3.20) We have $x = \frac{\mu B}{kT} = \frac{9.27 \times 10^{-24}\ J/T \times 2.06\ T}{1.38 \times 10^{-23}\ J/K \times 2.2\ K} = 0.629$

$\tanh x = 0.558$, and

$\frac{U}{U_{max}} = -\tanh x = -0.558$, while $\frac{M}{M_{max}} = \tanh x = 0.558$.

Now, $\frac{N_\uparrow}{N} = \frac{1}{2}\left(1 - \frac{U}{U_{max}}\right) = 0.78$. Thus, $\frac{N_\downarrow}{N} = 0.22$.

Thus, $\frac{S}{S_{max}} = \frac{-Nk\left(x \ln x + (1-x)\ln(1-x)\right)}{-Nk \ln 2} = 0.76$.

To get to 99% magnetization, i.e., $\tanh x = 0.99$,

$x = 2.65$.

Thus T should be $2.2K \times \left(\frac{2.65}{0.629}\right)^{-1} = 0.52K$.