

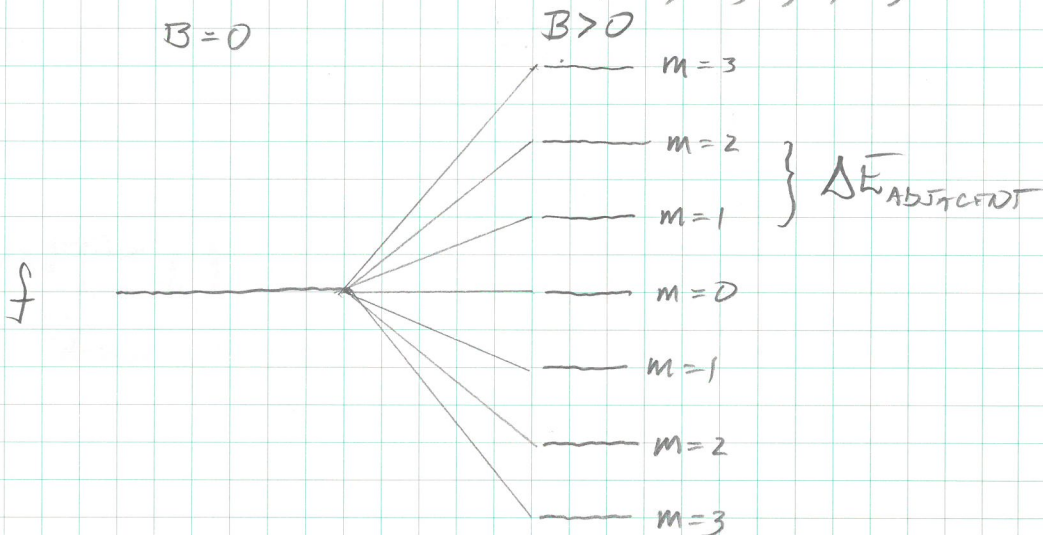
9.15) A HELIUM ATOM HAS  $1e^-$  IN AN S STATE ( $l=0$ ) AND ONE IN AN f STATE ( $l=3$ ). THE SPINS ARE OPPOSITE, SO THE CARBON FOR A SINGLET STATE. THE Hc IS IN  $B = 0.8 T$ .

- a) SKETCH THE SPLITTING OF THE ORIGINAL ENERGY LEVELS.  
 b) WHAT'S THE ENERGY DIFFERENCE BETWEEN ADJACENT LEVELS?

a) THE SPLITTING DEPENDS ON  $m$

s-STATE:  $l=0 \Rightarrow m=0 \Rightarrow$  NO SPLITTING!

f-STATE:  $l=3 \Rightarrow m = -3, -2, -1, 0, 1, 2, 3$



b) THE ENERGY OF THE  $m^{\text{th}}$  LEVEL IS  $E_m = m \mu_B B$

$\Rightarrow$  FOR ADJACENT LEVELS

$$\begin{aligned} \Delta E_{\text{ADJACENT}} &= E_{\text{UPPER}} - E_{\text{LOWER}} \\ &= \mu_B B (m_{\text{UPPER}} - m_{\text{LOWER}}) \end{aligned}$$

$\Delta m = 1$  FOR ADJACENT LEVELS

$$\Rightarrow \Delta E_{\text{ADJACENT}} = \mu_B B$$

FOR  $B = 0.8 T$

$$\Delta E_{\text{ADJ}} = (5.79 \times 10^{-5} \frac{\text{eV}}{T})(0.8 T) = \boxed{4.63 \times 10^{-5} \text{ eV} = \Delta E_{\text{ADJ}}}$$

SO IT'S A tiny DIFFERENCE!