Homework (back by February 11th, 3 pm EST, to ufother@clemson.edu as well as to local instructor)

1. **Consider the series of a Kelvin-Voigt model and a spring as 1st realistic representation of bulk viscoelasticity. Derive the following formula which holds for constant strain:**

$$\sigma(t) = \frac{3 \cdot K_1 \cdot K_2}{K_1 + K_2} \cdot \varepsilon_0 + \frac{3 \cdot K_2 \cdot K_2}{K_1 + K_2} \cdot \varepsilon_0 \cdot e^{-t \cdot 3 \cdot (K_1 + K_2)/\eta_V)}$$

(Start with the following consideration: both for the Kelvin-Voigt-model and the single spring, the stress is σ(t). The strains are $\varepsilon_1(t)$ and $\varepsilon_2(t)$ which are also time-dependent. However, $\varepsilon_1(t) + \varepsilon_2(t) = \varepsilon_0$ at all times. If one replaces $\varepsilon_1(t) + \varepsilon_2(t)$ with expressions depending on σ(t), one will arrive at a differential equation for σ(t). Solving this equation will lead to the above formula.)

2. **Consider the glass LaSK3. At the temperature where the shear viscosity is 10^{12}dPa·s (650°C) the flexure pendulum seems to give good results, too. Look at the value corresponding logarithmic decrement (my estimate: $20 \cdot 10^{-4}$) and the formula for the latter. Make a suggestion for the technical set-up (sample length, sample cross section, length and cross section of metal strip , metal type – in fact, only Young´s modulus of the metal enters the formula, mass of the oscillating load) so that the logarithmic decrement of LaSK3 will have the value "$20 \cdot 10^{-4}$" at 650°C.**