DRILL

CHAPTER 8 PRACTICE QUESTIONS

Directions: Complete the following problems as specified by each question, and then check your work using the solutions that follow. For extended, step-by-step solutions, access your Student Tools online.

- 1. The displacement between a mass $m_1 = 2 \text{ kg and a mass } m_2 = 5 \text{ kg is}$ $\vec{r} = (4 \text{ m})\hat{j}$, point from m_2 toward m_1 . What is the vector gravitational force on m_1 due to m_2 ?
- 2. What is the altitude above the Earth's surface that satellites undergo geosynchronous orbits? Recall that a geosynchronous orbit is one in which the satellite is always above the same point on the Earth's surface. Note that the radius of the Earth is 6.4×10^6 m and the mass is 5.97×10^{24} kg.
- 3. Planet X has a mass twice that of the Earth and a radius half that of the Earth. Without looking up the mass or radius of the Earth, what is the gravitational acceleration on X at the surface? What about at an altitude equal to half the Earth's radius?
- 4. If an astronaut could jump to a height of 50 cm on the Earth, should he worry that jumping on the Moon would cause him to leave the surface and never fall back down? Note that the mass of the Moon is 7.35×10^{22} kg and the radius is 1.74×10^{6} m.
- What speed would you have to throw a baseball to get it to orbit the Earth just above its surface?

- 6. A comet is a relatively small body in orbit around the Sun. Haley's comet is a comet that passes by Earth every 75 years or so (the last passing was in 1986 and the next passing will be in 2061). Haley's comet has an extremely high eccentricity, 0.967. The apogee (the furthest distance from the attracting body) of Haley's comet is 5.25×10^{12} m, and its perigee (the shortest distance from the attracting body) is 8.77×10^{10} m. What is:
 - (a) The semi-major axis?
 - (b) The semi-minor axis?
 - (c) Its orbital period? Note that the mass of the Sun is 1.99×10^{30} kg.
 - (d) To think about: A comet is visible because it begins glowing in the night's sky. This glowing is known as the comet's coma, which is a very hot outgas being emitted from the comet. A comet is not visible at all points in its orbit, but only a certain point in its orbit. What point do you think this is?
- 7. A 1×10^{13} kg comet has an angular momentum of 1×10^{30} J-s around the Sun. The eccentricity of its orbit is 0.9. If its semi-major axis is 1.5×10^{12} m, what is its tangential speed at apogee? At perigee? Note that the distance on an ellipse between the center and the focus is *ae* (the semi-major axis times the eccentricity).