Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/23**

Paper 2 AS Level Structured Questions **October/November 2021**

MARK SCHEME

Maximum Mark: 60

Published

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[Turn over

Question	Answer	Marks
1(a)	$m = \rho V$ **or** ρAL	**C1**
	$W = mg$	**C1**
	$(A =)\ 24 / (9.81 \times 850 \times 0.18) = 0.016\ (m^2)$	**A1**
	or	
	$P = F / A$	**(C1)**
	$P = \rho gh$	**(C1)**
	$(A =)\ 24 / (9.81 \times 850 \times 0.18) = 0.016\ (m^2)$	**(A1)**
1(b)(i)	(upthrust =) 24 + 8(.0) = 32 (N)	**A1**
1(b)(ii)	$(\Delta)p = 32 / 0.016\ (= 2000)$	**C1**
	$(\Delta)p = \rho g(\Delta)h$ $\rho = 2000 / (9.81 \times 0.17)$	**C1**
	$= 1200\ kg\ m^{-3}$	**A1**
1(c)(i)	$E = ½Fx$ **or** $E = ½kx^2$ **or** E = area under graph	**C1**
	$(\Delta)E = (½ \times 8.0 \times 0.40) – (½ \times 4.0 \times 0.20)$ **or** $(½ \times 20 \times 0.40^2) – (½ \times 20 \times 0.20^2)$ **or** $½ \times (4.0 + 8.0) \times 0.20$	**C1**
	$= 1.2\ J$	**A1**
1(c)(ii)	length = 30 cm	**A1**

Question	Answer	Marks
2(a)	force × displacement in the direction of the force	**B1**
2(b)	units: kg m s^{-2} × m = kg m^2 s^{-2}	**A1**
2(c)	T_1: K and T_2: K	**C1**
	A: m^2 and t: s and L: m	**C1**
	c = (kg m^2 s^{-2} m) / (m^2 K s) = kg m s^{-3} K^{-1}	**A1**

Question	Answer	Marks
3(a)	change in displacement / time (taken)	**B1**
3(b)	by calculation: $v^2 = 42^2 + 23^2 - (2 \times 42 \times 23 \times \cos 54°)$ **or** $v^2 = (42 - 23\cos 54°)^2 + (23 \sin 54°)^2$ **or** $v^2 = (42 - 23 \sin 36°)^2 + (23 \cos 36°)^2$	**C1**
	$v = 34\ \text{m s}^{-1}$	**A1**
	or	
	by scale diagram: triangle of vector velocities drawn	**(C1)**
	$v = 34\ \text{m s}^{-1}$ (*allow* $\pm 1\ \text{m s}^{-1}$ *if scale diagram used*)	**(A1)**
3(c)(i)	$(\Delta)E = mg(\Delta)h$ **or** $(\Delta)E = W(\Delta)h$	**C1**
	$h = 6100/46$ (= 133 m)	**C1**
	$\theta = \sin^{-1}(133/280)$ $= 28°$	**A1**
3(c)(ii)	force = 6100 / 280 **or** 46 sin 28°	**C1**
	= 22 N	**A1**
3(d)	$v_{(s)} = 280 / 14$ (= $20\ \text{m s}^{-1}$)	**C1**
	$f_o = f_s\, v / (v - v_s)$ $f_s = 450 \times (340 - 20) / 340$	**C1**
	= 420 Hz	**A1**

Question	Answer	Marks
4(a)	to the left/from the right/from B to A/opposite (direction) to (α-particle) velocity	**B1**
4(b)	$v^2 = u^2 + 2as$ $s = (4.1 \times 10^6)^2 / (2 \times 2.7 \times 10^{14})$	**C1**
	$= 0.031$ m	**A1**
4(c)	$E = F / Q$ **or** $E = ma / Q$	**C1**
	$= (4 \times 1.66 \times 10^{-27} \times 2.7 \times 10^{14}) / (2 \times 1.60 \times 10^{-19})$	**C1**
	$= 5.6 \times 10^6$ V m^{-1}	**A1**
4(d)	straight line with negative gradient that intercepts both the momentum and t axes	**B1**
4(e)	force (on α-particle)	**B1**
4(f)(i)	$E = ½mv^2$	**C1**
	$= ½ \times 9.11 \times 10^{-31} \times (4.1 \times 10^6)^2$	**C1**
	$= 7.7 \times 10^{-18}$ J	**A1**
4(f)(ii)	particles have opposite charges	**B1**
	(so) forces (on charges) are opposite (directions)	**B1**
	β^- has less/half the charge so less/half the force	**B1**
4(f)(iii)	(electron) antineutrino	**B1**

Question	Answer	Marks
5(a)	maximum displacement (of a point/particle on string/wave)	**B1**
5(b)	$v = \lambda / T$ **or** $v = f\lambda$ **and** $f = 1 / T$	**C1**
	$T = 690 \times 10^{-9} / 3.00 \times 10^{8}$	**C1**
	$= 2.3 \times 10^{-15}$ s	**A1**
5(c)(i)	$\lambda = ax / D$	**C1**
	$G = x / D$ (so) $a = \lambda / G$	**A1**
5(c)(ii)	straight line from origin always below printed line	**M1**
	line is half the height of printed line at maximum D	**A1**

Question	Answer	Marks
6(a)	$R = \rho L / A$	C1
	$(R =)\ 5(.0) \times 10^{-7} \times 2(.0) / 3.3 \times 10^{-7} = 3.0\ \Omega$	A1
6(b)(i)	$I = 1.2 / 3.0$ $= 0.40$ A	A1
6(b)(ii)	$r = (1.50 - 1.20) / 0.40$ **or** $1.50 / 0.40 - 3.0$	C1
	$= 0.75\ \Omega$	A1
6(c)	$E / 1.20 = 1.4 / 2.0$	C1
	$E = 0.84$ V	A1
	or	
	$R_{XP} = (1.4 / 2.0) \times 3.0\ (= 2.1\ \Omega)$ $E = 2.1 \times 0.40$	(C1)
	$E = 0.84$ V	(A1)
6(d)	(second wire has) larger resistance/resistance increases	M1
	p.d. across XY is larger/increases (for second wire) **or** p.d. across the (second) wire is larger/increases	M1
	(so) length XP (for second wire) is shorter	A1