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PHYSICS**9702/23**

Paper 2 AS Level Structured Questions

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MARK SCHEME

Maximum Mark: 60

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This document consists of **13** printed pages.

Question	Answer	Marks
1(a)(i)	wavelength = 8.5×10^{-5} m	A1
1(a)(ii)	$f = v / \lambda$ or c / λ	C1
	$= 3.0 \times 10^8 / 8.5 \times 10^{-5}$ ($= 3.5 \times 10^{12}$) = 3.5 THz	A1
1(a)(iii)	infrared	B1
1(b)	(implied) percentage uncertainty in $I = 4\%$ or (implied) fractional uncertainty in $I = 0.04$	C1
	percentage uncertainty in $E = 5\% + (4\% \times 2)$ = 13%	A1

Question	Answer	Marks
2(a)	point where (all) the weight (of the body) is considered/seems to act	M1 A1
2(b)(i)	horizontal component of force = $38 \cos 60^\circ$ or $38 \sin 30^\circ$ = 19 N	A1
2(b)(ii)	$(T \times 1.2)$ or (19×0.9) or 17 $(T \times 1.2) = (19 \times 0.9)$ $T = 14 \text{ N}$	C1 A1
2(b)(iii)	$F = 45 + 38 \sin 60^\circ$ = 78 N	A1

Question	Answer	Marks
3(a)	$s = \frac{1}{2}at^2$	C1
	$57 = \frac{1}{2} \times 9.81 \times t^2$ and $t = 3.4$ (s)	A1
3(b)	horizontal distance = 41×3.4 = 140 m	A1
3(c)	(displacement) ² = $57^2 + 140^2$	C1
	displacement = $(57^2 + 140^2)^{0.5}$ = 150 m	A1
3(d)	straight line from the origin with positive gradient	B1
3(e)	$(1480 - m) \times 0.340 = m \times 41.0$	C1
	$m = 12.2$ kg	A1
	or	
	$m_c 0.34 = m_b 41$ and $m_c + m_b = 1480$	(C1)
	$m_c = (41 / 0.34)m_b$	(A1)
	$(41 / 0.34)m_b + m_b = 1480$	
	$m_b = 12.2$ kg	
3(f)	acceleration (of free fall) is unchanged/is not dependent on mass	M1
	(so) no change (to the graph)	A1

Question	Answer	Marks
4(a)	compression/extension is proportional to force (provided limit of proportionality is not exceeded)	B1
4(b)	$(E) = \frac{1}{2}Fx$ or $\frac{1}{2}kx^2$ or area under graph $= \frac{1}{2} \times 8 \times 16 \times 10^{-2} = 0.64 \text{ (J)}$ or $= \frac{1}{2} \times 50 \times (16 \times 10^{-2})^2 = 0.64 \text{ (J)}$	A1
4(c)(i)	$(E) = \frac{1}{2}mv^2$ $0.64 = \frac{1}{2} \times 0.076 \times v^2$ $v = 4.1 \text{ m s}^{-1}$	C1
4(c)(ii)	$(\Delta)(E) = mg(\Delta)h$ $= 0.076 \times 9.81 \times 0.24$ $(= 0.18 \text{ (J)})$ kinetic energy = $0.64 - 0.18$ $= 0.46 \text{ J}$	A1
4(c)(iii)	$v = 4.1 \text{ m s}^{-1}$	A1
4(d)	$W = Fs$	C1
	$d = 0.30 + (2\pi \times 0.12) + 0.25 (= 1.3 \text{ m})$	C1
	$F = 0.23 / 1.3$ $= 0.18 \text{ N}$	A1

Question	Answer	Marks
5(a)(i)	$T = 2.0 \times 10^{-5} \times 6.0$ ($= 1.2 \times 10^{-4} \text{ s}$)	C1
	$f = 1 / (2.0 \times 10^{-5} \times 6.0)$ $= 8300 \text{ Hz}$	
5(a)(ii)	new trace shows the same period	B1
	new trace shows amplitude of 10 small squares	B1
5(a)(iii)	(trace is a) vertical line	B1
5(b)(i)	$n\lambda = d \sin \theta$	C1
	$\lambda = (3.4 \times 10^{-6} \times \sin 16^\circ) / 2$ $= 4.7 \times 10^{-7} \text{ m}$	
5(b)(ii)	$n = 3.4 \times 10^{-6} (\times \sin 90^\circ) / 4.7 \times 10^{-7}$ or $2 (\times \sin 90^\circ) / \sin 16^\circ$ ($= 7.2$ or 7.3)	C1
	highest order = 7	
		A1

Question	Answer	Marks
6(a)	<u>work (done) / energy (transferred from electrical to other forms)</u> charge	B1
6(b)	$R = \rho L / A$	B1
	$V = LA$ and (so) $R = \rho V / A^2$ (with ρ and V constant)	B1
6(c)	$E = IR + Ir$ or $E = I(R + r)$ or $E - Ir = IR$ and $R = (E / I) - r$	A1
6(d)(i)	$P = I^2 R$ or $P = IV$ or $P = V^2 / R$	C1
	$R = 5.4 (\Omega)$ or $V = 10.8 (V)$	C1
	$P = 2.0^2 \times 5.4$ $= 22 W$	A1
6(d)(ii)	1. $r = 0.60 \Omega$	A1
	2. $E = \text{gradient}$	C1
	$= \text{e.g. } 5.4 / 0.45$ $= 12 V$	A1

Question	Answer	Marks
7(a)(i)	electric field strength = V/d	B1
7(a)(ii)	force = Vq/d	B1
7(a)(iii)	kinetic energy = Vq	B1
7(b)(i)	no change	B1
7(b)(ii)	no change	B1
7(c)(i)	nucleon number = 14 and proton number = 7	A1
7(c)(ii)	(electron) antineutrino	B1