Point Charges & Electric Potential

Mark Scheme 6

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Electric Fields
Sub Topic	Point Charges & Electric Potential
Paper Type	Theory
Booklet	Mark Scheme 6

Time Allowed: **50 minutes**

Score: **/41**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1	(a	(i)	force proportional to product of masses	B1	
			force inversely proportional to square of separation	B1	[2]
		(ii)	separation <u>much</u> greater than radius / diameter of Sun / planet	B1	[1]
	(b)	(i)	e.g. force or field strength $\propto 1 / r^2$		
			potential $\propto 1 / r$	B1	[1]
		(ii)	e.g. gravitational force (always) attractive	B1	
			electric force attractive or repulsive	B1	[2]
2	(a)		arrow pointing up the page	B1	[1]
	(b)	(i)	$Eq = Bqv$	C1	
			$v = (12 \times 10^3) / (930 \times 10^{-6})$	C1	
			$= 1.3 \times 10^7$ m s^{-1}	A1	[3]
		(ii)	$Bqv = mv^2 / r$	C1	
			$q/m = (1.3 \times 10^7) / (7.9 \times 10^{-2} \times 930 \times 10^{-6})$	C1	
			$= 1.8 \times 10^{11}$ C kg^{-1}	A1	[3]
3	(a		arrow labelled E pointing down the page	B1	**[1]**
	(b)	(i)	$Bqv = qE$	M1	
			forces are independent of mass and charge 'cancels'	M1	
			so no deviation	A1	**[3]**
		(ii)	magnetic force > electric force	M1	
			so deflects	M1	
			'downwards'	A1	**[3]**

4	**(a)**	$\frac{1}{2}mv^2 = qV$ ……(or some verbal explanation) ……	B1	
		$\frac{1}{2} \times 9.11 \times 10^{-31} \times v^2 = 1.6 \times 10^{-19} \times 1.2 \times 10^4$ ……	B1	
		$v = 6.49 \times 10^7$ m s^{-1} ……	A0	**[2]**
	(b)(i)	*within field:* circular arc ……	B1	
		in 'downward' direction ……	B1	
		beyond field: straight, with no 'kink' on leaving field ……	B1	**[3]**
	(ii) 1.	*v* is smaller ……	M1	
		deflection is larger ……	A1	**[2]**
	2.	(magnetic) force is larger ……	M1	
		deflection is larger ……	A1	**[2]**

5	**(a)**	e.g. E-field, force independent of speed, B-field, force ∝ speed …	B2	
		E-field, force along field direction, B-field, force normal etc …	B2	[4]
	(b) (i)	out of plane of paper {not 'upwards'} ……	B1	
	(ii)	$mv^2 / r = Bqv$ ……	C1	
		r = (1.67 x 10^{-27} x 4.5 x 106:)/(0.12 x 1.6 x 10^{-19}) ……	C1	
		r = 0.39 m ……	A1	[4]
	(c) (i)	arrow pointing up page ……	B1	
	(ii)	$Bqv = Eq$ ……	CI	
		$E = 0.12 \times 4.5 \times 10^6$		
		$= 5.4 \times 10^5$ **vm^{-1}** ……	A1	[3]
	(d)	gravitational force << Fs or FE ……	BI	[1]