Chem 111

Lecture 3

Announcements

- Supplementary Instructors
- Don’t be afraid to ask questions

Homework

- Finish “Let’s Review”
- Start Reading Chapter 2
- OWL online homework.

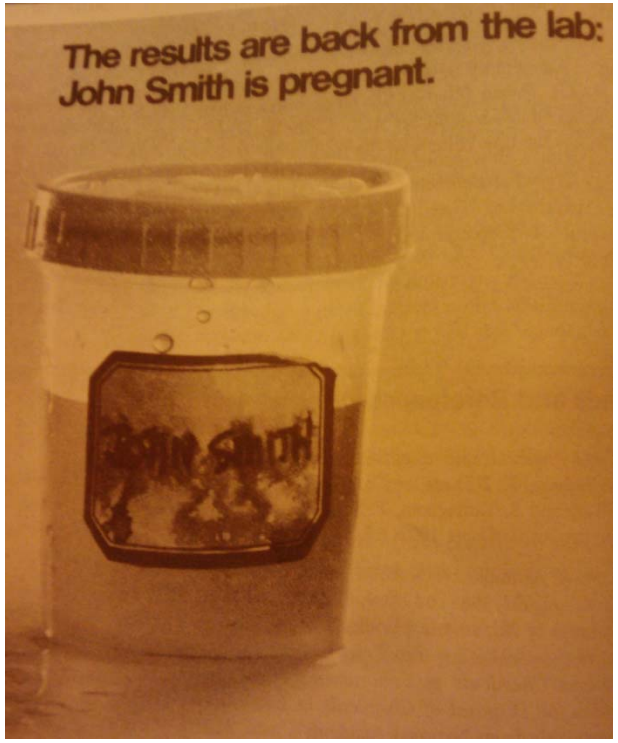
Recap

- Flow chart on classification of matter
- Physical and Chemical Properties
- Physical and Chemical Changes
- SI units and prefixes **Memorize**
- Temperature – know conversations
- Precision V accuracy

.

Error

$$precent\ error = \frac{error\ in\ measurement}{accepted\ or\ 'true'\ value}\ x\ 100\%$$



Standard Deviation

$$s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n-1}}$$

measure value

avg

measurements

Scientific Notation

.00000102
132600000

Sometimes called exponential notation, is a way of writing numbers that accommodates values too large or small to be conveniently written in decimal notation.

Expressed as a product: N x 10^{y}

$10 > N \geq 1$

y = integer

Decimal: 1207000000

$1.207 \times 10^{3} \rightarrow 1.207 \times 10^{9}$

$y < 1, < 1$

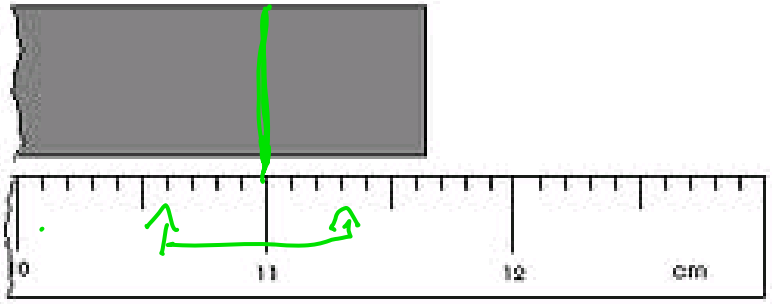
SN: 3.6×10^{5}

$3.6 \times 10E5 \rightarrow 3.6 \times 10 \times 10^{5}$

Calculators, Excel, OWL, Computer etc… PAGE 34

Significant Figures

Indicates the exactness of a measurement



11.62

11.623598654

11.0

11

The number of digits that can be justified by the data.

Guidelines

- Nonzero = significant. 963, 2.9
- Zeros between nonzeros = significant. 1006, 1.03
- Leading zeros not significant. 0.002, 0046
- Trailing zeros after decimal = significant 3.0, 0.0200
- Trailing zeros with no decimal are ambiguous →use scientific notation

406.
4×10^2
4.0×10^2

2.00×10^{-2}

2×10^{-2}

- Exact numbers have infinite significant figures.

