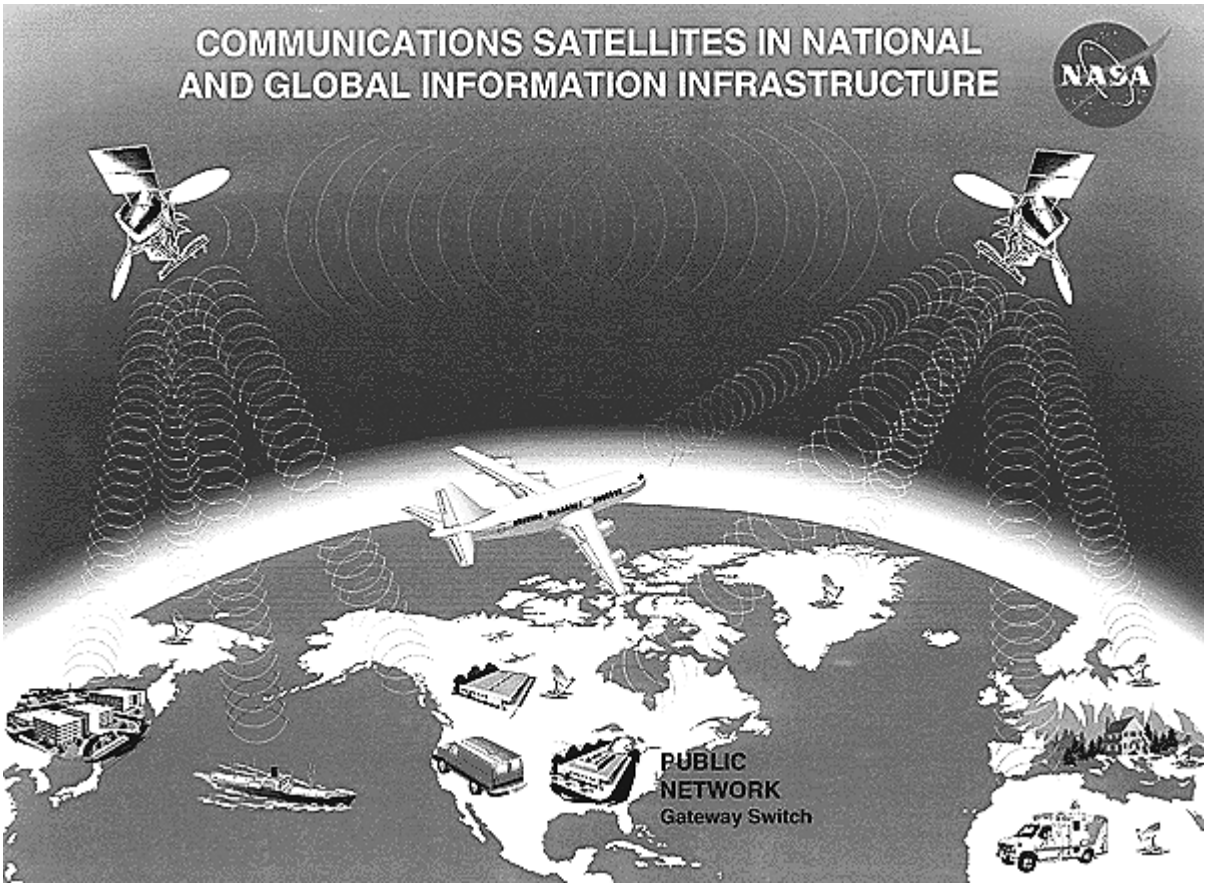
Satellites and Weightlessness



1. **A geosynchronous satellite is one that stays above the same point on the equator of the Earth. Such satellites are used for cable TV, weather forecasting and communication relay.**

Example 5-15 page 130: Determine the height above the ground for a geosynchronous satellite and its speed.

Part 1:

$$G\frac{m_{sat}m_e}{r^2} = m_{sat}\frac{v^2}{r}$$

$$G\frac{m_e}{r} = v^2$$

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$$v = 2\pi r/T$$

$$\frac{Gm_e}{r} = \frac{4\pi^2 r^2}{T^2}$$

$$\frac{Gm_e T^2}{4\pi^2} = r^3$$

$$\frac{(6.67 \times 10\text{-}11 Nm^2/kg^2)(5.98 \times 10^{24} kg)\ (86400s)^2}{4\ \pi^2}$$

$$7.54 \times 10^{22} m^3 = r^3$$

$$r = 7.54 \times 10^{22} m^3$$

$$r = 4.23 \times 10^7 m$$

Part 2:

$$v = \frac{Gme}{r}$$

$$v = \frac{(6.67 \times 10^{-11} nm^2/kg^2)(5.98 \times 10^{24} kg)}{4.23 \times 10^7 m}$$

$$3070 m/s$$

2. Weightless in an elevator, see overhead.

Case 1: w – mg =0
Case 2: w – mg = ma
Case 3: w = mg + ma