13. (a) If m is the mass of a pellet and v is its velocity as it hits the wall, then its momentum is $p = mv = (2.0 \times 10^{-3}\,\text{kg})(500\,\text{m/s}) = 1.0\,\text{kg}\cdot\text{m/s}$, toward the wall.

(b) The kinetic energy of a pellet is

$$K = \frac{1}{2}mv^2 = \frac{1}{2}\left(2.0 \times 10^{-3}\,\text{kg}\right)(500\,\text{m/s})^2 = 2.5 \times 10^2\,\text{J} .$$

(c) The force on the wall is given by the rate at which momentum is transferred from the pellets to the wall. Since the pellets do not rebound, each pellet that hits transfers $p = 1.0\,\text{kg}\cdot\text{m/s}$. If ΔN pellets hit in time Δt, then the average rate at which momentum is transferred is

$$F_{\text{avg}} = \frac{p\,\Delta N}{\Delta t} = (1.0\,\text{kg}\cdot\text{m/s})\left(10\,\text{s}^{-1}\right) = 10\ \text{N} .$$

The force on the wall is in the direction of the initial velocity of the pellets.

(d) If Δt is the time interval for a pellet to be brought to rest by the wall, then the average force exerted on the wall by a pellet is

$$F_{\text{avg}} = \frac{p}{\Delta t} = \frac{1.0\,\text{kg}\cdot\text{m/s}}{0.6 \times 10^{-3}\,\text{s}} = 1.7 \times 10^3\,\text{N} .$$

The force is in the direction of the initial velocity of the pellet.

(e) In part (d) the force is averaged over the time a pellet is in contact with the wall, while in part (c) it is averaged over the time for many pellets to hit the wall. During the majority of this time, no pellet is in contact with the wall, so the average force in part (c) is much less than the average force in part (d).