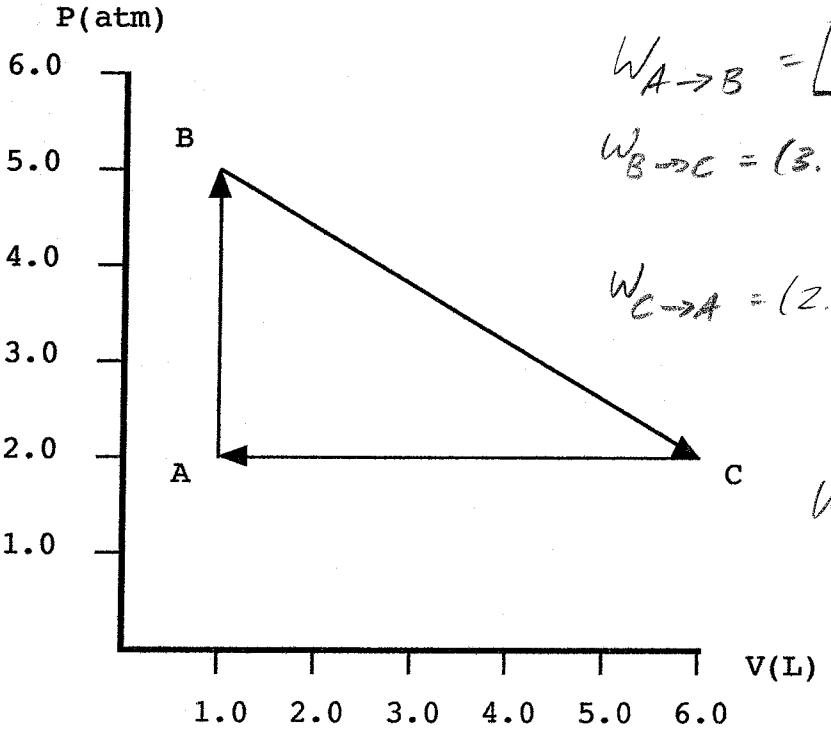
Phys 10154 - Fall 2006 - Exam #11A

Be sure to answer with the proper units and significant figures. Indicate your answers clearly with boxes. SHOW ALL WORK. Even if your answer is correct, I will deduct points if I can't see how you solved the problem. Both problems are worth 50 points.

1. An ideal gas goes through the cycle shown in the graph below. During the A-->B-->C process, 220 Joules of heat are added to the gas.

Find the work done by the gas during each of the three steps of the cycle.

Also, find the amount of heat added to the gas during the C-->A part of the cycle.



$W_{A\to B} = \boxed{0}$ $(\Delta V = 0)$

$W_{B\to C} = (3.5\times10^5)(5\times10^{-3})$

$= \boxed{1750\ J}$

$W_{C\to A} = (2.0\times10^5)(-5\times10^{-3})$

$= \boxed{-1000\ J}$

$W_{Tot} = 750\ J$

$\Delta U = Q_{tot} - W_{Tot} = 0$

$220 + Q_{CA} = 750$

$\boxed{Q_{CA} = 530\ J}$

2. A frictionless, horizontal spring (k = 120 N/m) has a 1.5 kg mass attached. The spring is stretched to a point 35 cm from its equilibrium position.

a) What is the total energy of this system?

b) How far from the equilibrium point is the mass when it reaches half of its maximum speed?

c) What is the maximum speed the mass reaches at the equilibrium point?

d) If there is friction (coefficient = 0.38) between the mass and the surface, what is the speed of the mass when it passes through the equilibrium point for the first time?

a) $E = \frac{1}{2}kA^2$

$= \frac{1}{2}(120)(.35)^2 = \boxed{7.35\ J}$

b) $v_{max} = \sqrt{\frac{k}{m}A^2}$

$\frac{1}{2}\sqrt{\frac{k}{m}A^2} = \sqrt{\frac{k}{m}(A^2 - x^2)}$

$\frac{1}{4}A^2 = A^2 - x^2 \Rightarrow x^2 = \frac{3}{4}A^2$

$x = \sqrt{\frac{3}{4}(.35)^2} = \boxed{.30\ m}$

c) $v_{max} = \sqrt{\frac{k}{m}A^2}$

$= \sqrt{\frac{(120)(.35)^2}{1.5}} = \boxed{3.1\ m/s}$

d) $\Sigma W_F = W_{spr} + W_{KF} = \Delta K$

$\frac{1}{2}kA^2 - \mu_k mgA = \frac{1}{2}mv^2 - 0$

$7.35 - (.38)(1.5)(9.8)(.35) = .75v^2$

$7.35 - 1.96 = .75v^2$ $\Rightarrow \boxed{v = 2.7\ m/s}$