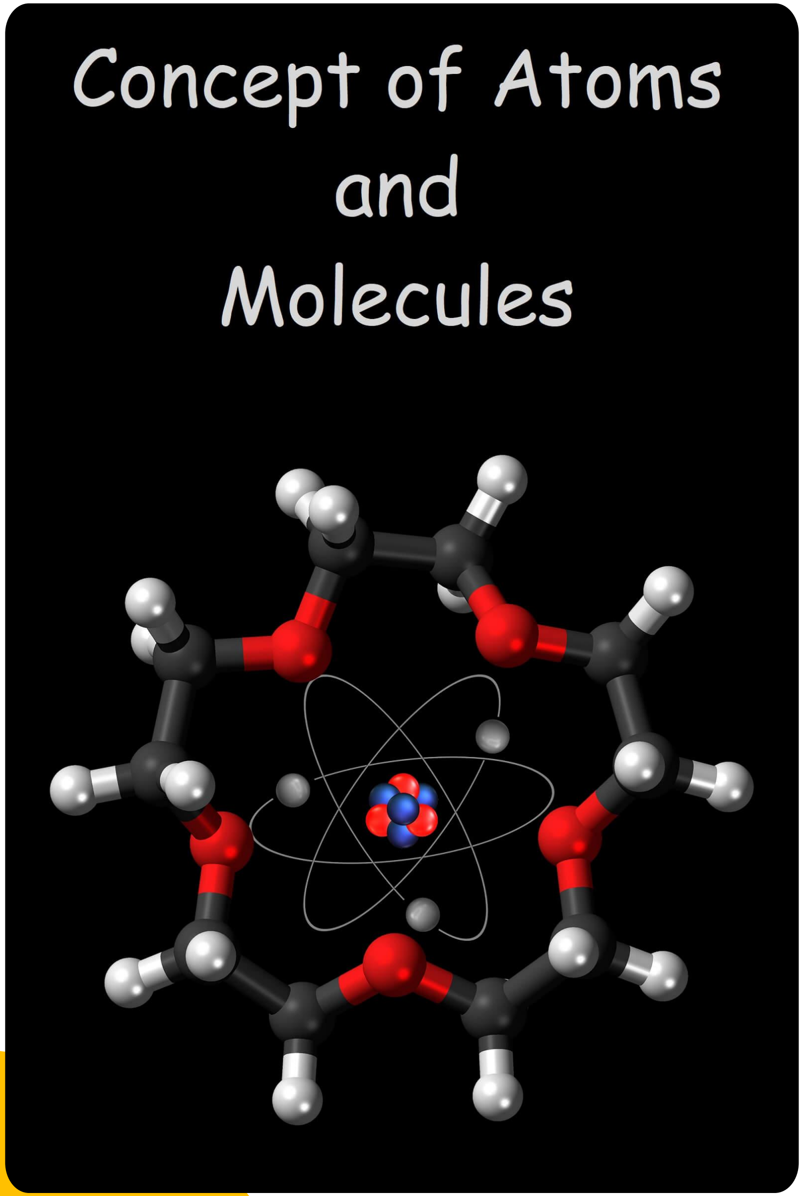
Chapter 2: Atoms and Molecules



- Atoms and molecules are the building blocks of chemistry. You’ve probably been hearing this since middle school, so the existence of atoms is not something that you are likely to question or challenge. Chances are that you rarely think about atoms or molecules, however, when you come across items in your day-to-day life. Chemistry has matured tremendously during the past century by building an increasingly thorough understanding of atoms and molecules.

Chapter Objectives

After mastering this chapter, you should be able to

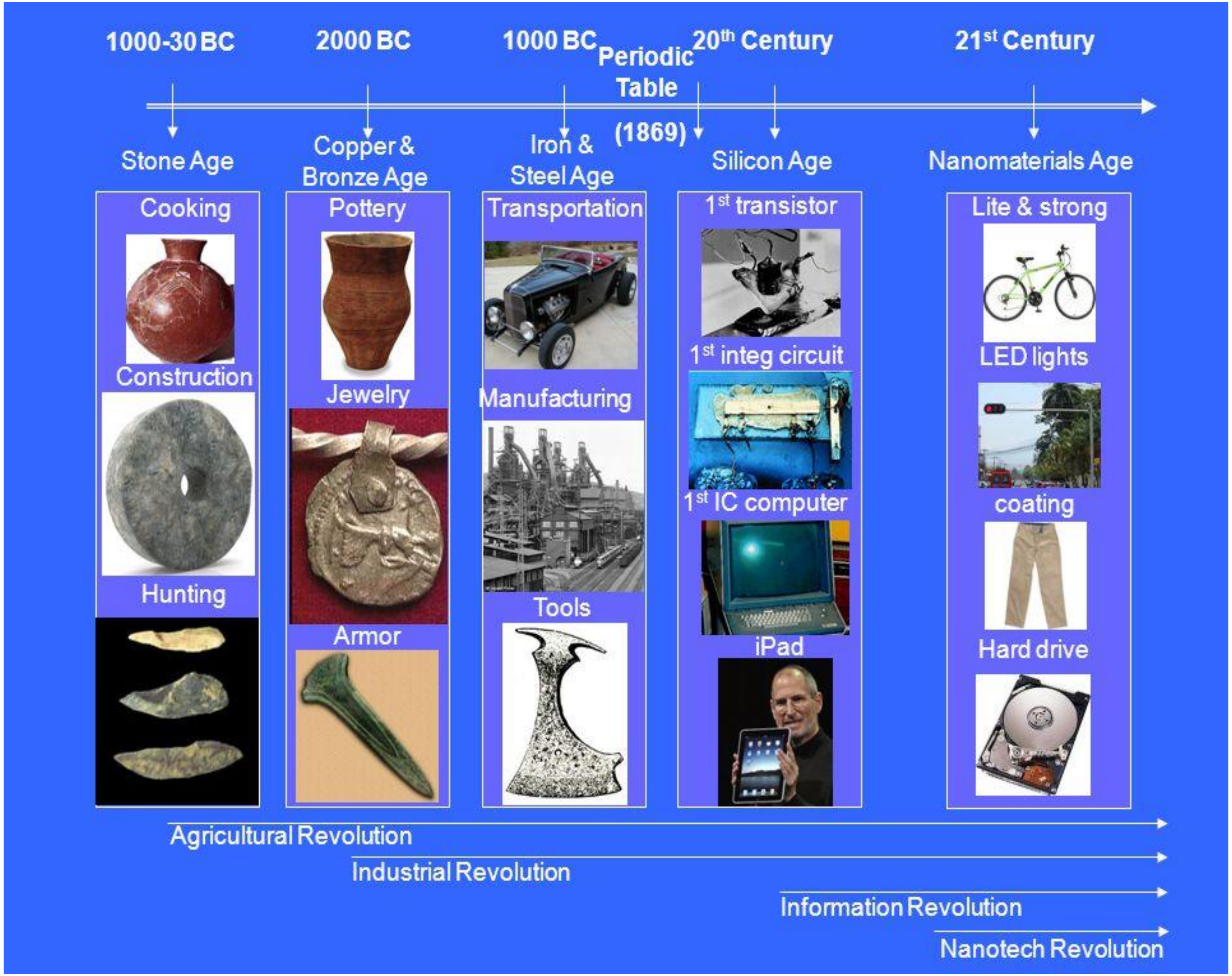
- name at least three common polymers and give examples of their uses.
- define the terms atom, molecule, isotope, ion, compound, polymer, monomer, and functional group in your own words.
- describe the nuclear model for the atom and identify the numbers of protons, electrons, and neutrons in a particular isotope from its chemical symbol.
- calculate the atomic mass of an element from the masses and abundances of its isotopes.
- explain the difference between a molecular formula and an empirical formula.

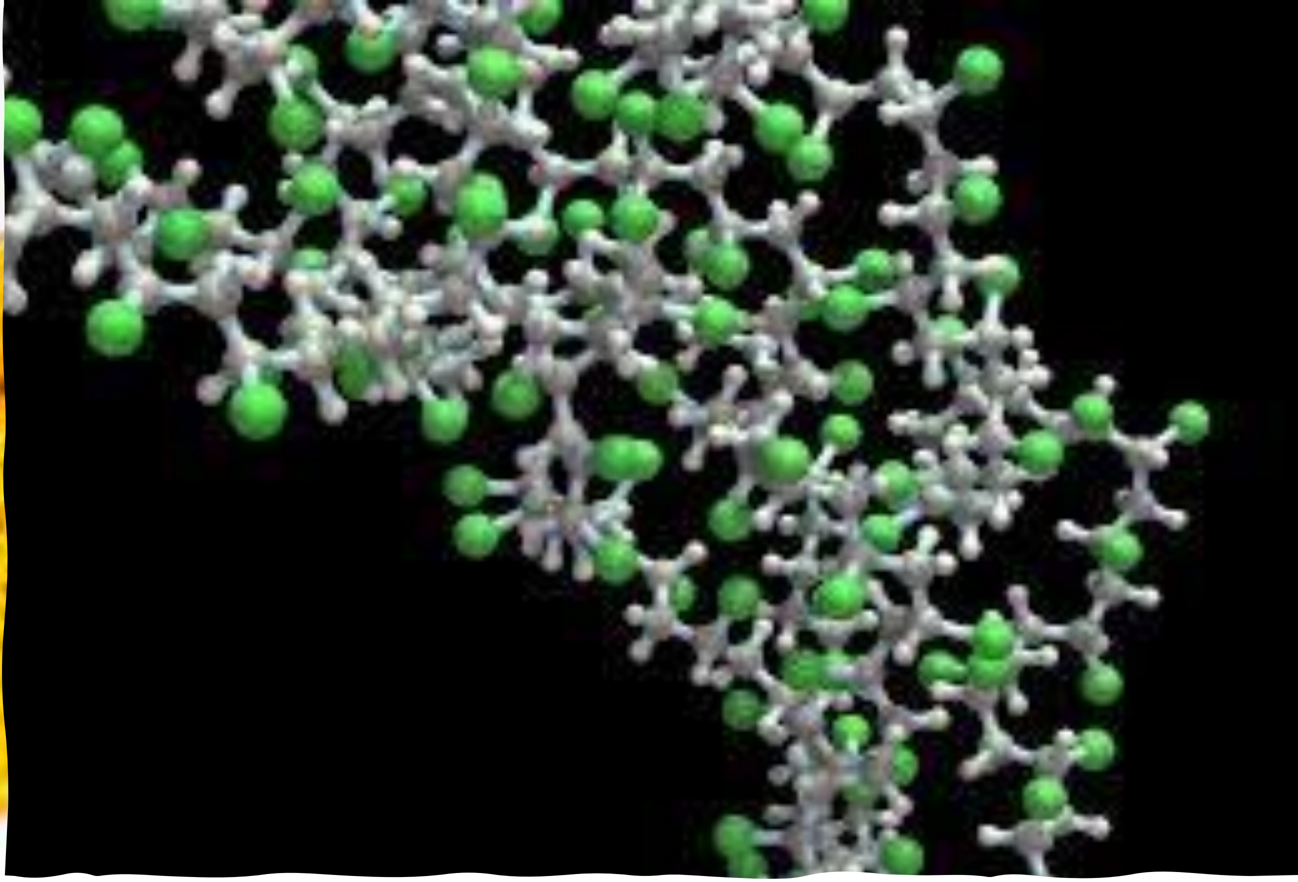
Cont..

- determine the number of atoms in a molecule from its chemical formula.
- describe the arrangement of elements in the periodic table and explain the useful- ness of the table.
- obtain a correct chemical formula from a line drawing of an organic molecule.
- use standard chemical nomenclature to deduce the names of simple inorganic compounds from their formulas or vice versa.
- describe different forms of polyethylene and how their properties and applications are related to their molecular structures.

Insight Into:

- As human civilization and technology have progressed, historical eras have been closely associated with materials from which important objects have been made. The Stone Age gave way to the Bronze Age, which in turn was followed by the Iron Age.



•**Polymers -** But it isn't hard to imagine that future archaeologists or historians might label the late 20th century and early 21st century as the Polymer Age. As you go about your life, the many plastics and synthetic fibers you encounter are examples of what chemists call polymers.

The properties and applications of these polymers

1. Hard and durable plastics are routinely used as structural materials for things like computer cases and casual furniture.

2. Softer, flexible plastics give us sandwich bags and Saran wrap. Other polymers make up the nylon and rayon that are found in our carpets and clothing.

3. Still more polymer materials, such as the filling in many bulletproof vests, offer incredible combinations of light weight and high strength.

