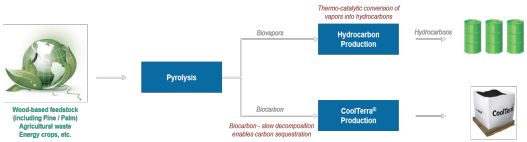
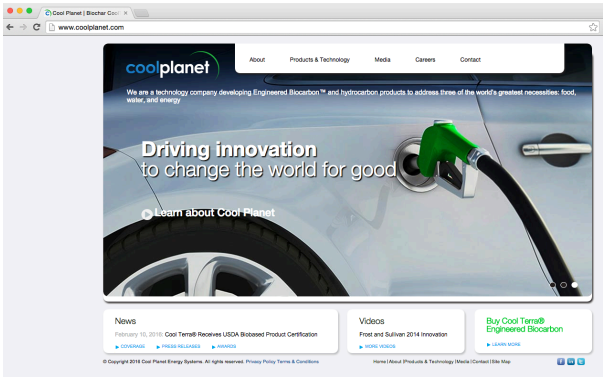
# ChE-304 Problem Set 1

Week 1

## Problem 1

Every few months a new “miracle technology” appears.

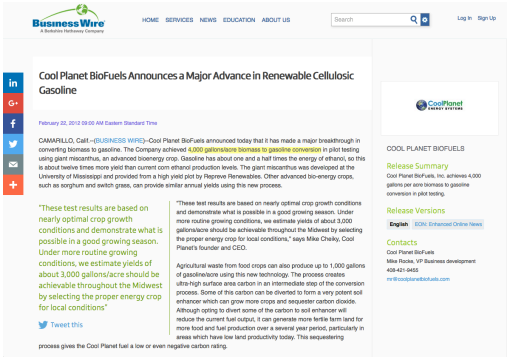



Serious company: investements from BP, Google Ventures, Conoco Phillips…

Claims to produce hydrocarbons and biocarbon.

Impressive number: **3000-4000 gallons/acre gasoline**



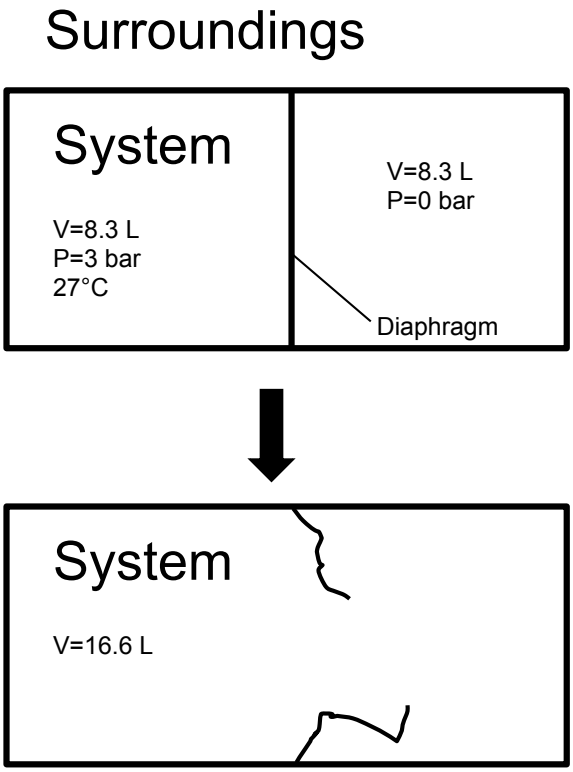

### Should you invest?

This was a real question that William Banholzer got when he was CEO of Dow Chemical.

Hint: Let’s use the first law to calculate the absolute minimum amount of biomass that would require and see if it is a realistic amount to expect from one acre…

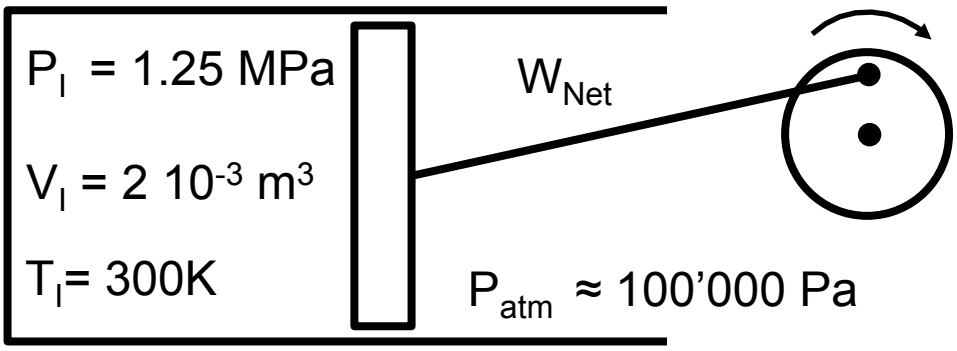
**Problem 2**

Assume we have a perfectly isolated system with 1 mole of an ideal gas at a pressure P = 3 bar in a 16.6 L chamber that is isolated by a diaphragm from another 16.6 L chamber that has been evacuated. What is the change in entropy?



**Problem 3**

In order to properly understand PV work, let's calculate the work done in a single reversible expansion stroke of a piston. In this case, the gas is air and it is assumed that it acts ideally. The expansion occurs until the gas inside the cylinder is at atmospheric pressure. You can assume that the piston and cylinder are perfectly isolating.




Recall that for an ideal gas where $c_p$ and $c_V$ are constant

$P_1 \ V_1^k = P_2 \ V_2^k$ or $PV^k$= constant with $k=c_p/c_V \approx 1.4$ for air

**Calculate $W_{Net}$, as well as $T_{final}$ and $V_{final}$ of the gas.**