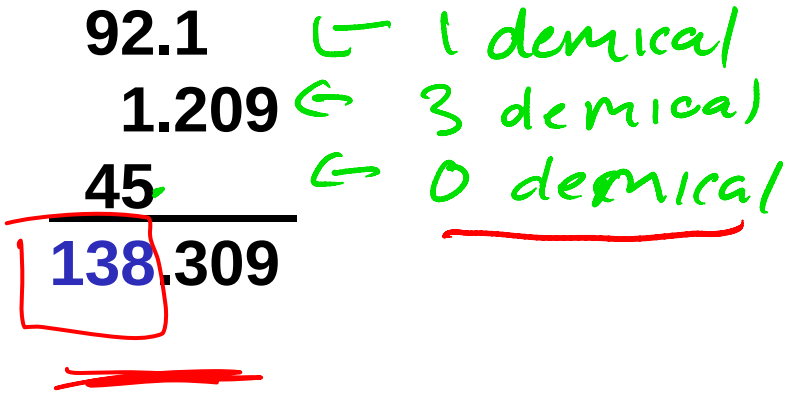
4.00×10^2

12 inche = 1 ft
12.00000

Sig Figs In Calculations

The precision of the result is the precision of the measurement.

Adding/Subtracting – the result cannot have more digits to the right of the decimal point than any of the original number.
Fewest Decimal Places



Sig. Figs. In Calculations

The precision of the result is the precision of the measurement.

Dividing/Multiplying – the result must be reported with the same number of significant figures as the measurement with the fewest significant figures.

Fewest Significant Figures.

7.273 ← 4
1.20 ← 3
X 1.5124421 ← 8
13.19998967196 → 13.2

Dimensional Analysis

Conversion Factor is a fraction whose numerator and denominator are the same quantity expressed in different units.

$$2.54\ cm = 1\ in.$$

$$\frac{2.54\ cm}{1\ in.} = \frac{1\ in.}{2.54\ cm} = 1$$

$$given\ unit \times \frac{desired\ unit}{given\ unit} = desired\ unit$$

Length in inches of an 8.00m rod?

100cm = 1m

$$\frac{8.00\ m}{}\left(\frac{100\ cm}{1\ m}\right)\left(\frac{1\ in.}{2.54\ cm}\right) = 315\ in$$

Atomic Structure

Atoms are the basic building blocks of matter. They are the smallest particles of an element that retains the chemical identity of the element.

TABLE 2.1 Properties of Subatomic Particles*

Particle	Mass		Charge	Symbol
	Grams	*Atomic Mass Units*		
Electron	9.109383×10^{-28}	0.0005485799	1−	${}_{-1}^{0}e$ or e^-
Proton	1.672622×10^{-24}	1.007276	1+	${}_{1}^{1}p$ or p^+
Neutron	1.674927×10^{-24}	1.008665	0	${}_{0}^{1}n$ or n

* These values and others in the book are taken from the National Institute of Standards and Technology website at http://physics.nist.gov/cuu/Constants/index.html

Table 2-1, p. 52

Atomic Structure

amu

Atomic mass unit (u) is one twelfth of the mass of an atom of carbon with six protons and six neutrons. ^{12}C

