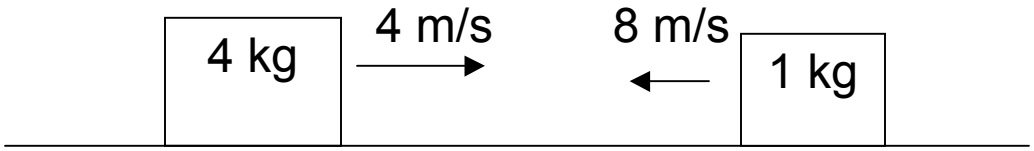
Physics 213 **Quiz 1-1 [20 points]** Name_____

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?
$\frac{1}{2} mv_1^2 + \frac{1}{2} mv_2^2 = 32 \text{ J} + 32 \text{ J}$

b) [5 points] What is the kinetic energy of the combined block after the collision?
$p_{before} = p_{after} = (4*4 - 8) = 8$ kg m/s to the right
$E_{after} = p^2/(2m) = 8\text{^}2/(2*5) = 6.4$ J

c) [3 points] What is the thermal energy released in the collision?
$E_{thermal} = E_{KE,\ before} - E_{KE,}$ after = 57.6 J

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.

**1. Since the temperature stays the same equipartition tells us that the average energy of a single molecule stays the same.*

b) [3 points] Which of the following equations is always correct for an *isothermal* process of an ideal gas? (Circle the correct statements.)

X i) $(PV)_{before} = (PV)_{after}$ ii) $Q = C_V \Delta T$ iii) $Q = 0$
iv) $P_{before} = P_{after}$ X v) $U_{before} = U_{after}$ vi) $Q = W_{on}$

c) [3 points] Which of the following equations is always correct for an *adiabatic* process of an ideal gas? (Circle the correct statements.)

i) $(PV)_{before} = (PV)_{after}$ ii) $Q = C_V \Delta T$ X iii) $Q = 0$
iv) $P_{before} = P_{after}$ v) $U_{before} = U_{after}$ vi) $Q = W_{on}$