Ejercicio 3) (n, l, m_l, m_s)

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$3d \rightarrow$ $(3,2,2,+1/2)$ $(3,2,2,-1/2)$
$(3,2,1,+1/2)$ $(3,2,1,-1/2)$
$(3,2,0,+1/2)$ $(3,2,0,-1/2)$
$(3,2,-1,+1/2)$ $(3,2,-1,-1/2)$
$(3,2,-2,+1/2)$ $(3,2,-2,-1/2)$

10

6

$2p \rightarrow$ $(2,1,1,+1/2)$ $(2,1,1,-1/2)$
$(2,1,0,+1/2)$ $(2,1,0,-1/2)$
$(2,1,-1,+1/2)$ $(2,1,-1,-1/2)$

a) Impulso angular $= L = \hbar\sqrt{l(l+1)}$

Para el estado $\underline{3d} \Rightarrow l = 2 \Rightarrow L = \hbar\sqrt{2(2+1)}$

$\Rightarrow \boxed{L_1 = \frac{6{,}62\cdot10^{-34}}{2\pi}\ J\cdot s\cdot\sqrt{6} = 2{,}58\cdot10^{-34}\ J\cdot s}$ ✓

Para el estado $\underline{2p} \Rightarrow l = 1 \Rightarrow L = \hbar\sqrt{1(1+1)}$

$\Rightarrow L = \frac{6{,}62\cdot10^{-34}}{2\pi}\ J\cdot s\cdot\sqrt{2} \Rightarrow \boxed{L_2 = 1{,}49\cdot10^{-34}\ J\cdot s}$ ✓

b) Las reglas de selección son:

$\Delta m_l = 0, +, -1$
$\Delta l = +1, -1$
$\Delta m_s = 0$

Las transiciones posibles son:

$(3,2,2,1/2) \rightarrow (2,1,1,1/2)$

$(3,2,1,1/2) \rightarrow (2,1,1,1/2)$
$\hookrightarrow (2,1,0,1/2)$

$(3,2,0,1/2) \rightarrow (2,1,1,1/2)$
$\hookrightarrow (2,1,0,1/2)$
$\hookrightarrow (2,1,-1,1/2)$

$(3,2,-1,1/2) \rightarrow (2,1,0,1/2)$
$\hookrightarrow (2,1,-1,1/2)$

$(3,2,-2,1/2) \rightarrow (2,1,-1,1/2)$

Idem para los estados con $m_s = -1/2$ $\rightarrow$

$(3,2,2,-1/2) \rightarrow (2,1,1,-1/2)$

$(3,2,1,-1/2) \rightarrow (2,1,1,-1/2)$
$\hookrightarrow (2,1,0,-1/2)$

$(3,2,0,-1/2) \rightarrow (2,1,1,-1/2)$
$\rightarrow (2,1,0,-1/2)$
$\rightarrow (2,1,-1,-1/2)$

$(3,2,-1,-1/2) \rightarrow (2,1,-1,-1/2)$
$\hookrightarrow (2,1,0,-1/2)$

$(3,2,-2,-1/2) \rightarrow (2,1,-1,-1/2)$

$Z_{Hg} = 6$

Como no hay campo magnético, sólo habrá energía de onda:

$$E_n = -\underbrace{\left(\frac{1}{4\pi\varepsilon_0}\right)^2 \frac{me^4}{2\hbar^2}}_{-13{,}6\,eV} \frac{1}{n^2}$$

$$\Rightarrow E_3 = -13{,}6\,eV\ \frac{1}{9}$$

$$E_2 = -13{,}6\,eV\ \frac{1}{4}$$

$$\Rightarrow \boxed{\Delta E = -13{,}6\,eV\left(\frac{5}{36}\right) = 1{,}89\,eV}$$

$\Rightarrow$ Se emiten fotones de esta energía.

La longitud de onda correspondiente es:

$$E = h\nu \qquad \lambda\nu = c \Rightarrow \nu = \frac{c}{\lambda} \Rightarrow E = \frac{hc}{\lambda}$$

$$\Rightarrow \lambda = \frac{hc}{E} = \frac{4{,}13\cdot 10^{-15}\,eV \cdot 2{,}99\cdot 10^{8}\,m}{1{,}89\,eV}$$

$$\Rightarrow \boxed{\lambda = 6560\,\text{Å}}$$