

54. The initial kinetic energy of the automobile of mass m moving at speed v_i is $K_i = \frac{1}{2}mv_i^2$, where $m = 16400/9.8 = 1673$ kg. Using Eq. 8-29 and Eq. 8-31, this relates to the effect of friction force f in stopping the auto over a distance d by

$$K_i = fd$$

where the road is assumed level (so $\Delta U = 0$). Thus,

$$d = \frac{K_i}{f} = \frac{mv_i^2}{2f} = \frac{(1673 \text{ kg}) \left((113 \text{ km/h}) \left(\frac{1000 \text{ m/km}}{3600 \text{ s/h}} \right) \right)^2}{2(8230 \text{ N})} = 100 \text{ m} .$$