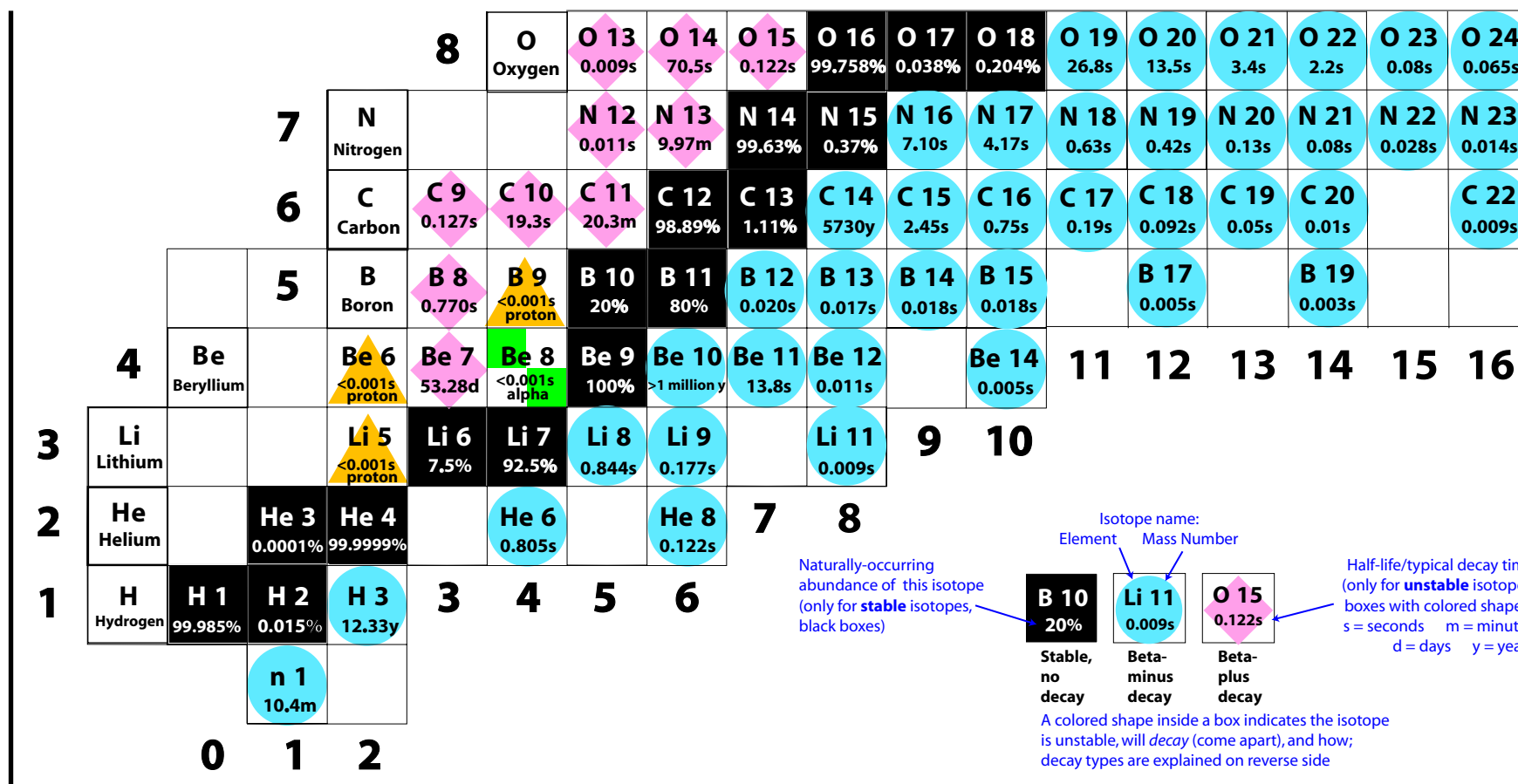


## CHART of the NUCLIDES featuring the first eight elements

**P** Protons (Elements)



Isotope name: Element Mass Number

Naturally-occurring abundance of this isotope (only for **stable** isotopes, black boxes)

Half-life/typical decay time (only for **unstable** isotopes, boxes with colored shapes)  
 s = seconds    m = minutes  
 d = days    y = years

Stable, no decay    Beta-minus decay    Beta-plus decay

A colored shape inside a box indicates the isotope is unstable, will *decay* (come apart), and how; decay types are explained on reverse side

**N** Neutrons (Isotopes)

# QUICK REFERENCE SHEET

# Learn Nuclear Science *with Marbles*



A JINA/NSCL outreach service by Zach Constan [www.jinaweb.org/educational-outreach/marble-nuclei-lessons](http://www.jinaweb.org/educational-outreach/marble-nuclei-lessons) Version 4.3 • January 2019

## Types of radioactive decay

	Be 6 <0.001s proton	Be 7 53.28d	Be 8 <0.001s alpha	Be 9 100%	Be 10 >1 million y
	Yellow triangle = <b>proton decay</b>	Pink diamond = <b>beta-plus decay</b>	Green checkerboard = <b>alpha decay</b>	Black square = <b>stable isotope, no decay</b>	Blue circle = <b>beta-minus decay</b>
	Nucleus ejects one proton —	Turns a proton into a neutron, emits a positron & a neutrino —  +  +  +	Nucleus ejects an alpha particle (two protons & two neutrons) —  +  +  +	% = abundance of this isotope found in nature	Turns a neutron into a proton, emits an electron & antineutrino —  +  +  +
	Isotope moves down one square on chart	Isotope moves down one square, right one square on chart	Isotope moves down 2 squares, left 2 squares on chart		Isotope moves left one square, up one square on chart