Answer on Question 48071, Physics, Mechanics | Kinematics | Dynamics |

Question:

A rifle is firmly attached to a heavy bench, with its 75.0 cm long barrel pointing horizontally. It fires a 9.00 g bullet which leaves the muzzle at a speed of 970 m/s. assuming the acceleration of the bullet down the length of the barrel to be constant, what horizontal force does the gun exert on the bench as it fires?

Solution:

From the second Newton's law of motion we have:

$$F = m \cdot a.$$

For the case of uniform acceleration motion we can write the next equations:

$$s = \frac{a \cdot t^2}{2},$$

$$v = a \cdot t.$$

By expressing t in terms of v and a and substituting it in equation for s we obtain the acceleration a:

$$a = \frac{v^2}{2 \cdot s}$$

Therefore:

$$F = m \cdot a = m \cdot \frac{v^2}{2 \cdot s} = \frac{0.009kg \cdot \left(970 \frac{m}{s}\right)^2}{2 \cdot 0.75m} = 5645.4\ N$$

Answer:

$F = 5645.4\ N$