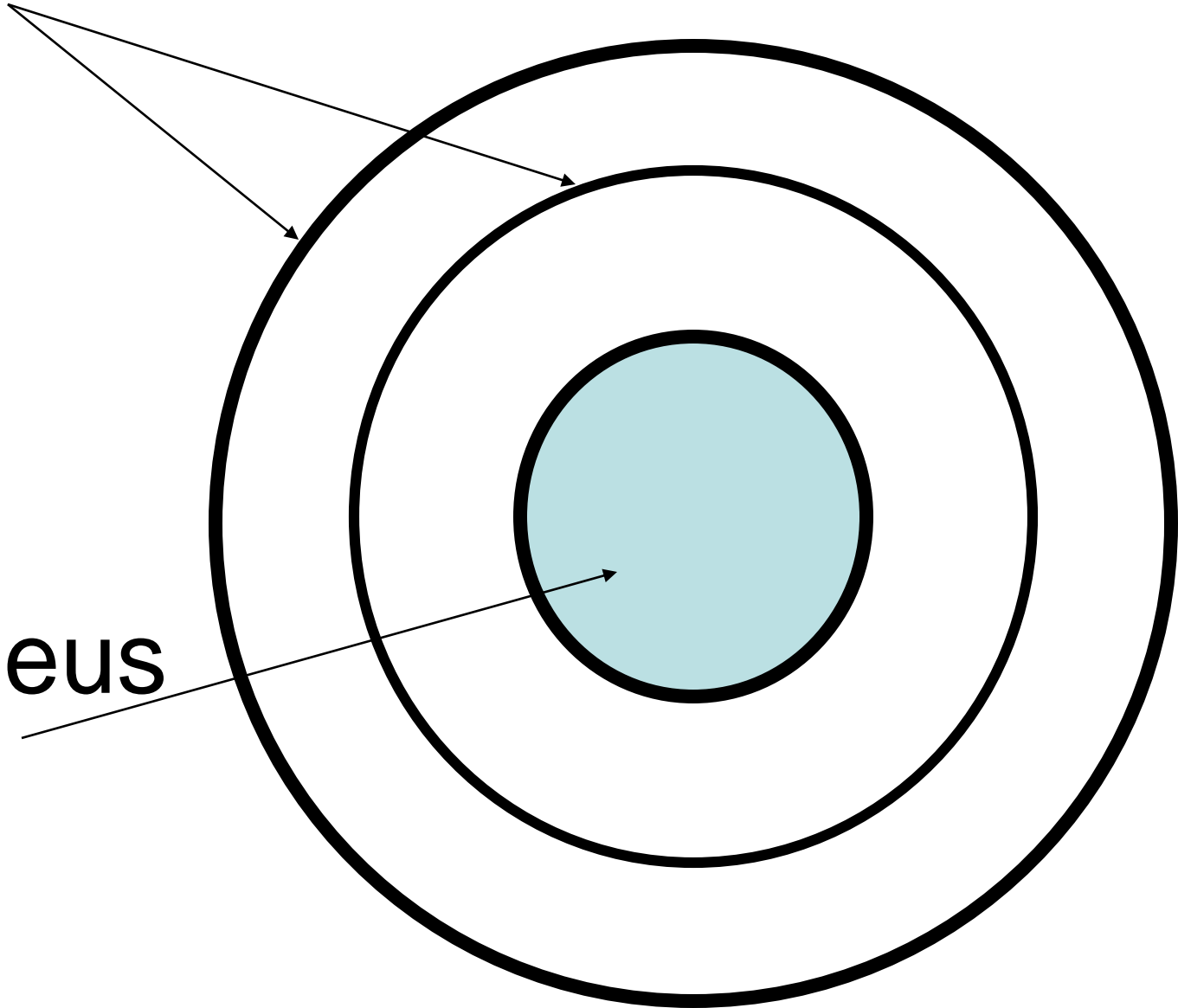


The Atom

Essential Questions

- What is the structure of the atom?
- What are the 3 subatomic particles?
- What particles make up the nucleus?

