Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/21**

Paper 2 AS Level Structured Questions **May/June 2022**

MARK SCHEME

Maximum Mark: 60

Published

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[Turn over

Question	Answer	Marks
1(a)	change in displacement / time (taken)	**B1**
1(b)(i)	(displacement =) area under graph	**C1**
	(at t = 4.0 s) v = (–) 2.4	**C1**
	height = ½ × 2.5 × 4.0 – ½ × 1.5 × 2.4 = 3.2 m	**A1**
1(b)(ii)	change in momentum = 7.5 (–4.0 – 2.4)	**C1**
	= (–) 48 N s	**A1**
1(b)(iii)	$W = \Delta p / (\Delta)t$ **or** $\Delta mv / (\Delta)t$	**C1**
	= 48 / 4.0 = 12 N	**A1**
	or	
	$W = ma$ **or** mg **or** $m(v – u) / t$	**(C1)**
	= 7.5 × 1.6 **or** 7.5 × (4 + 2.4) / 4.0 = 12 N	**(A1)**
1(c)	speed/velocity decreases so viscous force decreases	**B1**
	viscous force decreases (and weight constant) so resultant force decreases	**B1**

Question	Answer	Marks
2(a)	point where (all) the weight (of the object) is taken to act	**B1**
2(b)(i)	moments about P are: ($F \times 1.10$), (44.0×0.60) and (3.0×2.90) *1 mark for any one correct moment and 2 marks for two correct moments*	**C2**
	$(F \times 1.10) = (44.0 \times 0.60) + (3.0 \times 2.90)$ $F = 32$ N	**A1**
2(b)(ii)	force = 32 + 44 + 3 = 79 N	**A1**
2(c)(i)	$(F = \rho g V)$ $V = 2.5 / (1100 \times 9.81)$ $(= 2.32 \times 10^{-4})$	**C1**
	$V = (4 / 3)\pi r^3$	**C1**
	$r = [(3 \times 2.32 \times 10^{-4}) / 4\pi]^{1/3}$ $r = 0.038$ m	**A1**
2(c)(ii)	resultant moment = 2.5×2.9 = 7.3 N m **or** resultant moment = $F \times 1.1 - (44 \times 0.6 + 0.5 \times 2.9)$ = 7.3 N m (allow 7.2 N m or 7.4 N m from rounded values of F)	**A1**
	direction: anticlockwise	**A1**

Question	Answer	Marks
3(a)(i)	work (done) / time (taken)	**B1**
3(a)(ii)	$W = Fx$ **or** $E = Fx$	**B1**
	$(P =)\ Fx / t = Fv$ **or** $P = Fvt / t = Fv$	**B1**
3(b)(i)	$T = 430 \sin 11°$ **or** $430 \cos 79°$	**C1**
	$= 82$ N	**A1**
3(b)(ii)	speed $= 56 / 82$ $= 0.68$ m s^{-1}	**A1**
3(b)(iii)	no change in kinetic energy (of block)	**B1**
3(b)(iv)	(input power) $= 56 / 0.80$ $(= 70$ W)	**C1**
	time taken $= 1.2 \times 10^3 / 70$ $= 17$ s	**A1**
	or	
	(useful energy) $= 1200 \times 80 / 100$ $(= 960$ J)	**(C1)**
	time taken $= 960 / 56$ $= 17$ s	**(A1)**

Question	Answer	Marks
4(a)	$k = F / \Delta L$ **or** F / x **or** gradient	**C1**
	= e.g. 30 / (0.60 – 0.20) = 75 N m^{-1}	**A1**
4(b)	$E = \frac{1}{2}F\Delta L$ **or** $\frac{1}{2}Fx$ **or** $\frac{1}{2}k(\Delta L)^2$ **or** $\frac{1}{2}kx^2$ **or** area under graph	**C1**
	$= \frac{1}{2} \times 15 \times 0.20$ **or** $\frac{1}{2} \times 75 \times 0.20^2$	**C1**
	= 1.5 J	**A1**

Question	Answer	Marks
5(a)	wave(s) (travel along string and) reflect at fixed point / A / B / end	**B1**
	incident and reflected waves superpose / interfere **or** two waves travelling / with speed in opposite directions superpose / interfere	**B1**
5(b)	line has an approximate sinusoidal shape with maximum downward displacement at P and zero displacement at each node	**B1**
5(c)	$v = \lambda / T$ **or** $v = f\lambda$ **and** $f = 1 / T$	**C1**
	λ $= 35 \times 0.040$ **or** $35 / 25$ ($= 1.4$ m)	**C1**
	distance $= 1.4 \times 2.5$ $= 3.5$ m	**A1**
5(d)	(number of periods / cycles) ($= t / T$) $= 0.060 / 0.040$ ($= 1.5$)	**C1**
	amplitude $= 72 / 6$ $= 12$ mm	**A1**

Question	Answer	Marks
6(a)	sum of current(s) into junction = sum of current(s) out of junction **or** (algebraic) sum of current(s) at a junction is zero	**B1**
6(b)(i)	same potential difference (across X and Y as in parallel)	**B1**
	power = V^2 / R (and $R_X > R_Y$) **or** power = VI **and** $I_X < I_Y$	**M1**
	(so) Y (dissipates more power)	**A1**
6(b)(ii)	$R = \rho L / A$ (and $R_X > R_Y$)	**M1**
	(so) Y (has the larger (cross-sectional) area)	**A1**
6(c)(i)	current = 5.4 / 1800 $= 3.0 \times 10^{-3}$ A	**A1**
6(c)(ii)	5.4 / 9.0 = 1800 / (1800 + R_L) **or** $R_L = (9.0 – 5.4) / 3.0 \times 10^{-3}$	**C1**
	R_L = 1200 Ω	**A1**
6(c)(iii)	resistance of LDR / R_L decreases	**B1**
	current (in the circuit) increases (so) voltmeter reading increases	**B1**

Question	Answer	Marks
7(a)(i)	change in A = 0	**A1**
	change in Z = (+)1	**A1**
7(a)(ii)	(electron) antineutrino	**B1**
7(b)(i)	up / u (charge) = $(+)\frac{2}{3}e$ **or** antidown / $\bar{d}$ = $(+)\frac{1}{3}e$ **or** (q)= $\frac{2}{3}e+\frac{1}{3}e$	**M1**
	q = (+)1e	**A1**
7(b)(ii)	hadron(s)	**B1**
	meson(s)	**B1**