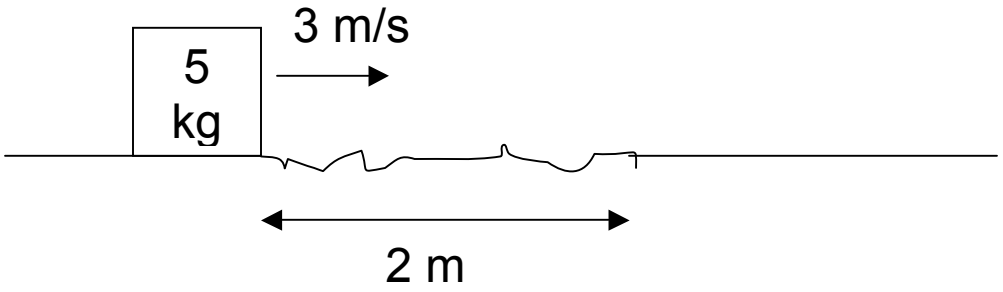
Physics 213 **Quiz 1-2 [20 points]** Name_____

1. [11 points]



A block of 5 kg moving at 3 m/s enters a rough terrain spanning 2 m, traverses its length, and exits with a velocity of 1 m/s.

i) [3 points] What are the kinetic energies of the block before entering the rough terrain and after exiting it?
KE_{before} = 5*3^2/2 = 22.5 J
KE_{after} = 2.5 J

ii) [4 points] What is the thermal energy released in traversing the rough terrain?
$Q = KE_{before} - KE_{after} = 20J$

iii) [4 points] What is the force due to friction in this region?

*Work due to friction (done on the rough terrain) is the same as the heat released and is = $F_{friction}$ * distance. So F = 20J/2m = 10 N.*

2. [9 points]

a) [3 points] The pressure of an ideal diatomic gas is isothermally increased by 50%. 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) $Q = W_{on}$