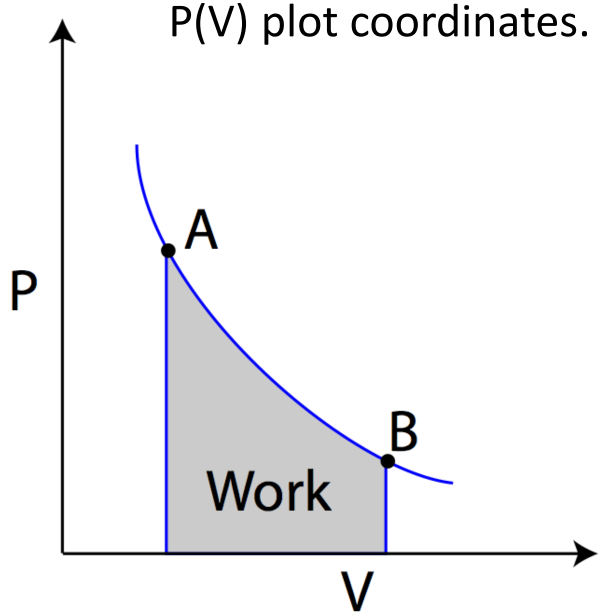
Applying the 1st Law of Thermodynamics to ideal gas

$$\Delta Q = \Delta U + \Delta W = \mathrm{n}C_V \Delta T + P\Delta V$$

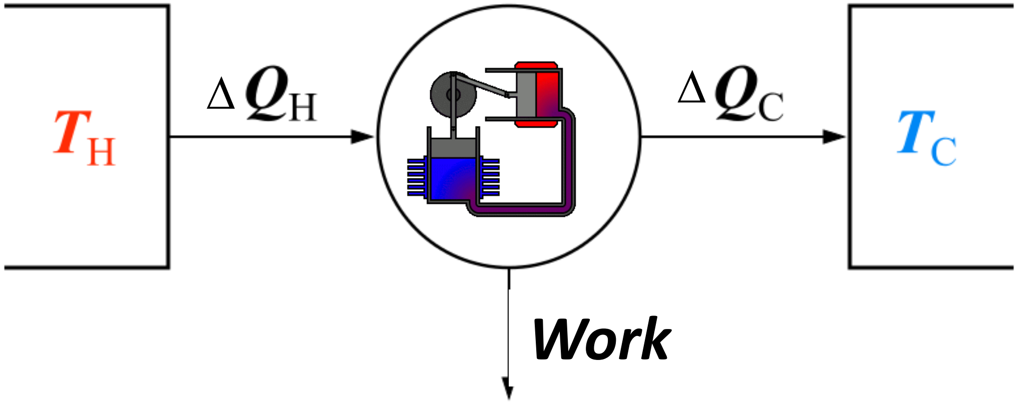
- ΔQ - total heat adsorbed by gas

- ΔU – change in internal energy, $\Delta U = \mathrm{n}C_V\Delta T$. Here C_V is specific heat per mole at constant volume.
- Work <u>done by the gas </u> ΔW can be found as an integral $\int PdV$, or area under P(V) plot coordinates.



Remember the gas law: $PV = nRT$

Efficiency of Heat Engine



Heat Engine has to take heat Q_H from "heater", and return heat Q_C to a "cooler".

$$\boxed{Work = \Delta Q_H - \Delta Q_C}$$

Efficiency of a heat engine is $\frac{Work}{Q_H} = \frac{\Delta Q_H - \Delta Q_C}{\Delta Q_H} = 1 - \frac{\Delta Q_C}{\Delta Q_H}$

Homework

Problem 1. A typical midsize car uses about 5 liter of gasoline per 100 km. 1 liter of gasoline produces about 31.5 MJ of heat when burned. Assuming that car runs at 30% efficiency, estimate the mean force with which the engine "propels" the car on the road (of course, technically the force comes from friction).

Problem 2. A heat engine is using 1 mole of gas that undergoes the process shown on PV diagram. Find the change in internal energy , work done by the gas, and total heat adsorbed during each segment (a->b,b->c, and c->d). What is efficiency of this overall process?
Specific heat of the gas at constant volume is C_V =20 J/K/mol. Note that PV=RT for n=1 mole. Universal gas vconstant is R= 8.3 J/K/mol

	Δ E, J	Δ W, J	Δ Q,J
a->b			
b->c			
c->a