2. Gravitation

For the sattelite to be in a circular orbit, we know:

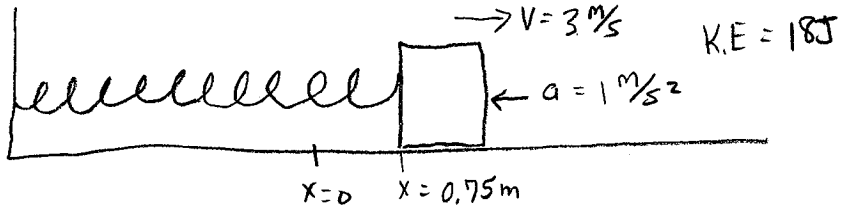
$$\Sigma F = G\frac{m_s m_E}{(R_E+h)^2} = m_s a_s = m_s\frac{v_s^2}{(R_E+h)}$$

$$\Rightarrow v_s = \sqrt{\frac{GM_E}{(R_E+h)}}$$

$$= \sqrt{\frac{6.67\times10^{-11}\frac{m^3}{kg\,s^2}\cdot 5.97\times10^{24}\,kg}{(6.37\times10^6\,m + 3.00\times10^6\,m)}}$$

$$\boxed{v_s = 6.5\times10^3\,\frac{m}{s}}$$

1) Simple Harmonic Motion



$$|F| = kx = ma \Rightarrow \frac{k}{m} = \frac{a}{x}$$

$$KE = 18\,J = \frac{1}{2}mV^2 \Rightarrow m = \frac{2 \cdot KE}{V^2} = 4\,kg$$

$$\therefore k = \frac{ma}{x} = \frac{(4\,kg)(1\,m/s^2)}{0.75\,m} = 5.33\,\frac{N}{m}$$

$$U = \frac{1}{2}kx^2 = \frac{1}{2}\left(5.33\,\frac{N}{m}\right)(0.75\,m)^2 = 1.5\,J$$

$$\therefore E_{tot} = KE + U = 18\,J + 1.5\,J = 19.5\,J = KE_{max}$$

$$= \frac{1}{2}mV_{max}^2 \Rightarrow$$

$$V_{max} = \sqrt{\frac{2\,KE_{max}}{m}} = 3.12\,\frac{m}{s}$$