A 2.5 kg block slides head on into a spring with a spring constant of 320 N/m. When the block stops, it has compressed the spring by 7.5 cm (μk = 0.25). While the block is in contact with the spring and being brought to rest,

a) What is the work done by the spring force between i and f?

\[ W_s = \frac{1}{2} k (x_i^2 - x_f^2) \]
\[ = \frac{1}{2} k (a - 0.075^2) \]
\[ = \frac{1}{2} (320) (0.075)^2 = -0.9 \text{ J} \]

b) What is the work done by the gravitational force between i and f?

\[ W_g = 0 \]
because \( \vec{f}_g \) is \( \perp \) to the displacement vector.

c) What is the work done by the frictional force between i and f?

\[ W_f = -f_k d = -\mu_k N d = -\mu_k m g d \]
\[ = - (0.25) (2.5) (9.8) (0.075) = -0.46 \text{ J} \]

e) What is the block's speed just as it reaches the spring?

\[ W_{net} = \Delta K \]
\[ -0.9 - 0.46 = \frac{1}{2} m (v_f^2 - v_i^2) \]
\[ -1.36 = - \frac{1}{2} (2.5) v_i^2 \]
\[ \Rightarrow v_i = \sqrt{\frac{2 \times 1.36}{2.5}} \approx 1.1 \text{ m/s} \]