1. A glass containing 150g of water is heated in a 600 Watt microwave oven. Starting from room temperature, $T = 20^\circ$C, how long does it take for the water to boil? Assume that no energy is wasted. The specific heat of water is $c(H_2O) = 4.186 \text{ J/(g} \cdot \text{K)}$.

2. The figure shows an approximate PV diagram for a gasoline engine. In the following we shall assume that the working substance is an ideal diatomic ($f = 5$) gas and that the power and compression strokes are adiabatic.

(a) The initial volume is $V_1 = 1 \text{ liter (1 l = (10 cm)}^3\), the initial temperature and pressure are $T_1 = 293 \text{ K}$ and $P_1 = 1 \text{ atm}$. The compression ratio is $V_1/V_2 = 10$. Compute the temperature $T_2$ and the pressure $P_2$.

(b) Compute the amount of work $W_{12}$ required to compress the gas.

(c) During the ignition stage the temperature of the gas is further raised to $T_3 = 1200 \text{ K}$. Compute the amount of heat $Q_{in}$ transferred to the gas.

(d) In the power stroke the volume changes adiabatically back to $V_1$. What is the amount of work $W_{34}$ being done during the expansion? The efficiency $\epsilon$ is defined as the ratio of the net (total) work done over the heat input $Q_{in}$. Compute $\epsilon$. 

\begin{center}
\begin{tikzpicture}
\begin{scope}
\draw[very thick,->] (0,0) -- (5,0) node[anchor=north] {$V_1$} node[anchor=south] {$V$};
\draw[very thick,->] (0,0) -- (0,5) node[anchor=east] {$P_1$} node[anchor=west] {$P_2$} node[anchor=north] {$P_3$};
\draw[very thick,->] (1,1.5) node[anchor=north] {Ignition} -- (2,2) node[anchor=south] {Power};
\draw[very thick,->] (2,2) -- (3,3) node[anchor=south] {Exhaust};
\draw[very thick,->] (0,0) -- (1,1) node[anchor=north] {Compression};
\end{scope}
\end{tikzpicture}
\end{center}