{-3})^2 \times 80$ **or** $0.60^2 / 80$ $= 4.5 \times 10^{-3}$ W	**A1**
6(c)(iv)	current = 2.5 mA	**A1**

Question	Answer	Marks
7(a)	number of protons = 92	**A1**
	number of neutrons = 142	**A1**
7(b)	5.6 MeV = $5.6 \times 1.60 \times 10^{-19} \times 10^6$ (= 8.96×10^{-13} J)	**C1**
	number = $0.15 / (5.6 \times 1.60 \times 10^{-13})$ = 1.7×10^{11}	**A1**
	or	
	0.15 W = $0.15 / (1.60 \times 10^{-19} \times 10^6)$ (= 9.38×10^{11} MeV s^{-1})	**(C1)**
	number = $9.38 \times 10^{11} / 5.6$ = 1.7×10^{11}	**(A1)**