...ATIONS

4. <u>Spin Quantum Number</u> (m_s): $m_s = +½$ or $-½$.

Specifies the **orientation of the spin axis** of an electron. An electron can spin in only one of two directions (sometimes called *up* and *down*).

The **Pauli exclusion principle** (Wolfgang Pauli, Nobel Prize 1945) states that *no two electrons in the same atom can have identical values for all four of their quantum numbers*. What this means is that no more than **two** electrons can occupy the same orbital, and that two electrons in the same orbital must have **opposite spins**.

Because an electron spins, it creates a magnetic field, which can be oriented in one of two directions. For two electrons in the same orbital, the spins must be opposite to each other; the spins are said to be **paired**. These substances are not attracted to magnets and are said to be **diamagnetic**. Atoms with more electrons that spin in one direction than another contain **unpaired** electrons. These substances *are* weakly attracted to magnets and are said to be **paramagnetic**.

Fill in the following Table

Table of Allowed Quantum Numbers

n	l	m_l	Number of orbitals	Orbital Name	Number of electrons
1	0	0	1	1*s*	2
2	0	0	1	2*s*	2
	1	-1, 0, +1	3	2*p*	6
3	0	0	1	3s	2
	1	-1, 0, +1	3	3p	6
	2	-2, -1, 0, +1, +2	5	3d	10
4	0	0	1	4s	2
	1	-1, 0, +1,	3	4p	6
	2	-2, -1, 0, 1, 2	5	4d	10
	3	-3, -2, -1, 0, 1, 2, 3	7	4f	14
5	0	0	1	5s	2
	1	±1, 0	3	5p	6
	2	±2, ±1, 0	5	5d	10
	3	±3 ±2 ±1, 0	7	5f	14

① $\Delta E = -2.18 \times 10^{-18} J \left(\frac{2^2}{n^2 final} - \frac{2^2}{n^2 initial} \right)$

$\Delta E = -2.18 \times 10^{-18} J \left(\frac{1}{2^2} - \frac{1}{3^2} \right)$

$= -3.03 \times 10^{-19} J$

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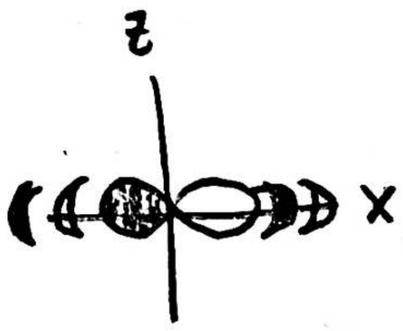
②

a)



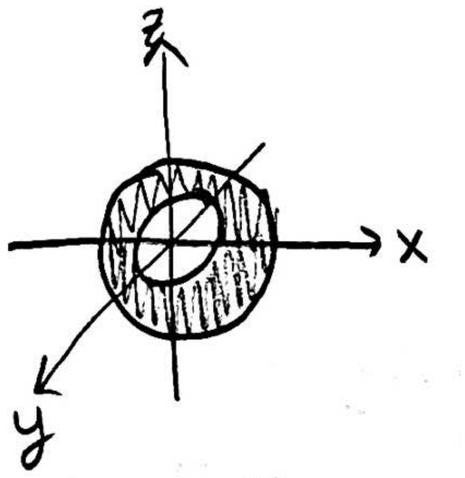
$n = 4$

nodes total $= n - 1 = 3$

$l = 1$

radial = total nodes $- l = 3 - 1 = \boxed{2}$

b)

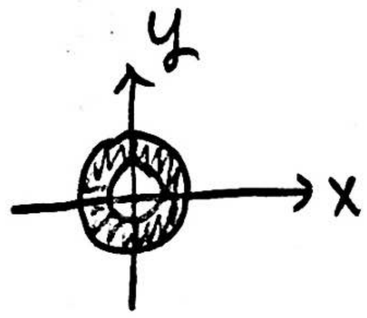


$n = 2$

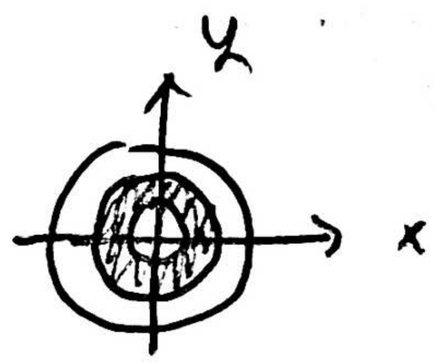
$l = 0$

$T_n = 1$

radial nods $= 1 - 0 = 1$



c) 3s ⇒ 1 more radial node than last



d) $n = 5$ total nodes $= 4$ $l = 2$ Radial N. $= 2$

Example explanation

(3) a) $\underline{4e^-}$ only $l=2$ (d) and $l=(3)$ (f) on $n=4$ can have $m_l=+2$ orbitals, each can hold $2e^-$ ∴ $4e^-$ total

