# Übungsaufgaben I, von 24.04.2001

## Musterlösungen

1.

$$\alpha = \left(\frac{\frac{\partial V}{\partial T}}{V}\right)_p \approx \frac{\Delta V}{V \cdot \Delta T}$$

$$\Delta V = \alpha \cdot V \cdot \Delta T$$

$$\Delta V = 5.01 \cdot 10^{-5} \times 50 \cdot 10^{-6} \times 5 = 1.25 \cdot 10^{-3} m^3$$

$$\boxed{\Delta V = 125\ mm^3}$$

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2.

1 cal ≈ 4.184 J ; 1 Watt $\leftrightarrow$ 1J . $s^{-1}$

$$P_{av} = \frac{2500 \cdot 10^3 \cdot 4.184}{24 \cdot 60 \cdot 60\,\text{sec}}$$

$$\boxed{P_{av} \approx 7.02\ \text{MW}}$$

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3.

Anfangszustand: $P_0 \cdot V_0 = n \cdot R \cdot T_0$

Endzustand: $P_1 \cdot V_0 = n \cdot R \cdot T_1$

Wobei $T_0$ = 0°C 273,15 K

$\therefore$ $T_1$ = 296,15 K (23°C),

$P_0$ (mm Hg) = $P_{ext}$ (mm Hg) + $h_0$ (mm),
$P_1$ (mm Hg) = $P_{ext}$ (mm Hg) + $h_1$ (mm);

$P_{ext}$ : extern Druck = 1 atm

$$V_0 = \frac{n \cdot R \cdot T_0}{P_0} = \frac{n \cdot R \cdot T_1}{P_1}$$

$$P_1 = \frac{P_0 \cdot T_1}{T_0}$$

$$h_1 = \frac{h_0 \cdot T_1}{T_0} + P_{ext} \cdot \frac{(T_1 - T_0)}{T_0}$$

$$\boxed{h_1\,(\text{mm}) = 1{,}086\ h_0 + 65\ \text{mm}}$$

4.

$$f(x,y,z)=\frac{e^{-\lambda^2x^2}}{\cos^2(3y-z^2)}$$

Vollständiges Differential $$df(x,y,z)=\frac{\partial f}{\partial x}dx+\frac{\partial f}{\partial y}dy+\frac{\partial f}{\partial z}dz$$

Benötigte Formeln: $$\frac{d}{dx}(e^{f(x)})=\frac{df(x)}{dx}e^{f(x)} \qquad (e^f)'=f'e^f$$

$$(\frac{1}{f})'=-\frac{f'}{f^2};$$

$$(f^{\alpha})'=\alpha f^{\alpha-1}f';$$

$$\cos(f)'=-f'\sin(f)$$

Daraus folgt:

$$\frac{\partial f}{\partial x}=\frac{-2\lambda^2xe^{-\lambda^2x^2}}{\cos^2(3y-z^2)},$$

$$\frac{\partial f}{\partial y}=\frac{6e^{-\lambda^2x^2}}{\cos^3(3y-z^2)}\sin(3y-z^2),$$

$$\frac{\partial f}{\partial z}=\frac{-4e^{-\lambda^2x^2}}{\cos^3(3y-z^2)}z\sin(3y-z^2)$$

$$df(x,y,z)=\frac{-2e^{-\lambda^2x^2}}{\cos^2(3y-z^2)}[\lambda^2xdx-3\tan g(3y-z^2)dy+2z\tan g(3y-z^2)dz]$$