See the HiHW grading rubric posted on Carmen

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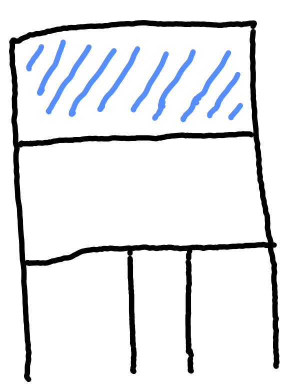
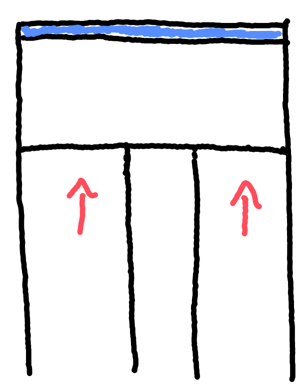
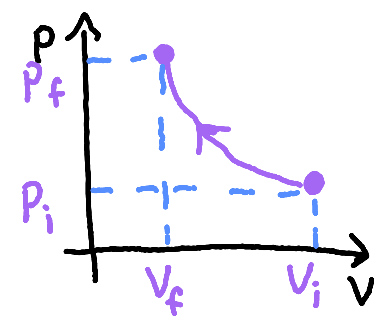
A glass cylinder filled with $n = 0.91$ mol of air is capped with a moveable piston that can slide frictionlessly inside the cylinder. The gas is adiabatically compressed by rapidly slamming the piston down into the cylinder with a constant force $F = 190$ N over a distance of $d = 14$ cm. What is the change in temperature ΔT of the gas? Draw a PV diagram of this process as part of your representation; make sure it includes the adiabatic process, isothermal lines corresponding to the initial and final temperatures, and shading that corresponds to the work done on/by the gas. For the limit check, investigate what happens to ΔT if the piston is pushed only a very short distance into the cylinder ($d \to 0$).

Representation:	0	1	2
Physics Concept(s):	0	1	2
Initial Equation(s):	0	0.5	1
Symbolic Answer:	0		1
Units Check:	0	0.5	1
Limits Check:	0	0.5	1
Neatness:	-2	-1	0
Total:			
Correct Answer:	Y	N	

Representation







Physics Concept(s) (Refer to the list posted on Carmen)

(1) 1st Law of Thermodynamics

(2) Processes on the PV plane

Initial Equations

$W = \frac{5}{2} n R \Delta T$

$W = Fd$

↓ Show Your Equation Work On Next Page ↓

Algebra Work (Symbols only. Don't plug in any numbers yet.)

$$\frac{5}{2} n R \Delta T = F d \longrightarrow \Delta T = \frac{2Fd}{5nR}$$

Symbolic Answer: $\Delta T = \dfrac{2Fd}{5nR}$

Units Check

$$\frac{J/\cancel{m} \cdot \cancel{m}}{\cancel{mol} \cdot \frac{J}{\cancel{mol} \cdot K}} = \frac{\cancel{J}}{\frac{\cancel{J}}{K}}$$

$$= K$$

Limits Check

a) As $d \to 0$, what limit does ΔT approach?

$$\lim_{d \to 0} \Delta T = 0$$

b) Why does the result make physical sense?

Because no compression would mean no change in temp.

Numerical Answer: (Obtain this by plugging numbers into your symbolic answer.)

1.41 K