Warm Up.

1. A 22 g sample of an unknown element is found to decay to 2.490 g after 4.715 ms. Use the table to determine which element this sample is.

$$N = N_0 e^{-\frac{\ln|2|t}{t_{1/2}}}$$

$$\frac{N}{N_0} = e^{-\frac{\ln|2|t}{t_{1/2}}}$$

$$\ln\left|\frac{N}{N_0}\right| = -\frac{\ln|2|t}{t_{1/2}}$$

$$t_{1/2} = -\frac{\ln|2|t}{\ln\left|\frac{N}{N_0}\right|} \qquad t = 4.715\text{ ms}, \quad N = 2.490\text{ g}, \quad N_0 = 22\text{ g}$$

$$t_{1/2} = 1.500\text{ ms}$$

^{35}Na

Quantum Numbers

- Parameterize energy of the e^- in an atom

Principal quantum number

$$n = 1, 2, 3, \ldots, \infty$$

- distance from the nucleus

Angular momentum quantum number

$$L = \sqrt{l(l+1)}\ \frac{h}{2\pi}$$

- angular momentum ~~was~~ is quantized

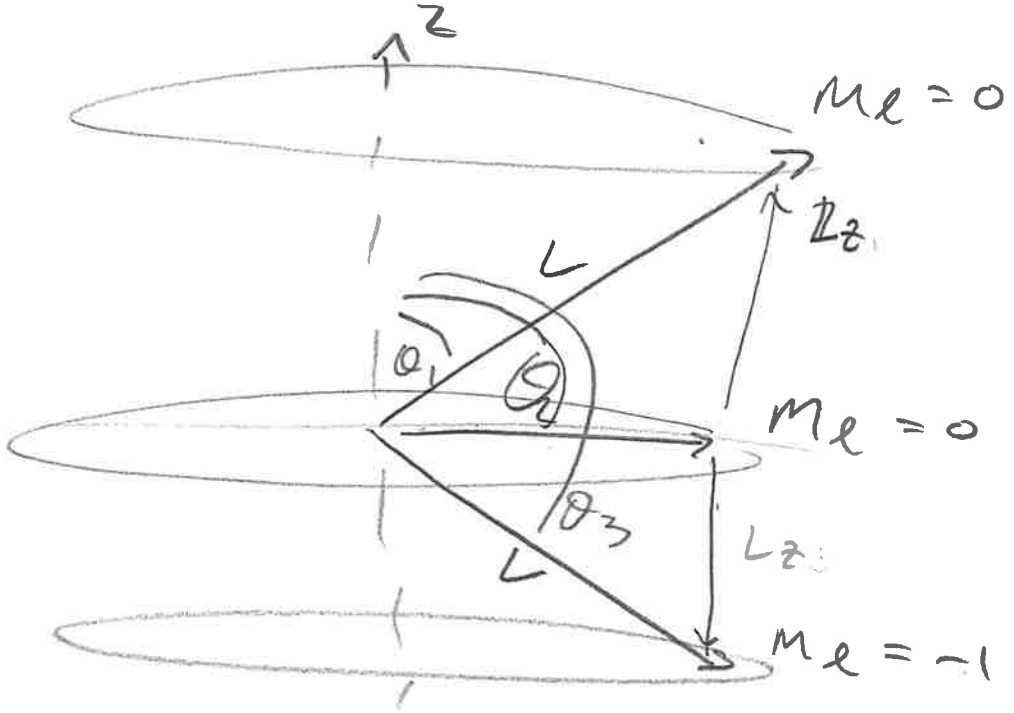
$$l = 0, 1, 2, \ldots, n-1$$

- z-component of angular momentum also quantized.

z - component of Angular Momentum

$$L_z = m_\ell \frac{h}{2\pi}$$

$$m_\ell = -\ell, -\ell+1, \ldots, -1, 0, 1, \ldots, \ell-1, \ell$$



- fixed angular momentum
- z-component of angular momentum varies.

Intrinsic Spin

$$S = \sqrt{s(s+1)}\ \frac{h}{2\pi}$$

$s = 1/2$ (Fermions, electrons)

Direction of spin

$$S_z = m_s \frac{h}{2\pi}$$

$$m_s = -\frac{1}{2}, \frac{1}{2}$$

"spin down" and "spin up"

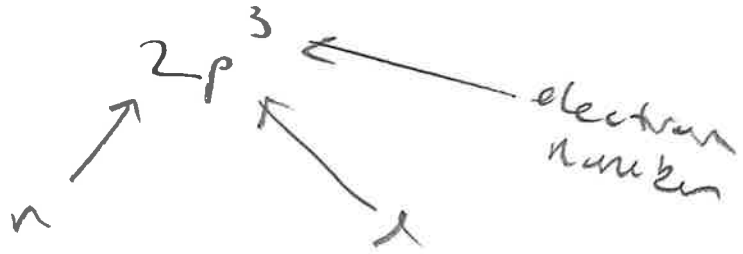
Parameter	Symbol	Values
principal quantum number	n	$n = 1, 2, 3, \ldots$
angular momentum	l	$l = 0, 1, 2, \ldots, n-1$
projected angular momentum	m_l	$m_l = -l, -l+1, \ldots, -1, 0, 1, l$
Spin	s	$s = 1/2$ (electrons)
Spin projection	m_s	$-1/2, 1/2$

- show orbitals

Pauli Exclusion Principle

- No two electrons can have the same set of quantum numbers
- Electrons occupy lowest-energy states first.

Spectroscopic Notation



$l = 0 \longrightarrow s$

$l = 1 \longrightarrow p$

$l = 2 \longrightarrow d$

$l = 3 \longrightarrow f$

Maximum Number of Electrons

$$N = 2n^2$$

$n = 1$, $N = 2$

$n = 2$, $N = 8$

$n = 3$, $N = 18$