11-24-13 MORE P vs T LAB NOTES: (1

PZA

PRESSURE GAUGE

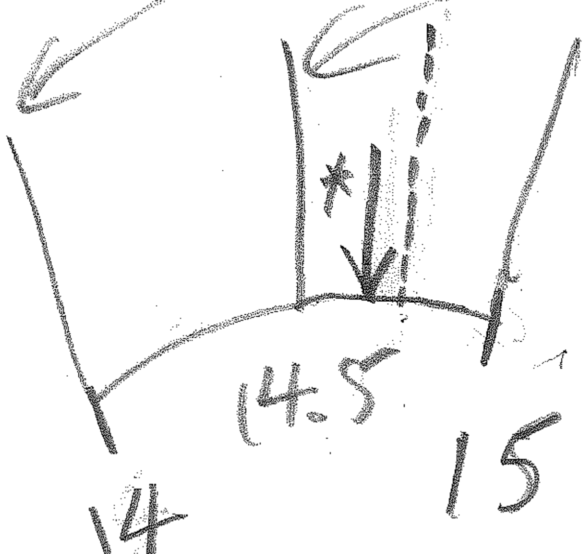
P vs T ~

issue of initial P calibration

measurement.

ACTUAL MARKS on gauge.

example




* MARKER

Guess: 14.7

IF YOU USE 14.7 GUESS

→ offset = 0.06.

→ ZERO OFFSET.

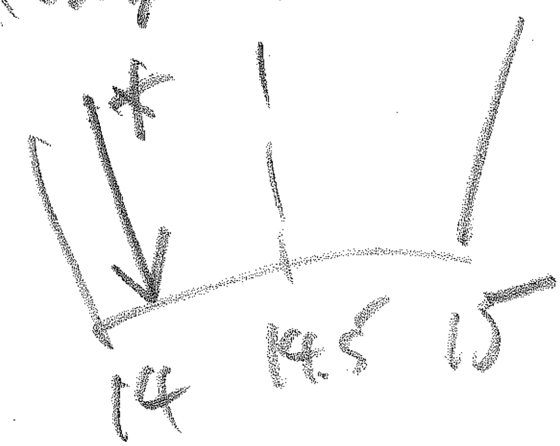
follow these RULES. → RULES: * ROUND to 14.5;

* OFFSET: $|14.76 - 14.5| = 0.26 = 0.3$

11-24 (2

OFFSET: ADD 0.3 to each of five PRESSURES.

Example:




* Marker: 14.2 ⇒ 14.0

ROUND DOWN

OFFSET WAS + 0.76

= 0.8 (ROUND)

ADD TO $P_1$, $P_2$, $P_3$, $P_4$ and $P_5$.

IF you use "non-rule"

Guess for $P_1$,

include data + offset

for E.C. for #8:

Example: Guess 14.1

"Break" rules:

⟶ Offset 14.76 − 14.1

= 0.66

= 0.7

$\boxed{\begin{array}{l}\text{Rules: } 14.1 \Rightarrow 14.0 \\ \text{offset} = 0.76 \\ \quad = 0.8\end{array}}$

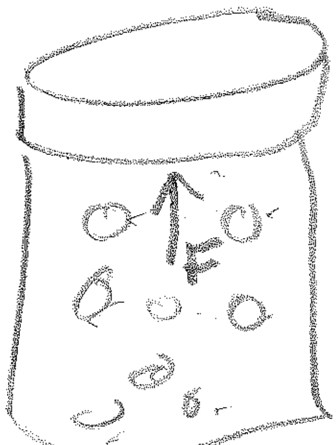
12-2-2013

CH 15 finish up: ALSO Lab Returns +

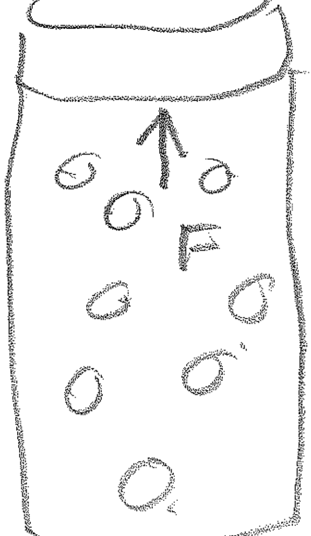
FINAL EXAM = CH 16, 15, 14, 13, 12, 11 + TEST 1, 2 OR 3 PROBLEMS

15.6 Adiabatic process

$\Delta Q = 0$ (FLAME off)




↑ PISTON moves due to F = FORCE of gas on piston.




$\Delta Q = 0$ FLAME off

Gas cools down; gas does work and loses KE

$\Rightarrow$ T drops.

