Chapter 13

13.3 What must the separation be between a 5.2kg particle and a 2.4 kg particle for their gravitation attraction have a magnitude of $2.3\times10^{-12}N$?

Newton's Law of Universal Gravitation states

$$F = G\frac{M\,m}{r^2}$$

$$r = \sqrt{G\frac{M\,m}{F}} = \sqrt{6.67\times10^{-11}\cdot\frac{5.2kg\cdot2.4kg}{2.3\times10^{-12}}}$$

$$= 19.02m$$

13.19 At what altitude above Earth's surface would the gravitation acceleration be 4.9 m/s^2

We begin by writing the gravitational force on a mass at a distance r from the earth's center. We then calculate the distance d above the surface.

$$ma = G\frac{M_E m}{r^2}$$

$$a = G\frac{M_E}{r^2}$$

$$r = \sqrt{G\frac{M_E}{a}} = \sqrt{6.67\times10^{-11}\frac{5.98\times10^{24}}{4.9}} = 9.02\times10^6 m$$

$$d = r - r_E = 9.02\times10^6 m - 6.37\times10^6 m$$

$$= 2.65\times10^6 m$$