



$$mv_1 = 9mv_2 \text{ or } v_1 = \frac{v_0}{3} \quad \dots(i)$$

Now applying work energy theorem from centre of mass frame

$$W_{\text{total}} = (\Delta K)_{\text{cm}} = \left(\frac{1}{2} \mu v_{\text{rel}}^2 \right)_{\text{final}} - \left(\frac{1}{2} \mu v_{\text{rel}}^2 \right)_{\text{initial}}$$

$$mgR = \frac{1}{2} \frac{m \cdot 9m}{(m + 9m)} (v_1 + v_2)^2 = \frac{9m}{20} \left(\frac{4}{3} v_2 \right)^2$$

$$v_2 = \sqrt{\frac{5}{4} gR}$$