Task:

A 9.9 g bullet is accelerated in a rifle barrel 101 cm long to a speed of 933 m/s. Use the work-energy theorem to find the average force exerted on the bullet while it is being accelerated. Answer in units of N

Solution:

$m = 0.0099\ kg, \qquad v_1 = 933\,\frac{m}{s}, \qquad v_0 = 0\,\frac{m}{s}, \qquad s = 1.01\ m$

Work-energy theorem in conservative system:

$$A_{total} = \Delta(E_k) = \Delta\left(\frac{mv^2}{2}\right) = \frac{mv_1^2}{2} - \frac{mv_0^2}{2} = \frac{mv_1^2}{2}$$

$$A_{total} = F_{net} \cdot s$$

$$F_{net} = \frac{mv_1^2}{2s} = \frac{0.0099\ kg \cdot 933^2\,\frac{m^2}{s^2}}{2 \cdot 1.01\ m} \approx 4266\ N$$

Answer:

$F_{net} \approx 4266\ N$