b) $\underline{6e^-}$

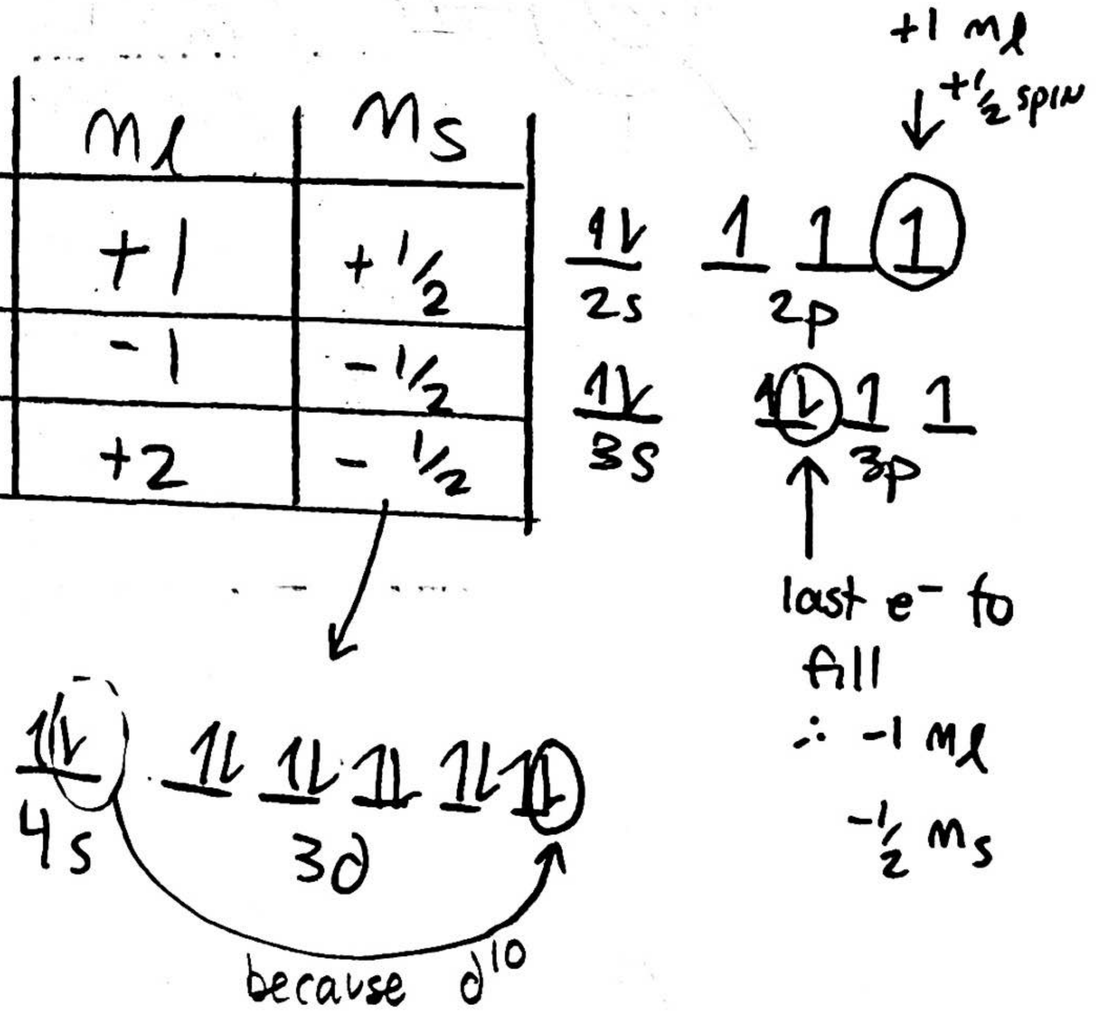
c) $\underline{1e^-}$

(4)

l	0	1	2
m_l	0	$-1, 0, +1$	$-2, -1, 0, +1, +2$
m_s	$+\frac{1}{2}, -\frac{1}{2}$	$+\frac{1}{2}, -\frac{1}{2}$	$+\frac{1}{2}, -\frac{1}{2}$

(5)

	n	l	m_l	m_s
a)	2	1	+1	$+\frac{1}{2}$
b)	3	1	-1	$-\frac{1}{2}$
c)	3	2	+2	$-\frac{1}{2}$



(6) a) $1s^2\ 2s^1$

b) $1s^2$

c) $1s^2 2s^2 2p^6\ 3s^1$

d) $1s^2\ 2s^2\ 2p^6$

e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

f) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

g) $1s^2\ 2s^2 2p^6$

h) $[Ar]\ 4s^1\ 3d^{10}$

↑ filled 3d first... done in class, Aufbau Rule not filled

i) $1s^2 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^5$

protons = $26\ e^-$ usually "+3" state means lost 3 electrons

$\therefore\ 26 - 3 = 23\ e^-$ total