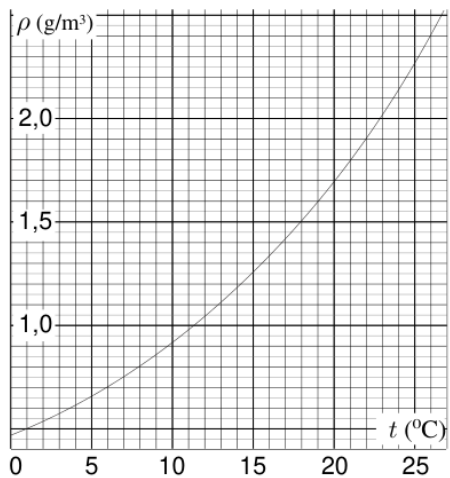
1. Drying (12 p)

According to the wide-spread belief, it is useful to keep window open wen drying laundry even if the relative humidity outside is 100%, because the temperature of the incoming air rises and thereby the relative humidity drops. Let us analyse, do these arguments hold, when heating is switched off.

Suppose that inside a room, the volume of air $V_1 = 20\,\mathrm{m}^3$ from inside at the temperature $t_1 = 25\,\mathrm{C}^\circ$ is mixed with the volume of air $V_2 = 10\,\mathrm{m}^3$ from outside at the temperature $t_2 = 1\,\mathrm{C}^\circ$. The specific heat of the air (by fixed pressure) $c_p = 1005\,\mathrm{J/(kg \cdot K)}$ can be assumed to be constant for the given temperature range; the heat exchange with the medium can be neglected. For the time being, you may neglect the possibility of (partial) condensation of the vapour.

1) Prove that the total volume of the air will not change i.e. that the volume of the mixed air $V = V_1 + V_2$.

2) What is the temperature of the mixed air T?



3) The graph below shows the dependence of the saturated vapour density for water as a function of temperature. Before mixing, both the interior and exterior air had relative humidity of $r_0 = 100\%$. What is the relative humidity r of the mixed air (if it happens to increase $r > 100\%$ then assume that an oversaturated vapour with $r > 100\%$ is formed)?

4) If you happened to obtain $r > 100\%$ then the oversaturated vapour breaks down into a fog which contains tiny water droplets. In that case, what is the mass m of the condensed water (i.e. the total mass of the water droplets)? Air density $\rho_0 = 1{,}189\,\mathrm{Kg/m}^3$; latent heat of vaporization for water $q = 2500\,\mathrm{kJ/kg}$.