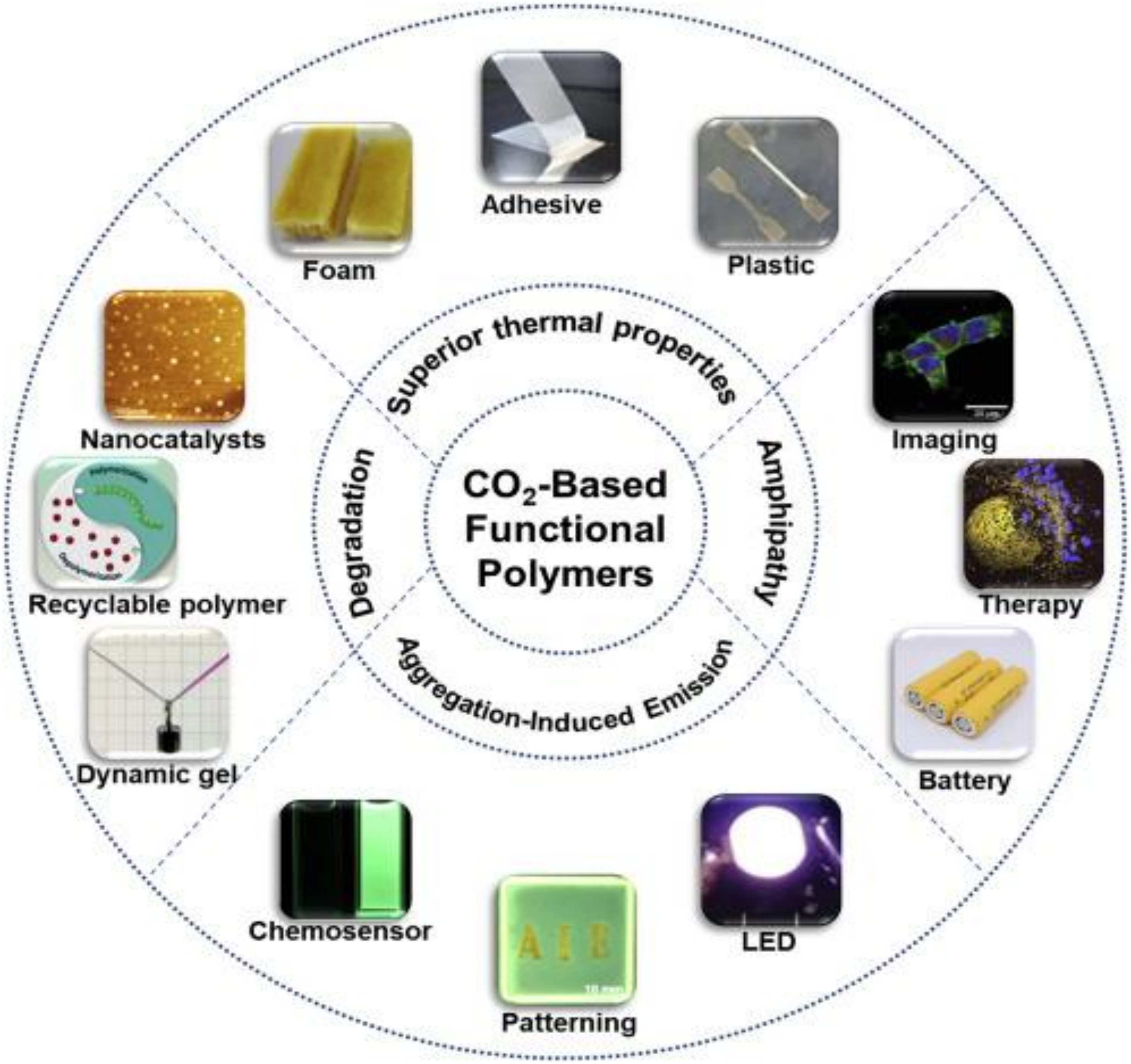
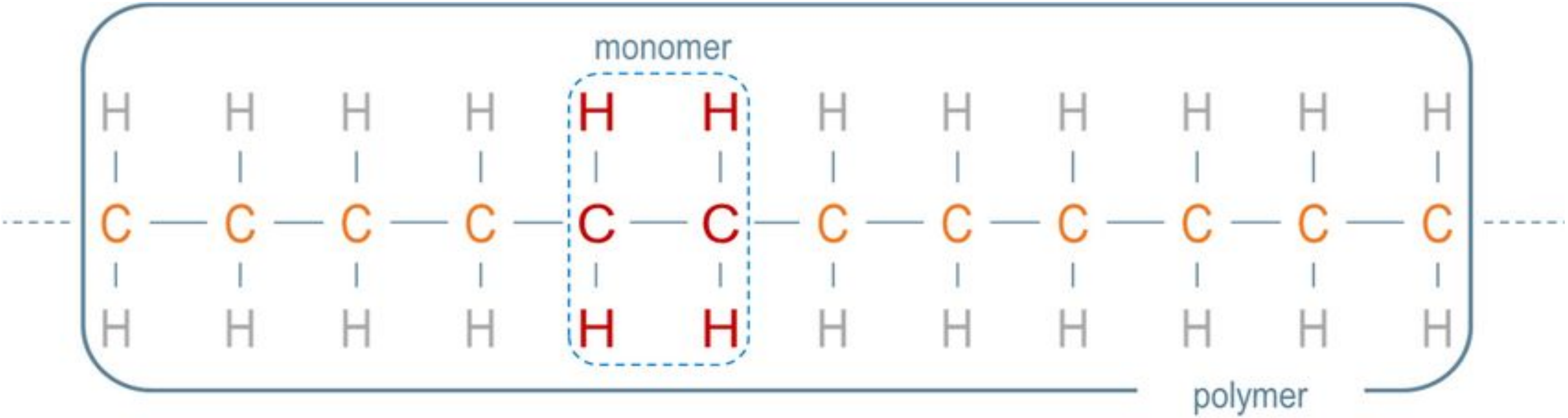


Figure 2.1 Polymers are the materials of choice for a host of everyday objects. All of the items shown in the left-hand photo are made from high-density polyethylene. The objects in the center are made from polystyrene, and those in the right-hand photo are made from poly(vinyl chloride).

A typical polymer molecule might contain hundreds or even thousands of these smaller constituent molecules, which are called **monomers**.

Polyethylene molecules are composed entirely of just two elements, carbon and hydrogen. The carbon atoms are linked together in a long chain that is called the **polymer backbone** of the polymer molecule, and there are two hydrogen atoms attached to each carbon.



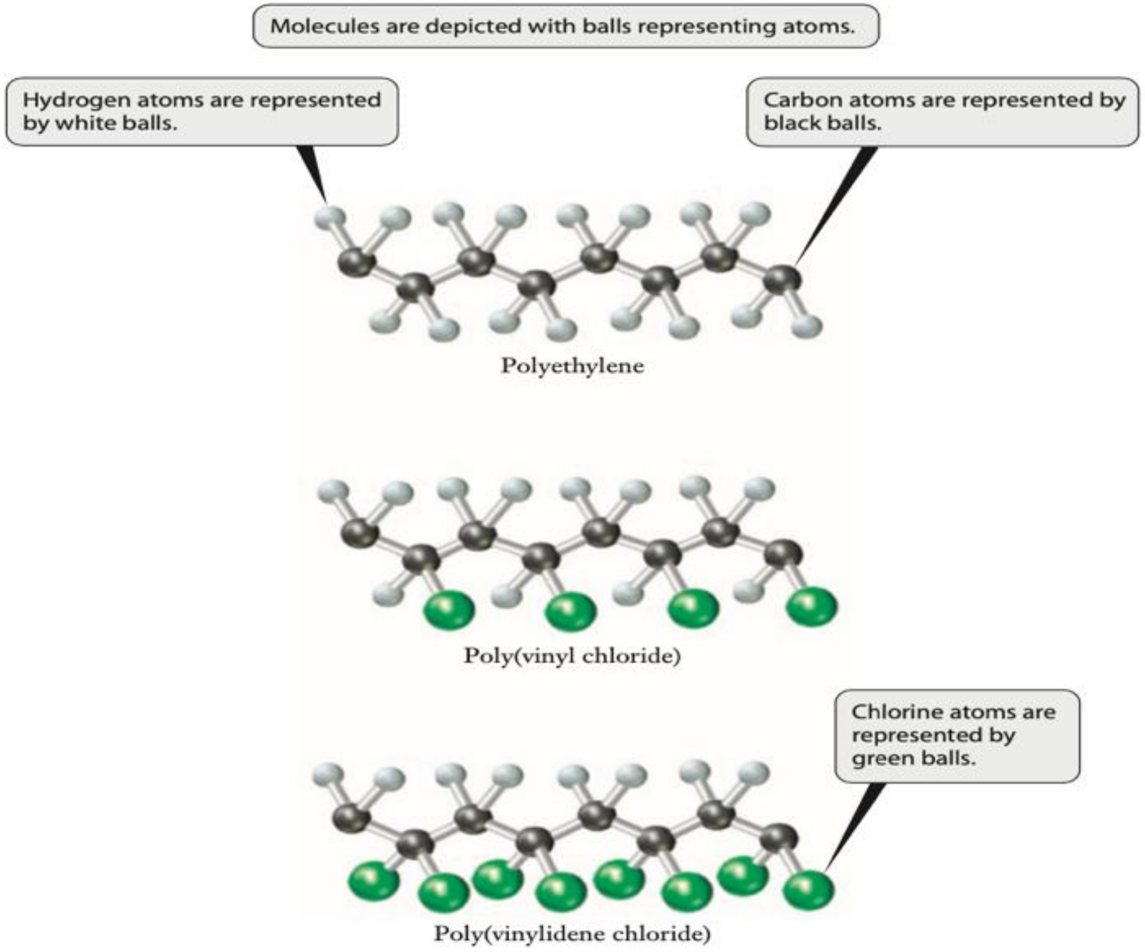


Figure 2.2 Models showing how atoms are arranged in molecules of polyethylene, poly(vinyl chloride), and poly(vinylidene chloride).

These three common examples show how strongly the physical properties of a polymer are influenced by its chemical composition.

To begin to explore the world of polymers systematically, we will need to know a little more about the atoms that are the simple building blocks of these giant molecules.

PVC vs PVDC

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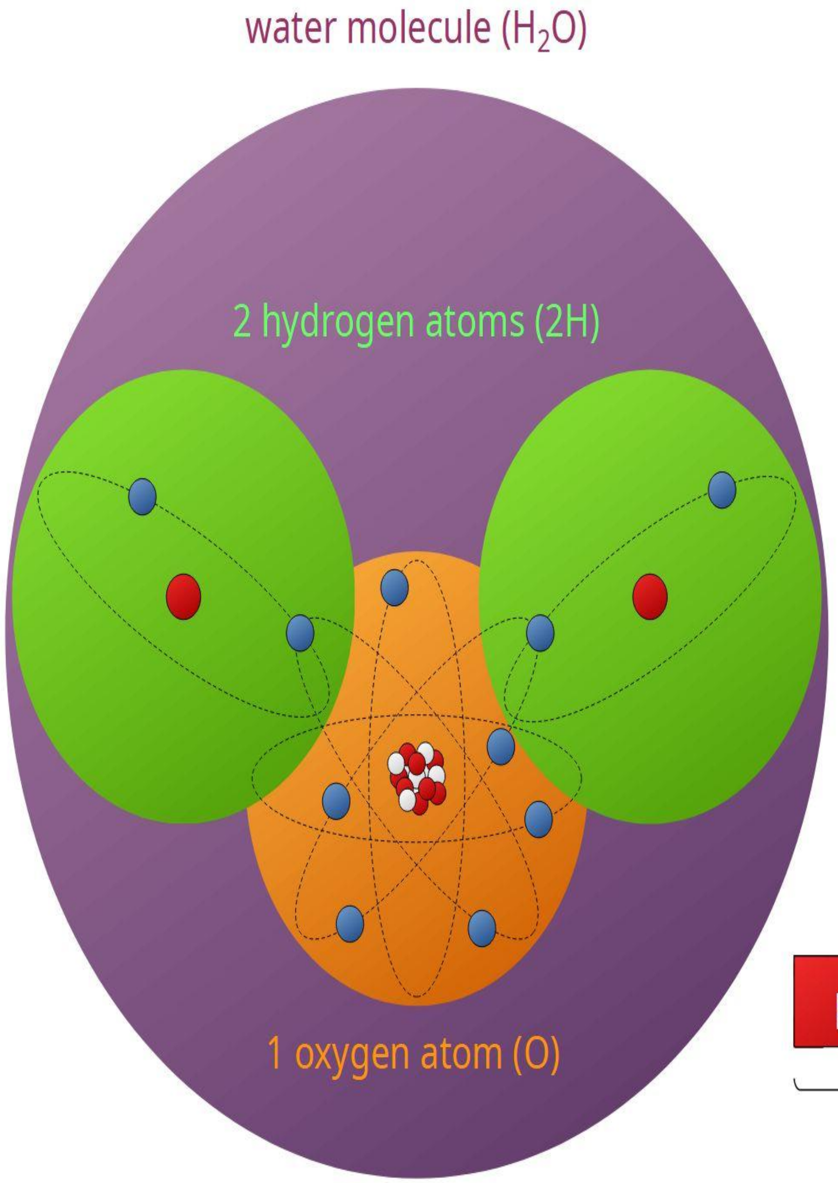
	PVC	PVDC
DEFINITION	The term PVC stands for polyvinyl chloride	The term PVDC stands for polyvinylidene chloride
STRUCTURE	The repeating unit has one C-Cl bond	The repeating unit has two C-Cl bonds
MONOMER	Chloroethene	Vinylidene chloride
USES	Production of pipes, electric cables, useful in construction purposes, PVC fabric production, production of flexible containers in healthcare products, etc.	Used as a packaging material, as a water-based coating to other plastic films, cleaning cloths, filters, screens, tape, etc.

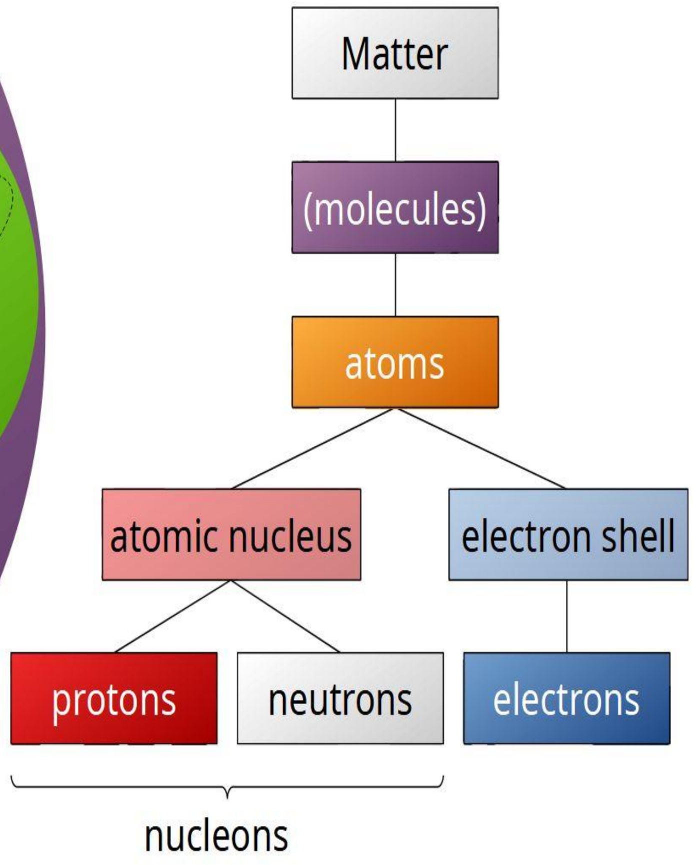
- **2.2 Atomic Structure and Mass**

- The comparison of polyethylene, poly(vinyl chloride), and poly(vinylidene chloride) demonstrates that the identity of the atoms in a molecule can have a tremendous impact on that molecule’s properties.

Fundamental Concepts of the Atom

- Our current model of the structure of atoms has been accepted for nearly a century, but it took great creativity and many ingenious experiments to develop. The atom is composed of a small, compact core called the **nucleus** surrounded by a disperse cloud of **electrons**. The nucleus is composed of two types of particles: **protons** and **neutrons**. There is so much space between the electrons and the nucleus that it is impossible to show it to scale in an illustration.





