ESF II project of the University of West Bohemia in Pilsen

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Examples to practice - 1

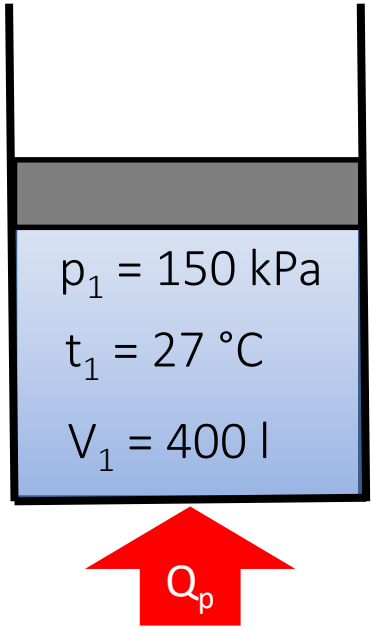
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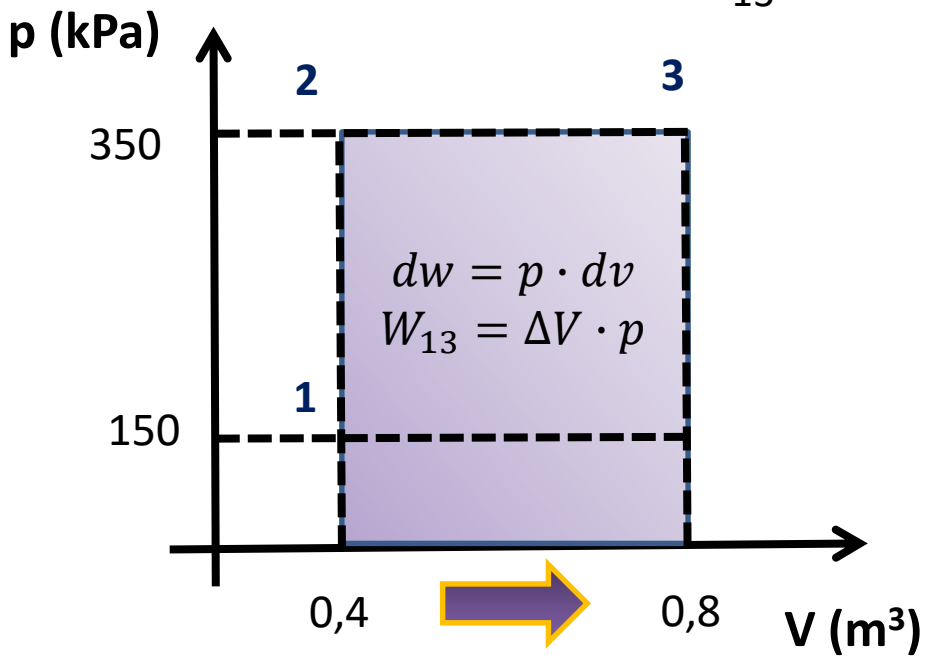
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Example 1

Initially, the piston cylinder contains air with a pressure of 150 kPa and a temperature of 27 ° C. The position of the piston is given by the stops as shown in the figure and the closed volume is 400 l. The weight of the piston is such that the air pressure to move it upwards must reach a value of 350 kPa. The air is heated so that its volume increases twice. Calculate the final temperature T_3 (K) and the work done with air W_{13}. The assumption is that the air behaves like an ideal gas.

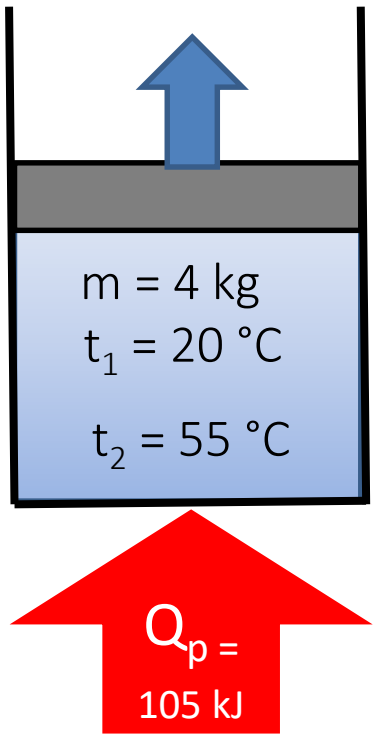




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Example 2

We supply heat weighing 105 kJ to the air weighing 4 kg, which raises the temperature from 20 ° C to 55 ° C. How much expansion work (W_{12}) must the air do?



