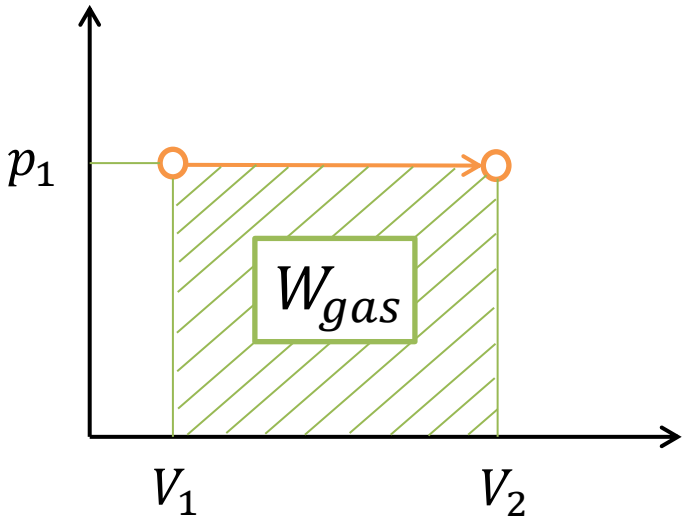
The first law of thermodynamics

Work done by gas as an area under the graph:



$$W_{gas} = p_1(V_2 - V_1)$$

$$W_{gas} = p_1 \cdot \Delta V$$

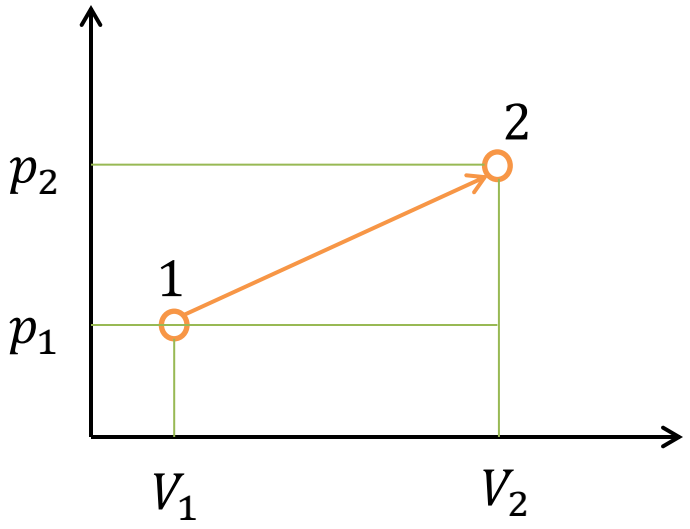
The heat supplied to the gas goes into the change of internal energy and into work done by the gas:

$$Q = m \cdot c \cdot \Delta T \quad \longrightarrow \quad Q = \Delta E_{internal} + W_{gas}$$

Homework 28

Problem 1.

The gas is placed in the container under a piston (the outside pressure is not fixed). The initial pressure and volume are $p_1 = 10^5\ Pa$ and $V_1 = 0.1\ m^3$. After some heating, the pressure and volume increased to $p_2 = 2 \cdot 10^5\ Pa$ and $V_2 = 0.2\ m^3$. The graph below represents the heating process as a line from point 1 to point 2. Using the fact that work is the area under the graph, compute the work done by the gas during this process.



Problem 2.

See the next page!

Homework 28

Problem 2.
A student eats a dinner rated at 1000 calories ($1\ calorie = 4.186\ Joules$). She wishes to do an equivalent amount of work in the gym by lifting a $30\ kg$ mass to a height of $2\ m$. How many lifts does she have to do to spend all the energy? (Assume that no energy is spent when she drops the weight.)

Problem 3.
The gas is heated at constant pressure $p = 10^5\ Pa$. The gas volume changes from 0.5 liters to 1.5 liters. The amount of heat supplied to the gas is $300\ J$. How did the internal energy of the gas change?