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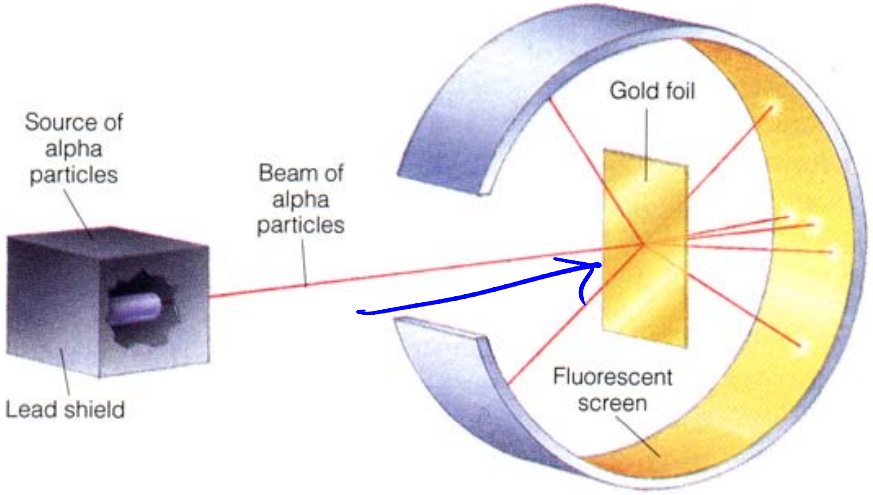
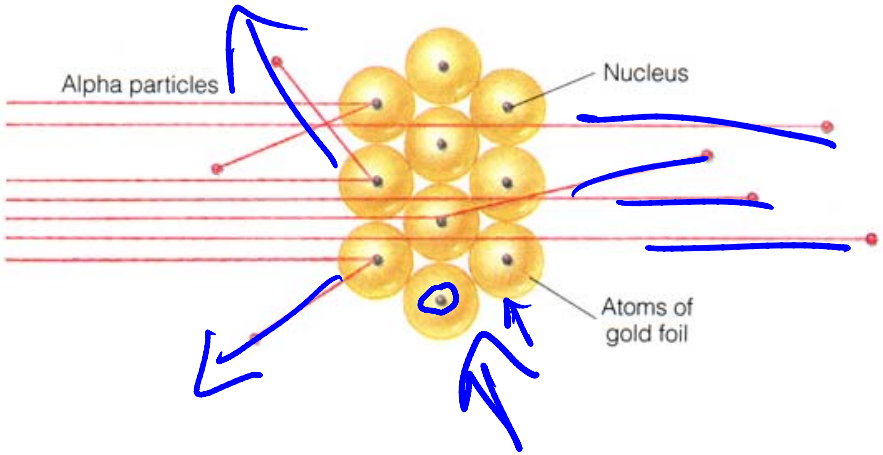
A proton is about 1836 times more massive than an electron.

0.000548...
1.007...

Atomic Structure





Sizes

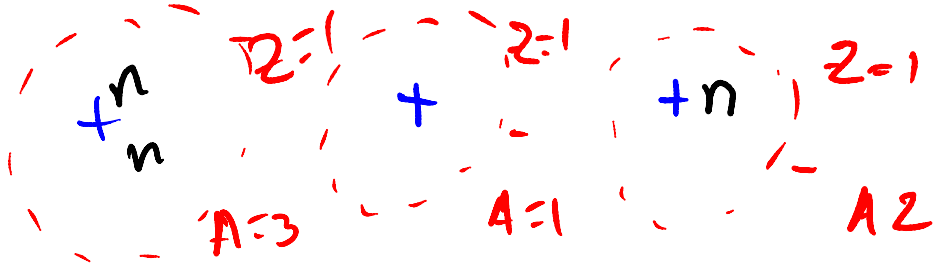
Nucleus: **2 – 7 fm**

Atom: **30 – 300 pm**

Imagine nucleus the size of a golf ball – 1.68 inches

$$\left(\frac{30 \times 10^{-12}\ m\ atom\ size}{2.0 \times 10^{-15}\ m\ nucleus\ size}\right)\left(\frac{1.68\ in.\ nucleus}{}\right)\left(\frac{1\ ft}{12\ in.}\right) = 2100\ ft\ atomic\ size$$

Atomic Structure



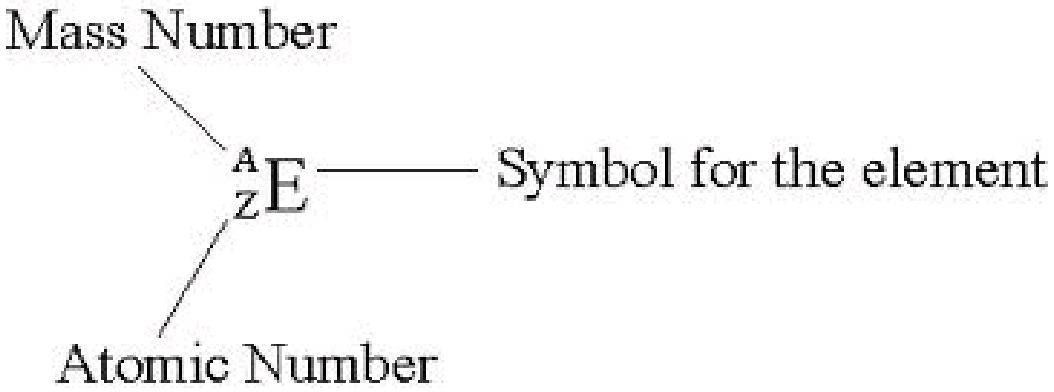
All atoms of an element have the same number of protons in the nucleus.

