2.16) 0,25 kg gas

$P = 5 \cdot 10^5$ Pa $\quad v_1 = 0,20$ m³/kg

$$W = \int_{V_1}^{V_2} P\,dV = P\int_{V_1}^{V_2} dV = P(V_2 - V_1) = mP(v_2 - v_1)$$

P = constant

$mP(v_2 - v_1) = -15 \cdot 10^3$

$v_2 - v_1 = -15 \cdot 10^3 / 0,25 \cdot 5 \cdot 10^5$

$= -0,12$ m³

$v_2 = 0,08$ m³

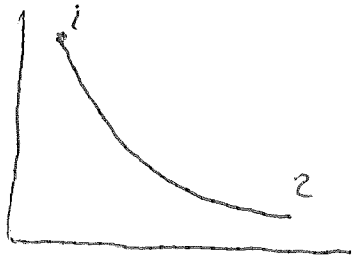
2.17 $P_1 = 1 \cdot 10^5$ Pa $\quad P_2 = 3 \cdot 10^5$ Pa

$V_1 = 0,3$ m³ $\quad V_2 = 0,1$ m³

b) Boyle law $\quad V_1 P_1 = V_2 P_2 = \text{const} = C \quad C = 3 \cdot 10^4$ Pa m³

$$W = \int_{V_1}^{V_2} P\,dV = \int_{V_1}^{V_2} \frac{C}{V}\,dV = C \ln\left(\frac{V_2}{V_1}\right) = 3 \cdot 10^4 \cdot = -33\ \text{kJ}$$

2.18



$P_1 = 500 \cdot 10^3$ Pa $\quad P \cdot V = C$

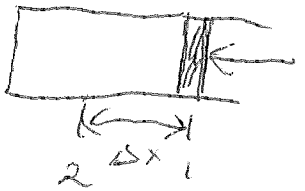
$V_1 = 0,1$ m³

$P_2 = 100 \cdot 10^3$ P

$V_2 = \rightarrow 0,5$ m³ $\quad C = 50 \cdot 10^3$ Pa m³

$$W = C \ln\left(\frac{V_2}{V_1}\right) = 50 \cdot 10^3 \cdot \ln(5) = 80,4\ \text{kJ}$$

2.19



~~$F = k(x_1 - x_2)$~~

$F = kx$

$F_1 = 900$ N

$F_2 = 0$

$V_1 = 0,003$ m³

$V_2 = 0,002$ m³

$A = 0,1 d^2$

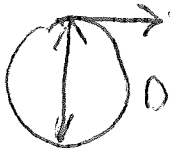
$\Delta V = A \cdot \Delta x \quad \Delta x = \frac{0,001}{0,018} = 0,055$ m

$k = \frac{F}{\Delta x} = \frac{900}{0,055} = 16,4$ kN/m

$$W = \int_{x_1}^{x_2} F \cdot ds = \int_{x_1}^{x_2} kx\,dx = \tfrac{1}{2} k x^2 \Big|_{x_1}^{x_2} = \tfrac{1}{2} \cdot 16,4 \cdot 10^3 \cdot (0,055^2 - 0^2)$$

2.22) $300\ RPM = \frac{300}{60} \cdot 2\pi\ rad/s$

$= 10\pi\ rad/s$



$= M = F \cdot R = 2000 \cdot \frac{D}{2} = 300\ Nm$

Vermogen $= P = M \cdot \omega = 300 \cdot 10\pi = 9.4\ kW$

2.23 $I = 10\ A \quad V = 110\ V$

$P_{elec} = 10 \cdot 110 = 1100\ Watt$

$1000\ RPM = \frac{1000}{60} \cdot 2\pi\ (rad/s) = 104.7\ rad/s$

$P_{shaft} = M\omega = 10.2 \cdot 104.7 = 1068\ Watt$

$\eta = \frac{P_{shaft}}{P_{elec}} = \frac{1068}{1100} = 97\%$

2.30) $Q = -kA\frac{\partial T}{\partial x} \qquad T = lineair$

$Q = -kA\frac{\Delta T}{\Delta x} \qquad \Delta x = 0,2\ m$

Table A-19 $k = 1.4\ W/mK$ (alleen ook edelie)

$0,13 \cdot 10^3 = 1,4 \cdot 1 \cdot \frac{\Delta T}{0,2} \qquad \Delta T = 2,4\ °C\ (K)$