
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 $\text{kg m s}^{-2} / \text{m}^2$	B1
	$= \text{kg m}^{-1} \text{s}^{-2}$	A1
1(b)(i)	$0.58 = 2\pi \times [(4 \times 0.500 \times 0.600^3) / (E \times 0.0300 \times 0.00500^3)]^{0.5}$	C1
	$E = [4\pi^2 \times 4 \times 0.500 \times (0.600)^3] / [(0.58)^2 \times 0.0300 \times (0.00500)^3]$ $= 1.35 \times 10^{10} \text{ (Pa)}$	C1
	$= 14 \text{ (13.5) GPa}$	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.	<i>l</i> is (cubed so) $3 \times$ (percentage/fractional) uncertainty and <i>T</i> is (squared so) $2 \times$ (percentage / fractional) uncertainty and (so) <i>l</i> 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
	$= 18.4 + 20.1$	A1
	$= 39 \text{ (38.5) m}$	
2(b)(iii)	$\Delta E = \frac{1}{2} \times 95 [(8.8)^2 - (4.6)^2]$	C1
	$= 3678 - 1005$	A1
	$= 2700 \text{ (2673) J}$	
2(b)(iv)1.	weight = 95×9.81 (= 932 N)	C1
	vertical tension force = $280 \sin 25^\circ$ or $280 \cos 65^\circ$ (=118.3 N)	C1
	$F = 932 + 118$ $= 1100 \text{ (1050) N}$	A1
2(b)(iv)2.	horizontal tension force = $280 \cos 25^\circ$ or $280 \sin 65^\circ$ (= 253.8 N)	C1
	resultant force = 95×1.4 (= 133 N)	C1
	$133 = 253.8 - R$ $R = 120 \text{ (120.8) N}$	A1

Question	Answer	Marks
3(a)	$\rho = m / V$	C1
	$V = \pi d^2 L / 4$ or $\pi r^2 L$	C1
	weight = $2.7 \times 10^3 \times \pi (1.2 \times 10^{-2})^2 \times 5.0 \times 10^{-2} \times 9.81 = 0.60 \text{ N}$	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
	$W = (2 + 22.8) / 12$ $= 2.1 (2.07) \text{ N}$	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)	$\lambda = 12 / 250 (= 0.048 \text{ m})$	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)	$360 = (400 \times 340) / (340 \pm v)$	C1
	$v = 38 (37.8) \text{ m s}^{-1}$	A1
	away (from the observer)	B1

Question	Answer	Marks
6(a)	volt / ampere	B1
6(b)(i)	$R_T = [1/3.0 + 1/6.0]^{-1} + 4.0 (= 6.0 \Omega)$	C1
	$I = 1.5 / 6.0$	C1
	$= 0.25 \text{ A}$	A1
6(b)(ii)	$V_B = 0.5 \text{ V}$	A1
	$I = 0.5 / 3.0$	
	$= 0.17 (0.167) \text{ A}$	
6(b)(iii)	$P = I^2 R \text{ or } VI \text{ or } V^2 / R$	C1
	ratio $= (0.167^2 \times 3.0) / (0.25^2 \times 4.0)$	A1
	$= 0.33$	
6(c)(i)	vary/change/different radius/diameter/ <u>cross-sectional</u> area (of wire)	B1
6(c)(ii)	$v = I / Ane$	C1
	ratio $= \frac{(I_B / A_B)}{(I_C / A_C)} \text{ or } \frac{I_B}{I_C} \times \frac{A_C}{A_B}$	
	$(R \propto 1 / A \text{ so}) \text{ ratio} = \frac{I_B}{I_C} \times \frac{R_B}{R_C} = \frac{0.167}{0.25} \times \frac{3.0}{4.0}$ $= 0.50$	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 border="1"> <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> <p><i>all correct</i></p>		β^-	β^+	nucleon number	90	64	proton number	39	28	B1
	β^-	β^+									
nucleon number	90	64									
proton number	39	28									
7(b)(ii)	weak (nuclear force/interaction)	B1									
7(b)(iii)	β^- decay: electron and (electron) antineutrino β^+ decay: positron and (electron) neutrino <i>all correct</i>	B1									