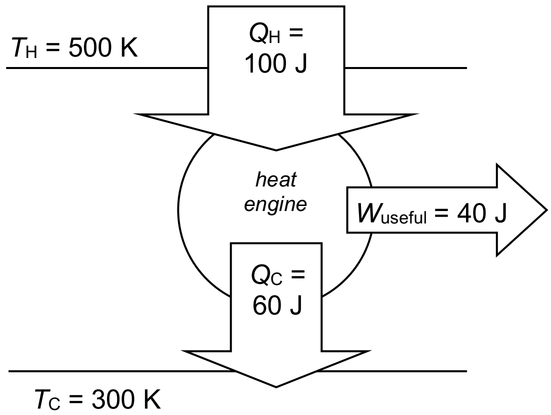
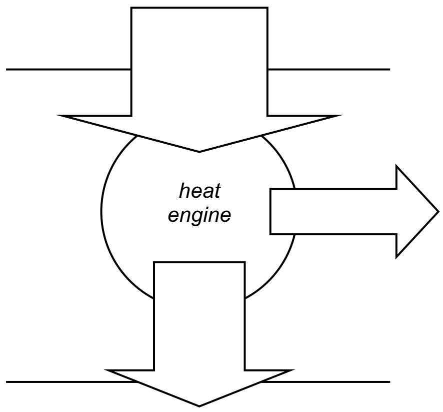
Heat engines

1. Here's an the energy flow chart for a heat engine.
Calculate the Carnot efficiency from
a) *Only* the useful work done by the engine and the heat absorbed from the hot region
b) *Only* the heat absorbed from the hot region and the heat released to the cold region
c) *Only* the given temperatures of the two regions (hot and cold)



2. Here's another energy flow chart for a heat engine:



a) Write the following values in the diagram: Q_H = 200 J, W_{useful} = 50 J, T_H = 400 K.
b) Calculate the heat released to the cold region and write your result in the diagram.
c) Calculate the Carnot efficiency.
d) Calculate the temperature of the cool region and write your result in the diagram.

3. When is the Carnot efficiency of a heat engine greater? If the difference between T_H and T_C is large or small? Give reasons for your answer.

4. An ideal heat engine operates at ϑ_H = 500 °C and ϑ_C = 20.0 °C. It absorbs Q_H = 2.60 MJ.
a) Calculate the Carnot efficiency.
b) What is the useful work done by the heat engine?
c) What is the heat released to the cold region („waste heat“)?

5. A heat engine with a Carnot efficiency of 30.0 % operates at ϑ_H = 200 °C and produces 1.00 GJ of useful electrical energy per second.
a) Calculate the “waste heat” which is released per second.
b) What is the temperature of the cold region?
c) How could the Carnot efficiency be increased to 60 %? There are two options.

<u>solutions:</u>

1. a), b) and c) 40 %		
2. b) 150 J	c) 25 %	d) 300 K
4. a) 62 %	b) 1.6 MJ	c) 986 kJ
5. a) 2.33 GJ	b) 58 °C	c) ϑ_C = - 84 °C or ϑ_H = 555 °C