Elements are distinguished from one another by the number of protons or **Atomic Number (Z).**

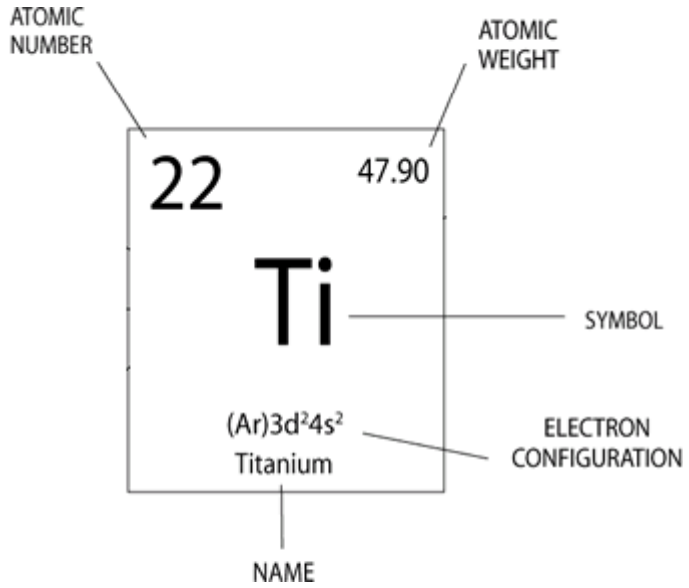
Isotopes are atoms of a given element that differ in the number of neutrons (and mass).

