

Atomic Number (Z)

3
Li
Lithium
6.941

of protons
- identifies the element

What is the atomic number for the following elements?

Nitrogen **7**
Argon **18**
Silver **47**
Tungsten **74**
Barium **56**

Isotopes

→ same # of protons

- Atoms of the same element that have different masses

- proton and electron number is the same but the number of neutrons is different

Ex. isotopes of Hydrogen

| | <u>Mass #</u> |
|---|---------------|
| Protium - 1 proton (99.985%) ① neutrons | 1 |
| Deuterium - 1 proton, 1 neutron (0.015%) | 2 |
| Tritium - 1 proton, 2 neutrons (radioactive) | 3 |

Identifying Isotopes

Two things you need to know....

3
Li
Lithium
6.941

atomic # → Z
↳ # of protons

mass # → A
↳ protons + neutrons

avg. atomic mass

* atomic # = # of protons = # of electrons
* mass number = # of neutrons + # of protons

Expressing Isotopes

Hyphen notation - mass number is written with a hyphen after the element name

$^{12}_6\text{C}$ $^{13}_6\text{C}$
 Carbon-12 Carbon-13
 $p^+ - 6$ $p^+ - 6$
 $n - 6$ $n - 7$
 $^{14}_6\text{C}$
Carbon-14
 $p^+ - 6$
 $n - 8$

Nuclear Symbol - superscript = mass # / subscript = atomic #

^1_1H ^3_1H
 Hydrogen-1 Hydrogen-3
 $p^+ - 1$
 $n - 0$
 $p^+ - 1$
 $n - 2$

| symbol | protons | neutrons | electrons |
|-------------------------|---------|----------|-----------|
| Fluorine - 11 | 9 | 2 | 9 |
| ${}_{30}^{66}\text{Zn}$ | 30 | 36 | 30 |
| Calcium - 22 | 20 | 2 | 20 |
| ${}_{5}^{12}\text{B}$ | 5 | 7 | 5 |
| Sulfur - 32 | 16 | 16 | 16 |

${}_{9}^{11}\text{F}$ / Zinc-66 / ${}_{20}^{66}\text{Zn}$ / Boron-12
 ${}_{11}^{32}\text{S}$

Relative Atomic Mass

- Scientists use the Carbon - 12 atom to govern units of atomic mass

- It has been assigned a mass of 12 atomic mass units (amu) or 12 amu

1 proton = 1 amu
1 neutron = 1 amu

Average Atomic Mass

* - The weighted average atomic masses of the naturally occurring isotopes of an element

Calculating weighted average

- Change % to decimals
- multiply
- add

| | | | | | |
|------|-------|---|-----|---|---------------|
| Test | 92.32 | * | .60 | → | 55.392 |
| Quiz | 87.43 | * | .30 | → | 26.229 |
| HW | 98.63 | * | .10 | → | 9.863 |
| | | | | + | <u>91.484</u> |

Calculating Average Atomic Mass

depends on mass and relative % abundance of each of the element's isotopes

| | | |
|-------------|----------|---------------|
| Oxygen - 16 | 99.762 % | 15.994915 amu |
| Oxygen - 17 | 0.038 % | 16.999131 amu |
| Oxygen - 18 | 0.200 % | 17.999160 amu |

$$.99762 \times 15.994915 = 15.976471$$

$$.00038 \times 16.999131 = 0.00645165$$

$$.00200 \times 17.999160 = 0.03599732$$

15.999 amu

| | | |
|-------------|---------|---------------|
| Copper - 63 | 69.17 % | 62.929599 amu |
| Copper - 65 | 30.83 % | 64.927793 amu |

$$.6917 \times 62.929599 = 43.521779$$

$$.3083 \times 64.927793 = 20.014121$$

> + together

63.536 amu

1. What is the atomic number for the following:

- a. Sodium
- b. Strontium
- c. Gallium
- d. Arsenic

2. What does the atomic number tell us about an atom?

3. How many protons, neutrons, and electrons does this isotope have
Manganese-54

4. How many protons, neutrons and electrons does this isotope have



5. Write Manganese-54 isotope in nuclear symbol form

6. Write the ${}_{15}^{31}\text{P}$ isotope in hyphen form

7. Write down what the following men did / discovered

- Democritus
- Aristotle
- JJ Thomsom
- Robert Millikan
- Ernest Rutherford

8. List 4 out of 5 parts to Dalton's atomic theory