

Question Number	Answer	Mark
17(a)(i)	<p>Use of $F = \frac{GMm}{r^2}$ (1)</p> <p>$F = 7.3 \times 10^{17} \text{ (N)}$ (1)</p> <p><u>Example of calculation</u></p> $F = \frac{6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2} \times 1.99 \times 10^{30} \text{ kg} \times 9.38 \times 10^{20} \text{ kg}}{(4.14 \times 10^{11} \text{ m})^2}$ <p>$\therefore F = 7.26 \times 10^{17} \text{ N}$</p>	2
17(a)(ii)	<p>Use of $F = m\omega^2 r$ (1)</p> <p>Use of $\omega = \frac{2\pi}{T}$ (1)</p> <p>Conversion to years (1)</p> <p>$T = 4.6 \text{ year}$ [ecf from (i)] (1)</p> <p>Or</p> <p>Use of $F = \frac{mv^2}{r}$ (1)</p> <p>Use of $v = \frac{2\pi r}{T}$ (1)</p> <p>Conversion to years (1)</p> <p>$T = 4.6 \text{ year}$ [ecf from (i)] (1)</p> <p><u>Example of calculation</u></p> $\omega = \sqrt{\frac{F}{mr}} = \sqrt{\frac{7.26 \times 10^{17} \text{ N}}{9.38 \times 10^{20} \text{ kg} \times 4.14 \times 10^{11} \text{ m}}} = 4.32 \times 10^{-8} \text{ rad s}^{-1}$ $T = \frac{2\pi}{\omega} = \frac{2\pi \text{ rad}}{4.32 \times 10^{-8} \text{ rad s}^{-1}} = 1.45 \times 10^8 \text{ s}$ $\therefore T = \frac{1.45 \times 10^8 \text{ s}}{3.15 \times 10^7 \text{ s year}^{-1}} = 4.61 \text{ year}$	4

17(b)	<p>Use of $g = \frac{GM}{r^2}$ to calculate g for Ceres (1)</p> <p>Ratio of field strengths calculated Or 5% of g for Mercury calculated (1)</p> <p>g_c is 7.7% of g_m so claim is inaccurate Or $g_c = 0.283 \text{ N kg}^{-1}$ and 5% of $g_m = 0.185 \text{ N kg}^{-1}$, so claim is inaccurate (1)</p> <p><u>Example of calculation</u></p> $g_c = \frac{6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2} \times 9.38 \times 10^{20} \text{ kg}}{(4.7 \times 10^5 \text{ m})^2} = 0.283 \text{ N kg}^{-1}$ $\therefore \frac{g_c}{g_m} = \frac{0.283 \text{ N kg}^{-1}}{3.7 \text{ N kg}^{-1}} = 0.0765$	3
	Total for question 17	9