84. (a) With $M = 2.0 \times 10^{30}$ kg and $r = 10000$ m, we find

$$a_g = \frac{GM}{r^2} = 1.3 \times 10^{12} \text{ m/s}^2 \ .$$

(b) Although a close answer may be gotten by using the constant acceleration equations of Chapter 2, we show the more general approach (using energy conservation):

$$K_\text{o} + U_\text{o} = K + U$$

where $K_\text{o} = 0$, $K = \frac{1}{2}mv^2$ and U given by Eq. 14-20. Thus, with $r_\text{o} = 10001$ m, we find

$$v = \sqrt{2GM\left(\frac{1}{r} - \frac{1}{r_\text{o}}\right)} = 1.6 \times 10^6 \text{ m/s} \ .$$