electron clouds



nucleus

Proton

- A. positively charged particle in the nucleus
- B. mass = 1 amu (atomic mass unit)
- C. The number of protons identifies the element
- D. Number of protons = the atomic number
- E. Quark – 3 small particles that make up a proton

Neutron

- A. particles with no charge in the nucleus
- B. mass = 1 amu (same as proton)
- C. # of protons + # of neutrons = atomic mass
- D. Adding or taking away neutrons DOES NOT change the atom, it makes different isotopes
- E. Quark – 3 quarks make up a neutron

Electron

- A. Negatively charged particle in the electron cloud
- B. Mass very small amu = 0
- C. It takes 1800 electrons to equal the mass of 1 proton
- D. # of electrons = # of protons in a neutral atom

Valence Electron

- The electron(s) in the shell farthest from the nucleus

electron clouds

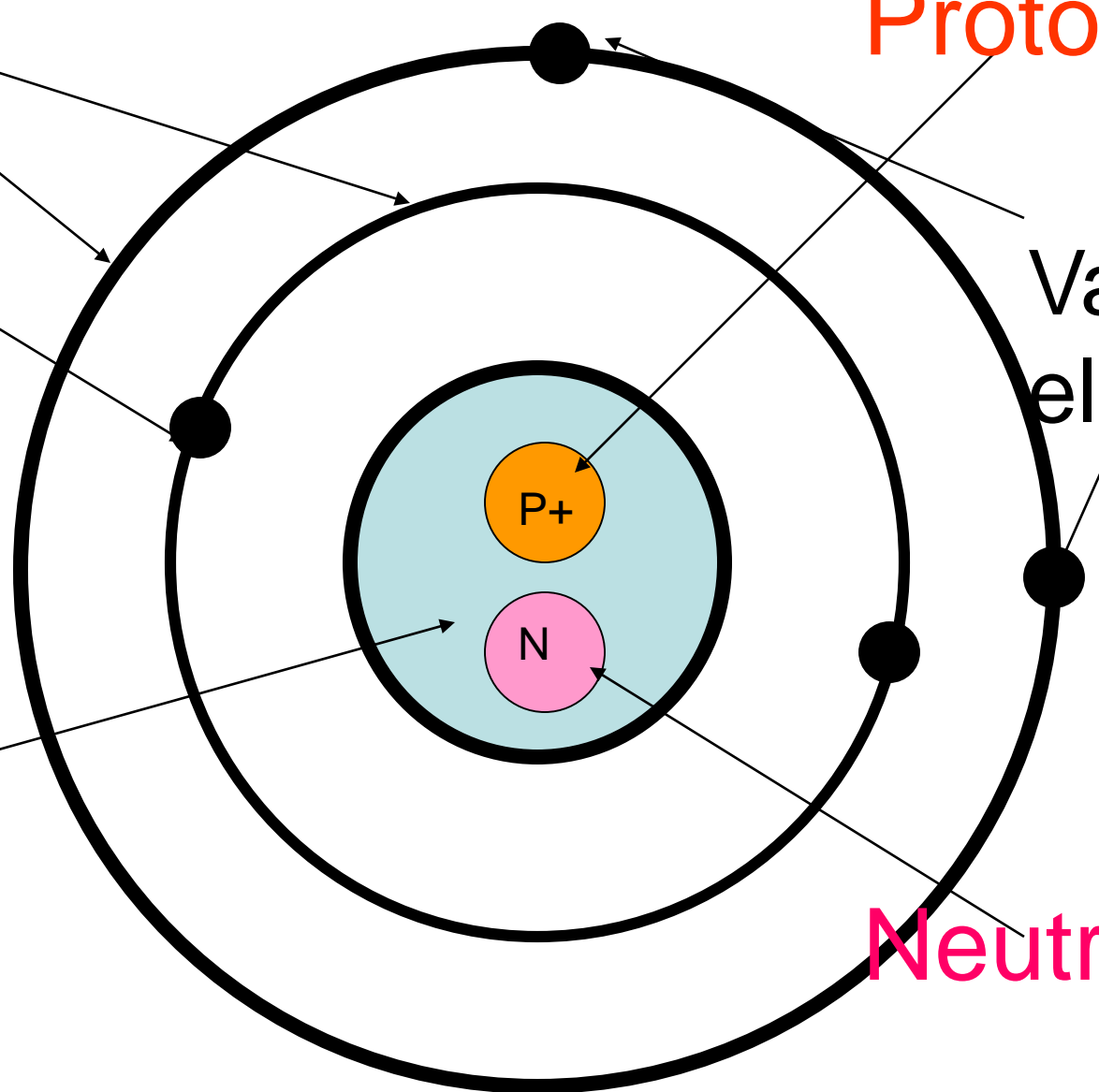
Protons (+)

