

44. We use Eq. 9-43 and simplify with  $v_i = 0$ ,  $v_f = v$ , and  $v_{\text{rel}} = u$ .

$$v_f - v_i = v_{\text{rel}} \ln \frac{M_i}{M_f} \quad \Rightarrow \quad \frac{M_i}{M_f} = e^{v/u}$$

(a) If  $v = u$ , we obtain  $\frac{M_i}{M_f} = e^1 \approx 2.7$ .

(b) If  $v = 2u$ , we obtain  $\frac{M_i}{M_f} = e^2 \approx 7.4$ .