A1)

$$\varrho(\nu)\,d\nu = \frac{8\pi\nu^2}{c^3}\,\frac{h\nu}{e^{h\nu/kT}-1}\,d\nu$$

$$\nu\lambda = c \Rightarrow \nu = c/\lambda, \quad d\nu = |-c/\lambda^2|\,d\lambda$$

$$\Rightarrow \varrho(\lambda)\,d\lambda = \frac{8\pi ch}{\lambda^5}\,\frac{1}{e^{hc/kT\lambda}-1}\,d\lambda$$

$$C_1 = 8\pi ch$$

$$C_2 = hc/k$$

$$\varrho(\lambda)\,d\lambda = \frac{C_1}{\lambda^5}\,\frac{1}{e^{C_2/T\lambda}-1}\,d\lambda$$

$$\varrho(\lambda) = \frac{C_1}{\lambda^5}\,\frac{1}{e^{C_2/T\lambda}-1}$$

$$0 \overset{!}{=} \frac{d\varrho(\lambda)}{d\lambda} = \frac{-5C_1}{\lambda^6}\,\frac{1}{e^{C_2/T\lambda}-1} + \frac{C_1}{\lambda^5}\,\frac{-1}{(e^{C_2/T\lambda}-1)^2}\cdot e^{C_2/T\lambda}\cdot\frac{-C_2}{T\lambda^2}$$

$$= \frac{C_1}{e^{C_2/T\lambda}-1}\cdot\frac{1}{\lambda^6}\left(-5 + \frac{C_2}{T\lambda}\,\frac{e^{C_2/T\lambda}}{e^{C_2/T\lambda}-1}\right) = 0$$

$$5 = \frac{C_2}{T\lambda}\,\frac{e^{C_2/T\lambda}}{e^{C_2/T\lambda}-1} \qquad \frac{C_2}{T\lambda} = x$$

$$5 = x\,\frac{e^x}{e^x-1}$$

$$5e^x - 5 = xe^x$$

$$1 - e^{-x} = x/5$$

$$\Rightarrow x = 4{,}965 \quad \text{(Extremalstelle, hier: } \varrho \text{ maximal)}$$

$$\Rightarrow \frac{hc/k}{T\lambda_{max}} = 4{,}965$$

$$\Rightarrow \lambda_{max}T = \frac{hc}{4{,}965\,k} = \text{const.} \qquad \text{Wiensches Verschiebungsges.}$$

A2) geg.: $d = 0{,}01\ cm$
$T = 2500\ K$
$\rho = 2{,}5 \cdot 10^{-4}\ \Omega cm$

ges.: I

Lös.: $P_{Stv.} = A \sigma T^4 = L \pi d \sigma T^4$

$P_{el} = U I = R I^2 = \frac{L}{A} \rho I^2 = \frac{4L}{\pi d^2} \rho I^2$

$\Rightarrow P_{Stv.} = P_{el}$

$L \pi d \sigma T^4 = \frac{4L}{\pi d^2} \rho I^2$

$\Rightarrow I = \sqrt{\pi^2 d^3 \sigma T^4 / 4\rho}$

$= \frac{\pi d T^2}{2} \sqrt{d\sigma/\rho} \approx 1{,}47\ A$

A3) geg.: $T = 5700\ K$
$d = 1{,}4 \cdot 10^9\ m$
$m = 2 \cdot 10^{30}\ kg$

ges.: $P_{Stv.} \cdot 1a$ [% von m]

Lös.: $P_{Stv.} = A \sigma T^4 = \pi d^2 \sigma T^4 \approx 3{,}7 \cdot 10^{26}\ W$

$\Delta m = P_{Stv.} \cdot 1a / c^2$

$\approx 1{,}4 \cdot 10^{17}\ kg$

$\hat{=} \quad 7 \cdot 10^{-12}$ % von m

A4) geg.: $T_0 = 30\,^\circ C = 303{,}15\ K$
$T_1 = 20\,^\circ C = 293{,}15\ K$
$T_2 = 10\,^\circ C = 283{,}15\ K$

ges.: r_2 / r_1

Lös.: $P_1 = A_1 \sigma (T_0^4 - T_1^4) = 4\pi r_1^2 \sigma (T_0^4 - T_1^4)$

$P_2 = A_2 \sigma (T_0^4 - T_2^4) = \quad "$

$P_1 \stackrel{!}{=} P_2$

$r_1^2 (T_0^4 - T_1^4) = r_2^2 (T_0^4 - T_2^4)$

$\Rightarrow r_2 / r_1 = \sqrt{(T_0^4 - T_1^4)/(T_0^4 - T_2^4)} \approx 0{,}72$

$\Rightarrow 72\ \%$