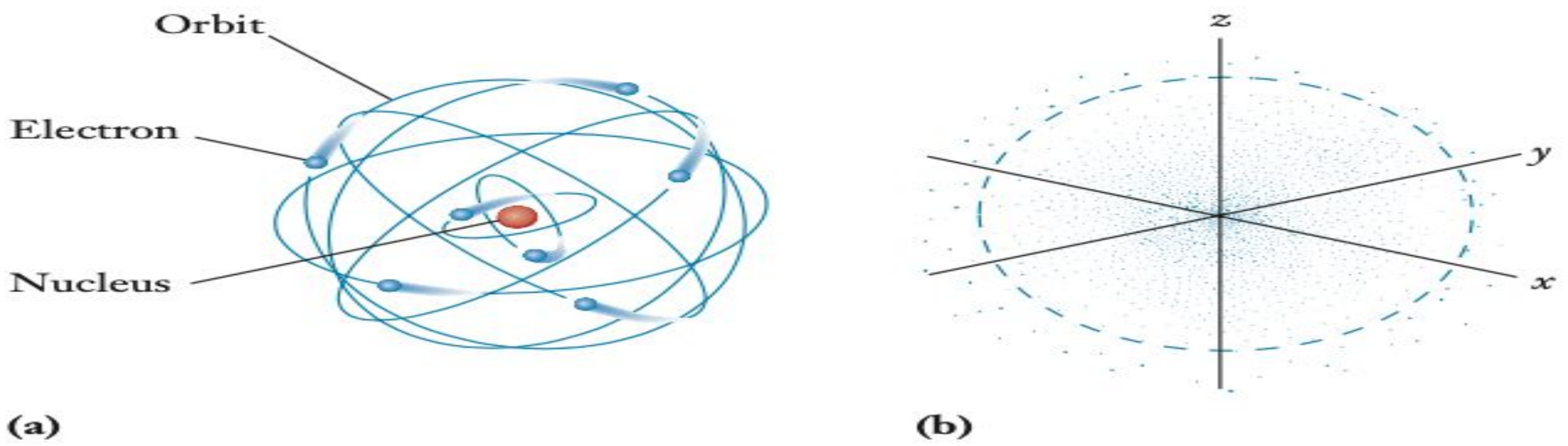


Figure2.3 ▌ Atoms have often been depicted as resembling a solar system: the nucleus is at
the center, and the electrons orbit around it, as seen here in (a). Although such pictures do help to emphasize the way that protons, neutrons, and electrons are distributed in the atom, they cannot illustrate accurately the currently accepted model of atomic structure. Instead, we depict the electrons as clouds of negative charge surrounding the nucleus, as shown in (b). In such pictures, the density of the small dots is related to the probability of finding an electron at a particular location.

Particle	Relative Mass	Relative Charge	Charge / C	Mass / kg
Protons	1	+ 1	$+ 1.6 \times 10^{-19}$	1.67×10^{-27}
Neutrons	1	neutral	0	1.67×10^{-27}
Electrons	0.0005	- 1	$- 1.6 \times 10^{-19}$	9.11×10^{-31}

Mass of Electron, Proton and Neutron

Because neutrons have no charge, the number of neutrons present is not restricted by the requirement for electrical neutrality. For most elements, the number of neutrons can vary from one atom to another, as we'll see.

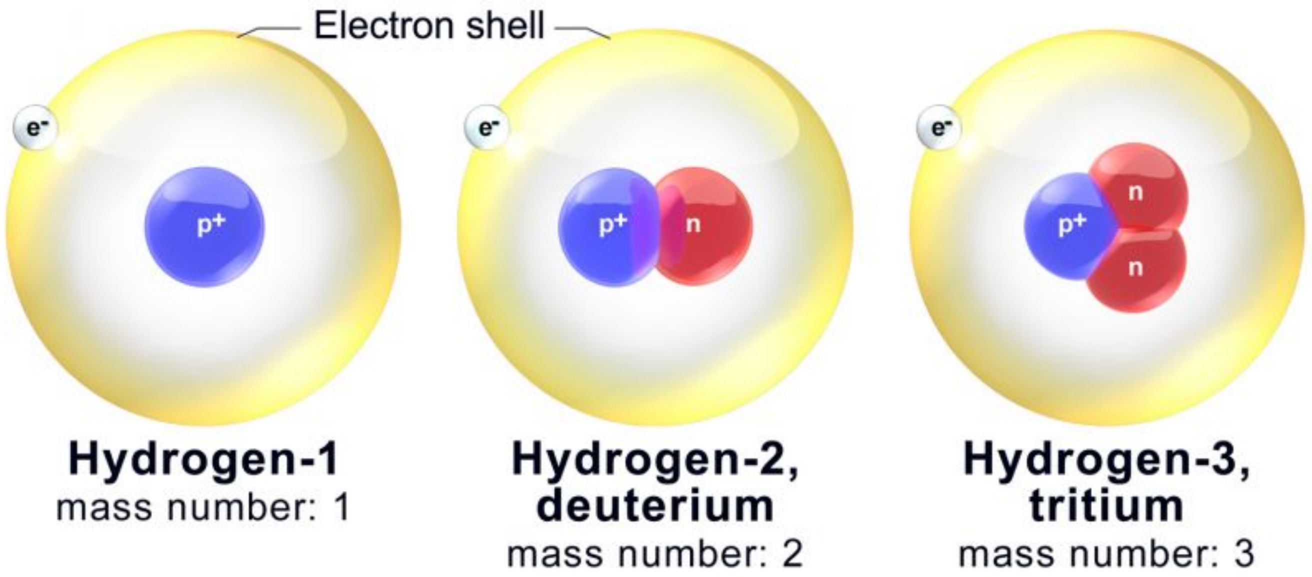
Atomic Number and Mass Number

The number of protons in a particular atom, referred to as the **atomic number**, identifies the element.

Atoms of the same element that have different numbers of neutrons are called **isotopes**. Isotopes are atoms of the same element with different numbers of neutrons, they will have the same atomic number but different mass numbers.

Individual atoms are so small and light that reporting their masses in conventional units such as kilograms or grams is not convenient. Instead, we use a unit that is appropriate to the atomic scale: the **atomic mass unit** or **amu**.
1 amu = 1.6605 × 10−24 g

Because of this, the combined total of protons and neutrons is called the



Isotopes

- How do we know that these isotopes exist? Modern instruments called mass spectrometers provide direct experimental evidence. The first important function of a mass spectrometer is to take a stream of microscopic particles—atoms or molecules—and “sort them” according to mass.

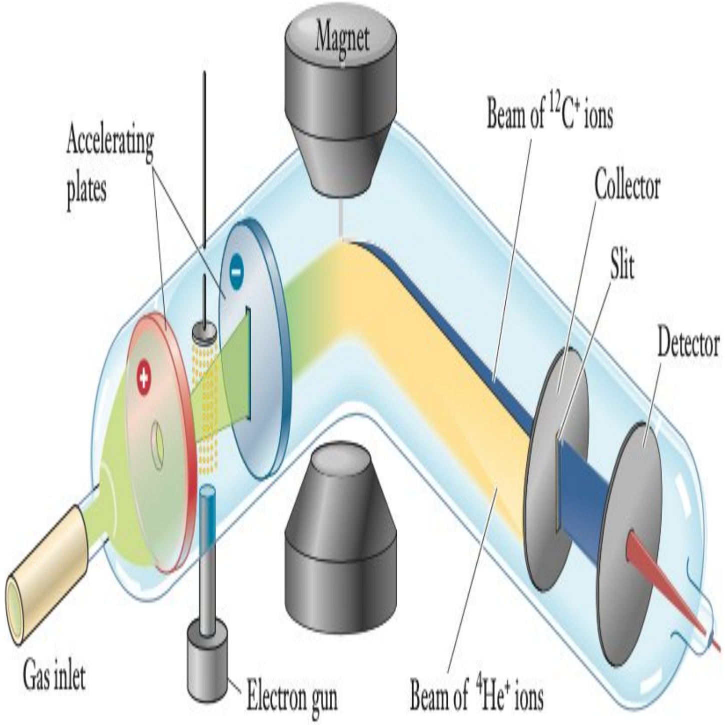


Figure 2.4 The schematic diagram shown here illustrates the key principles in the functioning of a mass spectrometer. 1. A stream of gas to be analyzed enters at the left, and an electron gun causes some of the atoms to lose an electron, forming charged particles called *ions.*
2. These ions are then accelerated to the right by an electric field, so that a beam of ions passes into a magnetic field. The magnetic field deflects the ions, and the extent of that deflection depends on the charge to mass ratio of each ion.
3. For a given charge, lighter particles are deflected more severely than heavier ones. So, if the sample contained both 4He+ and 12C+ ions, as shown here, the helium ions would be deflected much more than the carbon ions.
4. This allows a slit to select ions of a particular charge to mass ratio, which then strike a detector.
5. The current at this detector produces a signal that is proportional to the number of ions found with the desired charge to mass ratio, and this in turn is related to the amount of the parent gas molecule that entered the

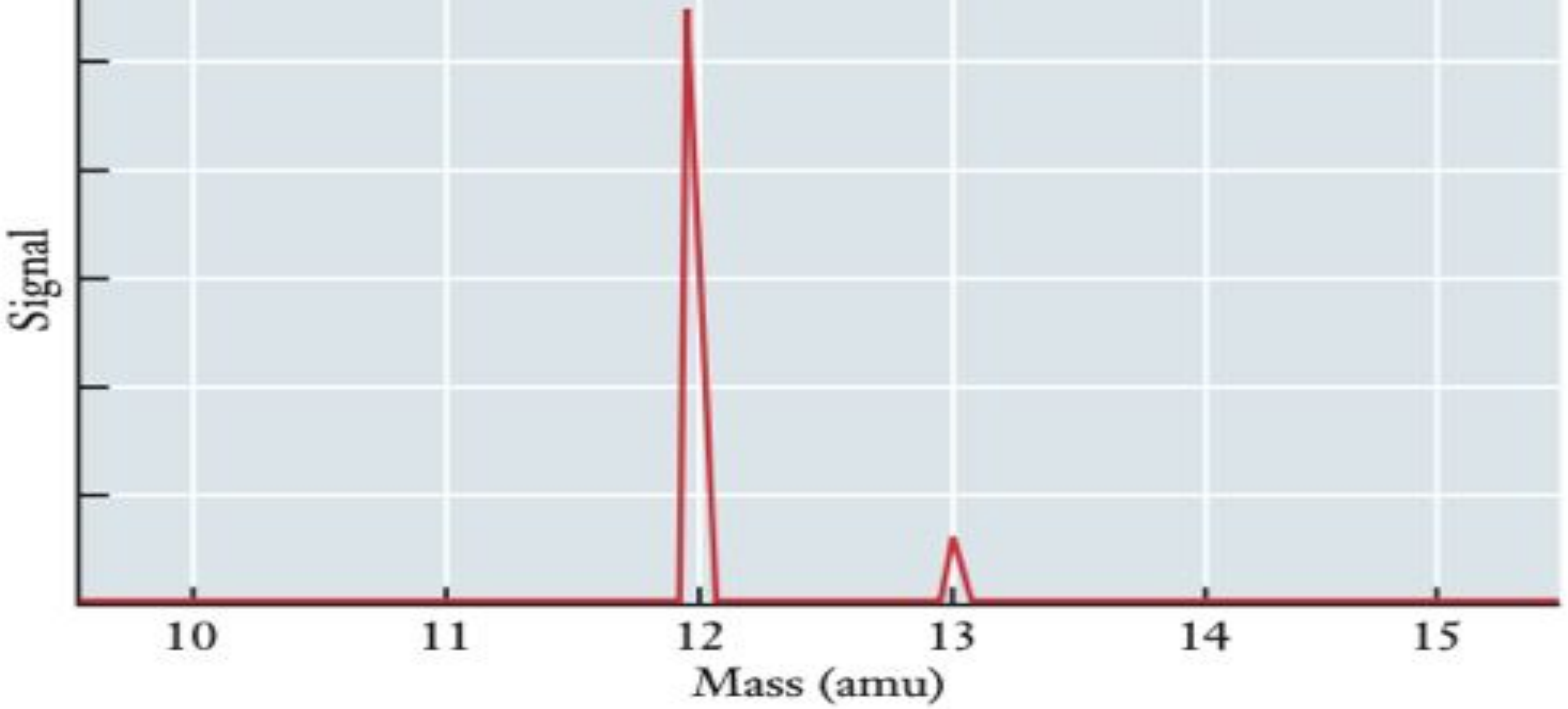


Fig. 2.5 ▮ A sketch of the mass spectrum of elemental carbon is shown. The large peak is due to 12C, and the smaller peak to the right is 13C. The size of the 13C peak here is somewhat exaggerated; it would actually be just 1/99 the size of the 12C peak.

Note: This tells us that there is a small amount of a second isotope, carbon-13, with seven neutrons. Comparing the relative sizes of the two peaks, we could determine that the carbon-12 isotope accounts for roughly 99% of the carbon atoms.

Comparing the relative sizes of the two peaks, we could determine that the carbon-12 isotope accounts for roughly 99% of the carbon atoms. More accurate measurement gives a value of **98.93%**, with just **1.07%** of carbon-13. It is also possible to determine that the exact mass of the carbon-13 isotope is 13.0036 amu.

Because any sample we measure will always contain vast numbers of atoms, these same percentages, or **isotopic abundances**, will be found in any naturally occurring sample of carbon.

Atomic Symbols

All the information about the structure of the atom, which we have just discussed, can be written in scientific shorthand, using atomic symbols. The general atomic symbol can be written as

$^{A}_{Z}E$

Ex. The symbol for carbon-12, for example, is $^{12}_{6}C$.

Table 2.1

Names and symbols of some common elements whose symbols are not related to their English names

Name	Symbol (name origin)
Gold	Au (aurum)
Iron	Fe (ferrum)
Lead	Pb (plumbum)
Mercury	Hg (hydrargyrum)
Silver	Ag (argentum)
Sodium	Na (natrium)

Atomic Masses

The atomic mass is defined as the *average* mass of an atom of a particular element.
Carbon has two stable isotopes with masses of 12.0000 and 13.0036 amu, respectively. Suppose that we could measure the mass of a 100-atom sample. Based on the isotopic abundances, we would expect to have 99 atoms of carbon-12 and only a single atom of carbon-13.

For carbon, the fact that we only need to consider two stable isotopes makes the calculation fairly simple. We can multiply the mass by the fractional abundance to weight each isotope’s contribution to the atomic mass.

Carbon-12: $12.0000 \times 0.9893 = 11.87$
Carbon-13: $13.0036 \times 0.0107 = 0.139$
Weighted average mass = $11.87 + 0.139 = 12.01$

The value of 12.011 found in the periodic table is obtained using additional

EXAMPLE PROBLEM 2.1

The chlorine present in PVC has two stable isotopes. 35Cl with a mass of 34.97 amu makes up 75.77% of the natural chlorine found. The other isotope is 37Cl, whose mass is 36.95 amu. What is the atomic mass of chlorine?

Strategy To determine the atomic mass, we must calculate the average mass weighted by the fractional abundance of each chlorine isotope. Because there are only two stable isotopes, their abundances must add up to 100%. So we can calculate the abundance of 37Cl from the given abundance of 35Cl.

Solution First, we calculate the abundance of the chlorine-37 isotope:

Abundance of ^{37}Cl = 100% − 75.77% = 24.23%

Now we can calculate the contribution of each isotope to the atomic mass.

