60. (a) For $r = R_p$,

$$\begin{aligned} v_p^2 &= GM_s\left(\frac{2}{R_p} - \frac{1}{a}\right) \\ &= \left(6.67\times10^{-11}\,\mathrm{m^3/s^2\cdot kg}\right)\left(1.99\times10^{30}\,\mathrm{kg}\right)\left(\frac{2}{8.9\times10^{10}\,\mathrm{m}} - \frac{1}{2.7\times10^{12}\,\mathrm{m}}\right) \\ v_p &= 5.4\times10^4\ \mathrm{m/s}\ . \end{aligned}$$

(b) For $r = R_a$,

$$\begin{aligned} v_a^2 &= GM_s\left(\frac{2}{R_a} - \frac{1}{a}\right) \\ &= \left(6.67\times10^{-11}\,\mathrm{m^3/s^2\cdot kg}\right)\left(1.99\times10^{30}\,\mathrm{kg}\right)\left(\frac{2}{5.3\times10^{12}\,\mathrm{m}} - \frac{1}{2.7\times10^{12}\,\mathrm{m}}\right) \\ v_a &= 9.6\times10^2\ \mathrm{m/s}\ . \end{aligned}$$

(c) We appeal to angular momentum conservation:

$$L = mvr = mv_aR_a = mv_pR_p = \text{constant} \quad \Longrightarrow \quad \frac{v_a}{v_p} = \frac{R_p}{R_a}\ .$$