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PHYSICS **9702/22**

Paper 2 AS Level Structured Questions **May/June 2024**

MARK SCHEME

Maximum Mark: 60

Published

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 [Turn over

Question	Answer	Marks
1(a)	charge underlined (and no others)	**B1**
1(b)(i)	$I = P / A$	**C1**
	$= 750 / (1300 \times 10^{-3})^2$	**C1**
	$= 440\ \text{W m}^{-2}$	**A1**
1(b)(ii)	percentage uncertainty $= 3 + 2 \times (5 / 1300) \times 100$	**C1**
	$= 3 + 2 \times 0.38$ $= (\pm)\ 4\%$	**A1**
1(b)(iii)	efficiency = useful output power / total input power $= (160 / 750) \times 100$ $= 21\%$	**A1**
1(b)(iv)	area (of the new panel) is less	**B1**
	input power (of the new panel) is less (than the input power of the original panel) (as intensity is constant)	**B1**
	(useful power output is unchanged so) efficiency is greater (than the original panel)	**B1**

Question	Answer	Marks
2(a)(i)	39 m s^{-1}	**A1**
2(a)(ii)	tangent line to curve drawn on Fig. 2.1	**C1**
	a = gradient of tangent line = $\Delta v / \Delta t$ e.g. = (44 – 26) / (18 – 0) 0.9 ⩽ a ⩽ 1.1 m s^{-2}	**A1**
2(b)	$(\Sigma)F$ = 68 × 9.81 – 1800 (= –1133 N)	**C1**
	a = $(\Sigma)F / m$ = – 1133 / 68 = (–)17 m s^{-2}	**A1**
	upwards	**B1**
2c(i)	drag force decreases (as speed decreases)	**B1**
	(as speed decreases) resultant force decreases so (magnitude of) acceleration decreases (to zero)	**B1**
2(c)(ii)	$(\Delta)p$ = $m\Delta v$ **or** $(\Delta)p = m(v – u)$	**C1**
	= 68 × (5.7 – 39) = (–)2300 N s	**A1**

Question	Answer	Marks
3(a)	$Q = It$	C1
	$= 3.3 \times 10^4 \times 2.6 \times 10^{-5}$ $= 0.86\,\text{C}$	A1
3(b)	$P = IV$ **or** $P = VQ / t$ **or** $V = IR$ **and** $P = V^2/R$ **or** $P = I^2R$	C1
	$P = 3.3 \times 10^4 \times 3.0 \times 10^7$ **or** $P = (3.0 \times 10^7 \times 0.86) / (2.6 \times 10^{-5})$ **or** $P = (3.0 \times 10^7)^2 / 910$ **or** $P = (3.3 \times 10^4)^2 \times 910$ $P = 9.9 \times 10^{11}$ (W) $= 990$ GW	A1
3(c)(i)	$R = \rho L / A$	C1
	$9.6 = 1.7 \times 10^{-8} \times 95 / \pi r^2$	C1
	$r = 2.3 \times 10^{-4}$ m	A1
3(c)(ii)	(resistance) decreases by a factor of four	A1

Question	Answer	Marks
3(d)	$E = \sigma / \varepsilon$	**C1**
	$x = \sigma L / E$ $= 1.9 \times 10^6 \times 0.12 / (1.3 \times 10^{11})$	**C1**
	$= 1.8 \times 10^{-6}$ m	**A1**

Question	Answer	Marks
4(a)	$E = ½kx^2$ **or** $E = ½Fx$ **and** $F = kx$	**C1**
	$E = ½ \times 29 \times (8.0 \times 10^{-2})^2$ **or** $E = ½ \times 2.32 \times 8.0 \times 10^{-2}$ $E = 9.3 \times 10^{-2}$ J	**A1**
4(b)(i)	$(\Delta)E_{(P)} = mg(\Delta)h$	**C1**
	$= 4.5 \times 10^{-2} \times 9.81 \times 8.0 \times 10^{-2} \sin 15°$	**C1**
	$= 9.1 \times 10^{-3}$ J	**A1**
4(b)(ii)	$E_{(K)} = ½mv^2$	**C1**
	$(9.3 \times 10^{-2} – 9.1 \times 10^{-3}) = ½ \times 4.5 \times 10^{-2} \times v^2$	**C1**
	$v = (2 \times 8.4 \times 10^{-2} / 4.5 \times 10^{-2})^{0.5}$ $= 1.9\,\text{m s}^{-1}$	**A1**
4(c)(i)	$1.7 \times 2.0\ (\times 10^{-2})$ **or** $4.5 \times 10^{-2} \times 9.81 \times d$	**C1**
	$1.7 \times 2.0 \times 10^{-2} = 4.5 \times 10^{-2} \times 9.81 \times d$ $d = 7.7 \times 10^{-2}$ m	**A1**
4(c)(ii)	clockwise	**B1**

Question	Answer	Marks
5(a)	sum of electromotive force(s) = sum of potential difference(s) around a (closed) loop.	**B1**
5(b)(i)	$R = V / I$	**C1**
	$= (9.0 - 4.0) / 1.1 \times 10^{-2}$ $= 450\,\Omega$	**A1**
5(b)(ii)	resistance (of thermistor) = 25 (Ω) (from graph)	**C1**
	$V = E \times R_Y / (R_Y + R_X)$ $= 9 \times 25 / (25 + 450)$ **or** $I = E / R_{Total} = 9 / (25 + 450) = 1.89 \times 10^{-2}$ A $V = IR = 1.89 \times 10^{-2} \times 25$ **or** $V_{(X)} = 9 \times 450 / (25 + 450) = 8.53$ V $V = 9 - 8.53$	**C1**
	$V = 0.47$ V	**A1**
5(b)(iii)	(resistance of X increases so) the <u>total</u> resistance increases	**B1**
	current decreases	**B1**
	potential difference (across thermistor / Y) decreases	**B1**

Question	Answer	Marks
6(a)	$n\lambda = d\sin\theta$	**C1**
	$n = (3.8 \times 10^{-6} \times \sin 90°) / (520 \times 10^{-9})$ $(= 7.3)$	**C1**
	number of bright fringes formed = 15 (given as an integer)	**A1**
6(b)(i)	(frequency of red light is) less (than frequency of original light)	**B1**
6(b)(ii)	(red light has) longer wavelength	**M1**
	(so) number (of bright fringes formed) is less / fewer (bright fringes are formed)	**A1**

Question	Answer	Marks
7(a)	meson(s) **or** hadron(s)	**B1**
7(b)	Q: anti-up **or** anti-charm **or** anti-top	**B1**
	R: up **or** charm **or** top	**B1**