$$dQ = \mathrm{dU} + \mathrm{dW}$$

$$dQ = m \cdot c_v \cdot dT + \mathrm{p.dV}$$

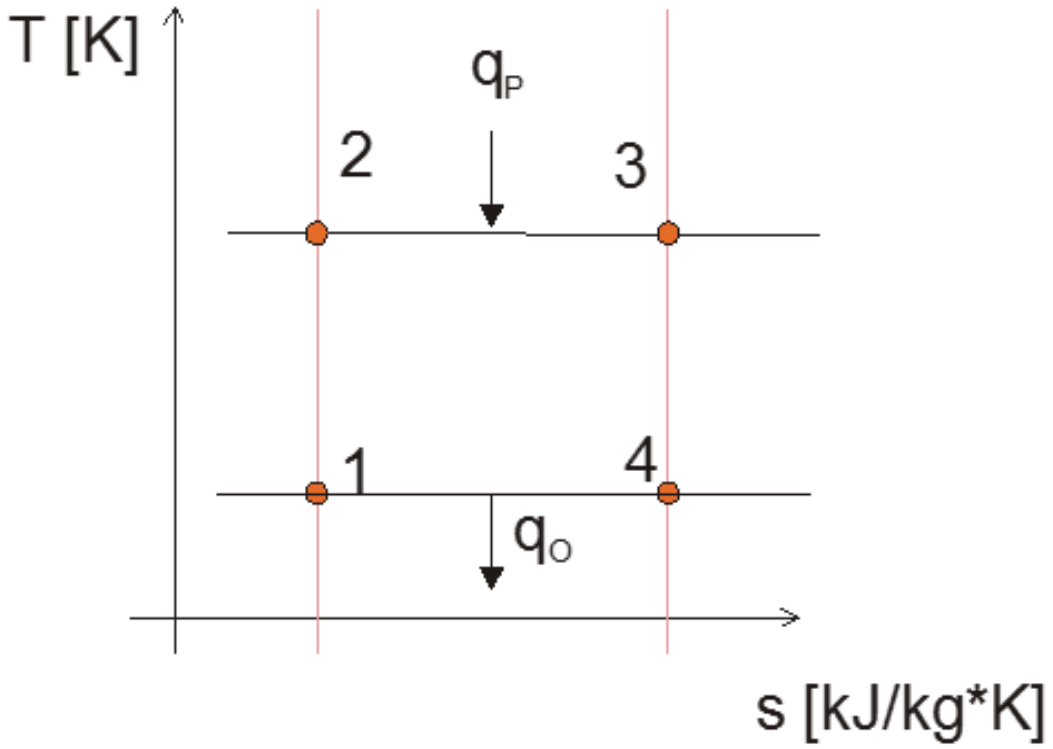
$$dQ = m \cdot c_p \cdot dT + \mathrm{dp.V}$$