T = Temperature

15.7

Let's review $C_v$ and $C_p$:

$C_v$:


$V = \text{constant}$

$$\Delta Q = \Delta U + \underbrace{W}_{0}$$

$$\Delta Q = n C_v \cdot \Delta T$$

$$C_v = \frac{3}{2} R$$

simple monatomic ideal gas (3 degrees of translational motion — see page 493)

$C_p$: SUMMARY ~


* simple monoatomic gas:

$$\Delta Q = \Delta U + \overline{W}$$

$$\Delta U = n c_v \cdot \Delta T; \quad c_v = \frac{3}{2} R \, *$$

$$\overline{W} = P \cdot \Delta V; \quad P = \text{constant}$$

$$PV = n \cdot R \cdot T \rightarrow \Delta(P \cdot V) = \Delta(n \cdot R \cdot T)$$

$$\Delta(p \cdot V) = \Delta p \cdot V + p \cdot \Delta V$$

0, since $\Delta p = 0$.

$$\boxed{p \cdot \Delta V = nR \cdot \Delta T}$$

THUS:

$$\Delta Q = nC_V \cdot \Delta T + nR\Delta T$$

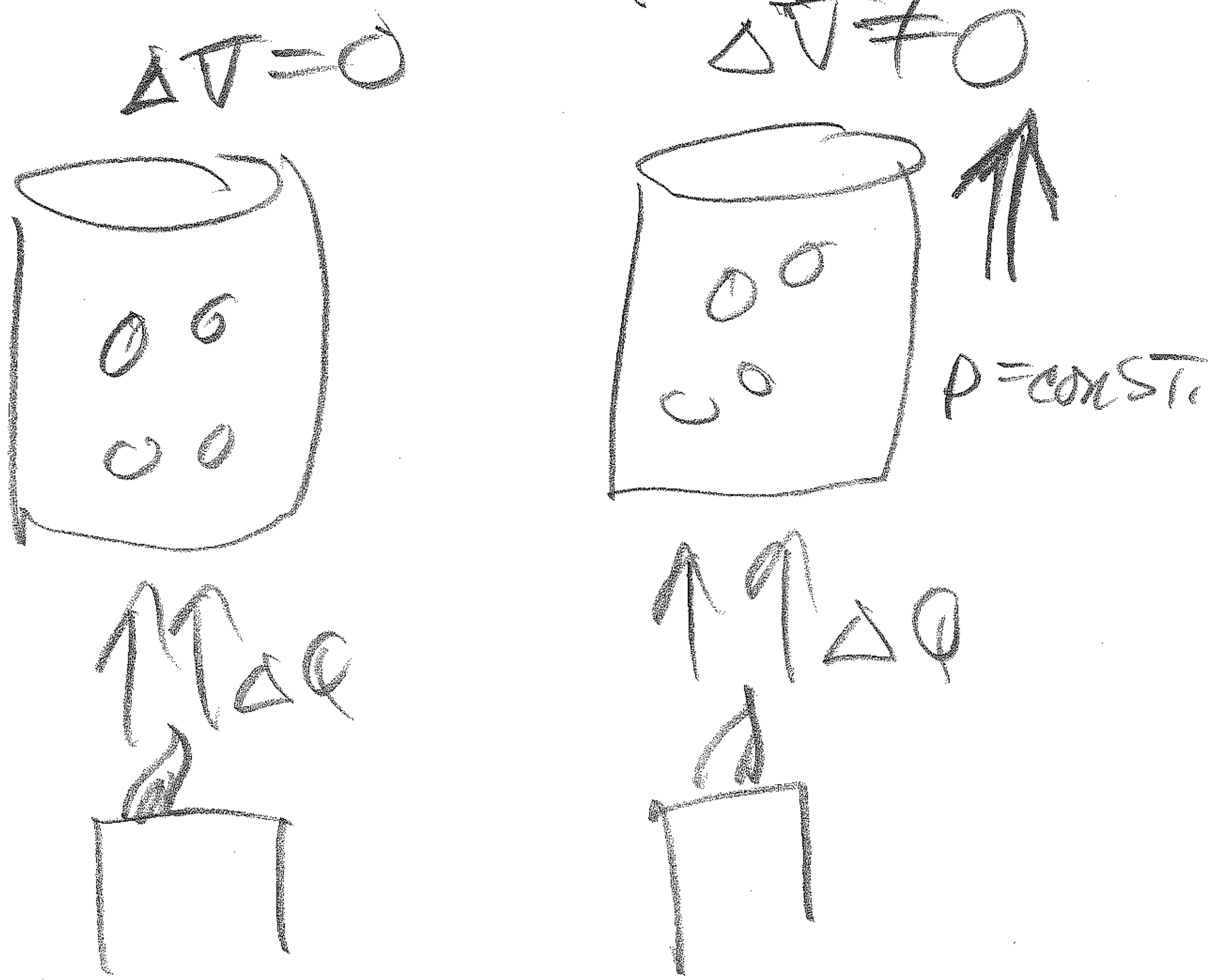
$$= n \cdot (C_V + R) \cdot \Delta T$$

$$= n \cdot C_p \cdot \Delta T$$

$$C_p = C_V + R = \frac{5}{2}R$$

$$\left(C_V = \frac{3}{2}R\right)$$

Conclusion:




$$C_p > C_v$$

since gas does work!

in the $p = \text{const.}$ case.

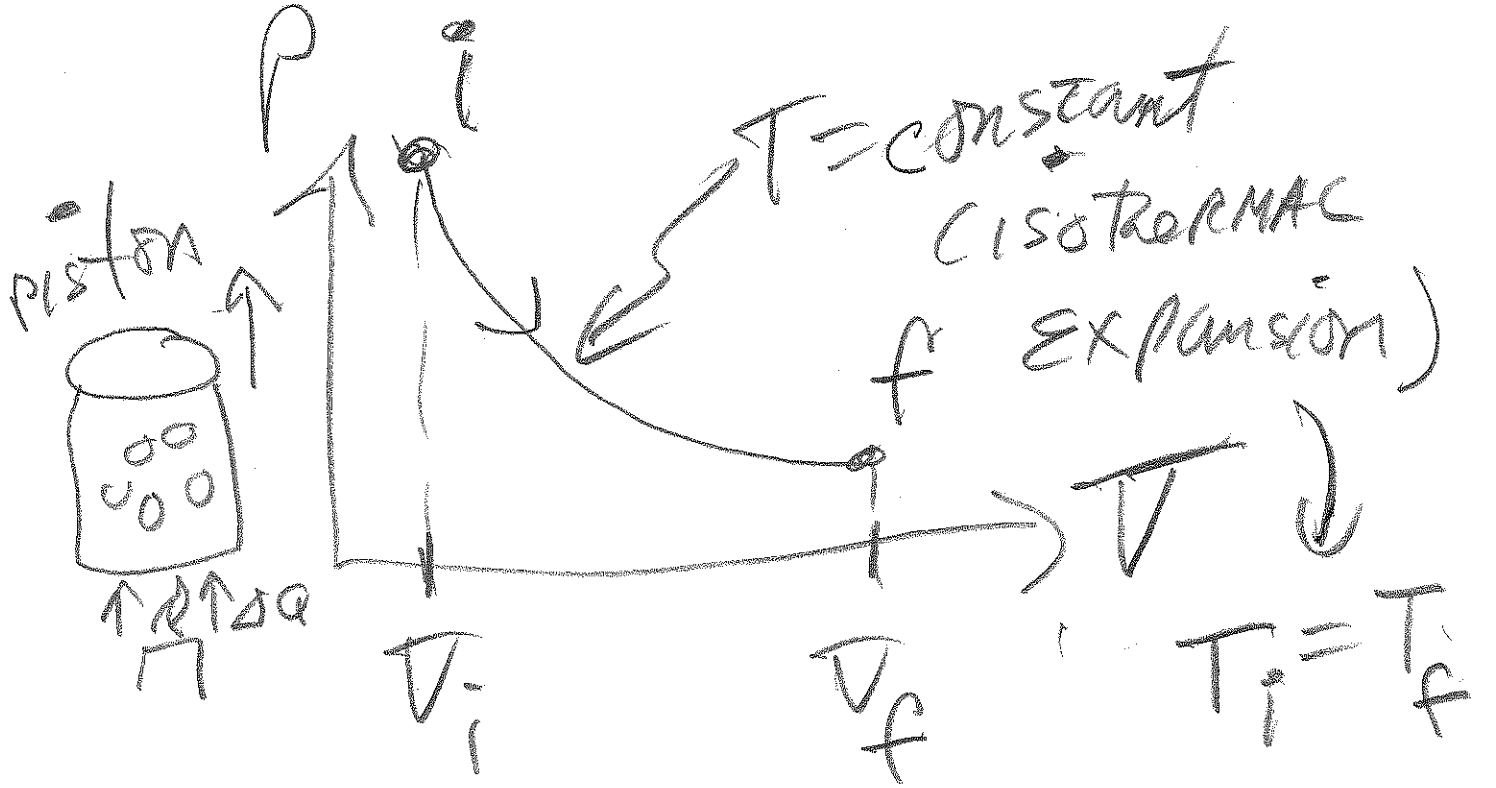
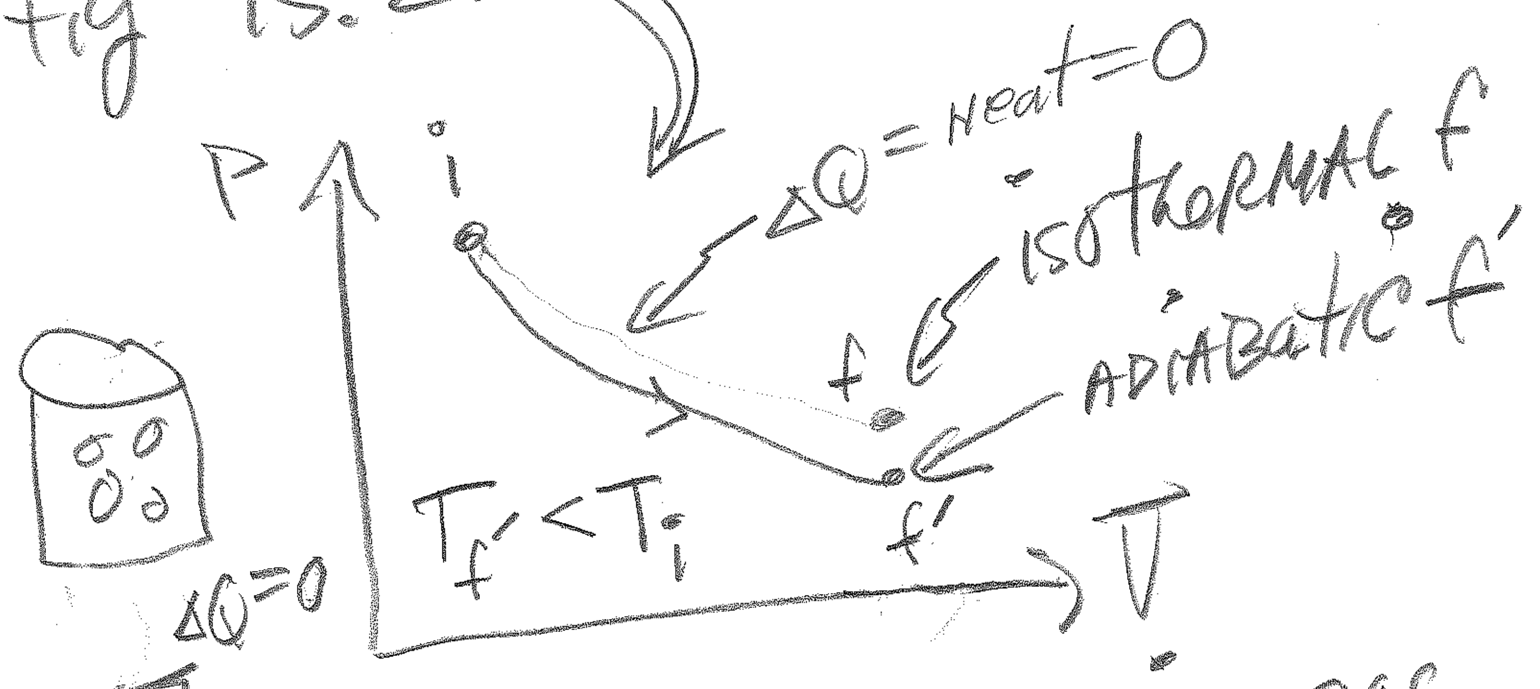



