

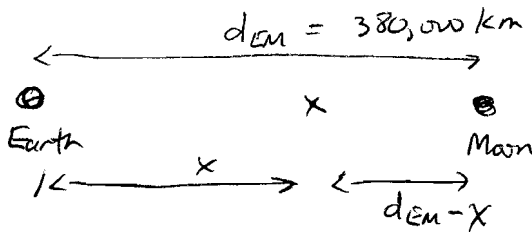
Homework - Oct 10, 2007

- ① Mass of shuttle in orbit is about 1×10^5 kg
 altitude = 380 km, radius of earth = 6370 km

$$F = \frac{GmM}{r^2} = \frac{(6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2})(1 \times 10^5 kg)(5.97 \times 10^{24} kg)}{(6370 \times 10^3 m + 380 \times 10^3 m)^2}$$

$$= 8.7 \times 10^5 N$$

②



$$F = \frac{GmM_E}{x^2} = \frac{GmM_M}{(d_{EM} - x)^2}$$

$$x^2 M_M = (d_{EM} - x)^2 M_E \Rightarrow x \sqrt{M_M} = (d_{EM} - x) \sqrt{M_E}$$

$$x = \frac{d_{EM} \sqrt{M_E}}{\sqrt{M_M} + \sqrt{M_E}} = \frac{d_{EM}}{\sqrt{\frac{M_M}{M_E}} + 1} = \frac{380,000 \text{ km}}{\sqrt{\frac{7.36 \times 10^{22}}{5.97 \times 10^{24}}} + 1} = 342,000 \text{ km}$$

③ (a) $k = \frac{F}{s} = \frac{(2.5 \text{ kg})(9.8 \text{ N/kg})}{0.142 \text{ m}} = 172 \text{ N/m}$

- (b) The force on each spring is only half as much, so each spring stretches half as much, or 0.071 m.