Question	Answer	Mark
2(a)	force × displacement in the direction of the force	**B1**
2(b)(i)	$E = \frac{1}{2}mv^2$	**C1**
	(m =) $23 \times 2 / 16^2 = 0.18$ (kg)	**A1**
2(b)(ii)	$(\Delta)E = mg(\Delta)h$ $60 = 0.18 \times 9.81 \times h$	**C1**
	$h = 34$ m	**A1**
2(b)(iii)	(work done =) 60 – 23 = 37 (J)	**C1**
	average resistive force = 37 / 34 = 1.1 N	**A1**
2(c)	air resistance (acting on ball) increases	**B1**
	resultant force (on ball) decreases or weight constant and air resistance increases	**B1**
	acceleration decreases	**B1**

Question	Answer	Mark
3(a)	Hooke's (law)	**B1**
3(b)(i)	$k = F / x$ or k = gradient e.g. $k = 7.0 / 5.0 \times 10^{-2}$	**C1**
	$= 140\ \text{N m}^{-1}$	**A1**
3(b)(ii)	$E = ½\ F\ x$ or $E = ½\ k\ x^2$ or E = area under graph $= ½ \times 5.6 \times 4.0 \times 10^{-2}$ or $½ \times 140 \times (4.0 \times 10^{-2})^2$	**C1**
	$= 0.11$ J	**A1**
3(c)(i)	(upthrust =) $6.20 – 5.60 = 0.60$ (N)	**A1**
3(c)(ii)	$\Delta p = \Delta F / A$ $= 0.60 / 1.2 \times 10^{-3}$	**C1**
	$= 500$ Pa	**A1**
3(c)(iii)	$(\Delta)p = \rho g(\Delta)h$ $\rho = 500 / (9.81 \times 5.8 \times 10^{-2})$	**C1**
	$= 880\ \text{kg m}^{-3}$	**A1**
3(d)(i)	(upthrust) increases	**B1**
3(d)(ii)	(extension) decreases	**B1**

Question	Answer	Mark
4(a)	(two or more) waves meet (at a point)	**B1**
	(resultant) displacement is the sum of the individual displacements	**B1**
4(b)(i)	it is a (wave) reflector / it reflects (the wave)	**B1**
4(b)(ii)	$v = f\lambda$ or $c = f\lambda$	**C1**
	$f = 3.0 \times 10^8 / 0.040$ $= 7.5 \times 10^9$ (Hz) $= 7.5 \times 10^9 / 10^9$ (GHz)	**C1**
	= 7.5 GHz	**A1**
4(b)(iii)	1 distance = 0.020 m	**A1**
	2 number = 5	**A1**

Question	Answer	Mark
5(a)	$f_o = f_s\, v / (v + v_s)$ $f_o = 951 \times 330 / (330 + 12)$	**C1**
	= 918 Hz	**A1**
5(b)	$t = d / 12$ $= (\pi \times 2.4) / 12$	**C1**
	= 0.63 s	**A1**

Question	Answer	Mark
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)	$I = 3.6 - 2.1$ $= 1.5$	**C1**
	$V = 4.4$	**C1**
	$R = 4.4 / 1.5$ $= 2.9\ \Omega$	**A1**
6(b)(ii)	$12.0 = 4.4 + 3.6r$ or $12.0 = 3.6\ (1.2 + r)$	**C1**
	$r = 2.1\ \Omega$	**A1**
6(b)(iii)	$t = (470 \times 10^3 - 240 \times 10^3) / (12 \times 3.6)$	**C1**
	$= 5300$ s	**A1**
6(b)(iv)	$I = Anvq$ ratio $= (360A / A) \times (2.5n / n)$ or 360×2.5	**C1**
	$= 900$	**A1**

Question	Answer	Mark
7(a)(i)	most of the atom is empty space *or* the nucleus (volume) is very small compared to the atom	**B1**
7(a)(ii)	the nucleus is charged	**B1**
	the mass is concentrated in nucleus / small region / small volume / small core *or* the majority of the mass is in nucleus / small region / small volume / small core	**B1**
7(b)(i)	proton number = 84	**A1**
	nucleon number = 214	**A1**
7(b)(ii)	up down down changes to up up down / udd → uud *or* down changes to up / d → u	**B1**