Cambridge International AS & A Level

PHYSICS **9702/22**

Paper 2 AS Level Structured Questions **February/March 2025**

MARK SCHEME

Maximum Mark: 60

Published

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Question	Answer	Marks
1(a)	how close the (measured) value is to the true value (of the quantity)	**A1**
1(b)(i)	(ρ =) m / V	**C1**
	= $31.3 \times 10^{-3} / (1.53 \times 10^{-2})^3 = 8.7 \times 10^3$ (kg m^{-3})	**A1**
1(b)(ii)	(0.5 / 31.3) or (0.01 / 1.53) % uncertainty = $(0.016 \times 100) + 3 \times (0.0065 \times 100)$	**C1**
	= 4%	**A1**
1(b)(iii)	The ranges (of the densities of A and B) overlap **or** the (calculated) density of A is within the range of the density of B **or** the difference in densities is within the uncertainty (of B)	**M1**
	(so) they could be the same	**A1**

Question	Answer	Marks
2(a)	in (rotational) equilibrium	**B1**
	sum / total of CW moments about a point = sum / total of ACW moments about the (same) point.	**B1**
2(b)(i)	The magnitudes of the moments about A are: (1700×3.0) $(660\ x)$ (1300×5) Correct magnitude of any one moment about A.	**C1**
	Correct magnitudes of a second moment about A.	**C1**
	$(1700 \times 3.0) + (660\ x) = (1300 \times 5)$ x = 2.1 m	**A1**

Question	Answer	Marks
2(b)(ii)	(Upthrust =) $11 \times 9.81 + 1300 = 1400$ (N)	**A1**
2(b)(iii)	y = Upthrust / ρgA $= 1400 / (990 \times 9.81 \times \pi \times (0.78 / 2)^2)$	**C1**
	$= 0.30$ m	**A1**
	OR [$P = F / A = 1400 / \pi \times (0.78 / 2)^2 = 2930$] $y = P / \rho g$ $= 2930 / (990 \times 9.81)$	**(C1)**
	$= 0.30$ m	**(A1)**
2(b)(iv)	line with a non-zero value of depth at distance = 0	**B1**
	A line from distance = 0 to distance = 6.0 m with a gradient that is always positive	**B1**

Question	Answer	Marks
3(a)(i)	$a = (v^2 - u^2) / 2s$ $= (22^2 - 13^2) / (2 \times 180)$	**C1**
	$= 0.88\ \text{m s}^{-2}$	**A1**
	OR [$t = (180 \times 2) / (22 + 13) = 10.3$] $180 = 13 \times 10.3 + ½\ a \times 10.3^2$ or $180 = 22 \times 10.3 - ½\ a \times 10.3^2$ or $22 = 13 + a \times 10.3$	**(C1)**
	$a = 0.88\ \text{m s}^{-2}$	**(A1)**
3(a)(ii)	$(\Delta)E = ½m(\Delta)v^2$	**C1**
	gain in KE $= ½m(v^2 - u^2)$ $= ½ \times 9400 \times (22^2 - 13^2)$	**C1**
	$= 1.5 \times 10^6\ \text{J}$	**A1**
	OR $W = Fs$ $= ma \times d$	**(C1)**
	gain in KE $= 9400 \times 0.88 \times 180$	**(C1)**
	$= 1.5 \times 10^6\ \text{J}$	**(A1)**
3(b)(i)	rate of change of momentum	**B1**
3(b)(ii)	(Force =) $(2.5 \times 10^4 - 21 \times 10^4) / 15 = -1.2 \times 10^4$ (N)	**A1**

