Szacowanie niepewności wyników do ćwiczenia M10

Oszacuj niepewności: $(u)\lambda$, $(u)\Delta S_1$, $(u)\Delta S_2$, $(u)\Delta S_3$.

$$\lambda = \frac{(c_w m_w + c_k m_k)(t_p - t_k) - c_w m_l (t_k - t_0)}{m_l}$$

$$u(\lambda) = \sqrt{\left(\frac{\partial\lambda}{\partial m_k}\right)^2 u^2(m_k) + \left(\frac{\partial\lambda}{\partial m_w}\right)^2 u^2(m_w) + \left(\frac{\partial\lambda}{\partial m_l}\right)^2 u^2(m_l) + \left(\frac{\partial\lambda}{\partial t_p}\right)^2 u^2(t_p) + \left(\frac{\partial\lambda}{\partial t_k}\right)^2 u^2(t_k)}$$

$u(m_k) = \frac{\Delta m_k}{\sqrt{3}}$	$u(m_w) = \frac{\Delta m_w}{\sqrt{3}}$	$u(m_l) = \frac{\Delta m_l}{\sqrt{3}}$	$u(t_p) = \frac{\Delta t_p}{\sqrt{3}}$	$u(t_k) = \frac{\Delta t_k}{\sqrt{3}}$
$\frac{\partial\lambda}{\partial m_k} = \frac{c_k(t_p - t_k)}{m_l}$	$\frac{\partial\lambda}{\partial m_w} = \frac{c_w(t_p - t_k)}{m_l}$	$\frac{\partial\lambda}{\partial m_l} = -\frac{(c_w m_w + c_k m_k)(t_p - t_k)}{{m_l}^2}$	$\frac{\partial\lambda}{\partial t_p} = \frac{c_w m_w + c_k m_k}{m_l}$	$\frac{\partial\lambda}{\partial t_k} = -\frac{c_w m_w + c_k m_k}{m_l} - c_w$

$$\Delta S_1 = \frac{Q_1}{T_0} = \frac{\lambda m_l}{T_0}$$

$$u(\Delta S_1) = \sqrt{\left(\frac{\partial \Delta S_1}{\partial m_l}\right)^2 u^2(m_l) + \left(\frac{\partial \Delta S_1}{\partial \lambda}\right)^2 u^2(\lambda)}$$

$u(m_l) = \frac{\Delta m_l}{\sqrt{3}}$	$u(\lambda)$ wyznaczone poprzednio
$\frac{\partial \Delta S_1}{\partial m_l} = \frac{\lambda}{T_0}$	$\frac{\partial \Delta S_1}{\partial \lambda} = \frac{m_l}{T_0}$

$$\Delta S_2 = \int_{T_0}^{T_k} \frac{dQ_2}{T} = \int_{T_0}^{T_k} \frac{m_l c_w}{T} dT = c_w m_l \ln \frac{T_k}{T_0}$$

$$u(\Delta S_2) = \sqrt{\left(\frac{\partial \Delta S_2}{\partial m_l}\right)^2 u^2(m_l) + \left(\frac{\partial \Delta S_2}{\partial T_k}\right)^2 u^2(T_k)}$$

$u(m_l) = \frac{\Delta m_l}{\sqrt{3}}$	$u(T_k) = \frac{\Delta T}{\sqrt{3}}$

$\frac{\partial \Delta S_2}{\partial m_l} = c_w \ln \frac{T_k}{T_0}$	$\frac{\partial \Delta S_2}{\partial T_k} = \frac{c_w m_l}{T_k}$

$$\Delta S_3 = \int_{T_p}^{T_k} \frac{dQ_{3,4}}{T} = \int_{T_0}^{T_k} \frac{c_w m_w + c_k m_k}{T} dT = (c_w m_w + c_k m_k) \ln \frac{T_k}{T_p}$$

$$u(\Delta S_3) = \sqrt{\left(\frac{\partial \Delta S_3}{\partial m_w}\right)^2 u^2(m_w) + \left(\frac{\partial \Delta S_3}{\partial m_k}\right)^2 u^2(m_k) + \left(\frac{\partial \Delta S_3}{\partial T_p}\right)^2 u^2(T_p) + \left(\frac{\partial \Delta S_3}{\partial T_k}\right)^2 u^2(T_k)}$$

$u(m_k) = \frac{\Delta m_k}{\sqrt{3}}$	$u(m_w) = \frac{\Delta m_w}{\sqrt{3}}$	$u(t_p) = \frac{\Delta T_p}{\sqrt{3}}$	$u(t_k) = \frac{\Delta T_k}{\sqrt{3}}$
$\frac{\partial \Delta S_3}{\partial m_k} = c_k \ln \frac{T_k}{T_p}$	$\frac{\partial \Delta S_3}{\partial m_w} = c_w \ln \frac{T_k}{T_p}$	$\frac{\partial \Delta S_3}{\partial T_p} = \frac{-c_w m_w - c_k m_k}{T_p}$	$\frac{\partial \Delta S_3}{\partial T_k} = \frac{c_w m_w + c_k m_k}{T_k}$