$\boxed{\text{Sheet 2}}$

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$\boxed{\text{Ex 2}}$: $r = \frac{n_\uparrow}{n_\downarrow}$

a) $$\frac{1-r}{1+r} n \frac{\hbar\gamma}{2} = \frac{\frac{n_\downarrow - n_\uparrow}{\cancel{n_\downarrow}}}{\frac{n_\downarrow + n_\uparrow}{\cancel{n_\downarrow}}} \cdot (n_\downarrow + n_\uparrow) \frac{\hbar\gamma}{2}$$

μ_0 of single uncancelled $\downarrow$

$$= (n_\downarrow - n_\uparrow) \cdot \frac{\hbar\gamma}{2} = \mu_0$$

not cancelled

$$r = e^{-\frac{\Delta E}{k_B T}} = e^{\underbrace{-\frac{\hbar\gamma}{k_B}\frac{B_0}{T}}_{=:\xi}} \text{ (see b))}$$

$\hbar = 1{,}054 \cdot 10^{-34}$ Js
$\gamma = 2{,}675 \cdot 10^{8}\ s^{-1} T^{-1}$
$k_B = 1{,}381 \cdot 10^{-23} \frac{J}{K}$

$B_0 := 1{,}5\,T$
$T := 310\ K$

$n = 6{,}69 \cdot 10^{19}$

$\Rightarrow \quad r \approx (1{,}00000988)^{-1} = 0{,}99999$

$\Rightarrow \quad \mu_0 = 4{,}658 \cdot 10^{-12} \frac{J}{T} = A\,m^2$ (magnetic moment in $1 (mm)^3$)

$\Rightarrow$ magnetization: $\frac{\mu_0}{1 (mm)^3} = 4{,}658 \cdot 10^{-3} \frac{A}{m}$