Question	Answer	Marks
3(b)(iii)	The change of momentum (for S and R to come to rest) is the same	**B1**
	(Average) force on R (to come to rest) is ($-21 \times 10^4 / 23$ =) 0.91×10^4 N **or** (Average) force on R (to come to rest) is less than the force on S / less than *F*	**B1**
	(S will come to rest in) less time (than R).	**B1**
	OR The change of momentum (for S and R to come to rest) is the same	**(B1)**
	Time for S to come to rest is ($-21 \times 10^4 / 1.2 \times 10^4$ =) 17.5 s (and time for R to come to rest is 23 s)	**(B1)**
	(S comes to rest in) less time (than R).	**(B1)**

Question	Answer	Marks
4(a)	(micro)wave (from the transmitter) reflects (at metal/sheet)	**B1**
	The incident and reflected waves superpose	**B1**
	(resultant) amplitude is maximum at an antinode	**B1**
	(resultant) amplitude is minimum/zero at a node	**B1**
4(b)(i)	$\lambda = c / f$ $= 3 \times 10^8 / 6.3 \times 10^9$	**C1**
	= 0.048 m	**A1**
4(b)(ii)	distance PQ = ¼λ = 0.048 / 4 = 0.012 m	**A1**

Question	Answer	Marks
4(b)(iii)	(Distance QR is the) same (as PQ) and one of: • Distance (between maxima / minima) does not depend on intensity • distance depends only on wavelength • wavelength is unchanged / constant	**B1**

Question	Answer	Marks
5(a)	$T = 5.8 \times 5.0 \times 10^{-4}$ $= 2.9 \times 10^{-3}$	**C1**
	$\lambda = vT$ or $v = f\lambda$ and $f = 1 / T$	**C1**
	$\lambda = 330 \times 2.9 \times 10^{-3}$ or $\lambda = 330 / 345$ $= 0.96$ m	**A1**
5(b)	(loudspeaker) moves away (from the microphone)	**B1**
	at an increasing speed / whilst accelerating	**B1**

Question	Answer	Marks
6(a)	$V = IR$ $= 0.85 \times 3.3 \times 10^{-3}$	**C1**
	$= 2.8 \times 10^{-3}$ V	**A1**
6(b)(i)	$(A =) \rho L / R$	**C1**
	$= 1.8 \times 10^{-8} \times 0.24 / 3.3 \times 10^{-3} = 1.3 \times 10^{-6}$ (m^2)	**A1**
6(b)(ii)	$(n =) 2.6 \times 10^{22} / (1.3 \times 10^{-6} \times 0.24) = 8.3 \times 10^{28}$ (m^{-3})	**A1**

Question	Answer	Marks
6(b)(iii)	$v = I / nAq$ $= 0.85 / (8.3 \times 10^{28} \times 1.3 \times 10^{-6} \times 1.6 \times 10^{-19})$	**C1**
	$= 4.9 \times 10^{-5}$ m s^{-1}	**A1**
	OR $v = IL / Nq$ $= 0.85 \times 0.24 / (2.6 \times 10^{22} \times 1.6 \times 10^{-19})$	**(C1)**
	$= 4.9 \times 10^{-5}$ m s^{-1}	**(A1)**
6(c)(i)	Length (of Q) is greater (than P)	**B1**
	(Average cross-sectional) area (of Q) is less (than P)	**B1**
	Resistance is proportional to length / (cross-sectional) area	**M1**
	(so) the resistance (of Q) is greater (than P)	**A1**
6(c)(ii)	A line starting from a non-zero value of drift speed at distance = 0	**B1**
	A line with an increasing positive gradient	**B1**

Question	Answer	Marks
7(a)	nucleon number of Q = 226 <u>and</u> proton number of R = 86	**B1**
7(b)	4(u) $\times$ 1.5 $\times 10^{7}$ or 222(u) $\times v$	**C1**
	$v = 4$(u) $\times$ 1.5 $\times 10^{7} / 222$(u)	**C1**
	$= 2.7 \times 10^{5}$ m s^{-1}	**A1**

Question	Answer	Marks
7(c)	Any three from: • momentum • charge • nucleon number • neutron number • proton number	**B3**