[tex152] Homogeneous atmosphere

Meteorological modeling uses the concept of homogeneous atmosphere with constant density over some vertical distance. Consider a column of air [molar mass $M = 29\text{g}$] treated as a classical ideal gas [$pV = nRT$] in a uniform gravitational field $g = 9.81\text{m/s}^2$. The column is assumed to have constant mass density $\rho(z) = \rho_0 = \text{const}$.
(a) Calculate the dependence on height z of the pressure p and the temperature T, assuming that $p = p_0$ and $T = T_0$ at $z = 0$.
(b) Find the height z_h, expressed as a function of T_0, at which T and p both reach zero.
(c) What must be the temperature (in °C) at sea level so that the homogeneous atmosphere just reaches the tip of Mount Everest?
Hints can be gleaned from [tex150] and [tex151].

Solution: