Question	Answer	Marks
2(a)	$v^2 = u^2 + 2as$ $u^2 = 8.7^2 - (2 \times 9.81 \times 1.5)$	**C1**
	$u = 6.8\ \text{m s}^{-1}$	**A1**
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 =) 0.059×8.7 **or** 0.059×5.4	**C1**
	change in momentum = 0.059 (8.7 + 5.4) = 0.83 N s	**A1**
2(c)(ii)	resultant force = 0.83 / 0.091 **or** 0.059 [(8.7 + 5.4) / 0.091] = 9.1 N	**A1**
2(c)(iii)	(W =) 0.059×9.81	**C1**
	(W =) 0.58 (N) force = 9.1 + 0.58 = 9.7 N	**A1**
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**
	$= 330 \times (4.0 - 1.1)$ $= 960$ J	**A1**
3(b)	(work =) 960 – 540 (= 420 J)	**C1**
	distance moved = (960 – 540) / 52 = 8.1 m	**A1**
3(c)(i)	$E = ½mv^2$	**C1**
	$540 = ½ \times (330 / 9.81) \times v^2$ $v = 5.7$ m s^{-1}	**A1**
3(c)(ii)	speed = horizontal component of velocity $= 5.7 \times \cos 41°$	**C1**
	$= 4.3$ m s^{-1}	**A1**

Question	Answer	Marks
4(a)	time for one oscillation/vibration/cycle **or** time between adjacent wavefronts (passing the same point) **or** shortest 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**
	$= 1.33 \times 10^{-10}$ (s) $= 1.33 \times 10^{-10} / 10^{-12}$ (ps) = 130 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**
	$(A = V / L)$ (so) $R = \rho L^2 / V$ (with ρ and V constant so $R \propto L^2$)	**B1**
5(c)(i)	$E = 2.4$ 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 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**