13. We neglect any work done by friction. We work with SI units, so the speed is converted: $v = 130(1000/3600) = 36.1$ m/s.

(a) We use Eq. 8-17: $K_f + U_f = K_i + U_i$ with $U_i = 0$, $U_f = mgh$ and $K_f = 0$. Since $K_i = \frac{1}{2}mv^2$, where v is the initial speed of the truck, we obtain

$$\frac{1}{2}mv^2 = mgh \quad \Longrightarrow \quad h = \frac{v^2}{2g} = \frac{36.1^2}{2(9.8)} = 66.5 \text{ m} .$$

If L is the length of the ramp, then $L \sin 15^\circ = 66.5\,\text{m}$ so that $L = 66.5/\sin 15^\circ = 257\,\text{m}$. Therefore, the ramp must be about 260 m long if friction is negligible.

(b) The answers do not depend on the mass of the truck. They remain the same if the mass is reduced.

(c) If the speed is decreased, h and L both decrease (note that h is proportional to the square of the speed and that L is proportional to h).