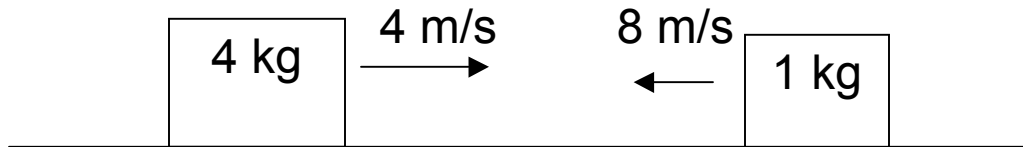


1. [11 points]



A 4-kg block moving at 4 m/s collides with a 1-kg block moving at 8 m/s in the opposite direction on a frictionless floor. After the collision, the blocks stick together and move as a single unit.

- a) [3 points] What are the kinetic energies of the blocks before collision?
- b) [5 points] What is the kinetic energy of the combined block after the collision?
- c) [3 points] What is the thermal energy released in the collision?

2. [9 points]

- a) [3 points] The pressure of an ideal diatomic gas is isothermally increased by 25%. By what factor does the average rotational energy of a molecule increase? Explain your reasoning.
- b) [3 points] Which of the following equations is always correct for an *isothermal* process of an ideal gas? (Circle the correct statements.)
- | | | |
|---|---|-------------------------|
| i) $(PV)_{\text{before}} = (PV)_{\text{after}}$ | ii) $Q = C_V \Delta T$ | iii) $Q = 0$ |
| iv) $P_{\text{before}} = P_{\text{after}}$ | v) $U_{\text{before}} = U_{\text{after}}$ | vi) $Q = W_{\text{on}}$ |
- c) [3 points] Which of the following equations is always correct for an *adiabatic* process of an ideal gas? (Circle the correct statements.)
- | | | |
|---|---|-------------------------|
| i) $(PV)_{\text{before}} = (PV)_{\text{after}}$ | ii) $Q = C_V \Delta T$ | iii) $Q = 0$ |
| iv) $P_{\text{before}} = P_{\text{after}}$ | v) $U_{\text{before}} = U_{\text{after}}$ | vi) $Q = W_{\text{on}}$ |