Electrons
(-)

Valence
electron

nucleus

Neutron (0)



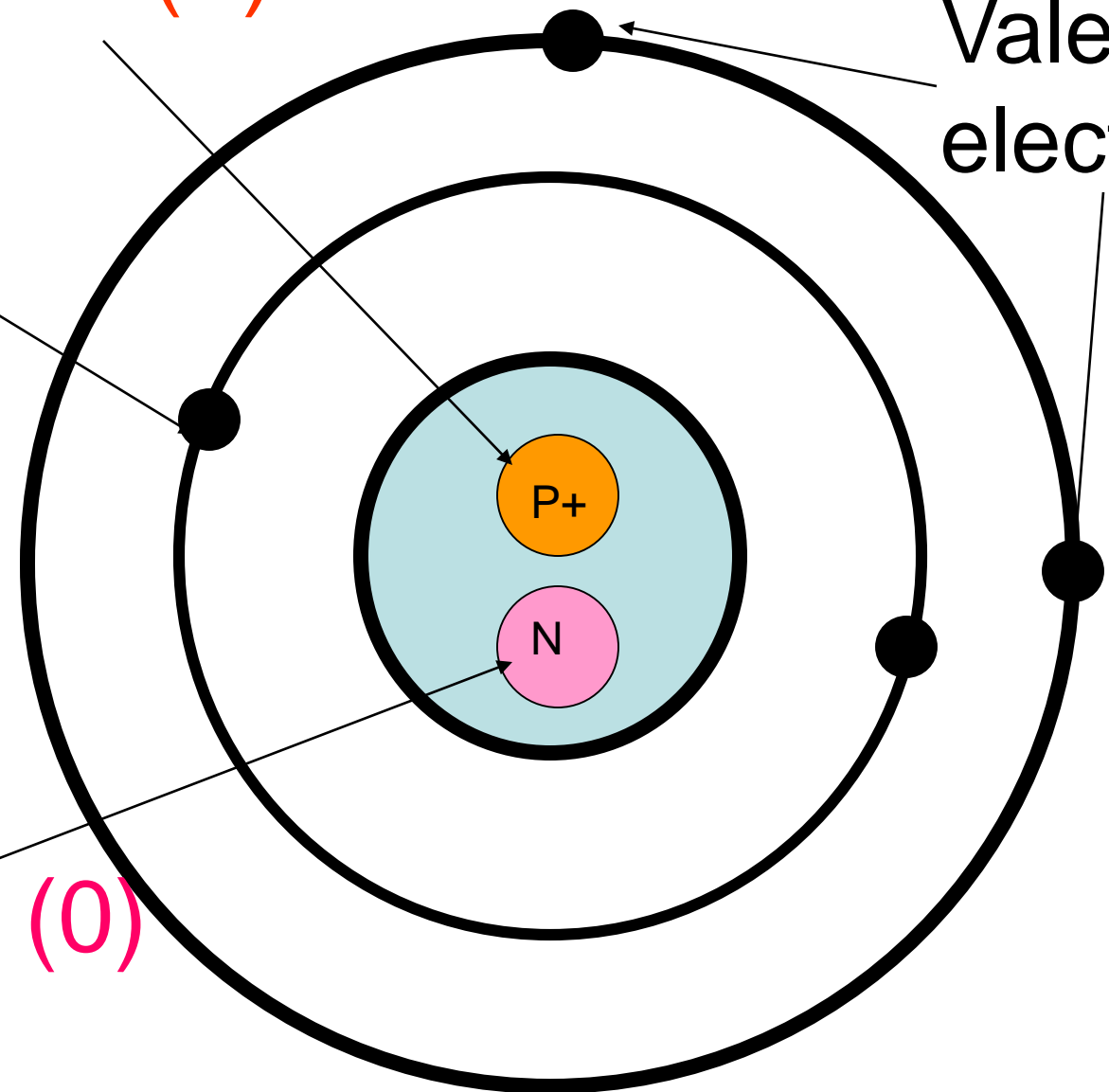


Protons (+)

Valence electrons

Electron (-)

Neutron (0)



In your journal....

