Quiz #11A

Clearly indicate (with a box) your answers to the following questions. SHOW ALL WORK.

1. An ideal gas starts at an initial state of 3.0 atmospheres and a volume of 1.5 Liters with an internal energy of 55 Joules. The gas is then allowed to expand at constant pressure to a volume of 3.2 Liters. While the gas is at 3.2 Liters, the pressure is then reduced to 1.2 atmospheres. The final internal energy of the gas is 120 Joules.

a) Calculate the work done <u>on</u> the gas during this process.

b) Calculate the heat added to the gas during this process.

$P_1 = 3.039 \times 10^5\ Pa$ $\quad U_1 = 55\ J$

$V_1 = 1.5 \times 10^{-3}\ m^3$

$P_2 = 3.039 \times 10^5\ Pa$

$V_2 = 3.2 \times 10^{-3}\ m^3$

$P_3 = 1.2156 \times 10^5\ Pa$ $\quad U_3 = 120\ J$

$V_3 = 3.2 \times 10^{-3}\ m^3$

a) $W_{on,1\to2} = -P\Delta V = -(3.039 \times 10^5)(1.7 \times 10^{-3})$

$= -517\ J$

$W_{on,2\to3} = -P\Delta V = 0$

$\boxed{W_{on\ gas} = -517\ J}$

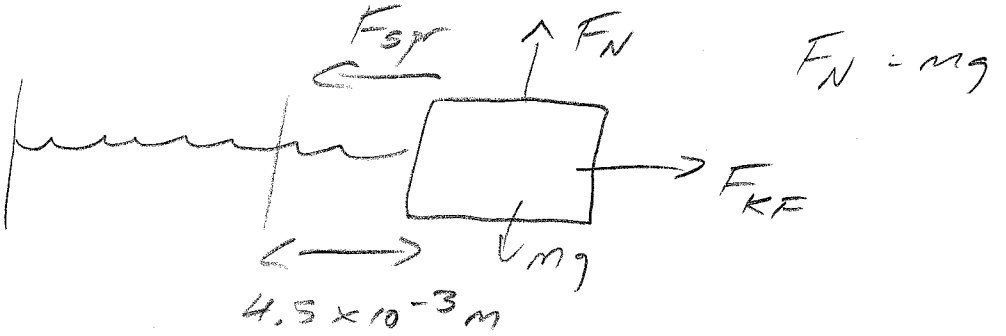
b) $\Delta U_{1\to3} = 120 - 55 = Q + W_{on\ gas}$

$65 = Q - 517$

$\boxed{Q = 582\ J}$

2. A 1.5-kg block is attached to a horizontal spring with a spring constant of 1800 N/m. The spring is then stretched a distance of 4.5 mm and the block is released from rest.

Calculate the speed of the block as it passes through the equilibrium position the first time if the coefficient of kinetic friction between the block and table is 0.20.



$$\Sigma W_F = W_{spr} + W_{KF} = \frac{1}{2}mv^2 - 0$$

$$W_{spr} = \frac{1}{2}k\Delta x^2 = \frac{1}{2}(1800)(4.5\times10^{-3})^2$$

$$= 0.0182\ J$$

$$W_{KF} = -\mu_k F_N \Delta s$$

$$= -(.20)(1.5)(9.8)(4.5\times10^{-3})$$

$$= -0.0132\ J$$

$$.0050\ J = \frac{1}{2}(1.5)v^2$$

$$v = .0816\ m/s$$

or $\boxed{8.2\ cm/s}$