Question	Answer	Marks
2(a)(i)	$E = \sigma / \varepsilon$ **or** $E = F / A\varepsilon$	**C1**
	$A = 1.4 \times 10^4 / (2.2 \times 10^{11} \times 0.0012)$ $= 5.3 \times 10^{-5}\ m^2$	**A1**
2(a)(ii)	$(\Delta)h = 0.64 \times 0.49$ (= 0.3136)	**C1**
	$(\Delta)E = mg(\Delta)h$ **or** $W(\Delta)h$	**C1**
	$= 1.4 \times 10^4 \times 0.64 \times 0.49$ $= 4.4 \times 10^3$ J	**A1**
2(b)	$P = Fv$ **or** W / t	**C1**
	$= (1.4 \times 10^4 \times 0.64) / 0.56$ **or** $(4.4 \times 10^3 / 0.49) / 0.56$	**C1**
	$= 1.6 \times 10^4$ W	**A1**
2(c)	$m = 1.4 \times 10^4 / 9.81$ (= 1427 kg)	**C1**
	(resultant) $F = (1.4 \times 10^4 / 9.81) \times 1.3$ (= 1855 N)	**C1**
	$T = 1.4 \times 10^4 - 1855$ **or** $(1.4 \times 10^4 / 9.81) \times (9.81 - 1.3)$ $= 1.2 \times 10^4$ N	**A1**
2(d)	upward sloping straight line from (t_X, 0) to t_Y	**B1**
	from t_Y to t_Z: an upward sloping curve with decreasing magnitude of gradient (that is horizontal at t_Z)	**B1**

Question	Answer	Marks
3(a)	resultant force (in any direction) is zero	**B1**
	resultant moment/torque (about any point) is zero	**B1**
3(b)	(component =) 17sin50° = 13 (N) **or** 17cos40° = 13 (N)	**A1**
3(c)	($W \times 0.25$) **or** (12×0.35) **or** (13×0.50)	**C1**
	($W \times 0.25$) + (12×0.35) = (13×0.50) $W = 9.2$ N	**A1**
3(d)	$F = 9.2 + 12 - 13$ $= 8$ N	**A1**
3(e)	decrease	**B1**

Question	Answer	Marks
4(a)	$E = \frac{1}{2}mv^2$	**C1**
	$p = mv$	**C1**
	$m = 0.37^2 / (2 \times 0.30)$ **or** $0.37 / 1.6$ **or** $(0.30 \times 2) / 1.6^2$ $= 0.23$ kg	**A1**
4(b)	$0.37 - 0.65 = -0.13 - p$ $p = 0.15$ kg m s^{-1}	**A1**
4(c)	$7.7 = (0.13 + 0.37) / (\Delta)t$ **or** $7.7 = (0.65 - 0.15) / (\Delta)t$	**C1**
	time = 0.065 s	**A1**

Question	Answer	Marks
5(a)(i)	period or $T = 1 / 5000$ ($= 2 \times 10^{-4}$ s)	**C1**
	time-base setting = $1.5 \times 2 \times 10^{-4} / 6.0$ **or** $2 \times 10^{-4} / 4.0$ $= 5 \times 10^{-5}$ s cm^{-1}	**A1**
5(a)(ii)	new trace drawn with same period as original trace	**B1**
	new trace drawn with amplitude greater than 1.0 cm	**M1**
	new trace drawn with amplitude of 1.7 cm	**A1**
5(b)(i)	path difference (from slits to P) is zero **or** phase difference (between waves at P) is zero (so constructive interference)	**B1**
5(b)(ii)	$\lambda = ax / D$	**C1**
	$D = (3.6 \times 10^{-4} \times 4.0 \times 10^{-3}) / 630 \times 10^{-9}$	**C1**
	$= 2.3$ m	**A1**
5(c)	upward sloping straight line starting from a non-zero value of x at $\lambda = 400$ nm	**B1**

Question	Answer	Marks
6(a)	energy (transferred from electrical to other forms) per unit charge	**B1**
6(b)(i)	(resistance is) infinite / very high	**B1**
6(b)(ii)	(resistance) decreases (as V increases)	**B1**
6(c)(i)	current = 2.7 – 1.5 = 1.2 A	**A1**
6(c)(ii)	12 = (1.5 × 5.0) + (1.5 × R) **or** R = (12 / 1.5) – 5.0	**C1**
	R = 3.0 Ω	**A1**
6(c)(iii)	$V_{(XZ)}$ = (1.6 / 2.0) × 12 (= 9.6 V)	**C1**
	$V_{(XW)}$ = 1.5 × 5.0 (= 7.5 V)	**C1**
	potential difference = 9.6 – 7.5 = 2.1 V	**A1**
	or	
	$V_{(ZY)}$ = (0.4 / 2.0) × 12 (= 2.4 V)	**(C1)**
	$V_{(WY)}$ = 1.5 × 3.0 (= 4.5 V)	**(C1)**
	potential difference = 4.5 – 2.4 = 2.1 V	**(A1)**

Question	Answer	Marks
6(c)(iv)	current in (fixed / variable) resistor decreases	**B1**
	current in (resistance) wire is unchanged	**B1**
	(so) current in battery decreases, (same e.m.f. so) power decreases	**B1**

Question	Answer	Marks
7(a)(i)	X has same number of protons as Y (and so) charge of X is the same as the charge of Y	**B1**
7(a)(ii)	X has (one) more proton (than Z)	**M1**
	(so) X has greater charge (than Z)	**A1**
7(b)(i)	meson(s)	**B1**
7(b)(ii)	one quark and one antiquark	**B1**