- Protons

Can you name the charge, location and mass

- Neutrons

Can you name the charge, location and mass

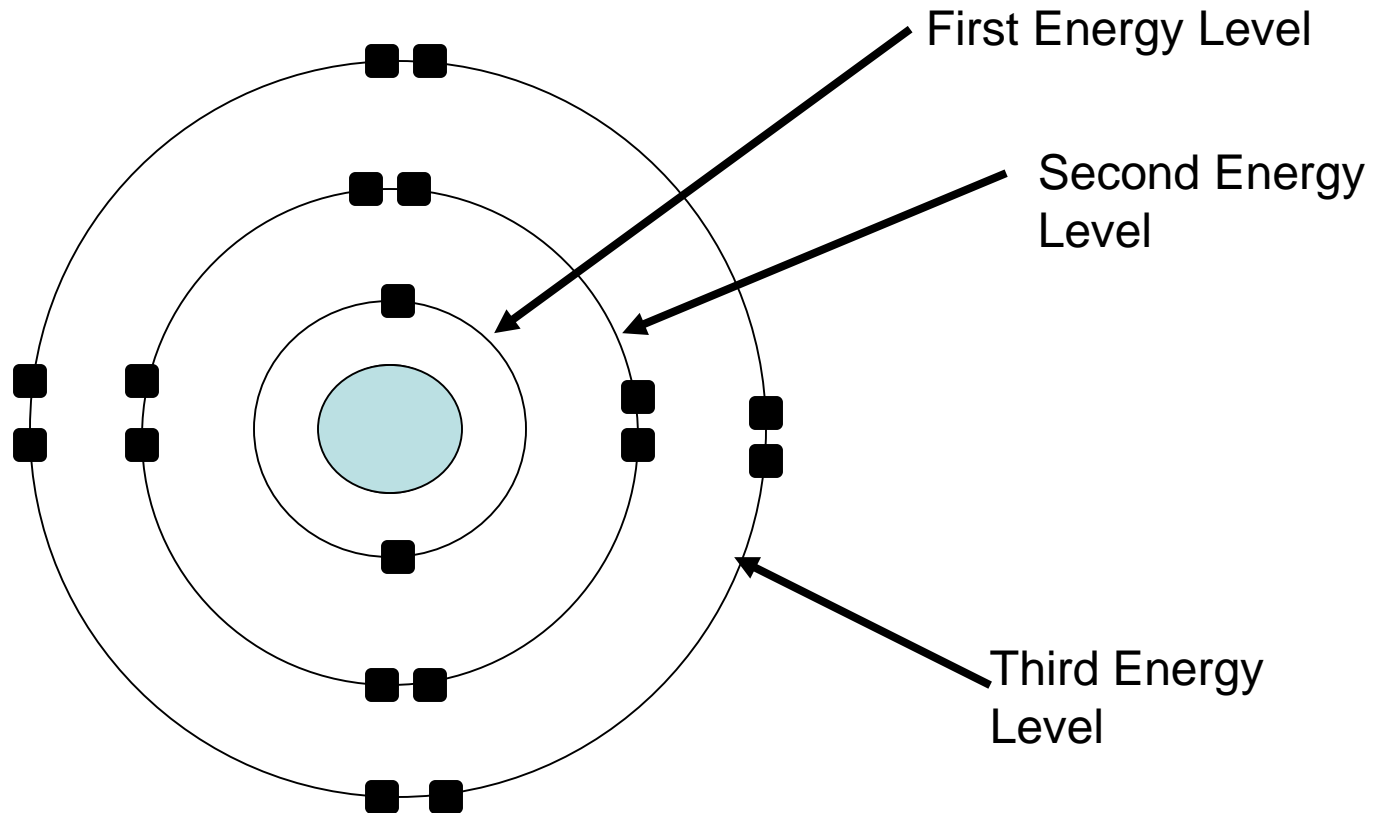
- Electrons

Can you name the charge, location and mass

Unlike protons and neutrons in an atom, the electrons are arranged in a particular order. The electrons fill the energy shells closest to the nucleus first and then fill outward:

