

Physics 10154 - Quiz 5B

A satellite orbits the Earth with a velocity of 14,400 miles/hour.

- a) What is the satellite's altitude (in miles) above the Earth's surface?
- b) What is the orbital period of the satellite, in hours?

$$v = \frac{14400 \text{ mi}}{\text{hr}} \cdot \frac{1609 \text{ m}}{\text{mi}} \cdot \frac{1 \text{ hr}}{3600 \text{ s}} = 6436 \text{ m/s}$$

$$v = \sqrt{\frac{GM}{r}} \Rightarrow v^2 = \frac{GM}{r}$$

$$r = \frac{GM}{v^2} = \frac{(6.67 \times 10^{-11}) (5.98 \times 10^{24})}{(6436)^2}$$

$$= 9.629 \times 10^6 \text{ m}$$

$$r = R_E + h$$

$$\Rightarrow h = r - R_E$$

$$= 9.629 \times 10^6 - 6.38 \times 10^6 = 3.25 \times 10^6 \text{ m}$$

$$= \boxed{2020 \text{ miles}}$$

$$b) T = \frac{2\pi r}{v} = \frac{2\pi (9.629 \times 10^6)}{6436} = 9400 \text{ s}$$

$$= \boxed{2.61 \text{ hr}}$$