Mass Number (A), is the total number of protons plus neutrons

Symbolic Representation



$$^{48}_{22}Ti$$



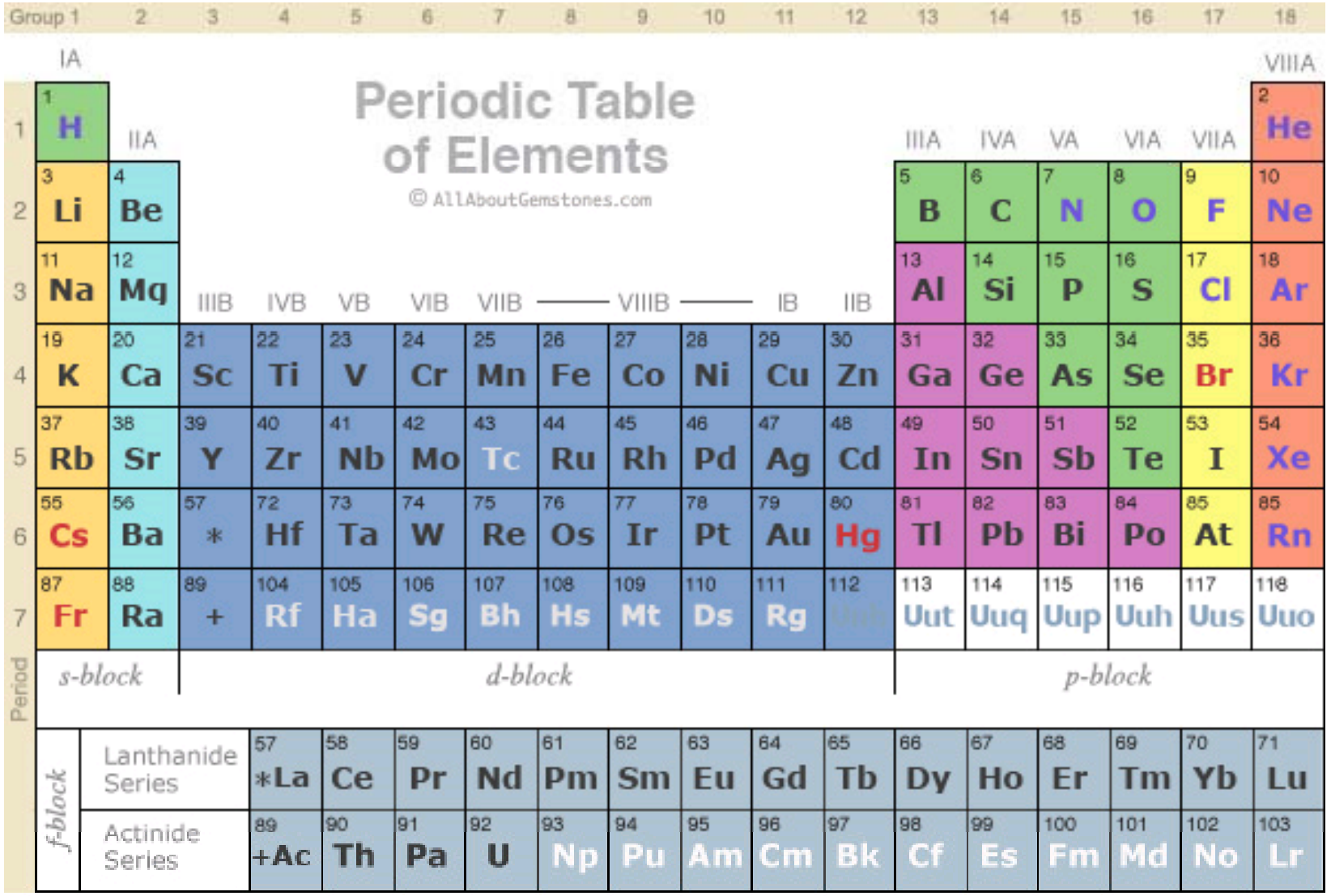
Abundance

$$percent\ abundance = \frac{\#\ of\ atoms\ in\ a\ given\ isotope}{total\ \#\ of\ atoms\ of\ all\ isotopes}\ x\ 100\%$$

Atomic weight - is the weighted average mass

$$atomic\ weight = \left(\frac{\%\ abundance\ isotope\ 1}{100}\right)(mass\ of\ isotope\ 1) + \left(\frac{\%\ abundance\ isotope\ 2}{100}\right)(mass\ of\ isotope\ 2) + \cdots$$