- The first energy shell can hold up to **2** electrons
- The second energy shell can hold up to **8** electrons
- The third energy shell can hold up to **18** electrons
- The fourth energy shell can hold up to **32** electrons

Electron Shell Diagram –



Atomic Number

- the number of protons in the nucleus of the atom.
- the atomic number identifies the element.

Table #1

Proton number	Atomic number	Element	Symbol
8	8	Oxygen	O
1	1	Hydrogen	H
6	6	Carbon	C
7	7	Nitrogen	N
10	10	Neon	Ne

Atomic Mass

- the number of **protons** plus the number of **neutrons** in the nucleus of one atom
- you can calculate the number of neutrons to identify isotopes
- Atomic mass – atomic Number = Neutrons
- protons + neutrons = atomic mass

Atomic weight

- The average of all the masses of all the isotopes of an element

Table 2 (Use PTE)

PTE = Periodic Table of Elements

Element	Atomic number	Proton number	Atomic mass (rounded)	Neutrons	Electrons
C Carbon	6	6	12	6	6
Na Sodium	11	11	23	12	11
Si Silicon	14	14	28	14	14
O Oxygen	8	8	16	8	8

Isotopes

- Most elements have naturally occurring isotopes. Atoms with the same number of protons but different numbers of neutrons are isotopes.

Isotopes

- If you gain a neutron, you will be more massive
 - Why?
- If you lose a neutron, you are less massive
 - Why?

In your journal....

The atomic mass that you see on the Periodic Table is the average of *all* the isotopes of that element.

How does this explain why there are no whole atomic mass numbers on the Periodic Table?

