Marking Scheme

#1

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
9	(a)		Conversion $4.32 \times 10^6 \times 1.6 \times 10^{-19}$ i.e. 6.912×10^{-13} [J] (1) Rearrangement for v i.e. $v = \sqrt{\frac{2E}{m}}$ (1) Answer = 1.44×10^7 m s^{-1} (1)		3		3	2	
	(b)		24 total energy 'kicks' (or 2 per revolution) (1) 4.32 MeV divided by 24 (=180 000) (1) Also need to divide by 2e, Answer = 90 000 V (1) (2 marks for 180 kV, 1 mark for 360 kV, 2.16 MV →1 mark)		3		3	2	
	(c)		Equating: $m\omega^2 r = Bqv$ (1) or $\omega = \frac{Bq}{m}$ Rearrangement: $f = \frac{Bq}{2\pi m}$ (1) By implication can give 2 marks for this Answer = 3.6 MHz (ecf on part (b) i.e. using 1e instead of 2e 1.8 MHz) (1)		3		3	2	
			Question 9 total	**0**	**9**	**0**	**9**	**6**	**0**

#2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
9	(a)		Force on charge carriers/electrons in mag field [1] [Force right] so left face becomes +ve [1] Electric field/voltage linked to charge movement [1] Electric force balances magnetic force / $V_H \propto B$ also constant I [1]	4			4		
	(b)		Correct application/substitution into equation $I = nAve$ [1] Answer = 0.204 [m s^{-1}] [1]		2		2	2	
	(c)		$eE = Bev$ used or equivalent e.g. $V = Bvd$ or $V = \frac{BI}{nte}$ [1] Correct comparison to get k e.g. $k = vd$ or $\frac{I}{nte}$ etc. [1] Correct answer = 6.13×10^{-4} V T^{-1} or m^2 s^{-1} or A m^2 C^{-1} unit mark, ecf on v [1]		3		3	3	
			Question 9 total	**4**	**5**	**0**	**9**	**5**	**0**

#3

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
(a)	Method for obtaining N e.g. $\frac{4\,000}{0.25 \times 10^{-3}}$ (1) Use of πd or $2\pi r$ (1) 1 508 m or $16\,000 \times \pi \times 0.03$ seen or equivalent (1)	1	1 1		3	3	
(b)	$R = \frac{\rho l}{A}$ used and $I = \frac{V}{R}$ used (1) 0.25 mm used as diameter for area or (0.125 mm as radius) (1) 24.6 mA seen or $\frac{12}{488}$ or $\frac{12}{486}$ seen or equivalent evidence (1)	1	1 1		3	3	
(c)	$n = \frac{N}{\text{length}}$ (1) Answer = 1.23×10^{-4} [T] (1) Award 1 mark only for answer of 3.35×10^{-7} [T]	1	1		2	2	
(d)	$B = \mu_0 nI$ used to calculate I **ecf** (1) Correct conclusion stated and consistent with calculation (1) Wires would melt / damaged / burnt / become hot / use superconductor / use cooling (1)			3	3	1	
	Question total	**3**	**5**	**3**	**11**	**9**	**0**

#4

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(a)	(i)	Answer = 57.3 m[T]	1			1	1	
		(ii)	Shape correct (minimum 3 lines) (1) Direction correct (no contradicting arrows) (1)	2			2		
		(iii)	Iron core	1			1		
	(b)	(i)	Change in flux (1) Complete circuit **OR** low resistance (1) Large rate of change of flux **OR** large flux & small t (1)		3		3		
		(ii)	Use FRHR **OR** use FLHR on electrons **OR** RH grip (1) on bottom part **OR** in bottom part **OR** induced field opposes (1)	1	1		2		
		(iii)	Faraday's law used e.g. 2.18 V **OR** $\frac{BA}{t}$ seen (1) $I = \frac{V}{R}$ used (1) Answer = 323 [A] (1)	1 1	 1		3	2	
		(iv)	Use of $F = BIL$ **ecf** (1) Answer = 205 [N] (1) Opposes motion (1)			3	3	2	
			Question total	**7**	**5**	**3**	**15**	**5**	**0**