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PHYSICS **9702/21**

Paper 2 AS Level Structured Questions **May/June 2017**

MARK SCHEME

Maximum Mark: 60

Published

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Question	Answer	Marks
1(a)	(stress =) force / area **or** kg m s^{-2} / m^2	**B1**
	= kg m^{-1} s^{-2}	**A1**
1(b)(i)	0.58 = 2π × [(4 × 0.500 × 0.600^3) / (E × 0.0300 × 0.00500^3)]$^{0.5}$	**C1**
	E = [4π^2 × 4 × 0.500 × (0.600)^3] / [(0.58)^2 × 0.0300 × (0.00500)^3] = 1.35 × 10^{10} (Pa)	**C1**
	= 14 (13.5) GPa	**A1**
1(b)(ii)1.	(accuracy determined by) the closeness of the value(s)/measurement(s) to the true value	**B1**
	(precision determined by) the range of the values/measurements	**B1**
1(b)(ii)2.	l is (cubed so) 3 × (percentage/fractional) uncertainty **and** T is (squared so) 2 × (percentage / fractional) uncertainty **and** (so) l contributes more	**B1**

Question	Answer	Marks
2(a)	resultant force (in any direction) is zero	**B1**
	resultant torque/moment (about any point) is zero	**B1**
2(b)(i)	$a = (v - u) / t$ **or** gradient **or** $\Delta v / (\Delta)t$	**C1**
	e.g. $a = (8.8 - 4.6) / (7.0 - 4.0) = 1.4\ \text{m s}^{-2}$	**A1**
2(b)(ii)	$s = 4.6 \times 4 + [(8.8 + 4.6) / 2] \times 3$	**C1**
	$= 18.4 + 20.1$ $= 39\ (38.5)\ \text{m}$	**A1**
2(b)(iii)	$\Delta E = ½ \times 95\ [(8.8)^2 - (4.6)^2]$	**C1**
	$= 3678 - 1005$ $= 2700\ (2673)\ \text{J}$	**A1**
2(b)(iv)1.	weight = 95 × 9.81 (= 932 N)	**C1**
	vertical tension force = 280 sin 25° **or** 280 cos 65° (=118.3 N)	**C1**
	$F = 932 + 118$ $= 1100\ (1050)\ \text{N}$	**A1**
2(b)(iv)2.	horizontal tension force = 280 cos 25° **or** 280 sin 65° (= 253.8 N)	**C1**
	resultant force = 95 × 1.4 (= 133 N)	**C1**
	$133 = 253.8 - R$ $R = 120\ (120.8)\ \text{N}$	**A1**

Question	Answer	Marks
3(a)	$\rho = m / V$	**C1**
	$V = \pi d^2 L / 4$ **or** $\pi r^2 L$	**C1**
	weight = $2.7 \times 10^3 \times \pi (1.2 \times 10^{-2})^2 \times 5.0 \times 10^{-2} \times 9.81 = 0.60$ N	**A1**
3(b)(i)	the point from where (all) the weight (of a body) seems to act	**B1**
3(b)(ii)	$W \times 12$	**C1**
	$(0.25 \times 8) + (0.6 \times 38)$	**C1**
	$W = (2 + 22.8) / 12$ $= 2.1\ (2.07)$ N	**A1**
3(c)(i)	pressure changes with depth (in water) **or** pressure on bottom (of cylinder) different from pressure on top	**B1**
	pressure on bottom of cylinder <u>greater than</u> pressure on top **or** force (up) on bottom of cylinder <u>greater than</u> force (down) on top	**B1**
3(c)(ii)	anticlockwise moment reduced and reducing the weight of X reduces clockwise moment **or** anticlockwise moment reduced so clockwise moment now greater than (total) anticlockwise moment	**B1**

Question	Answer	Marks
4(a)	(two) waves travelling (at same speed) in opposite directions overlap	**B1**
	waves (are same type and) have same frequency/wavelength	**B1**
4(b)(i)	λ = 12 / 250 (= 0.048 m)	**C1**
	distance = 1.5 × 0.048 = 0.072 m	**A1**
4(b)(ii)	T = 1 / 250 = 0.004 (s) or 4 (ms)	**C1**
	1. curve drawn is mirror image of that in Fig. 4.2 and labelled P	**A1**
	2. horizontal line drawn between A and B and labelled Q	**A1**

Question	Answer	Marks
5(a)	observed frequency is different to source frequency when source moves relative to observer	**B1**
5(b)	360 = (400 × 340) / (340 ± v)	**C1**
	v = 38 (37.8) m s^{-1}	**A1**
	away (from the observer)	**B1**

Question	Answer	Marks
6(a)	volt / ampere	**B1**
6(b)(i)	$R_T = [1/3.0 + 1/6.0]^{-1} + 4.0$ (= 6.0 Ω)	**C1**
	I = 1.5 / 6.0	**C1**
	= 0.25 A	**A1**
6(b)(ii)	V_B = 0.5 V I = 0.5 / 3.0 = 0.17 (0.167) A	**A1**
6(b)(iii)	$P = I^2R$ **or** VI **or** V^2/R	**C1**
	ratio = $(0.167^2 \times 3.0) / (0.25^2 \times 4.0)$ = 0.33	**A1**
6(c)(i)	vary/change/different radius/diameter/<u>cross-sectional</u> area (of wire)	**B1**
6(c)(ii)	$v = I / Ane$ ratio $= \dfrac{(I_B / A_B)}{(I_C / A_C)}$ **or** $\dfrac{I_B}{I_C} \times \dfrac{A_C}{A_B}$	**C1**
	($R \propto 1/A$ so) ratio $= \dfrac{I_B}{I_C} \times \dfrac{R_B}{R_C} = \dfrac{0.167}{0.25} \times \dfrac{3.0}{4.0}$ = 0.50	**A1**
6(d)(i)	0.25 A to 0.13 (0.125) A **or** halved	**A1**
6(d)(ii)	no change	**A1**

Question	Answer	Marks
7(a)(i)	(proton is uud so) (2 / 3)*e* + (2 / 3)*e* – (1 / 3)*e* = *e*	**B1**
7(a)(ii)	(neutron is udd so) (2 / 3)*e* – (1 / 3)*e* –(1 / 3)*e* = 0	**B1**
7(b)(i)	<table><tr><td></td><td>β^-</td><td>β^+</td></tr><tr><td>nucleon number</td><td>90</td><td>64</td></tr><tr><td>proton number</td><td>39</td><td>28</td></tr></table> *all correct*	**B1**
7(b)(ii)	weak (nuclear force/interaction)	**B1**
7(b)(iii)	β^- decay: electron and (electron) antineutrino β^+ decay: positron and (electron) neutrino *all correct*	**B1**