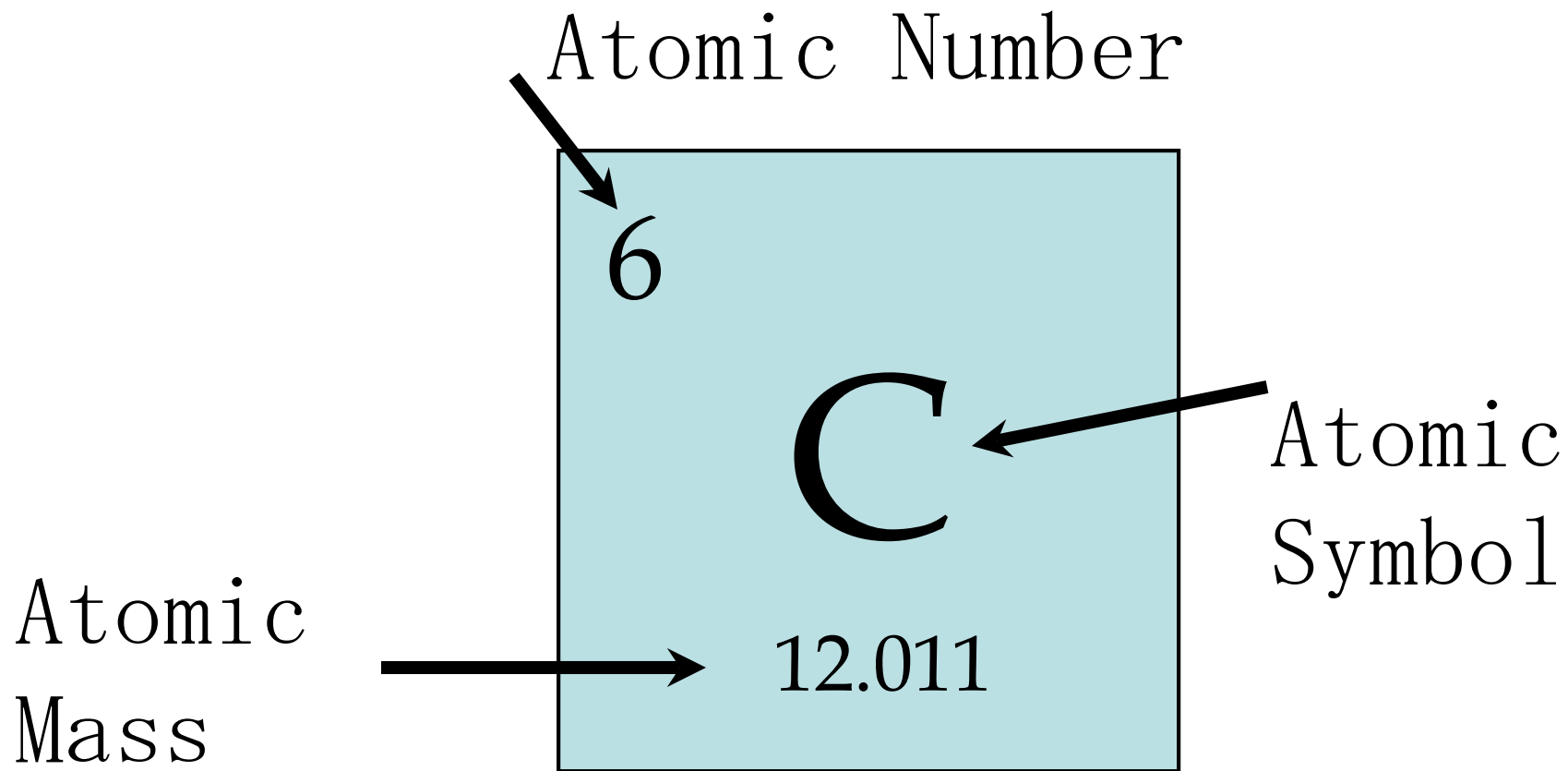
answer

- There are no whole number masses on the Periodic Table because averages usually don't equal a whole number.