^{35}Cl: 34.97 × 0.7577 = 26.50

^{37}Cl: 36.95 × 0.2423 = 8.953

Weighted average mass = 26.50 + 8.953 = 35.45

So the atomic mass of chlorine is 35.45 amu.

•Example 2: There are three naturally occurring isotopes of the element silicon, which is widely used in producing computer chips. Given the masses and abundances below, calculate the atomic mass of silicon.

Isotopes	Abundance	Mass
28Si	92.2%	27.977 amu
29Si	4.67%	28.977 amu
30Si	3.10%	29.974 amu

Ions

When the number of protons and the number of electrons do not match, the result is a species with a net charge, called an **ion. It** plays an important roles in many chemical processes, including large-scale production of polymers.

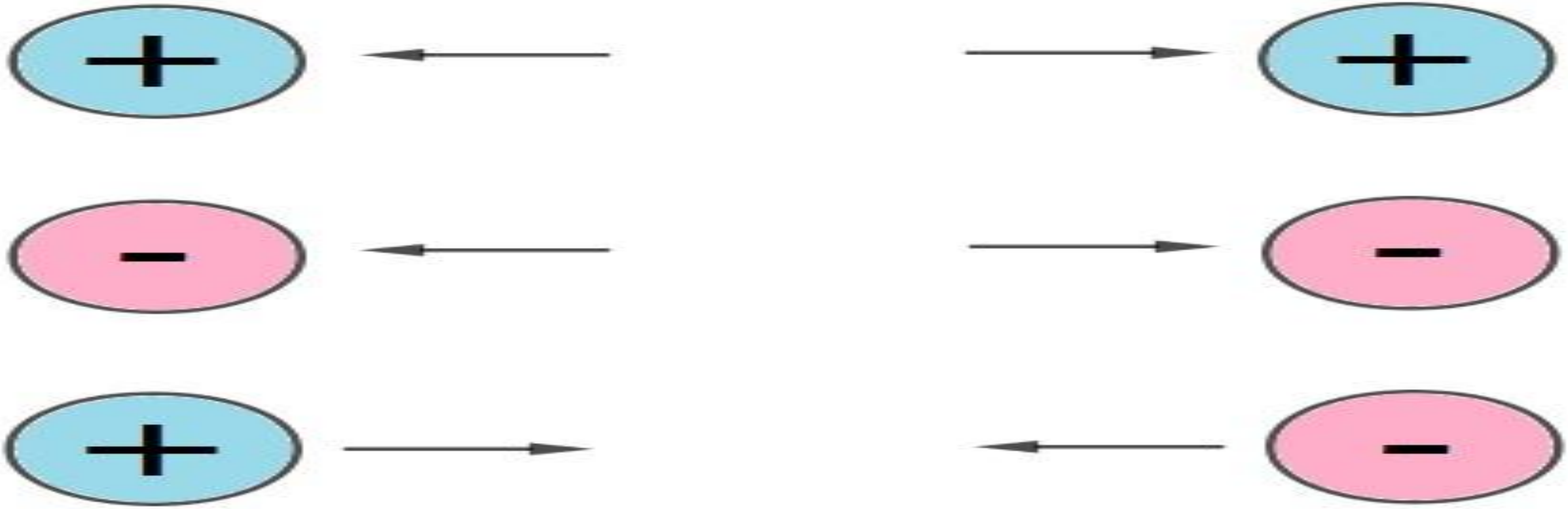
When an ion is derived from a single atom it is called a **monatomic ion**.

When groups of atoms carry a charge they are called **polyatomic ions**.

Monatomic or polyatomic ions may carry either negative or positive charges

Anions - negatively charged ions and they contain more electrons than protons.

Cations - an ion with more protons than electrons has a positive charge.



First, *opposite charges attract each other and like charges repel one another.* And second, *electric charge is conserved.*

Table 2.2

Examples of monatomic ions

Cation Name	Symbol	Anion Name	Symbol
Sodium ion	Na^+	Fluoride ion	F^-
Lithium ion	Li^+	Chloride ion	Cl^-
Potassium ion	K^+	Bromide ion	Br^-
Magnesium ion	Mg^{2+}	Sulfide ion	S^{2-}
Aluminum ion	Al^{3+}	Nitride ion	N^{3-}

Mathematical Description

The statement that “opposites attract and likes repel” can be quantified mathematically. **Coulomb’s law**, which you may recall from a physics class, describes the interaction of charged particles. The attraction of opposite charges and the repulsion of like charges are both described mathematically by one simple equation:

$$F = \frac{q_1 q_2}{4\pi\varepsilon_o r^2}$$

Here *q*1 and *q*2 are the charges, ε_o is a constant called the permittivity of a vacuum, and *r* is the distance between the charges. *F* is the force the objects exert on one another as a result of their charges.

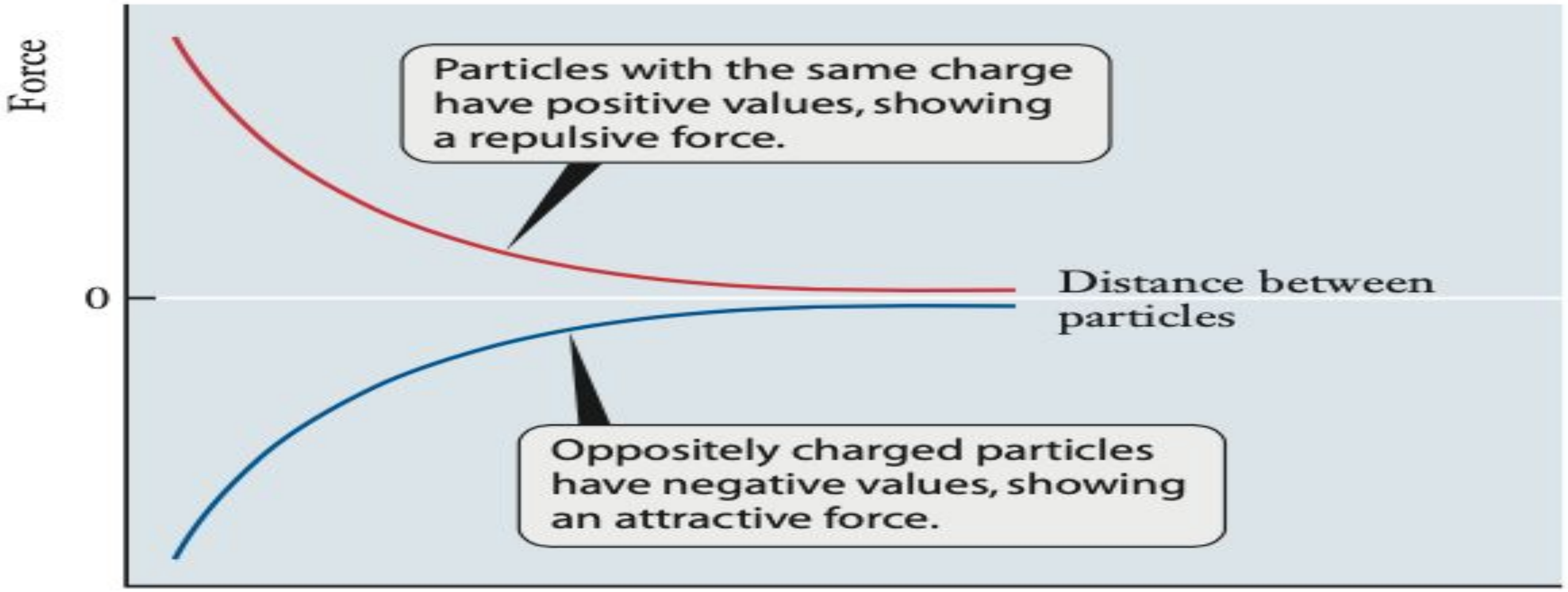


Figure 2.7 ▮ The figure shows how the coulombic force (Equation 2.1) varies with the distance *r* between two particles with opposite or like charges. When the charges have the same signs, the particles will repel one another, so the value of the force is positive. If the charges have opposite signs, the particles will attract one another and the value of the force will be negative.

Ions and Their Properties

Many monatomic cations and anions exist. These ions can exist in the gas phase, and many are important in atmospheric chemistry.

Example

Sodium atoms *lose* an electron relatively easily to form the sodium cation, Na^+. Because it still has 11 protons, this ion retains the symbol of sodium, yet it does not behave at all like an atom of sodium.

In contrast to sodium, chlorine readily *gains* an extra electron forming the chloride ion Cl^-. Again, there is a noticeable difference between the ion and the atom of chlorine.

Chemical Formulas

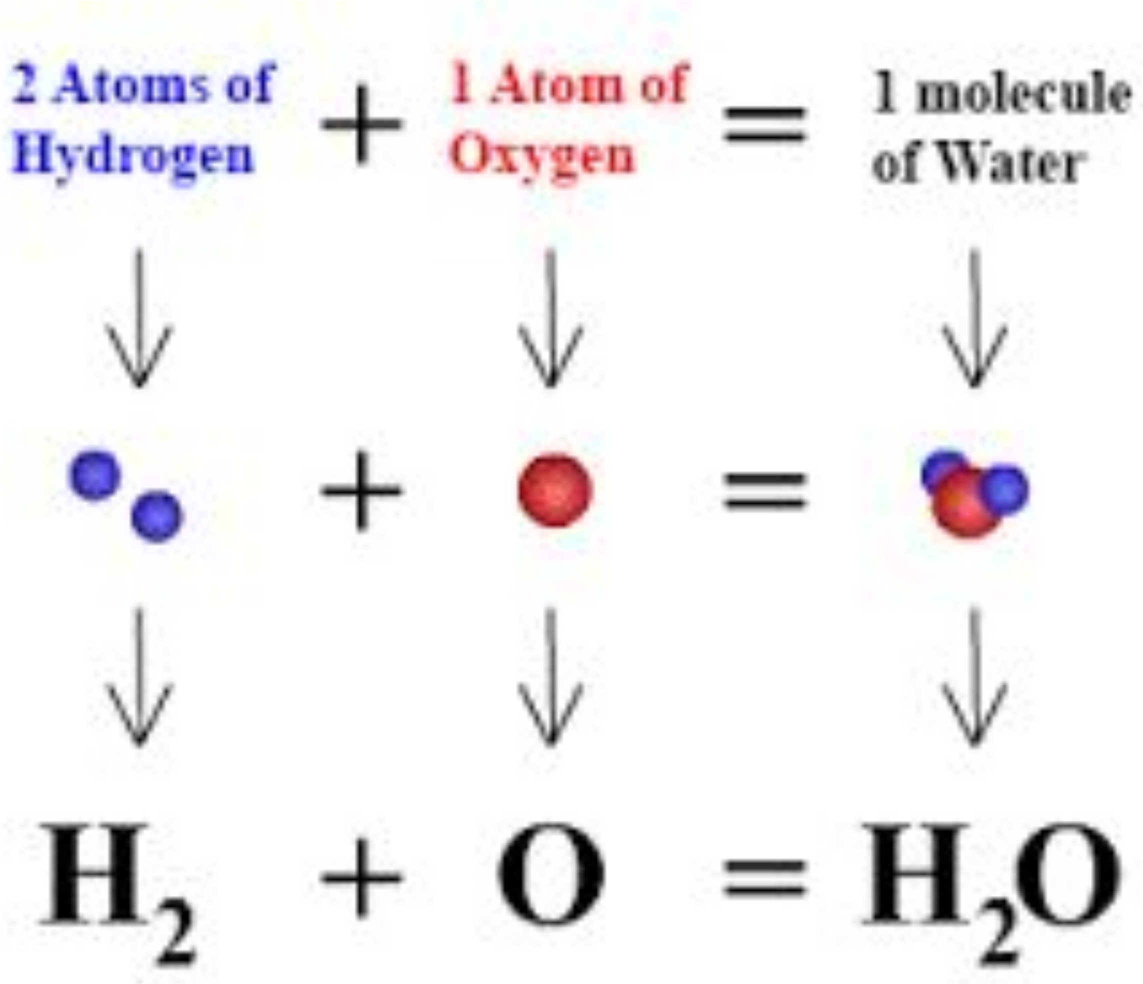
A **chemical compound** is a pure substance made up of atoms of two or more elements joined together by chemical bonds. In any compound, the atoms combine in fixed whole number ratios. In any such combination, the resultant substance behaves differently from the atoms alone.

In many compounds, atoms combine to form discrete particles called **molecules**. Molecules can be broken down into their constituent atoms, but the resulting collection of atoms no longer behaves like the original molecule.

A **chemical formula** describes a compound in terms of its constituent elements.

Two distinct types :
molecular formulas
empirical formulas.

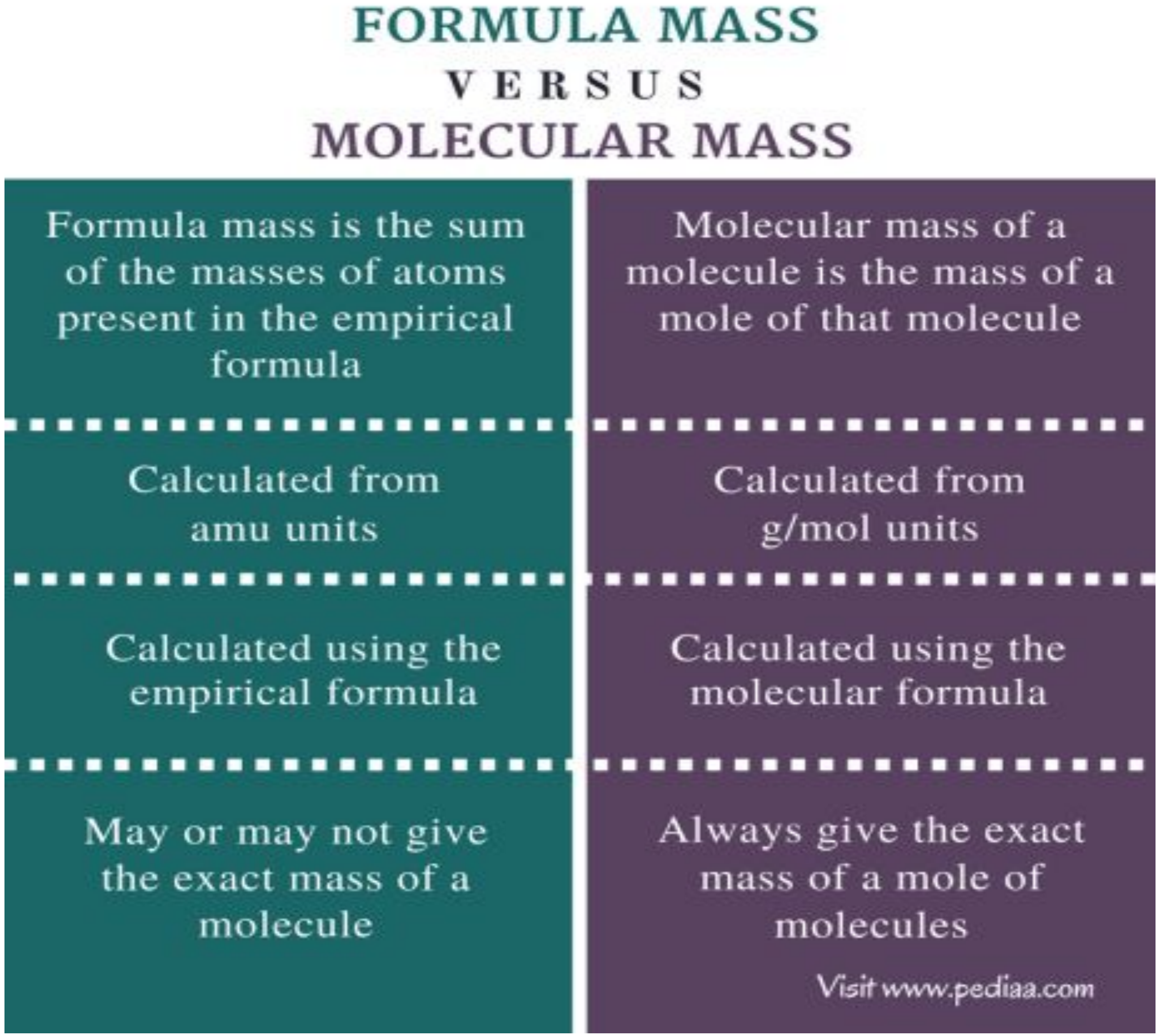
A **chemical formula** describes a compound in terms of its constituent elements.



