PHYS 2C

Discussion Section – 2/12

TA: Bharat Kambalur

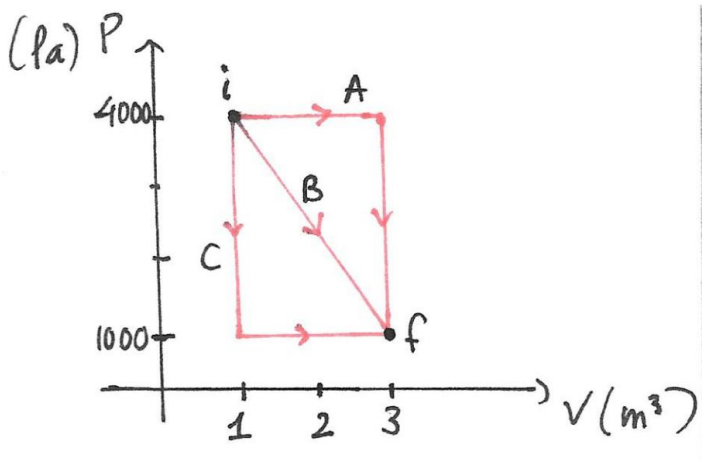
Email: bkambalu@ucsd.edu

Before we Begin:

- Try and **sit next to a student you don't know**
- Introduce yourselves and find out where the other student is from
- We will attempt to **solve 3 Problems** today (2 lengthy ones)

Discussion Problem 1

A sample of 1 mol of monoatomic gas expands from $1.0\ m^3$ to $3.0\ m^3$ while its pressure decreases from 4000 Pa to 1000 Pa.

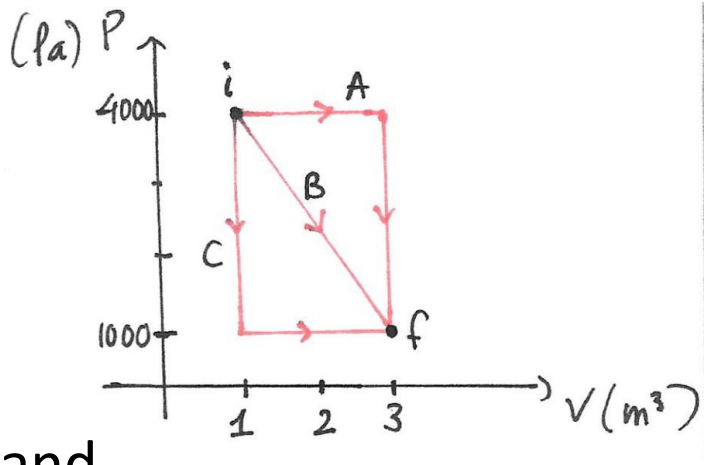


How much work is done by the gas and heat flow out of/into the gas if its pressure changes with volume via:

a) Path A
b) Path B
c) Path C
d) Calculate the work done and heat flow if the gas is diatomic

Discussion Problem 1 - Solution

A sample of 1 mol of monoatomic gas expands from $1.0\ m^3$ to $3.0\ m^3$ while its pressure decreases from 4000 Pa to 1000 Pa.



How much work is done by the gas and heat flow out of/into the gas if its pressure changes with volume via:

a) Path A - $W_A = -8000\ J, Q_A = +6504\ J$
b) Path B - $W_B = -5000\ J, Q_B = +3504\ J$
c) Path C - $W_C = -2000\ J, Q_C = +504\ J$
d) Calculate the work done and heat flow if the gas is diatomic - W_A, W_B, W_C -> Remain Same
$Q_A = 5507\ J, Q_B = 2507\ J, Q_C = -493\ J$

Discussion Problem 2

Adiabatic Processes

Two chambers of an insulting cylinder are separated by a movable, frictionless and, insulating wall. The chambers are filled with an ideal gas ($\gamma = 1.5$). Initially, the two chambers are of equal volume. The right chamber contains a heat source, which heats up the gas inside this chamber. When the Pressure of the right chamber increases to 8 times its initial value, what is the volume of the left chamber, relative to its initial value?

Discussion Problem 2 - Solution

Adiabatic Processes

Two chambers of an insulting cylinder are separated by a movable, frictionless and, insulating wall. The chambers are filled with an ideal gas ($\gamma = 1.5$). Initially, the two chambers are of equal volume. The right chamber contains a heat source, which heats up the gas inside this chamber. When the Pressure of the right chamber increases to 8 times its initial value, what is the volume of the left chamber, relative to its initial value?

Volume of left-chamber becomes ¼ of its original volume

Discussion Problem 3

Adiabatic Processes (Harder)

Adapted from LibreTexts.org

Gasoline vapor is injected into the cylinder of an automobile engine when the piston is in its expanded position. The temperature, pressure, and volume of the resulting gas-air mixture are $20°C$, $1.00 \times 10^5 N/m^2$, and $240cm^3$, respectively. The mixture is then compressed adiabatically to a volume of $40cm^3$.

(a) What are the pressure and temperature of the mixture after the compression?

(b) How much work is done by the mixture during the compression?

Note that in the actual operation of an automobile engine, the compression is not quasi-static, although we are making that assumption here.

Discussion Problem 3 - Solution

Adiabatic Processes (Harder)

Adapted from LibreTexts.org

Gasoline vapor is injected into the cylinder of an automobile engine when the piston is in its expanded position. The temperature, pressure, and volume of the resulting gas-air mixture are $20°C$, $1.00 \times 10^5 N/m^2$, and $240cm^3$, respectively. The mixture is then compressed adiabatically to a volume of $40cm^3$.

(a) What are the pressure and temperature (in K) of the mixture after the compression?

$1.23 \times 10^6 Pa, \quad 600K$

(b) How much work is done by the mixture during the compression?

$-63\ J$