Answer on Question #60999-Physics-Mechanics-Relativity

Block A in Fig. 1 has mass 1.00 kg, and block B has mass 3.00 kg. The blocks are forced together, compressing a spring between them; then the system is released from rest on a level, frictionless surface. The spring, which has negligible mass, is not fastened to either block and drops to the surface after it has expanded. Block B acquires a speed of 1.20 m/s.

(a) What is the final speed of block A?

(b) How much potential energy was scored in the compressed spring?

Solution

(a) Use the law of conservation of momentum:

$$p_i = p_f$$

$$0 = m_1 v_{1f} - m_2 v_{2f}$$

$$v_{1f} = \frac{m_2 v_{2f}}{m_1} = -\frac{(3.00kg)\left(1.20\frac{m}{s}\right)}{1.00kg} = 3.60\frac{m}{s}$$

(b)

Use the law of conservation of energy:

$$U = K_1 + K_2 = \frac{m_1 v_{1f}^2}{2} + \frac{m_2 v_{2f}^2}{2} = \frac{1}{2}\left((1.00kg)\left(3.60\frac{m}{s}\right)^2 + (3.00kg)\left(1.20\frac{m}{s}\right)^2\right) = 8.64\,J.$$