Question Number	Answer		Mark
2	(QWC- Work must be clear and organised in a logical manner using technical wording where appropriate **Max 4** Uniform electric field (between plates) **(1)** Force due to E **or** idea of attraction/repulsion **(1)** (Ball has an) acceleration (**not** an increasing velocity) **(1)** Which is constant/uniform (can be with reference to increasing velocity) **(1)** Vertical line/ + and – values shows change in direction **(1)** Inelastic collision/less energy after impact **(1)**		**4**
	Total for question		**4**

Question Number	Answer	Mark
3	Use of *W=mg* **(1)** Use of *F=BIL* **(1)** B = 0.04 T **(1)**	
	Total for question	**3**

Question Number	Answer		Mark
5(a)	The <u>magnetic</u> field (must be) at right angles to the current	**(1)**	
5(b)	All three units for force, length and current clearly identified (The unit of force is kg m s^{-2} **, t**he unit of current is A, the unit of length is m) T = kg A^{-1} s^{-2}	**(1)** **(1)**	**2**
5(c)	*Use* of $\rho = m/V$ Use of $mg = BIl$ B = 0.53 (T) (no u.e. as given in question for part (b)) <u>Example of calculation</u> $m = 2.7 \times 10^3$ kg $m^{-3} \times 10 \times 10^{-3}$ m $\times 10 \times 10^{-3}$ m $\times l$ $m = 0.27 \times l$ $B = (0.27 \times l \times 9.81$ m $s^{-2})/ (5$ A $\times l)$ B = 0.53 T	**(1)** **(1)** **(1)**	**3**
5(d)	(Magnetic field is) into paper/page	**(1)**	
	Total for question		**7**

Question Number	Answer		Mark
1(a)	Arrow(s) downwards	**(1)**	**1**
1(b)	Use of $E = V/d$ Use of $F = EQ$ $F = 5.1 \times 10^{-16}$ N Example of calculation $F = (160\text{ V} \times 1.6 \times 10^{-19}\text{ C})/ 5.0 \times 10^{-2}\text{ m}$ $F = 5.12 \times 10^{-16}$ N	**(1)** **(1)** **(1)**	**3**
1(c)	Between the plates there is an acceleration/force which is vertical/upwards Constant horizontal velocity Outside the plates no (electric) field /force acts **Or** Outside the plates speed so large that gravitational effect negligible	**(1)** **(1)** **(1)**	**3**
1(d)(i)	Release of (surface) electrons due to heating	**(1)**	**1**
1(d)(ii)	Use of $E_k = ½mv^2$ Use of $V = W/Q$ p.d. = 410 Example of calculation $E_k = 9.11 \times 10^{-31}\text{ kg} \times (1.2 \times 10^{7}\text{ m s}^{-1})^2/2$ $E_k = 6.56 \times 10^{-17}$ J p.d. = $(6.56 \times 10^{-17}\text{ J})/(1.6 \times 10^{-19}\text{ C})$ p.d. = 41	**(1)** **(1)** **(1)**	**3**
	Total for question		**11**

Question Number	Answer		Mark
4(a)	Use of $\Phi = BA$ Converts cm to m Or mT to T $\Phi = 1.1 \times 10^{-4}$ Wb Example of calculation $\Phi = 6.0 \times 10^{-2}$ m $\times$ 2.4×10^{-2} m $\times$ 74×10^{-3} T $\Phi = 1.07 \times 10^{-4}$ Wb	**(1)** **(1)** **(1)**	**3**
4(b)	Use of $\mathcal{E} = \Delta\Phi/\Delta t$ Use of time = distance/speed $\mathcal{E}$ = 5.3 mV (5.0 mV or 5.5 mV depending on value of Φ used, ecf value of Φ from (a)) **Or** Quotes $\mathcal{E} = Blv$ $l = 6.0 \times 10^{-2}$m used $\mathcal{E}$ = 5.3 mV Example of calculation Time = 0.024 m / 1.2 m s^{-1} t = 0.020 s $\mathcal{E} = 1.1 \times 10^{-4}$ Wb / 0.02 s = 5.5 mV	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**3**
4(c)	Use of $I = V/R$ Use of $F = BIl$ $F = 9.8 \times 10^{-5}$ N (ecf value of $\mathcal{E}$ from (b)) This force is too small to be felt. (this comment must be consistent with their value of force) Example of calculation I = 5.5 mV/ /0.25 Ω = 0.022 A $F = 74 \times 10^{-3}$ T $\times$ 0.022 A $\times$ 0.060 m $F = 9.8 \times 10^{-5}$ N	**(1)** **(1)** **(1)** **(1)**	**4**
	Total for question		**10**