- Two distinct types of chemical formulas:

- **Molecular mass or Molar mass (M.M)** refers to the mass of a molecular compound like CO_2, CO, H_2O

- **Formula mass (F.M)** refers to the mass of ionic compound like $NaCl$, $AlF3$, $CaCl_2$.



Example 1: Calculate the molecular mass of urea, $CO(NH_2)_2$

Example 2: Calculate the formula mass of $Al_2(SO_4)_3$

Percentage composition from formulas:

All samples of a pure compound contain the same relative amounts of elements by mass, and the proportion of each element present in a compound can be used to identify the compound. The commonly used proportion is the “percent composition or percent by mass” which is mathematically expressed as:

% composition = atomic mass x no. of atoms/ molar mass of the compound x 100

Example: Calculate the percentage composition of ethyl alcohol (C_2H_5OH)

Mole Concept:

A mole refers to a heap or a pile of individual particles (ion, atoms, or molecules) of any given substance. It contains the amount of matter equal to the number of atoms in exactly 12 grams of 12C (carbon -12). It is also referred to as the Avogadro's number of particles (6.02×10^{23}).

Conversion factors derived from the mole concept are used to operate many quantitative chemistry problems. Consider the ff:

a) 1 mole of any element contains 6.02 x 1023 atoms equivalent to atomic mass

Example: 1 mole of Cu = 6.02×10^{23}atoms = 64 grams

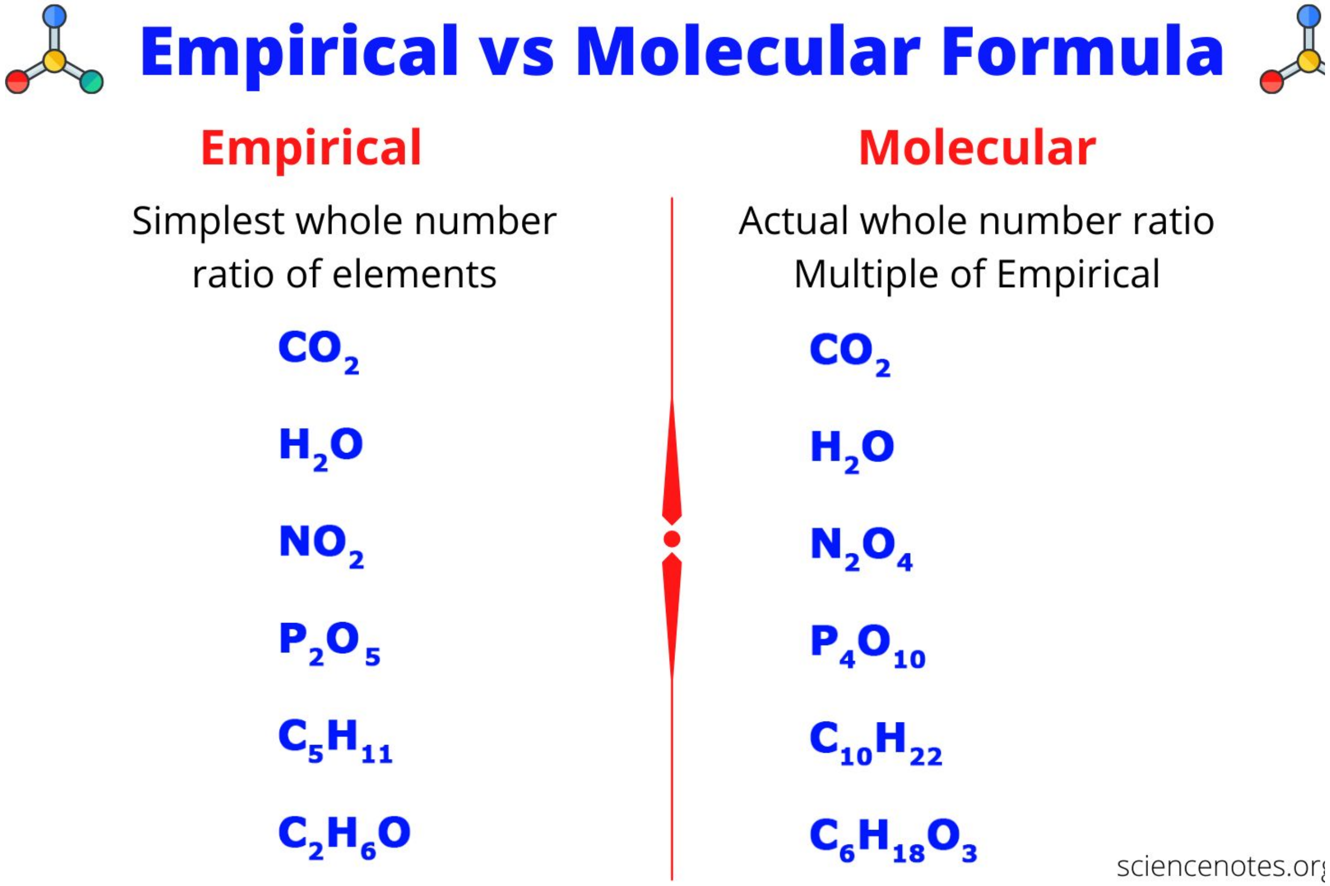
Example 1: How many atoms of zinc are there in 0.750 moles of zinc?

- The **molecular formula** of a compound is a kind of parts list that describes the atomic composition of a molecule efficiently. The molecular formula of the ethylene monomer from which polyethylene is produced is C_2H_4; this tells us that there are two carbon atoms and four hydrogen atoms per molecule.

- The **empirical formula** tells us only the relative ratio between the numbers of atoms of the different elements present.

Example:

- Let's consider ethylene again. The ratio of carbon atoms to hydrogen is 1:2. So the empirical formula is CH_2.



There are four rules that allow us to write most formulas that we will need.

1. Indicate the types of atoms in the substance by their atomic symbols.

2. The number of each atom in the compound is indicated by a subscript to the right of the atomic symbol. For example, the chemical formula of ethylene, C_2H_4, tells us that each molecule contains two carbon atoms and four hydrogen atoms.

3. Groups of atoms can be designated by using parentheses. Subscripts outside these parentheses mean that *all* atoms enclosed in the parentheses are multiplied by the value indicated in the subscript.

4. Water molecules associated with certain compounds called **hydrates** are indicated separately from the rest of the compound.

Example1: We cannot generally produce a polymer by simply mixing a large sample of the desired monomers. Instead, additional compounds called *initiators* or *catalysts* are almost always needed to start a polymerization. One polymerization catalyst is diethylaluminum chloride, $Al(C_2H_5)_2Cl$. How many of each type of atom are in a molecule of this compound?

Solution In each molecule of Al(C2H5)2Cl, there is one aluminum atom, one chlorine atom, and two groups of C2H5. Each of the C2H5 groups contains two carbon atoms and five hydrogen atoms. We multiply those numbers by two because there are two C2H5 groups present; so we have four carbon atoms and ten hydro- gen atoms.

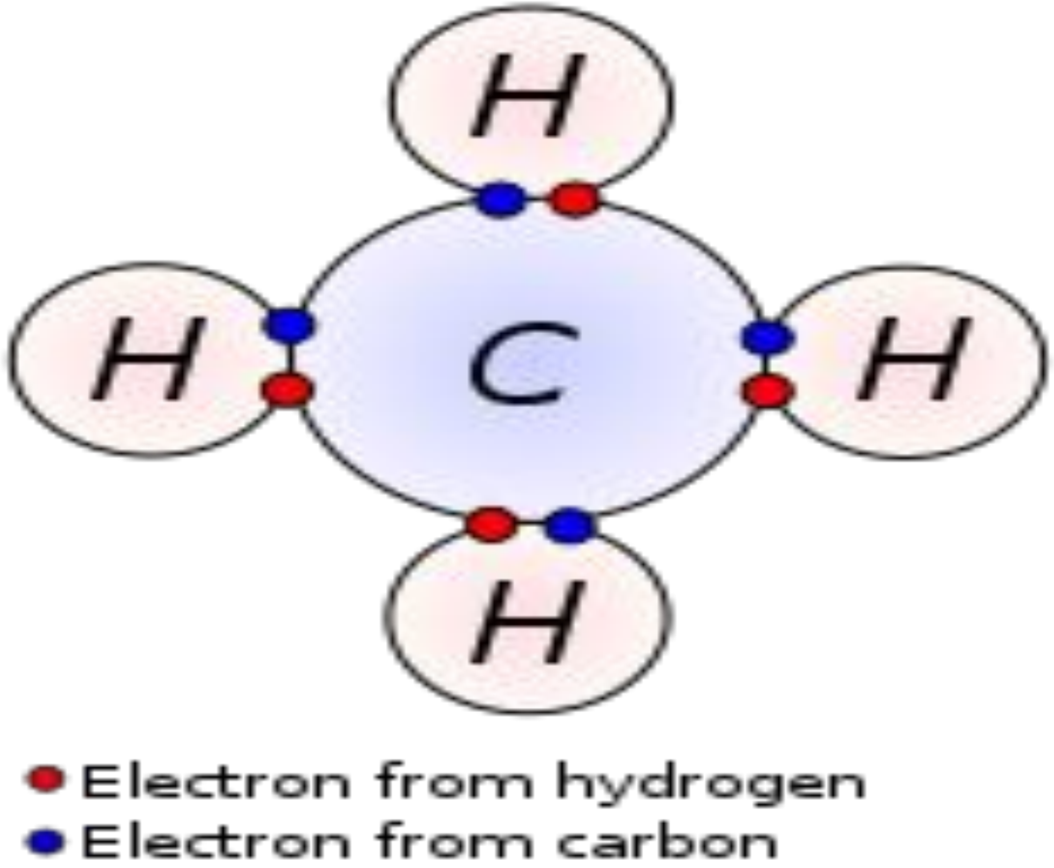
CHEMICAL BONDING

Atoms combine to make compounds by forming chemical bonds. Several different types of chemical bonds are possible,, these types of bonds will help us to understand some of the chemical properties of many substances.

All chemical bonds share two characteristics.

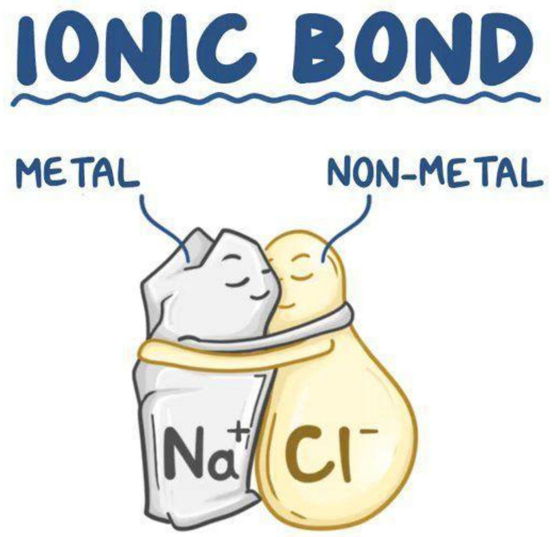
First, all bonds involve exchange or sharing of electrons.

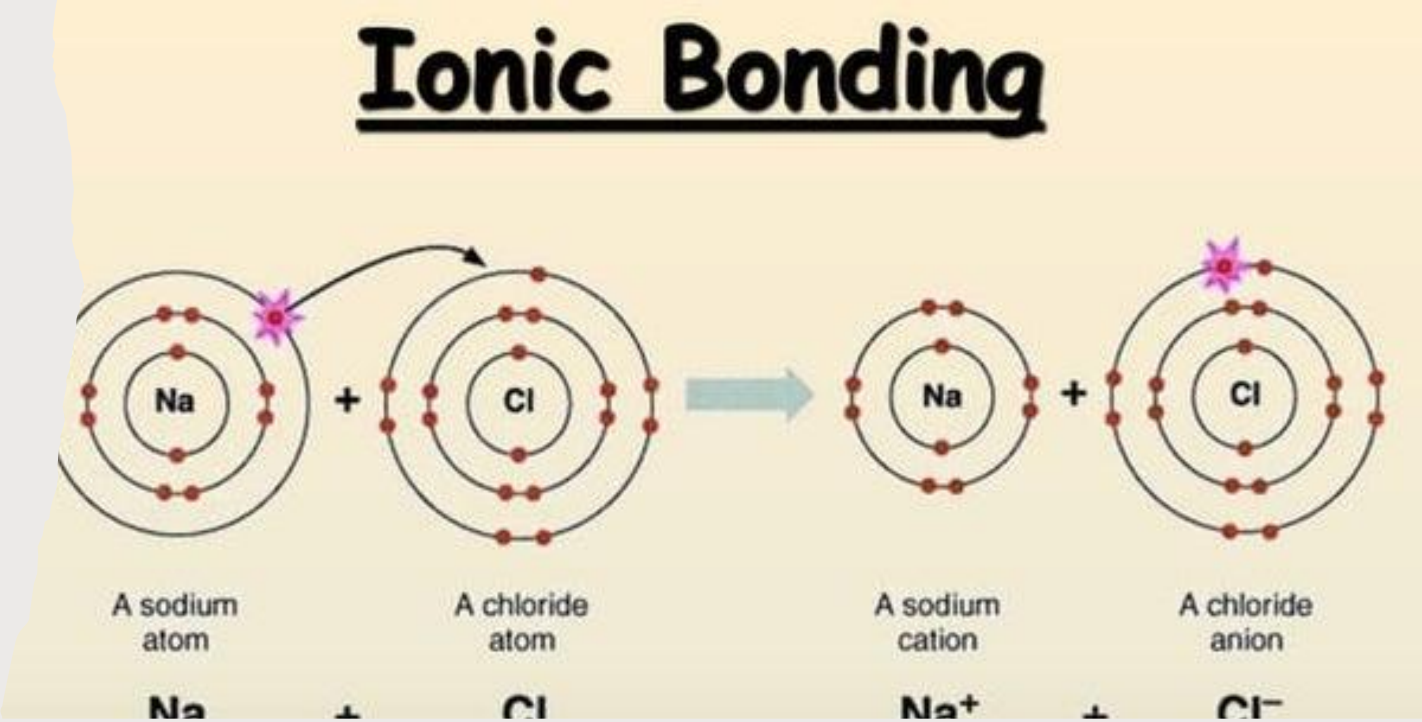
Second, this exchange or sharing of electrons results in lower energy for the compound relative to the separate atoms.



