

Question number	Answer	Notes	Marks
2 (a)	centre of gravity;	accept centre of mass	1
(b)	moment = force × (perpendicular) distance;	allow standard symbols and rearrangements e.g. $M = F \times d$ allow d, s, x for distance	1
(c)	substitution; rearrangement; evaluation;  e.g. $92 = F_s \times 0.84$ $F_s = 92 / 0.84$ $(F_s =) 110 \text{ (N)}$	-1 for POT error 2 marks max. if incorrect distance used e.g. 0.42 m giving answer of 219 (N)  allow 109.5, 109.52...	3
(d)	idea that every force has an equal and opposite reaction;	however expressed allow "action" for force	1
(e)	same value as (c);  down;	allow ecf from (c) expected answer is 110 (N)	2

Total for Question 2 = 8 marks

Question number	Answer	Notes	Marks
4 (a) (i)	substitution; evaluation;  e.g. (GPE $\Rightarrow$ ) $1.8 \times 10 \times 0.95$ (GPE $\Rightarrow$ ) 17 (J)	allow $g = 9.8, 9.81$  allow 16.8, 16.7..., 17.1... (J)	2
(a) (ii)	idea that KE (gained) is greater than GPE (lost); idea KE gained = GPE lost + work done; e.g. $17 + 4 = 21$ OR $21 - 17 = 4$		2
(b) (i)	use of $KE = \frac{1}{2} \times \text{mass} \times \text{speed}^2$ ;  substitution; rearrangement; evaluation;  e.g. $KE = \frac{1}{2} \times m \times v^2$ $21 = 0.5 \times 1.8 \times v^2$ $v = \sqrt{(21/0.9)}$ ( $v \Rightarrow$ ) 4.8 (m/s)	allow standard symbols can be implied from working  allow 4.83, 4.83... (m/s)	4
(ii)	substitution into $F = mv - mu / t$ ; evaluation;  e.g. $F = (1.8 \times 4.8) / 0.12$ ( $F \Rightarrow$ ) 72 (N)	allow ecf from (b)(i)  allow alternative method using $a = (v - u)/t$ and $F = ma$  allow 72.5, 72.45... (N)	2

Total for Question 4 = 10 marks

Question number	Answer	Notes	Marks
7 (a)	opposite poles facing; held (very) close together;	reject if magnets described as touching	2
(b) (i)	arrow directed towards the centre of the circle in line with the position of the proton;	judge by eye  condone arrow that does not originate at the position of the proton	1
(ii)	correct diameter given to 1 significant figure = 1 mark; correct diameter given to 2 or 3 significant figures = 2 marks;;	6 (cm)  5.8-6.1 (cm)	2
(iii)	use of radius; dimensionally correct substitution into $v = 2 \times \pi \times r / T$ ; evaluation;  e.g. $r = (6.0 / 2 =) 3.0 \text{ cm}$ $v = 2 \times \pi \times 0.030 / 8.7 \times 10^{-6}$ ( $v =$ ) 22 000 (m/s)	allow ecf from (b)(ii)  -1 for POT error accept alternative method using $v = \pi \times d / T$  allow 21 000-22 000 (m/s)	3

Total for Question 7 = 8 marks

