Question Number	Answer		Mark
18(a)	Use of $T^2 = KR^3$	(1)	
	K for Earth = 2.96×10^{-19} (s^2 m^{-3})	(1)	
	K for Mars = 2.97×10^{-1} (s^2 m^{-3})	(1)	**3**
	Example of calculation		
	$K = \frac{T^2}{R^3} = \frac{(3.16 \text{ x } 10^7 \text{s})^2}{(1.50 \text{ x } 10^{11} \text{ m})^3} = 2.959 \times 10^{-19} \text{ s}^2 \text{ m}^{-3}$		
	$K = \frac{T^2}{R^3} = \frac{(5.93 \text{ x } 10^7 \text{s})^2}{(2.28 \text{ x } 10^{11} \text{ m})^3} = 2.967 \times 10^{-19} \text{ s}^2 \text{ m}^{-3}$		
18(b)	**Either**		
	Use of $F = \frac{GMm}{r^2}$ with $F = \frac{mv^2}{r}$	(1)	
	Re-arrangement with $v = \frac{2\pi r}{T}$ to identify K as $\frac{(2\pi)^2}{GM}$	(1)	
	$K = 2.97 \times 10^{-19}$ (s^2 m^{-3})	(1)	
	Or		
	Use of $F = \frac{GMm}{r^2}$ with $F = m\omega^2 r$	(1)	
	Re-arrangement with $\omega = \frac{2\pi}{T}$ to identify K as $\frac{(2\pi)^2}{GM}$	(1)	
	$K = 2.97 \times 10^{-19}$ (s^2 m^{-3})	(1)	**3**
	Example of calculation		
	$\frac{GMm}{r^2} = m\omega^2 r$		
	$\frac{GM}{r^2} = \left(\frac{2\pi}{T}\right)^2 r$		
	$T^2 = \frac{(2\pi)^2}{GM} r^3$		
	$K = \left(\frac{4\pi^2}{6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2} \times 1.99 \times 10^{30} \text{ kg}}\right) = 2.97 \times 10^{-1}$ $s^2 m^{-3}$		

18(c)	Use of $T^2 = KR^3$	(1)	
	$T = 43$ hours	(1)	**2**
	Example of calculation $\left(\frac{T_I}{T_G}\right)^2 = \left(\frac{R_I}{R_G}\right)^3$ $T = \sqrt{\left(\frac{4.22 \times 10^8 \text{ m}}{1.07 \times 10^9 \text{ m}}\right)^3 \times (172 \text{ hour})^2} = 42.6 \text{ hours}$		
	Total for question 18		**8**