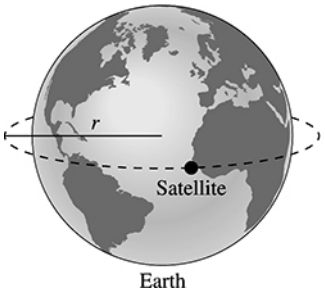
8.27. Model: Assume the particle model for the satellite in circular motion.
Visualize:

Pictorial representation



Known
$r = 3.58 \times 10^7\,\text{m} + 6.37 \times 10^6\,\text{m}$
$= 4.22 \times 10^7\,\text{m}$

Find
T and g

To be in a geosynchronous orbit means rotating at the same rate as the earth, which is 24 hours for one complete rotation. Because the altitude of the satellite is 3.58×10^7 m, $r = 3.58\times10^7$ m, $r_e = 3.58\times10^7\ \text{m} + 6.37\times10^6\ \text{m} = 4.22\times10^7$ m.

Solve: **(a)** The period (T) of the satellite is 24.0 hours.
(b) The acceleration due to gravity is

$$g = a_r = r\omega^2 = r\left(\frac{2\pi}{T}\right)^2 = \left(4.22\times10^7\,\text{m}\right)\left(\frac{2\pi}{24.0\ \text{hr}}\times\frac{1\ \text{hr}}{3600\ \text{s}}\right)^2 = 0.223\ \text{m/s}^2$$

(c) There is no normal force on a satellite, so the weight is zero. It is in free fall.