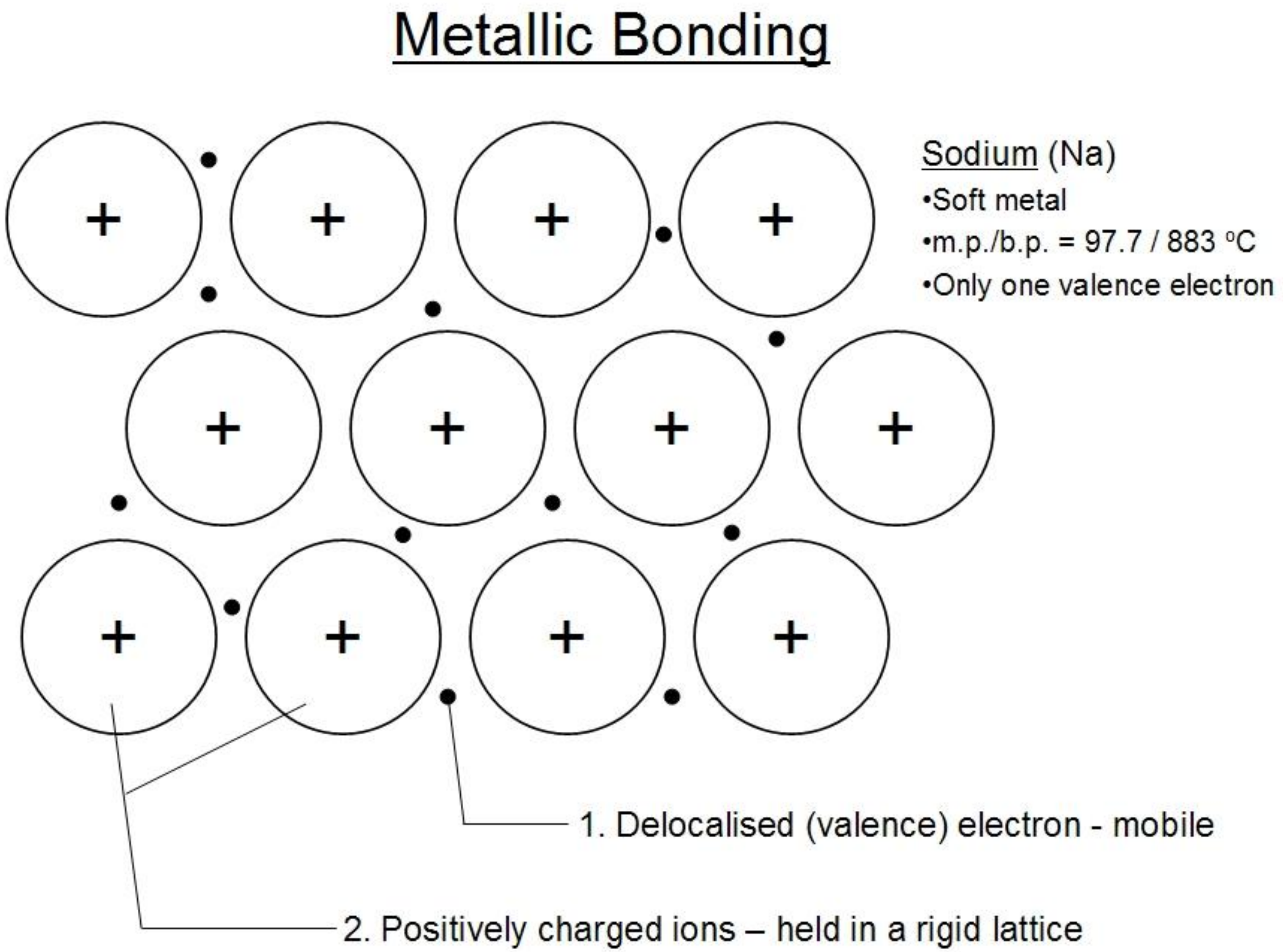
Chemical bonds can be divided into three broad categories: ionic, covalent, and metallic.

- A. Some compounds are composed of collections of oppositely charged ions that form an extended array called a **lattice**. The bonding in these compounds is called **ionic bonding**.

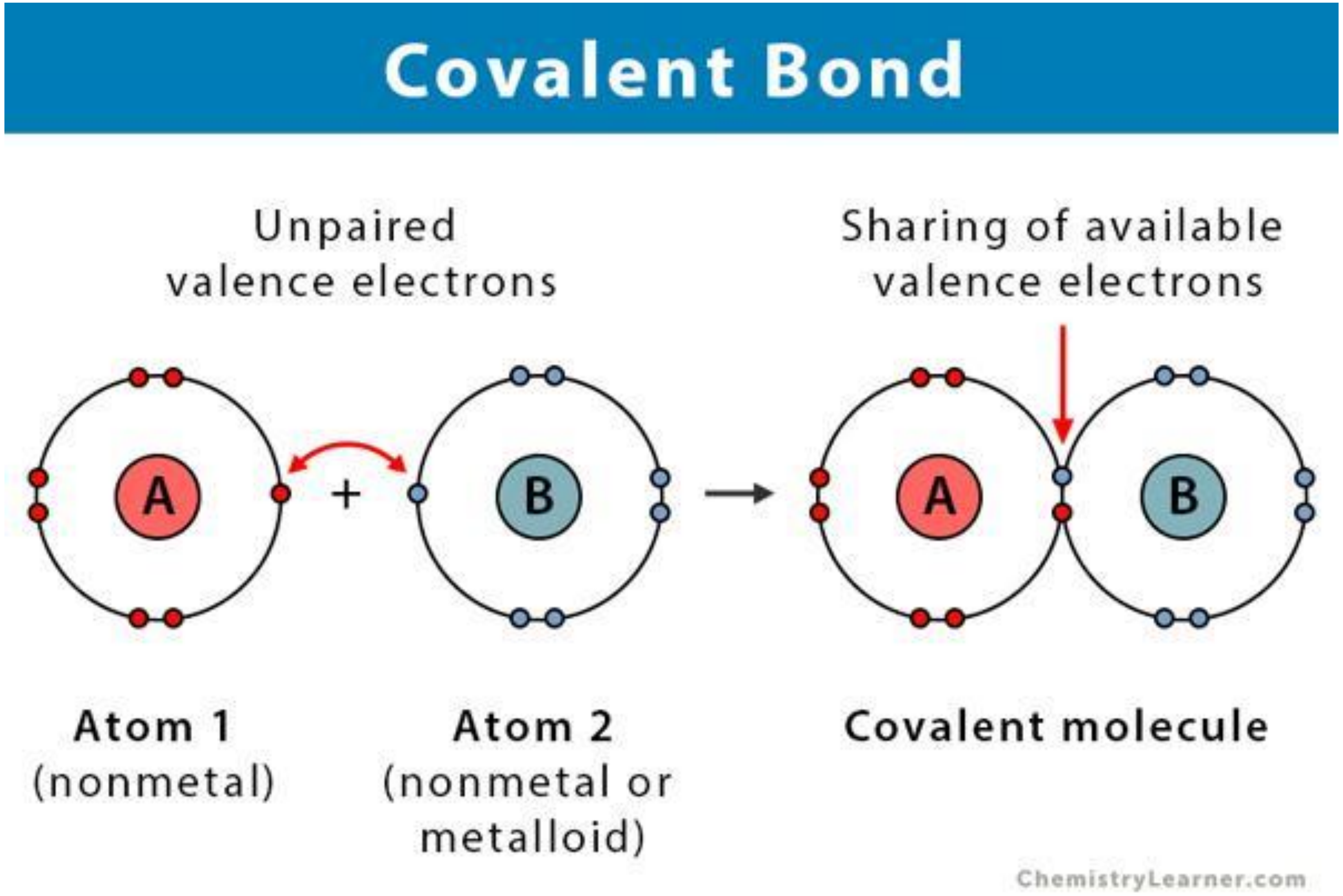




B. Metals represent another type of extended system, but here the chemical bonding is totally different. In metals, the atoms are once again arranged in a lattice, but positively and negatively charged species do not alternate. Instead, the nuclei and some fraction of their electrons comprise a positively charged “core” localized at these lattice points, and other electrons move more or less freely throughout the whole array. This is **metallic bonding**. Metallic bonding leads to electrical conductivity because electrons can move easily through the bulk material.



C. When electrons are shared between pairs of atoms rather than donated from one atom to another or mobile across an entire lattice, we have **covalent bonds**. In covalent bonds, electrons are usually shared in pairs.



BONDING REVIEW

2. Differentiate between the properties of ionic, covalent, and metallic bonds.

BOND	GENERALLY FORMED BTWN	TRANSFER OR SHARE E-	PROPERTIES OF BOND TYPE	EXAMPLE
IONIC	metal and nonmetal	transfer	high melting pt hard crystal good e- conductor as a liquid	KCl NaF
COVALENT	nonmetal and nonmetal	share	low melting pt brittle poor conductor any time	diatomic hydrogen water carbon dioxide
METALLIC	metal and metal	share	high melting pt flexible good conductor of heat and electricity always	sterling silver 14 karat gold

THE PERIODIC TABLE

- One of the most recognizable tools of chemistry is the periodic table. It is prominently displayed in practically every chemistry classroom, and many chemist own T-shirts, neckties, or coffee mugs on which the periodic table appears as a professional badge of honor.

A number of scientists had devised various schemes for arranging the elements. These attempts to organize the understanding of the elements

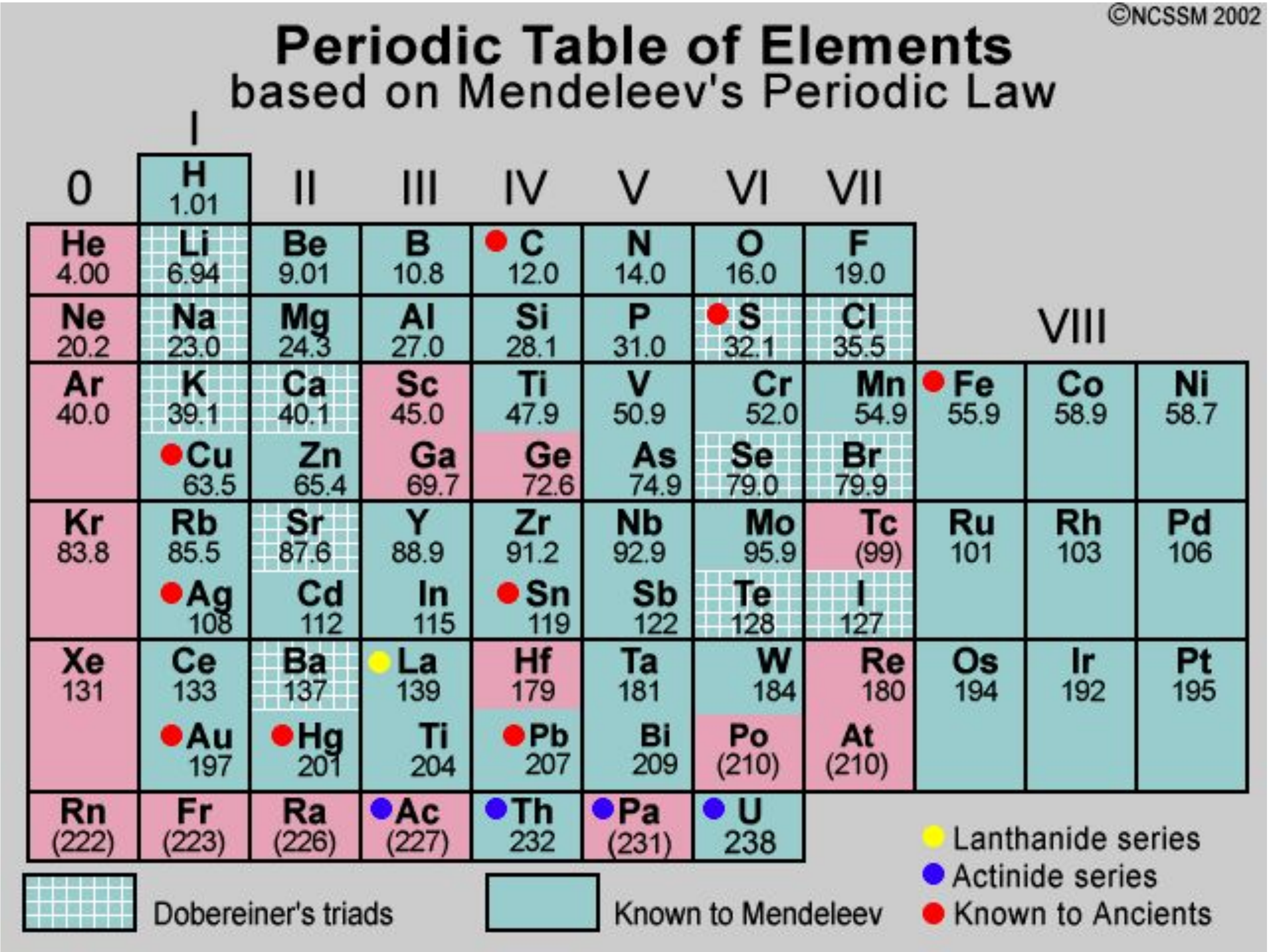
1. Moseley's contribution to the periodic table was that he arranged the elements in the periodic table according to atomic numbers. He realized his findings indicated that the identity of an element is how many protons it has. The number of protons represents the atomic number of an element.