Periodic Table



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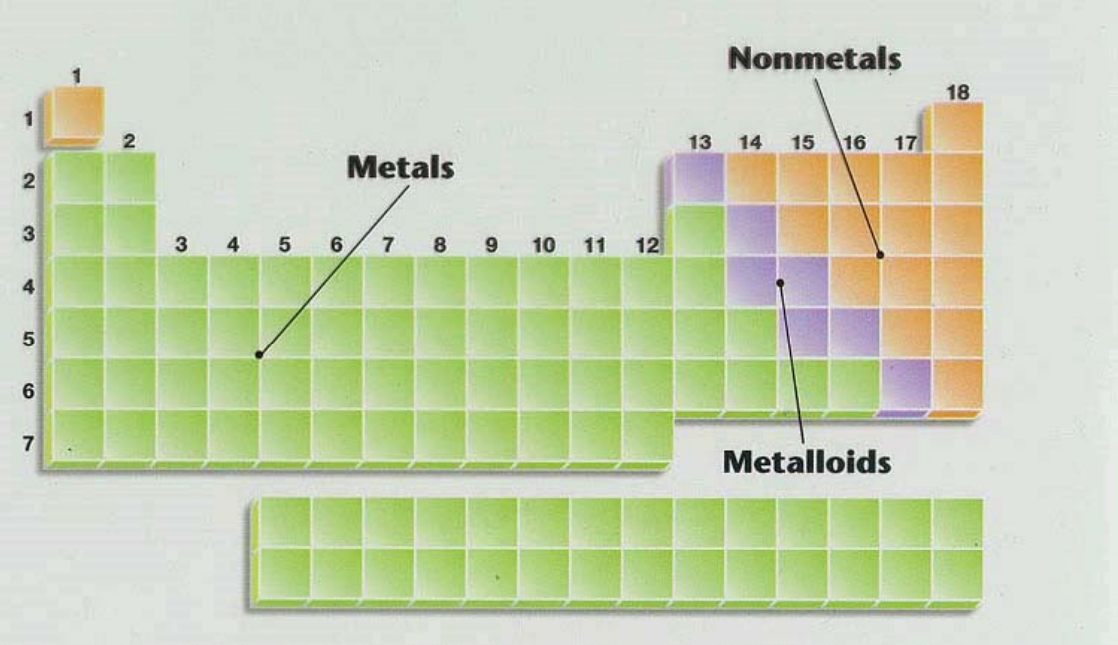
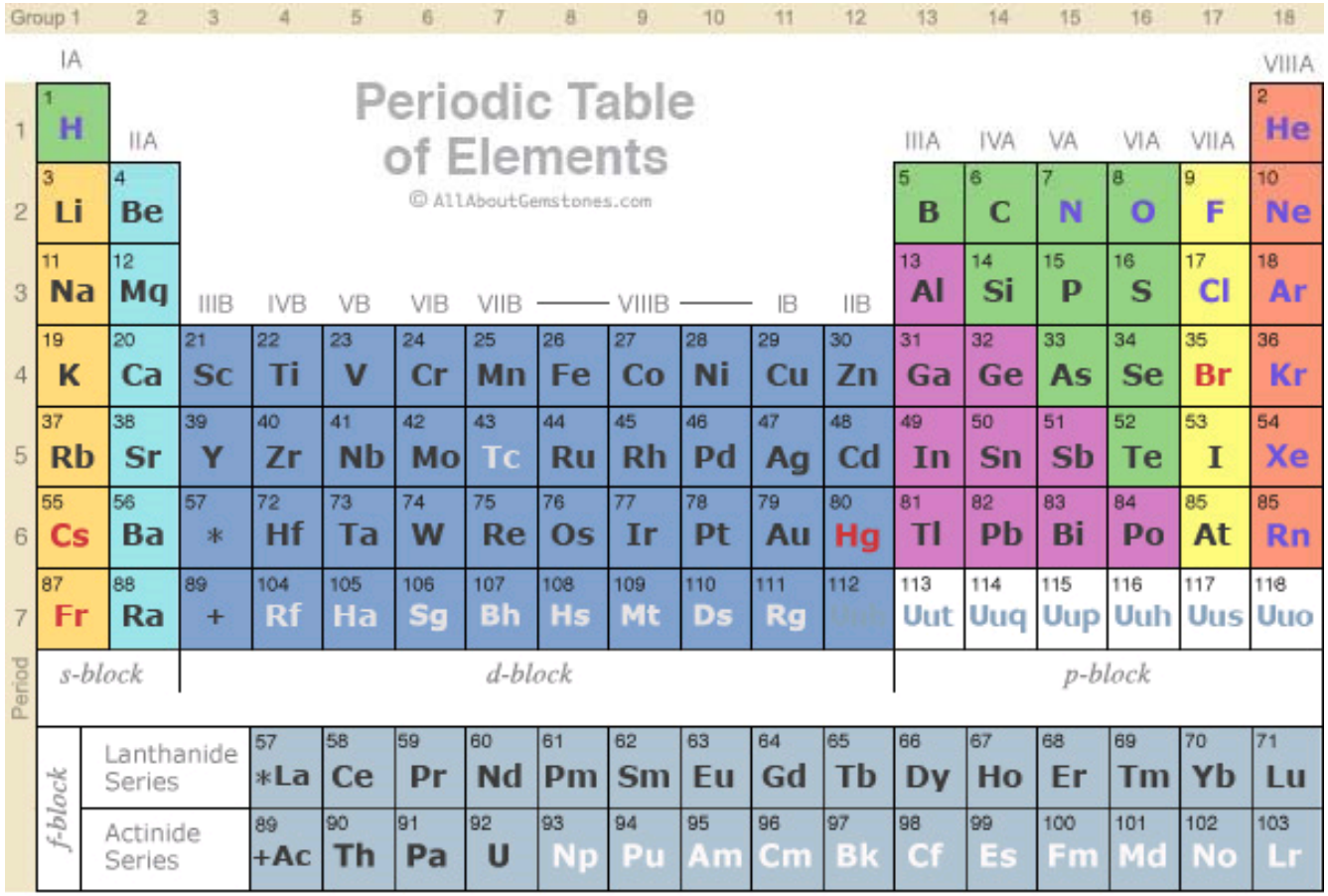


Metals – luster, high electrical and thermal conductivity, ductile and malleable.