$$cv = \frac{cp}{\kappa}$$

$$dU = m \cdot c_v \cdot dT$$

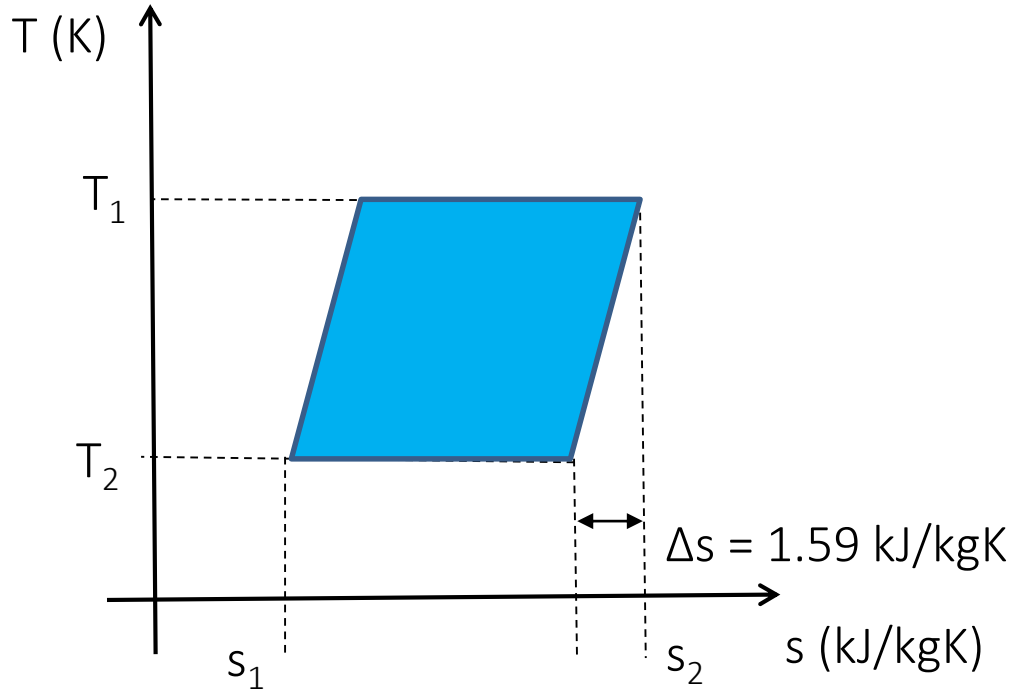
Example 3

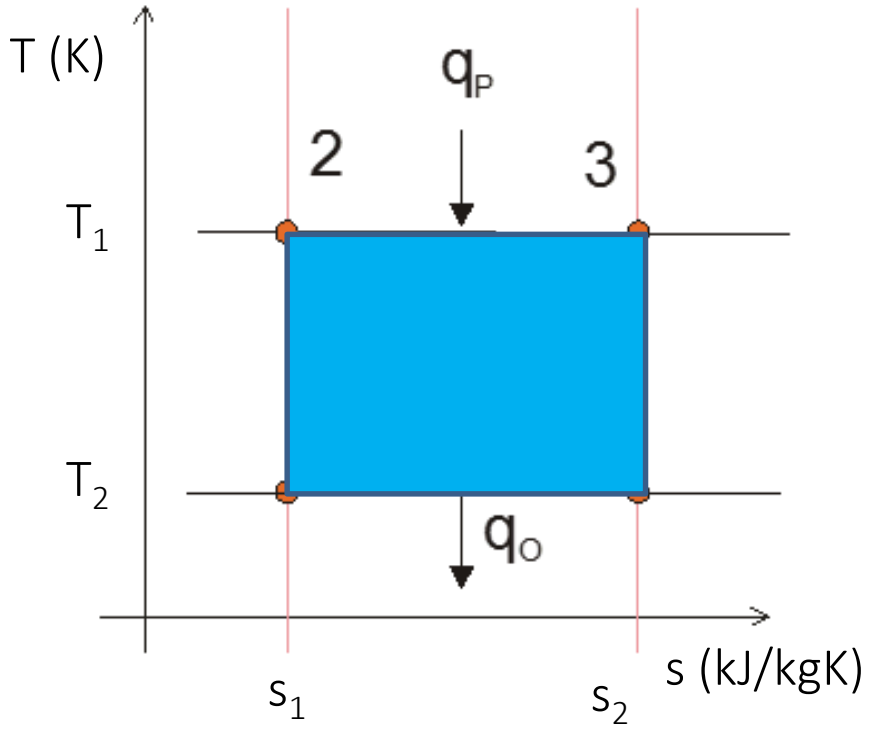
The ideal heat cycle works between temperatures t_1 = 20 ° C and t_2 = 520 ° C. Heat q_p = 66 kJ / kg is supplied to the circuit and heat q_o = 24.7 kJ / kg is removed from the circuit. What is the maximum efficiency of this cycle?



Example 4

The general heat cycle operates between temperatures t_1 = 450 ° C and t_2 = 100 ° C and entropies s_1 = 1.56 kJ / kgK and s_2 = 6.82 kJ / kgK (see figure). What is the efficiency of the cycle if the increase in entropy due to losses is Δs = 1.59 kJ / kgK and what is the efficiency of the equivalent Carnot cycle?





Used and recommended literature

- Dvorsky, Emil; Hejtmankova, Pavla; Kocmich, Martin. Elektrarny : zaklady vyroby elektricke energie : priklady. 1. vyd. Pilsen : UWB, 1994. ISBN 80-7082-133-7.
- Dvorsky, Emil; Hejtmankova, Pavla. Elektrarny : zvysovani ucinnosti premen energie v tepelnych elektrarnach : priklady. 1. vyd. Pilsen : UWB, 1999. ISBN 80-7082-523-5.

- …… and other literature listed in the course syllabus on the website Portal of the UWB in Pilsen

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