Moseley's Periodic Table

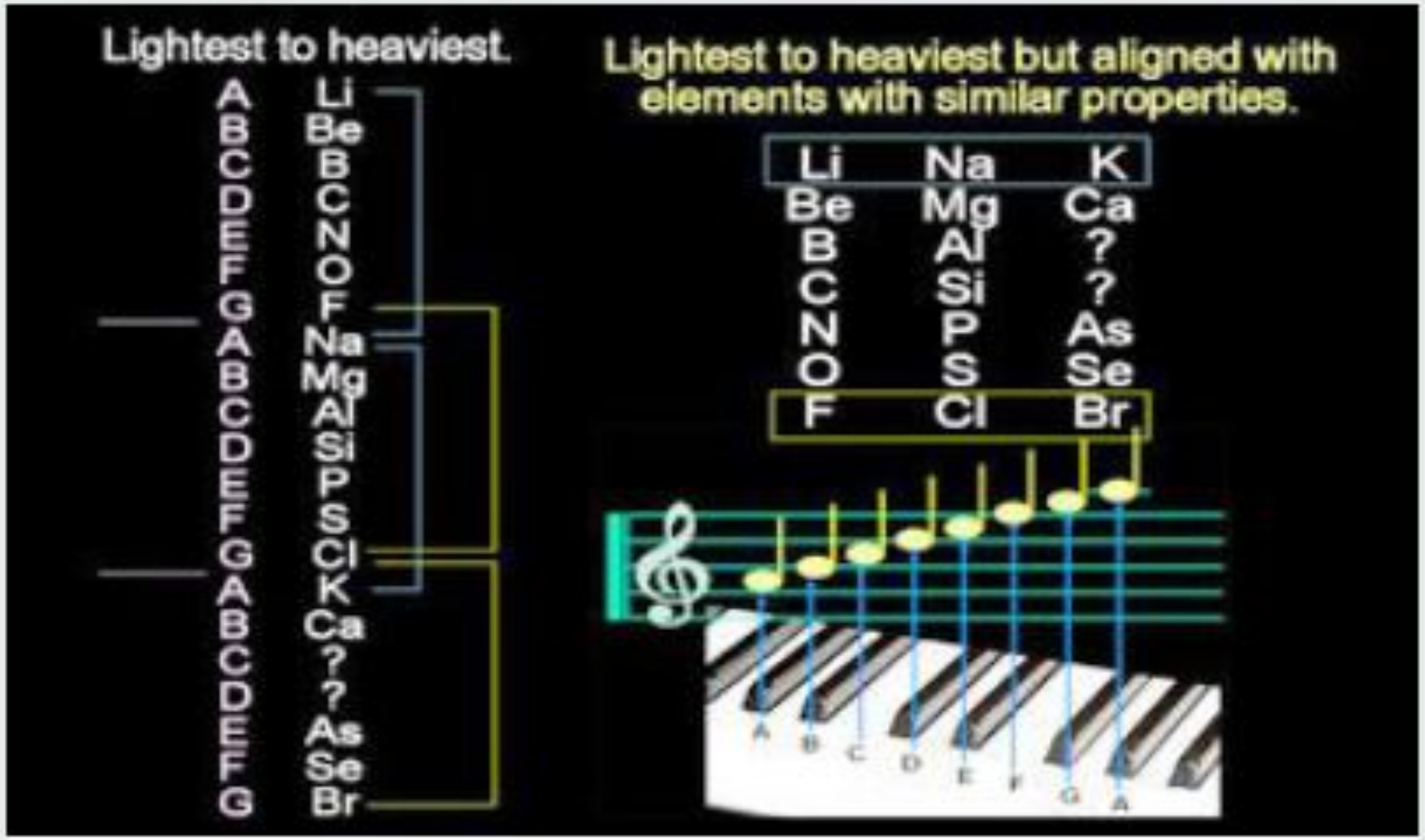
In 1913 Henry Moseley came up with this Periodic Table. The elements are arranged by increasing atomic number.

1	2											3	4	5	6	7	0
							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

•By 1869, Russian scientist **Dmitri Mendeleev** had published his first periodic table and enumerated the **periodic law**: when properly arranged, the elements display a regular and periodic variation in their chemical properties. The most significant and impressive feature of Mendeleev’s work was his prediction of the existence of undiscovered elements.



3. **John Newlands** - British chemist was the first to arrange the elements into a periodic table with increasing order of atomic masses. He found that every eight elements had similar properties and called this the law of octaves. He arranged the elements in eight groups but left no gaps for undiscovered elements.



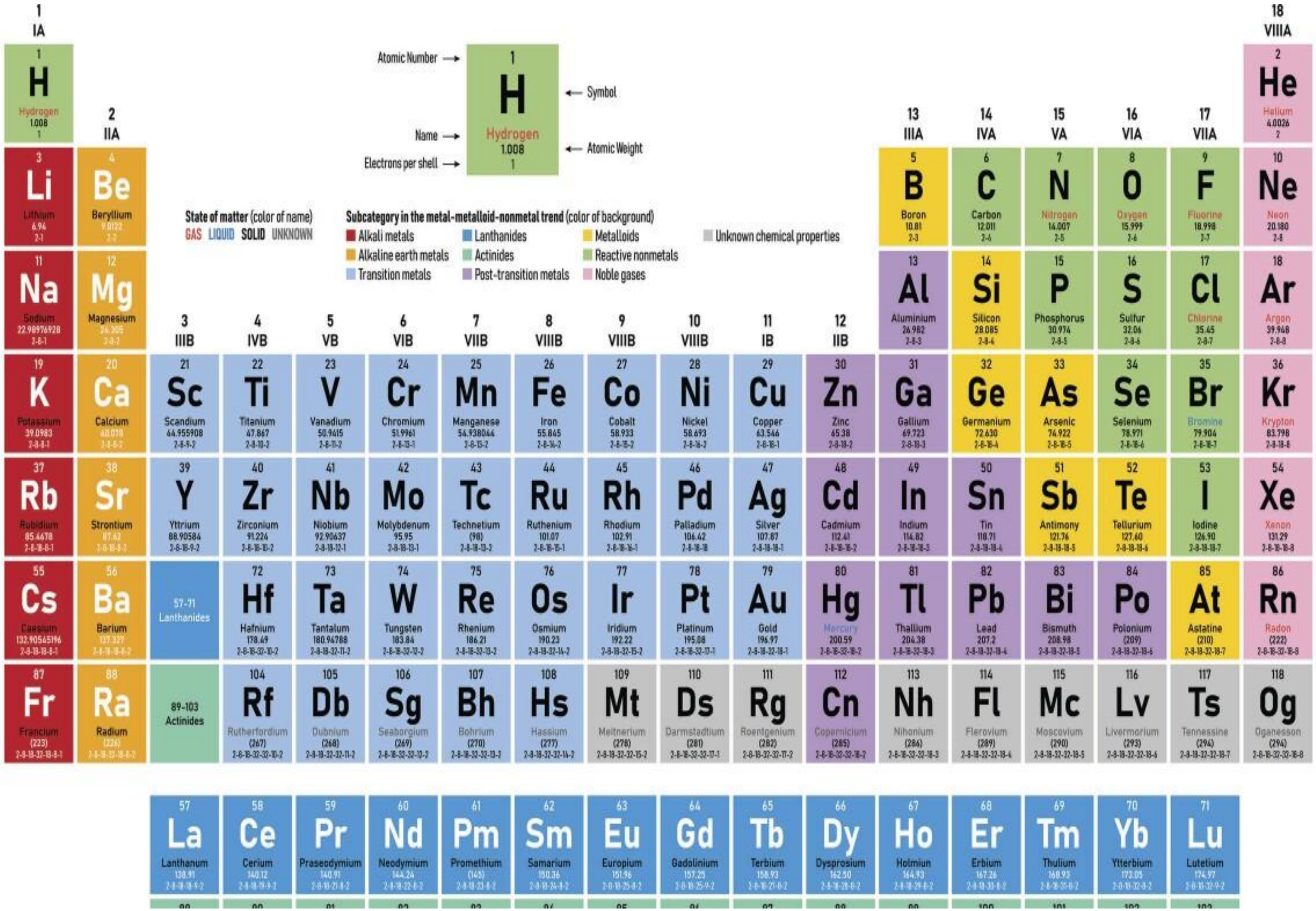
This was called the **Newlands law of octaves**. The law states that when elements are placed in the increasing order of atomic masses, the properties of the eighth elements are repeated.

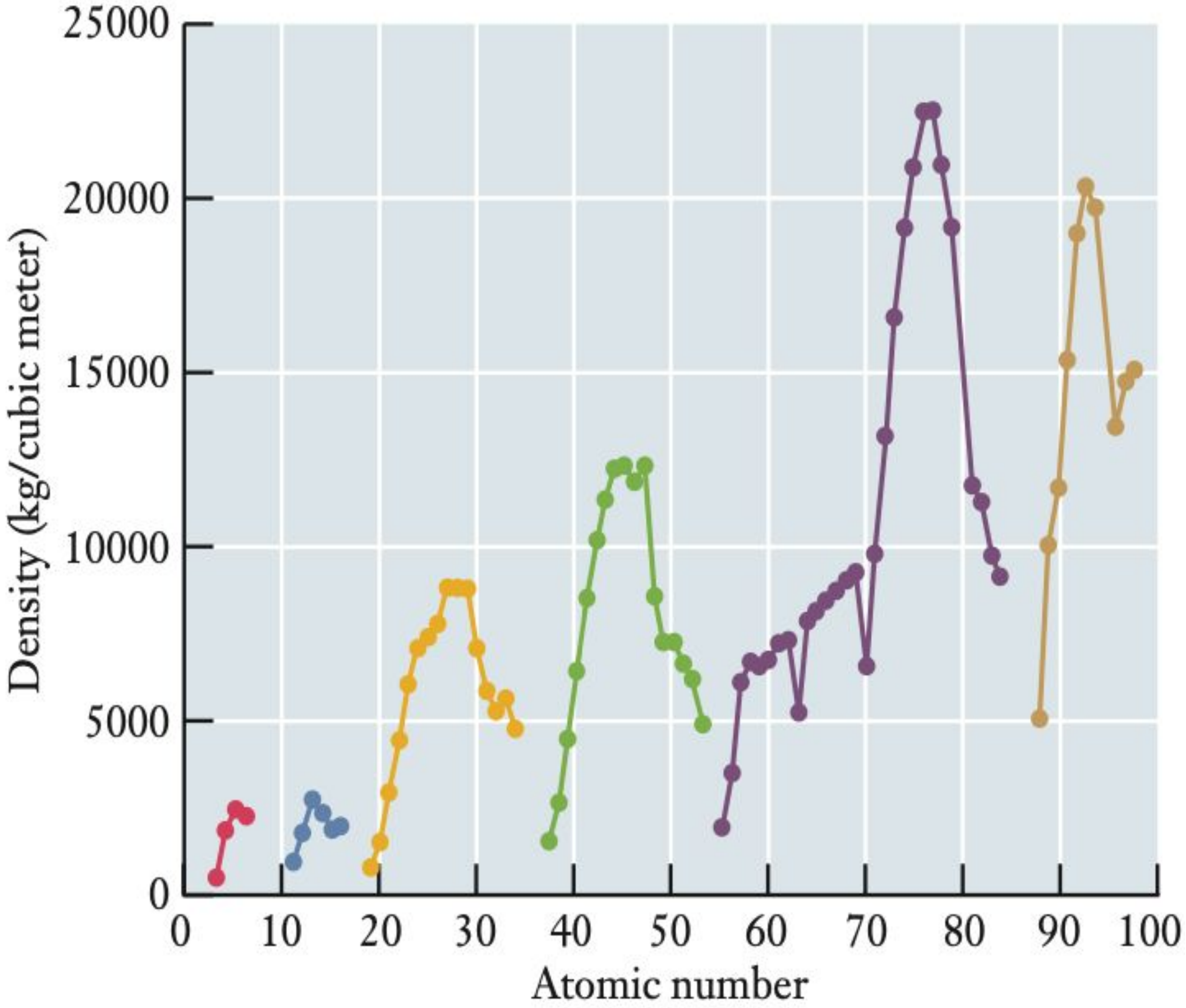
•PERIODS AND GROUPS

•The modern periodic table simultaneously arranges elements in two important ways:

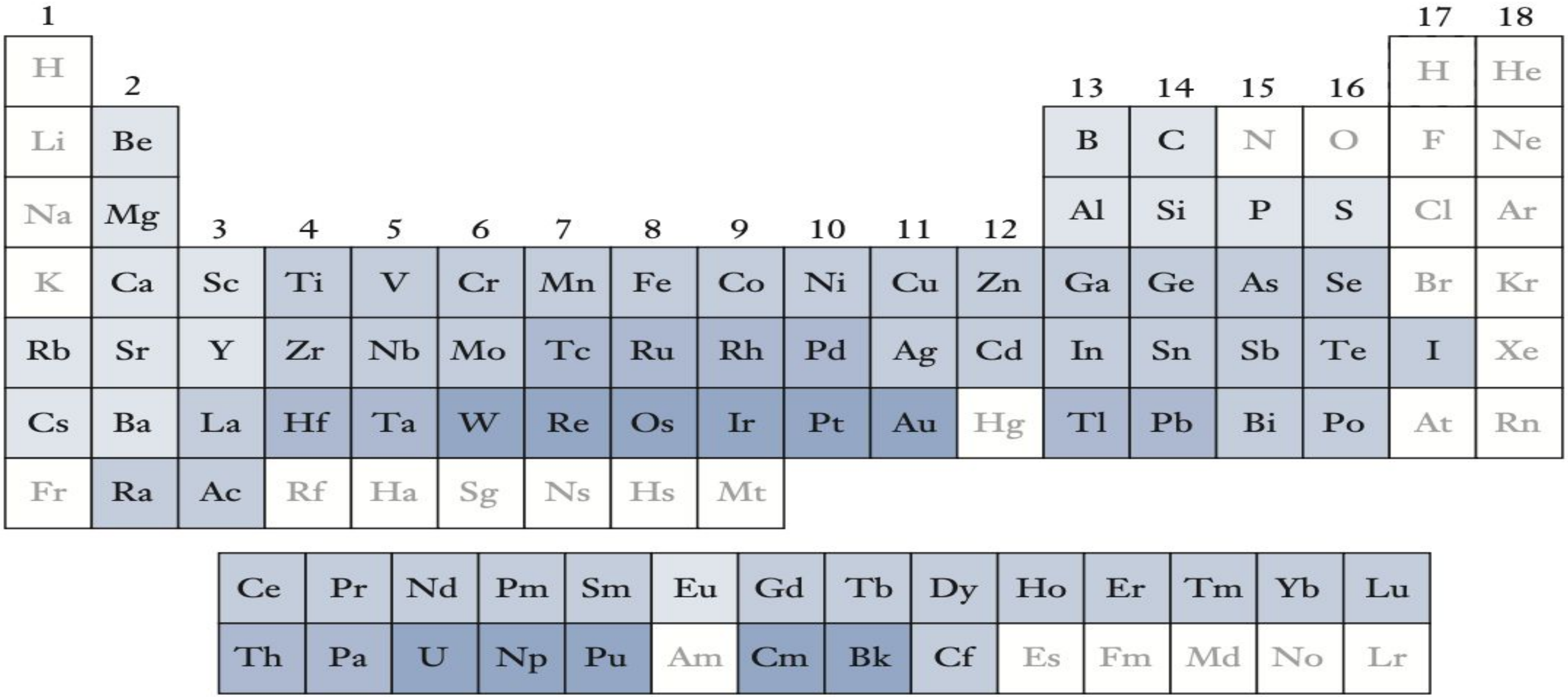
•**Periods** - the horizontal rows of the table.