Nonmetals – various colors, brittle, poor conductors, low mp

Metalloids – Have properties that fall in between those of metals and nonmetals

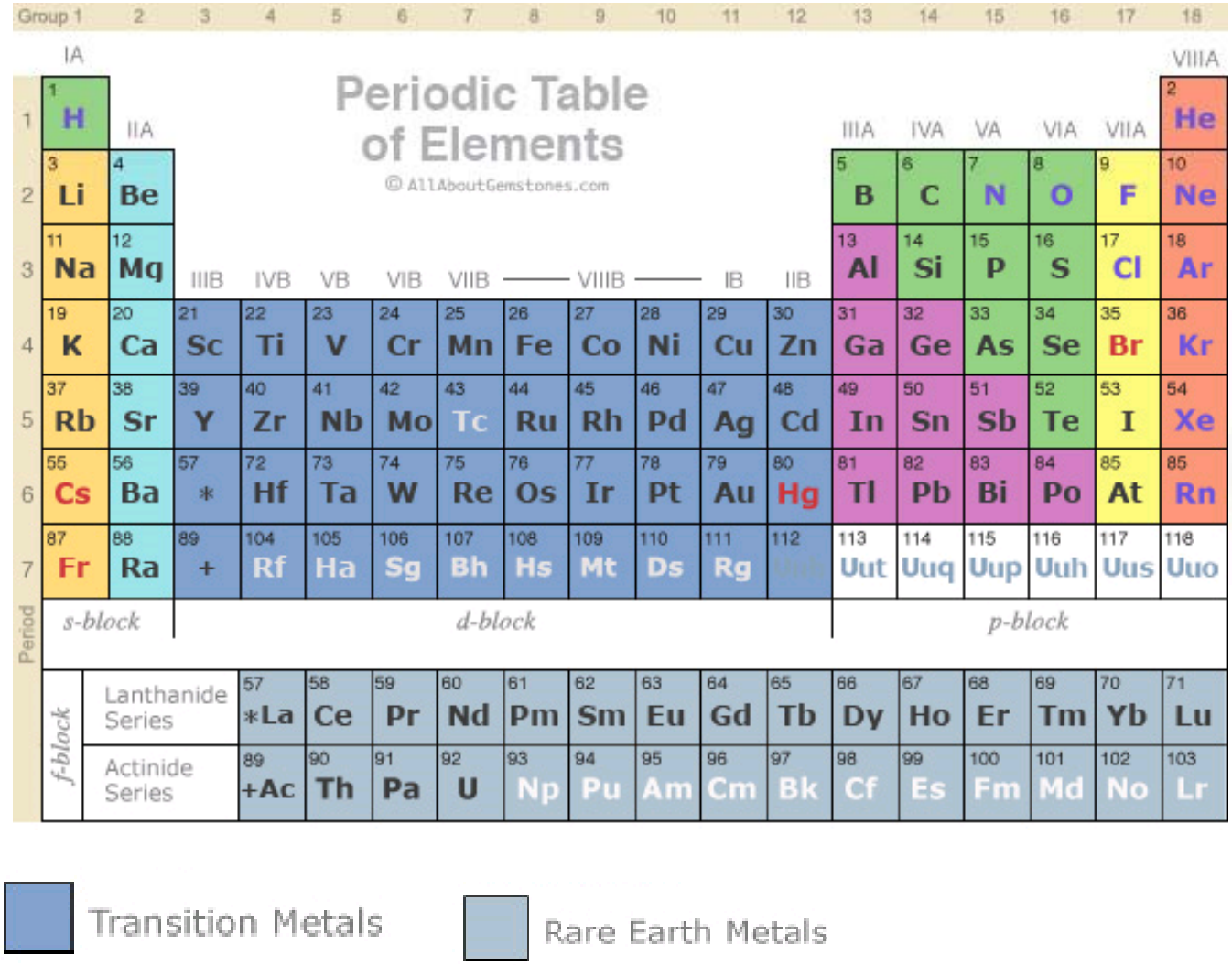
