$$\text{total mechanical energy} \quad = \quad KE \; + \; GPE$$

$$R_A \quad = \quad \left(\frac{M_B}{M_A + M_B} \right) a$$

$$R_B \quad = \quad \left(\frac{M_A}{M_A + M_B} \right) a$$

$$M_A \left(\frac{{v_A}^2}{R_A} \right) \quad = \quad \frac{G M_A M_B}{a^2}$$

$$v_A \quad = \quad \sqrt{\frac{G M_B}{a} \left(\frac{M_B}{M_A + M_B} \right)}$$

$$v_B \quad = \quad \sqrt{\frac{G M_A}{a} \left(\frac{M_A}{M_A + M_B} \right)}$$