Question	Answer	Marks
8(a)	• force per unit length • force per unit current • length/current perpendicular to field *1 mark for any two points, 2 marks for all three points*	**B2**
8(b)	change in potential energy = change in kinetic energy **or** $qV = ½mv^2$	**B1**
	$v = \sqrt{(2qV / m)}$	**A1**
8(c)(i)	magnetic force = centripetal force **or** $Bqv = mv^2 / r$	**M1**
	clear substitution of expression for v and correct algebra leading to $q / m = 2V / B^2r^2$	**A1**
8(c)(ii)	$q / m = (2 \times 230) / [(0.38 \times 10^{-3})^2 \times 0.14^2]$	**C1**
	$= 1.6 \times 10^{11}$ C kg^{-1}	**A1**
8(c)(iii)	(for α-particle,) q / m is (much) smaller	**B1**
	r would be <u>much</u> larger	**B1**

Question	Answer	Marks
9(a)	(particle is) stationary/not moving	**B1**
	(particle is) moving parallel to the (magnetic) field	**B1**
9(b)	magnetic field around each coil is circular **or** each coil is normal to magnetic field due to adjacent coils	**B1**
	current in coil interacts with (magnetic) field to exert force (on coil)	**B1**
	force is normal to both coil and magnetic field **or** force parallel to axis (of coil)	**B1**
	forces between coils are attractive so spring contracts	**B1**
9(c)	(oscillating) coils cut magnetic flux **or** as separation of coils changes, magnetic flux changes	**B1**
	cutting flux causes induced e.m.f. in coils	**B1**
	changing (induced) e.m.f. causes changing current (in coil)	**B1**

Question	Answer	Marks
10(a)	the steady current **or** the direct current	**M1**
	that produces the same heating effect (as the alternating current)	**A1**
10(b)(i)	peak current = 2.6 A **and** r.m.s. current = 1.8 A	**A1**
10(b)(ii)	peak current = 2.0 A **and** r.m.s. current = 2.0 A	**A1**
10(c)(i)	$k = 2\pi f$	**C1**
	$= 2\pi \times 50$ $= 310 \text{ rad s}^{-1}$	**A1**
10(c)(ii)	power = V_{RMS}^2 / R **or** power = $V_0^2 / 2R$	**C1**
	$R = (240 / \sqrt{2})^2 / 3200$ **or** $R = 240^2 / (2 \times 3200)$ $R = 9.0\ \Omega$	**A1**

Question	Answer	Marks
11(a)	to produce a 3-dimensional image of structure/body	**B1**
11(b)	X-rays (are used)	**B1**
	scanning in sections	**B1**
	scanning from many angles	**B1**
	image of each section is 2-dimensional	**B1**
	scanning repeated for many sections **or** images of many sections combined together	**B1**

Question	Answer	Marks
12(a)	quantum of energy	**M1**
	of electromagnetic radiation	**A1**
12(b)(i)	energy = hc / λ **or** energy = hf **and** $f = c / \lambda$	**C1**
	$0.57 \times 10^{6} \times 1.60 \times 10^{-19} = (6.63 \times 10^{-34} \times 3.00 \times 10^{8}) / \lambda$ $\lambda = 2.2 \times 10^{-12}$ m	**A1**

Question	Answer	Marks
12(b)(ii)	$p = h / \lambda$	**C1**
	$= (6.63 \times 10^{-34}) / (2.2 \times 10^{-12})$ $= 3.0 \times 10^{-22}$ N s	**A1**
	or	
	$p = E / c$	**(C1)**
	$= (0.57 \times 10^{6} \times 1.60 \times 10^{-19}) / (3.00 \times 10^{8})$ $= 3.0 \times 10^{-22}$ N s	**(A1)**
12(c)(i)	mass (of Sm-157 nucleus) $= 157 \times 1.66 \times 10^{-27}$ **or** mass (of Sm-157 nucleus) $= 0.157 / (6.02 \times 10^{23})$	**C1**
	recoil speed $= (3.00 \times 10^{-22}) / (157 \times 1.66 \times 10^{-27})$ $= 1.2 \times 10^{3}$ m s^{-1}	**A1**
12(c)(ii)	$(1.2 \times) 10^{3}$ m s^{-1} is <u>much</u> less than $(3.0 \times) 10^{8}$ m s^{-1}	**B1**