



Cambridge International AS & A Level

PHYSICS**9702/22**

Paper 2 AS Level Structured Questions

May/June 2021**MARK SCHEME**Maximum Mark: 60

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This document consists of **12** printed pages.

Question	Answer	Marks
1(a)	acceleration: vector electrical resistance: scalar momentum: vector <i>1 mark for two correct, 2 marks for all three correct</i>	B2
1(b)	resultant force (in any direction) is zero	B1
	resultant torque/moment (about any point) is zero	B1
1(c)(i)	upthrust = $\rho g(\Delta)h \times A$ $= (1.00 \times 10^3 \times 9.81 \times 0.190) \times 0.0230$ $= 42.9 \text{ N}$	C1 A1
1(c)(ii)	$(T =) 43 - 28 = 15 \text{ (N)}$ or $(T =) 42.9 - 28 = 14.9 \text{ or } 15 \text{ (N)}$	A1
1(c)(iii)	$\sigma = F/A \text{ or } T/A$ $= 15 / (3.2 \times 10^{-6})$ $= 4.7 \times 10^6 \text{ Pa}$	C1 A1
1(c)(iv)	upthrust (on cylinder) increases (and weight constant)	B1
	tension/stress increases and (so) strain energy increases	B1

Question	Answer	Marks
2(a)	$v^2 = u^2 + 2as$	C1
	$u^2 = 8.7^2 - (2 \times 9.81 \times 1.5)$	
	$u = 6.8 \text{ m s}^{-1}$	
2(b)	(magnitude of) force on ball (by ground) equal to force on ground (by ball)	B1
	(direction of) force on ball (by ground) opposite to force on ground (by ball)	B1
2(c)(i)	$(p =) 0.059 \times 8.7 \text{ or } 0.059 \times 5.4$	C1
	change in momentum = $0.059 (8.7 + 5.4)$ = 0.83 N s	A1
2(c)(ii)	resultant force = $0.83 / 0.091 \text{ or } 0.059 [(8.7 + 5.4) / 0.091]$ = 9.1 N	A1
2(c)(iii)	$(W =) 0.059 \times 9.81$	C1
	$(W =) 0.58 \text{ (N)}$	A1
	force = $9.1 + 0.58$ = 9.7 N	
2(d)	straight line with a positive gradient and starting from a non-zero value of speed at $t = 0$ and ending when $t = T$	B1
2(e)	air resistance increases	B1
	resultant force/acceleration decreases so gradient (of curve) decreases	B1

Question	Answer	Marks
3(a)	$(\Delta)E = mg(\Delta)h$ or $W(\Delta)h$	C1
	$= 330 \times (4.0 - 1.1)$	A1
	$= 960 \text{ J}$	
3(b)	(work =) $960 - 540$	C1
	(= 420 J)	
	distance moved = $(960 - 540) / 52$ $= 8.1 \text{ m}$	A1
3(c)(i)	$E = \frac{1}{2}mv^2$	C1
	$540 = \frac{1}{2} \times (330 / 9.81) \times v^2$	A1
	$v = 5.7 \text{ m s}^{-1}$	
3(c)(ii)	speed = horizontal component of velocity	C1
	$= 5.7 \times \cos 41^\circ$	
	$= 4.3 \text{ m s}^{-1}$	A1

Question	Answer	Marks
4(a)	time for one oscillation/vibration/cycle or time between <u>adjacent</u> wavefronts (passing the same point) or <u>shortest</u> time between two wavefronts (passing the same point)	B1
4(b)	(when two or more) waves meet/overlap (at a point)	B1
	(resultant) displacement is sum of the individual displacements	B1
4(c)(i)	microwave(s)	B1
4(c)(ii)	$v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$	C1
	$T = 0.040 / 3.00 \times 10^8$	C1
	$= 1.33 \times 10^{-10} \text{ (s)}$ $= 1.33 \times 10^{-10} / 10^{-12} \text{ (ps)}$ $= 130 \text{ ps}$	A1
4(c)(iii)	$(1.380 - 1.240) / 0.040 = 3.5$ or $1.380 / 0.040 - 1.240 / 0.040 = 3.5$	A1
4(c)(iv)	phase difference = 1260° or 180°	A1
4(c)(v)	(always) zero	A1
4(c)(vi)	increase in distance between (adjacent intensity) maxima/minima	A1

Question	Answer	Marks
5(a)	volt / ampere	B1
5(b)	$R = \rho L / A$	B1
	$(A = V / L)$	B1
	(so) $R = \rho L^2 / V$ (with ρ and V constant so $R \propto L^2$)	
5(c)(i)	$E = 2.4 \text{ V}$	A1
5(c)(ii)	$P = VI$ or I^2R or V^2/R	C1
	$= 1.3 \times 5.0$ or $5.0^2 \times 0.26$ or $1.3^2 / 0.26$	C1
	$= 6.5 \text{ W}$	A1
5(c)(iii)	(–) internal resistance or (–) r	B1

Question	Answer	Marks
6(a)	the nucleus is charged	B1
	the majority of the mass (of atom) is in the nucleus	B1
6(b)	made up of quarks (so) not a fundamental particle	B1
6(c)	$(Q =) 6.9 \times 10^{-9} \times 60$	C1
	number = $(6.9 \times 10^{-9} \times 60) / (2 \times 1.60 \times 10^{-19})$	C1
	= 1.3×10^{12}	A1
6(d)	(magnitude of electric) force is constant	B1
	(so magnitude of) acceleration is constant	B1
6(e)	(nuclei have) same charge/same number of protons	B1
	(so) same (magnitude of) force	B1