Warm Up

1. What type of beam did Rutherford shoot through the gold foil?

2. What did the gold foil experiment allow him to discover?

Objectives

TSWBAT:

Illustrate the atomic properties of atomic number, atomic mass, and isotopes.

We know that atoms are composed of:

- protons
- neutrons
- electrons

* Thanks to the work of Rutherford, we know that protons & neutrons reside where? Are there particles in an atom smaller than these? Yes. Take particle physics in college and you will learn about them.

What defines an "element?"

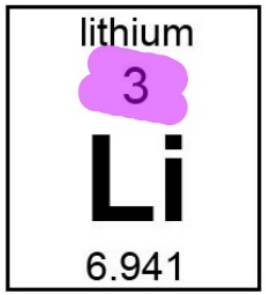
Def:

Element: the simplest form of matter that has a unique set of properties; an element cannot be broken down into simpler substances by chemical means.

What makes one element different from another?

Elements are different because they contain different numbers of **protons.**

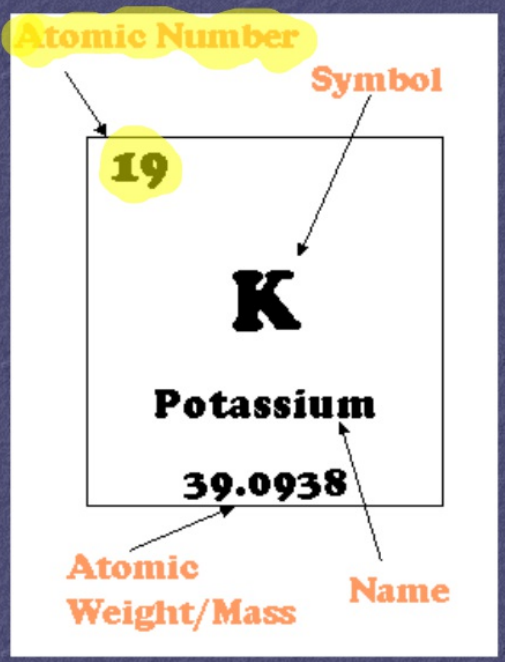
The **atomic number** of an element is the number of protons in the nucleus of an atom of that element.



Atomic Number

This tells you the number of protons

The number of protons is the one thing that makes one element different from another



periodic table

Observations:

1. The atomic number (in BLACK on our periodic table, upper left corner) is the number of protons in that element.

2. The atomic number is ALSO the number of electrons in a neutral atom of an element.

Another property of an atom is its **mass number**.

Def:

Mass number = total number of protons plus neutrons in the nucleus of an atom. (NOTE! **Mass number** and **atomic mass** are NOT the same thing!)

Math Fact:

 # neutrons = mass number - atomic number

p. 110 in your textbook

Table 4.2

Atoms of the First Ten Elements

Name	Symbol	Atomic number	Protons	Neutrons*	Mass number	Number of electrons
Hydrogen	H	1	1	0	1	1
Helium	He	2	2	2	4	2
Lithium	Li	3	3	4	7	3
Beryllium	Be	4	4	5	9	4
Boron	B	5	5	6	11	5
Carbon	C	6	6	6	12	6
Nitrogen	N	7	7	7	14	7
Oxygen	O	8	8	8	16	8
Fluorine	F	9	9	10	19	9
Neon	Ne	10	10	10	20	10

*Number of neutrons in the most abundant isotope. Isotopes are introduced later in Section 4.3.

15. Complete the table.

Element	Atomic number	Protons	Electrons
K	19	(a)	19
(b)	(c)	(d)	5
S	16	(e)	(f)
V	(g)	23	(h)

a. c. e. g.

b. d. f. h.

Practice

How many protons does sodium have?

How many protons does oxygen have?

How many protons does sulfur have?

How many electrons does sodium have?

Practice

How many electrons does neon have?

How many electrons does Magnesium have?

Mass number

The sum of the protons and the neutrons in the nucleus of the atom

Mass # = $p^+ + n^0$

How many neutrons does Magnesium have?

How many neutrons does carbon have?

How many neutrons does Chromium have?

If you are able, I strongly recommend the following Apps:

NOVA Elements (explore the interactive periodic table and build elements)

Chem Lite (to help study for tests)

Element	protons	neutrons	electrons	Atomic mass	Atomic number
Lithium					
Carbon					
Chlorine					
Silver					
Lead					
Calcium					

Element	protons	neutrons	electrons	Atomic mass	Atomic number
Uranium					
Radium					
Plutonium					
Molybdenum					
Antimony					
Cadmium					

Au is the chemical symbol for gold.

Warm Up

Which element has 17 protons and 17 electrons? If the mass number of one of these atoms is 35, how many neutrons does this atom have?

Each element has its own unique symbol. Each symbol is either a capital letter (e.g. S is sulfur) or a capital letter followed by a lower case letter (e.g. Cl is chlorine). It is NOT okay to write CL for chlorine or BR for bromine. It will confuse people b/c it can mean something other than an element. For example, Co = cobalt but CO is carbon monoxide. Follow the rules!

When we write the symbol for an element we put the mass number as a superscript to the left of the atomic symbol and the atomic number as a subscript to the left:

$$^{12}_{6}C$$

Determining the Composition of an Atom

How many protons, neutrons, and electrons are in each atom?

	Atomic Number	Mass Number
a) Beryllium	4	9
b) Neon	10	20
c) Sodium	11	23

How many neutrons are in each atom?

a) $^{16}_{8}O$

b) $^{32}_{16}S$

c) $^{80}_{35}Br$

d) $^{207}_{82}Pb$

e) $^{108}_{47}Ag$

Isotopes

What is an isotope?

Isoptopes are atoms of the same element with different numbers of neutrons.

How do isotopes of an element differ?

Def:

Isotopes: atoms of an element that have the SAME number of protons but different number of neutrons.

Warm Up

Isotopes are atoms of the same element. How are they the same and how are they different?

Isotopes have different mass numbers! (Same what?)

Practice:

p. 113 of textbook:
problems 19 & 20.

p. 122
34, 36, 39, 40, 41, 43, 47, 48

p.113

#19

O O O

#20

Atomic number = 24

^{50}Cr ^{52}Cr ^{53}Cr

p. 122

#34

The smallest particle of an element that still has the properties of that element.

#36

All of them!

#39

repel

#40 The mass of the proton is the same as the mass of a neutron. Protons are +1, neutrons are neutral.

#41

Atoms are neutral. Protons = electrons. Loss of an electron means now there are MORE protons than electrons.

#43

He did not expect the alpha particles to be deflected, or at least very, very little.

#47

Atomic number = number of protons in the nucleus

#48

a 15

b 42

c 13

d 48

e 24

f 82