•**Groups** - the vertical columns.

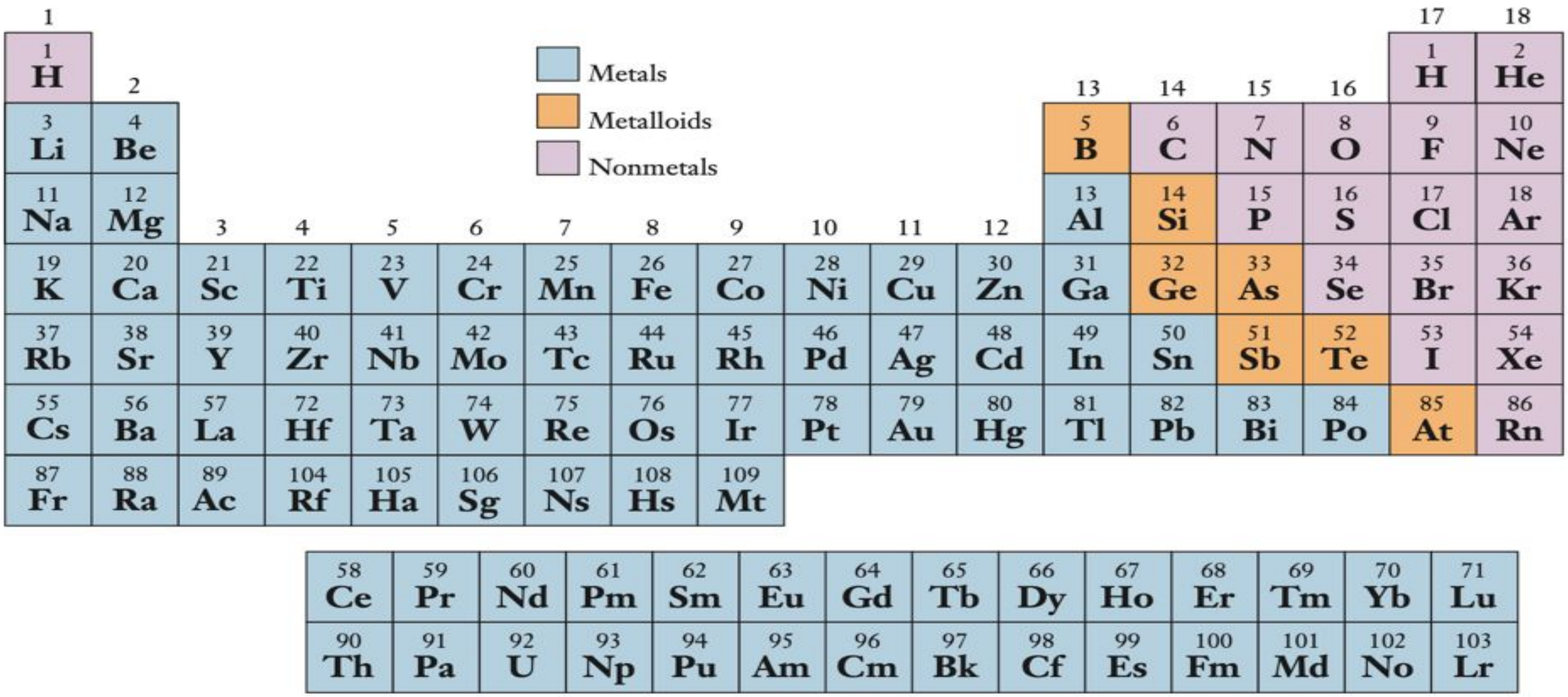




The density of elements in their solid states is plotted as a function of atomic number. Here density is in units of kg/m3. The various colors represent the different periods (rows) in the periodic table. Notice how the same general pattern repeats as we move across each row: the density is low at the left-hand edge of the row (Group 1), increases through a maximum, and then decreases as we continue to move from left to right across the table.



The data from figure are presented here in a different form. The shading of the boxes in the periodic table represents the density of each element; darker shading indicates higher density. The general trends in density are apparent as you look across a row or down a column.

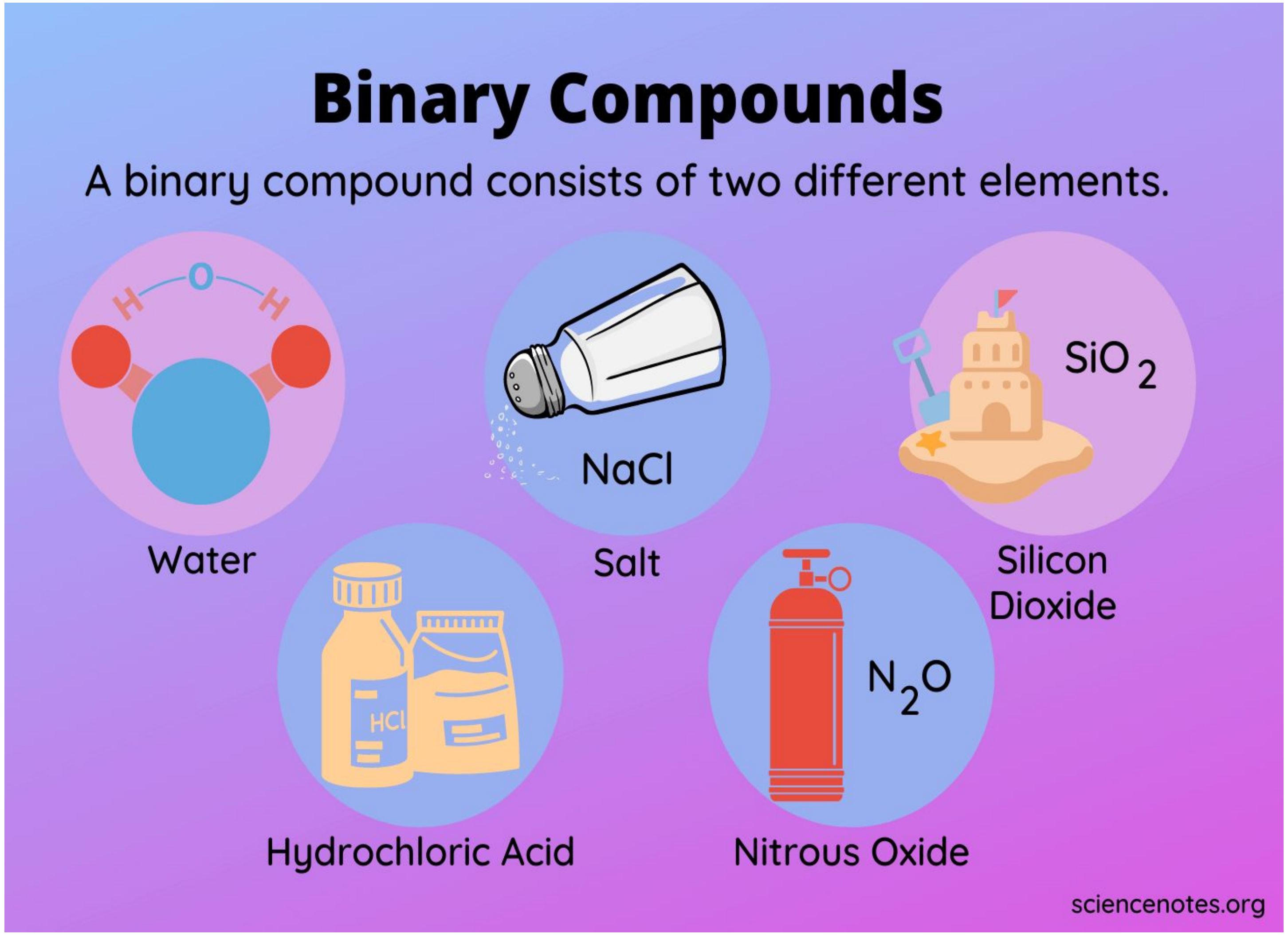


The colors in this periodic table identify each element as a metal, nonmetal, or metalloid. Notice how the metals are grouped toward the left and bottom of the table, and nonmetals are toward the upper right.

CHEMICAL NOMENCLATURE - the naming process for molecules.

- **BINARY SYSTEMS** - compounds that contain only two elements.

- Fe_2O_3, for example, is a binary compound. Many such compounds exist and they can be conveniently grouped according to their bonding tendencies.



NAMING COVALENT COMPOUNDS

- In some cases, a given pair of elements can form compounds in a number of different ways. Nitrogen and oxygen, for example, form NO, N_2O, NO_2, N_2O_3, N_2O_4, and N_2O_5, all of which are stable enough to observe.

Greek prefixes for the first ten numbers

Number	Prefix
One	Mono-
Two	Di-
Three	Tri-
Four	Tetra-
Five	Penta-
Six	Hexa-
Seven	Hepta-
Eight	Octa-
Nine	Nona-
Ten	Deca-

Rules:

In a binary compound, the element that appears first in the formula also appears first in the name. The first element retains its full name, whereas the second element is described by replacing the ending from its name with the suffix *-ide*. *Both elements will be preceded by a number-designating prefix* ***except*** *that when there is only one atom of the first element, it does not carry the prefix* mono-*.*

What are the systematic names of the following compounds?

(a) N2O5, (b) PCl3, (c) P4O6

Strategy The first element listed retains its full name and adds a prefix when more than one atom of it is in the compound. The second element will retain only the root of its name, followed by ***-ide***, and it too takes a prefix to indicate the number of atoms.

Check Your Understanding What are the names of the following compounds?
(a) CS2, (b) SF6, (c) Cl2O7

NAMING IONIC COMPOUND

- The iron chlorides are examples of binary ionic compounds. Because ionic compounds must be neutral, the positive and negative charges of the ions must balance each other and only one formula unit is possible.

- Therefore, once one of the charges is specified in the name, the entire formula is known.

NOMENCLATURE

I. Binary Ionic compounds

Binary means two different elements

Ionic means metal and nonmetal

Step 1

First give the name of the metal, followed by the nonmetal name using the "*ide*" suffix.

Step 2

If the metal is to the right of group IIA, then a Roman numeral is used after the metal to to describe the charge of the metal. Except Ag, Zn,and Al

Examples

NaCl	Sodium chloride	Al_2O_3	Aluminum oxide
$FeCl_2$	Iron(II) chloride	$FeCl_3$	iron(III) chloride

Table 2.5

Common cations

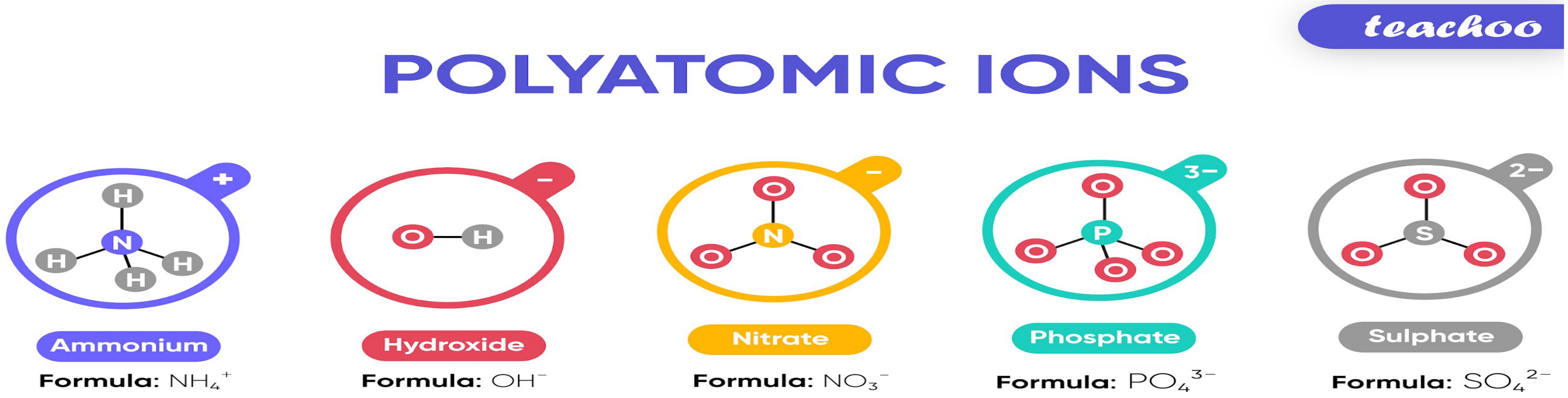
Sodium ion	Na^+	Potassium ion	K^+
Magnesium ion	Mg^{2+}	Calcium ion	Ca^{2+}
Iron(II) ion	Fe^{2+}	Copper(I) ion	Cu^+
Iron(III) ion	Fe^{3+}	Copper(II) ion	Cu^{2+}
Silver ion	Ag^+	Zinc ion	Zn^{2+}
Ammonium ion	NH_4^+	Hydronium ion	H_3O^+

Table 2.6

Common anions

Halides	F^-, Cl^-, Br^-, I^-	Sulfate	SO_4^{2-}
Nitrate	NO_3^-	Hydroxide	OH^-
Phosphate	PO_4^{3-}	Cyanide	CN^-
Carbonate	CO_3^{2-}	Hydrogen carbonate	HCO_3^-

Most often, the names of these **polyatomic ions** are memorized rather than being obtained by a systematic nomenclature rule. There is, however, a system for polyatomic anions that contain oxygen and one other element, **oxyanions**.



Naming Chemical Compounds Worksheet

Name the following *ionic* compounds:

1) $NaBr$ ______________________________
2) CaO ______________________________
3) Li_2S ______________________________
4) $MgBr_2$ ______________________________
5) $Pu(OH)_3$ ______________________________
6) $Hg(CN)_2$ ______________________________
7) $Mo(C_2H_3O_2)$ ______________________________
8) $Cr(CrO_4)_3$ ______________________________
9) WO_2 ______________________________
10) $Mg(ClO)_2$ ______________________________


THANK YOU!