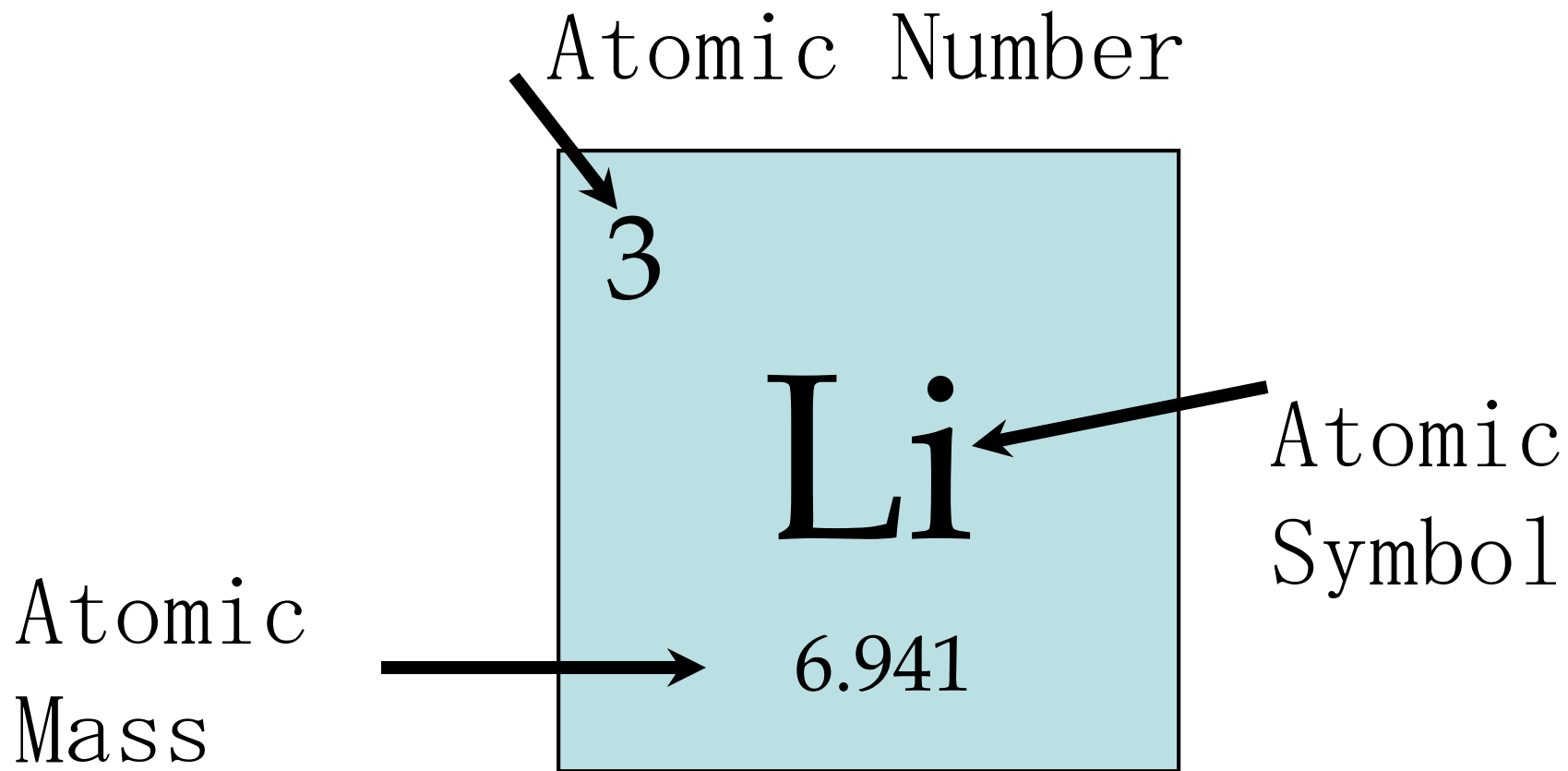
Table 3: sub atomic Particles

Subatomic particle	Atomic mass in atomic mass units	charge	location
Proton	1 amu	+ positive	nucleus
Neutron	1 amu	0 neutral	nucleus
Electron	0 amu	- negative	Orbits around nucleus in electron cloud

