2021-Ph-H1-Q7

Section: Our Dynamic Universe
Topic: Collisions, Explosions and Impulse

Summary:
A 5.0 kg nail gun fires a 4.0 g (0.004 kg) nail at 150 m/s. We are to find the recoil speed of the nail gun.

Solution:
Using **conservation of momentum**:
$m_{\text{nail}}v_{\text{nail}} + m_{\text{gun}}v_{\text{gun}} = 0,$

$$v_{\text{gun}} = -\frac{m_{\text{nail}}v_{\text{nail}}}{m_{\text{gun}}} = -\frac{0.004 \times 150}{5.0} = -0.12 \text{ m/s}.$$

Answer: C. 0.12 m/s

Guidance for Students:

- Momentum is conserved when no external forces act.
- Use mass in **kg**, not grams.
- The nail's forward momentum is equal and opposite to the gun's recoil momentum.

Revision Tips:

- **p = mv**; total momentum before = total momentum after.
- Always convert grams to kg by dividing by 1000.
- Direction is indicated by the sign (negative means opposite).