fig 15.27



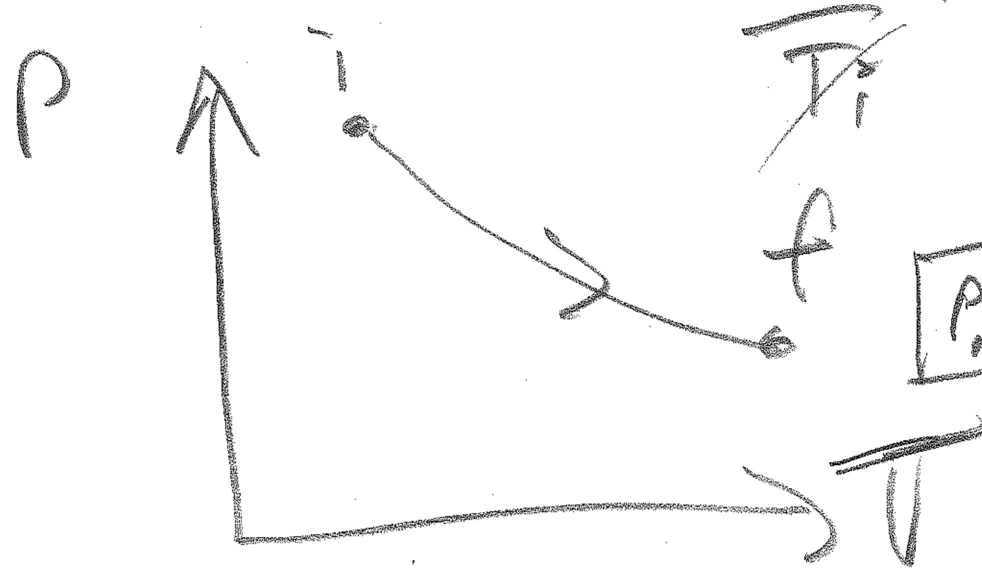

Flame off

$T_{f'} < T_f$ since gas

DID WORK <u>WITHOUT</u> Heat. (ΔQ = 0)

Isothermal

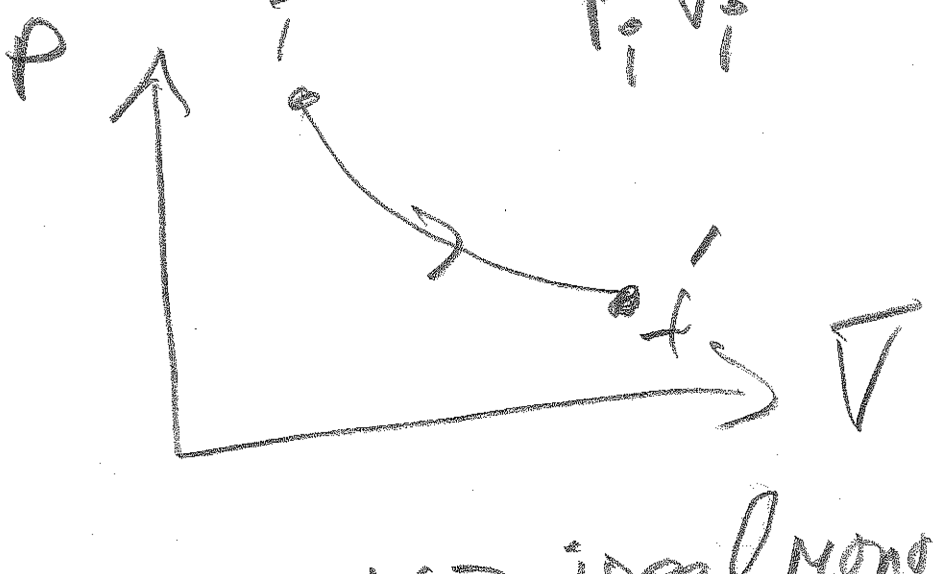
$$\frac{P_i V_i}{\cancel{T_i}} = \frac{P_f V_f}{\cancel{T_f}}$$




$$\boxed{P_i \cdot V_i = P_f \cdot V_f}$$

Adiabatic

$$P_i V_i^{\gamma} = P_f \cdot V_f^{\gamma}$$




$\gamma = 1.67$ ideal monoatomic gas; $\gamma = \frac{C_p}{C_v}$

p 493 $\Rightarrow$ <u>NOTE:</u> $C_v$ <u>varies</u> when gas is <u>diatomic</u>

## p493: degrees of energy freedom ~

CONSIDER:

A DIATOMIC molecule that DOES 3 things: TRANSLATES, ROTATES, VIBRATES.

3 degrees (1) TRANSLATES $KE = \frac{1}{2}MV^2$

$$V^2 = V_x^2 + V_y^2 + V_z^2$$

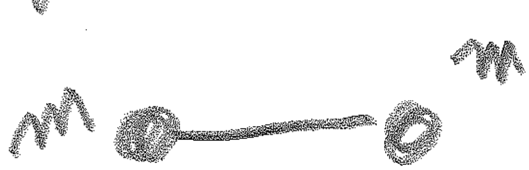
2 degrees (2) $\frac{1}{2}I_x w_x^2 + \frac{1}{2}I_y w_y^2$ (ROTATES)

2 degrees (3) $\frac{1}{2}MV_x^2 + \frac{1}{2}kx^2$ (VIBRATES)

$3+2+2 = 7$

$m$ = atom mass

$M = 2m$ = MOLECULE mass




diATOMIC molecule

HAS a CONSTANT volume gas SPECIFIC heat of

$$\Rightarrow C_V = \frac{f}{2}R \text{ where } f = 7.$$