Periodic Table



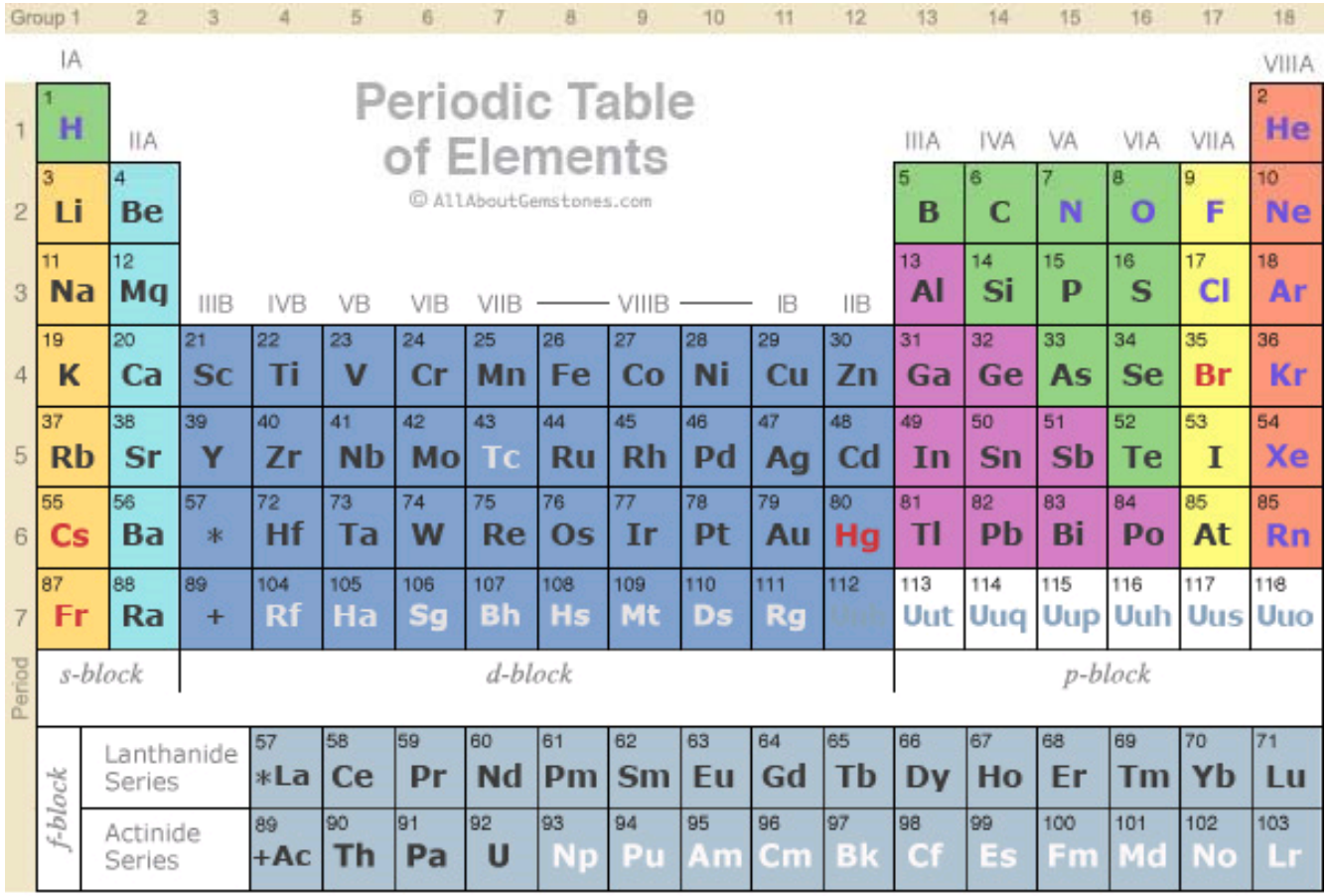
Alkali Metals

Alkali Earth Metals

Periodic Table



Periodic Table



Halogens

Noble Gasses

Chalogens