1) $m = 5g = 0{,}005\ kg$

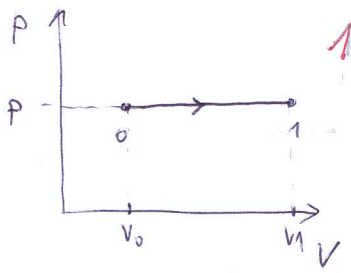
$t_0 = 0°C = 273\ K$

$t_1 = 50°C = 323\ K$

$p = konst.$

$c_v = 917\ J.kg^{-1}K^{-1}$

$\Delta S = ?$



1b

$$\Delta S = \int \frac{dQ}{T} = \int \frac{pdV + mc_v dT}{T} = \int_{T_0}^{T_1} \frac{mRdT}{T} + \frac{mc_v dT}{T}$$ 1b

$pdV = mRdT$

$c_p = c_v + R$

$R = c_p - c_v$

$$= mR \ln\frac{T_1}{T_0} + mc_v \ln\frac{T_1}{T_0}$$

$$= m(c_p - c_v)\ln\frac{T_1}{T_0} + mc_v \ln\frac{T_1}{T_0} = m(c_p - c_v)\ln\frac{T_1}{T_0} + mc_v \ln\frac{T_1}{T_0}$$

$$= mc_p \ln\frac{T_1}{T_0} - mc_v \ln\frac{T_1}{T_0} + mc_v \ln\frac{T_1}{T_0} = mc_p \ln\frac{T_1}{T_0} = m\varkappa c_v \ln\frac{T_1}{T_0}$$ 2b

$$= 0{,}005 \cdot 1{,}4 \cdot 917 \cdot \ln\frac{323}{273}$$

$$= 1{,}08\ JK^{-1}$$ 1b

$\varkappa = \frac{c_p}{c_v}$

$c_p = \varkappa c_v$ 1b

$\varkappa = \frac{i+2}{i} = \frac{5+2}{5} = \frac{7}{5} = 1{,}4$

(6b)

(2)

$\omega = 4\,s^{-1}$

$t = 5\,s$

$\varepsilon = 1{,}5\,s^{-2}$

$t_{celkové} = ?$

$n = ?$

$\omega_k = \omega_p - \varepsilon t_z$ 1

$\omega_p - \omega_k = \varepsilon t_z$

$t_z = \frac{\omega_p - \omega_k}{\varepsilon}$

$t_z = \frac{4 - 0}{1{,}5} = \frac{4}{1{,}5} = \underline{2{,}67\,s}$ 0,5

$t_{celkové} = t_z + t = 2{,}67 + 5 = \underline{\underline{7{,}67\,s}}$ 1

$\varphi_{celkové} = \varphi' + \varphi''$

$\varphi' = \omega . t = 4 . 5 = \underline{20\ rad}$ 1

$\varphi''(t_z) = \omega t_z - \frac{1}{2}\varepsilon t_z^2$ 1 $= 4 . 2{,}67 - \frac{1}{2} 1{,}5 (2{,}67)^2 =$

$= 10{,}68 - 5{,}35 \doteq \underline{5{,}33\,rad}$ 0,5

$\varphi_{celkové} = 20 + 5{,}33 = 25{,}33\,rad$

$n = \frac{\varphi_{celkové}}{2\pi} = \frac{25{,}33}{2\pi} \doteq 4{,}031 \Rightarrow$ **4 celé otáčky** 1

(6)

③ $\frac{A_1}{A_2} = R = 2{,}5$

$T = 0{,}175\,s$

$\delta = ?$

$T_0 = ?$

$$R = \frac{A_1}{A_2} = \frac{A_0 e^{-\delta t} \cos(\omega t + \varphi)}{A_0 e^{-\delta(t+T)} \cos(\omega(t+T)+\varphi)} = \frac{e^{-\delta t}}{e^{-\delta t} \cdot e^{-\delta T}} = e^{\delta T} \quad 1$$

$$\ln R = \delta T$$

$$\delta = \frac{\ln R}{T} = \frac{\ln 2{,}5}{0{,}175} = 1{,}22\ s^{-1} \quad 1$$

$\omega = \sqrt{\omega_0^2 - \delta^2}$ 0,5 $\omega = \frac{2\pi}{T}$ 0,5

$$\omega^2 + \delta^2 = \omega_0^2$$

$$\left(\frac{2\pi}{T}\right)^2 + \delta^2 = \left(\frac{2\pi}{T_0}\right)^2$$

$$T_0^2 = \frac{(2\pi)^2}{\left(\frac{2\pi}{T}\right)^2 + \delta^2}$$

$$T_0 = \frac{2\pi}{\sqrt{\left(\frac{2\pi}{T}\right)^2 + \delta^2}} \quad 1$$

$$T_0 = \frac{2\pi}{\sqrt{\left(\frac{2\pi}{0{,}175}\right)^2 + (1{,}22)^2}} = 0{,}172\ s \quad 1$$

5b