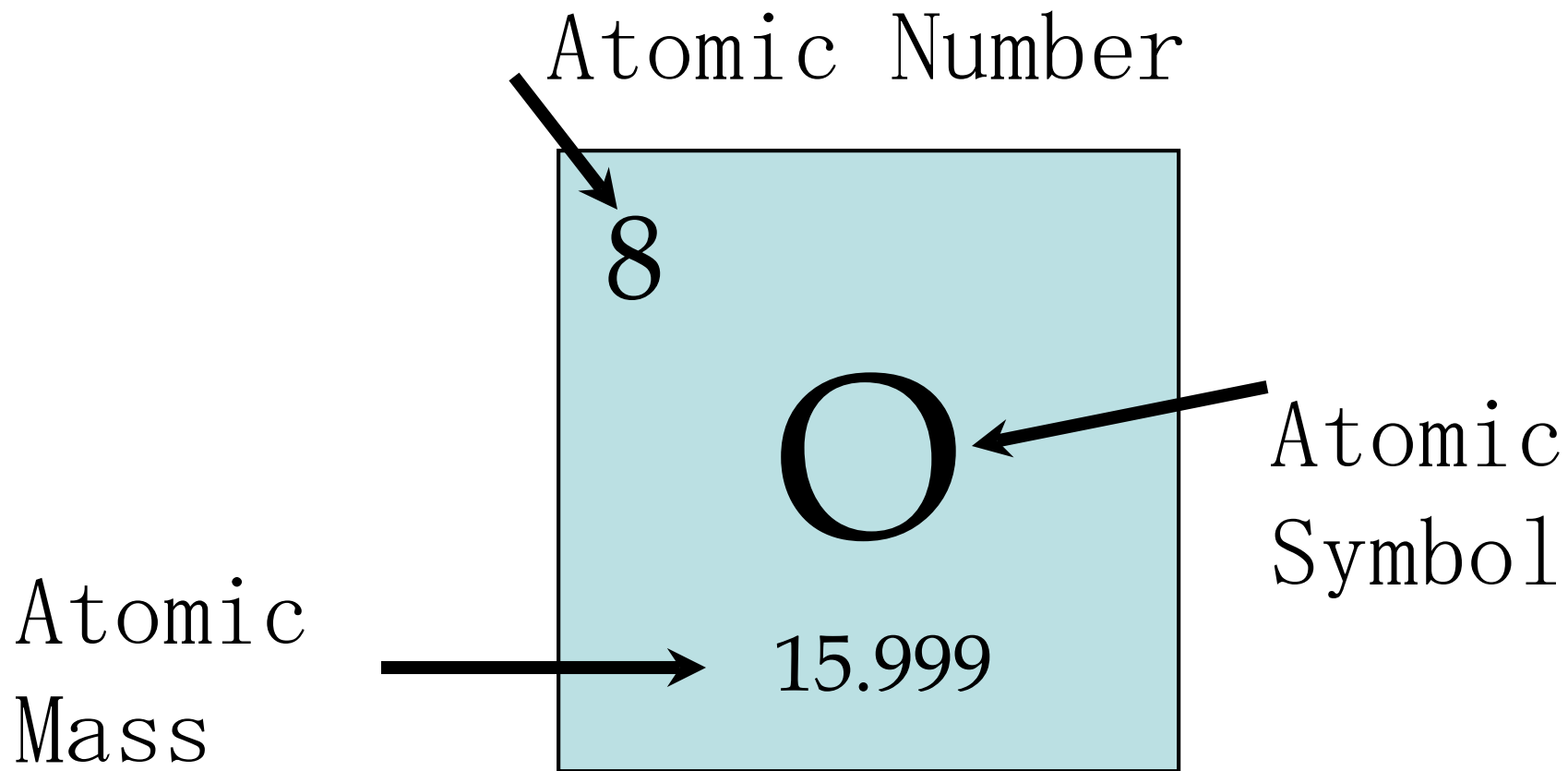
How to read a Periodic Table



How to read a Periodic Table



How to read a Periodic Table



XI. Forces that hold the atom together

- 1. Gravity - even in an atom... depends on:
 - A. How big (massive) the objects are
 - B. how far apart they are
- 2. Electromagnetic forces...like charges do what? Unlike charges do what?
 - A. Like charges **repel**
 - B. Unlike (opposite) charges **attract**
 - C. Electrons **repel** electrons, but **attract** protons
 - D. Protons **repel** protons, but **attract** electrons
- 3. Strong force (nuclear force) – holds protons together in the nucleus
- 4. Weak force – plays a role in radioactive (unstable) atoms when a neutron changes into a proton and an electron

IV. History of the Atom

- A. Democritus (400 BC)
 - 1. Said elements are invisible particles called atoms
 - 2. The atoms were “indivisible” or “uncuttable”
- B. Aristotle (384 – 322 BC)
 - 1. Disagreed with Democritus
 - 2. All matter was made up of the 4 elements: Air, Earth, Water, and Fire

History of the Atom (cont.)

- C. John Dalton (late 1700's)
 - 1. Atoms cannot be created, divided or destroyed.
 - 2. Atoms of the same element are alike.
 - 3. Atoms join with other atoms to make new substances
- D. J.J. Thompson (1897)
 - 1. Found that atoms are made of smaller parts.
 - 2. Discovered a negative charge – later called the electron.

History of the atom (cont.)

- E. Ernest Rutherford (1909)
 - 1. Proved atoms are not solid
 - 2. They are mostly empty space, but with a solid nucleus
- F. Neils Bohr (1913)
 - 1. Suggested that electrons traveled around the nucleus in definite paths (Sun and planets model for atoms)
 - 2. Electron can jump between levels.

Middle of page 5

- Before we move on, let's review protons and neutrons. Where are they located? **In the nucleus.** They each have a mass of **1** amu. An electron is much smaller than a proton or a neutron and has a mass of **0** amu. Electrons are located in the **electron cloud** of the atom. Protons have what charge? **Positive (+)** Electrons have what charge? **Negative (-)**