

# Lesson 2

Chemistry 0

Fall 2021, L. Tracey Gao

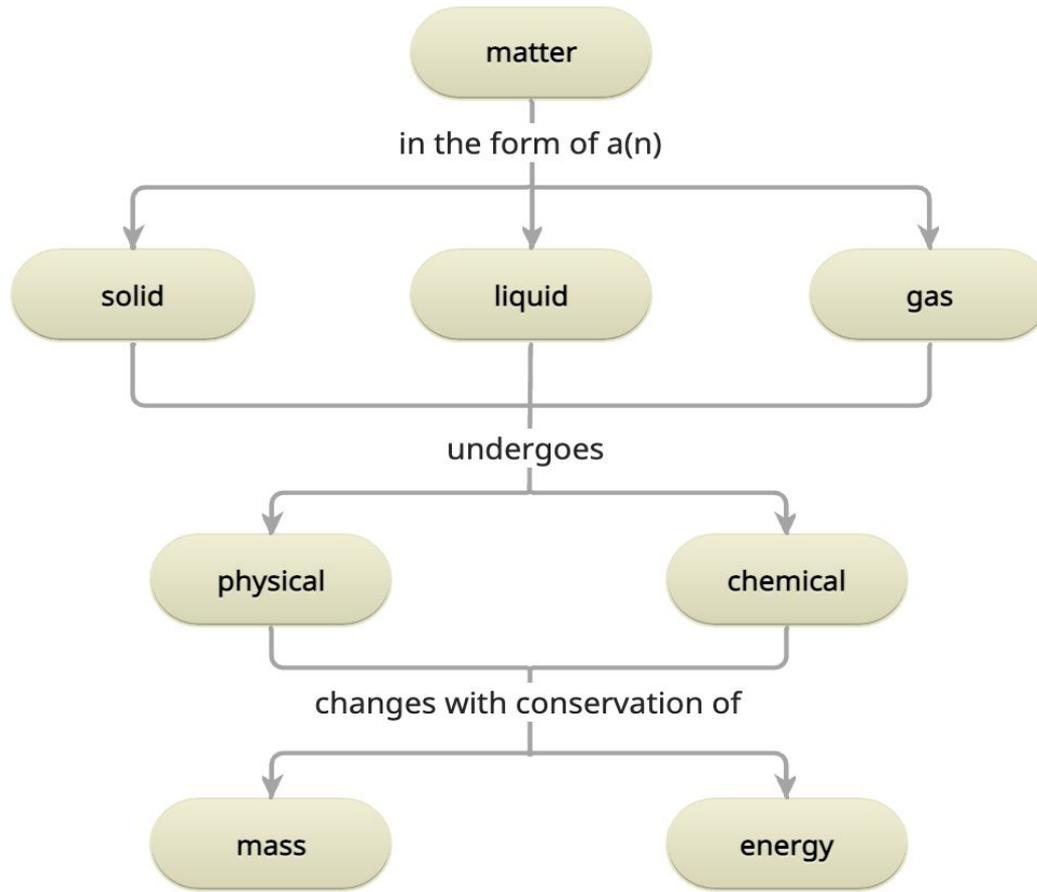
# Matter and Elements

- **Matter:** The term **matter** refers to anything that occupies space and has mass.
- **Elements:** All matter is made up of substances called **elements**, which have specific **chemical** and **physical** properties.



# Physical Change and Chemical Change





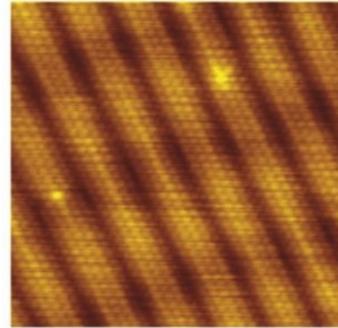


# Overview of Atom

- Basic unit of matter
- Made of subatomic particles



(a)

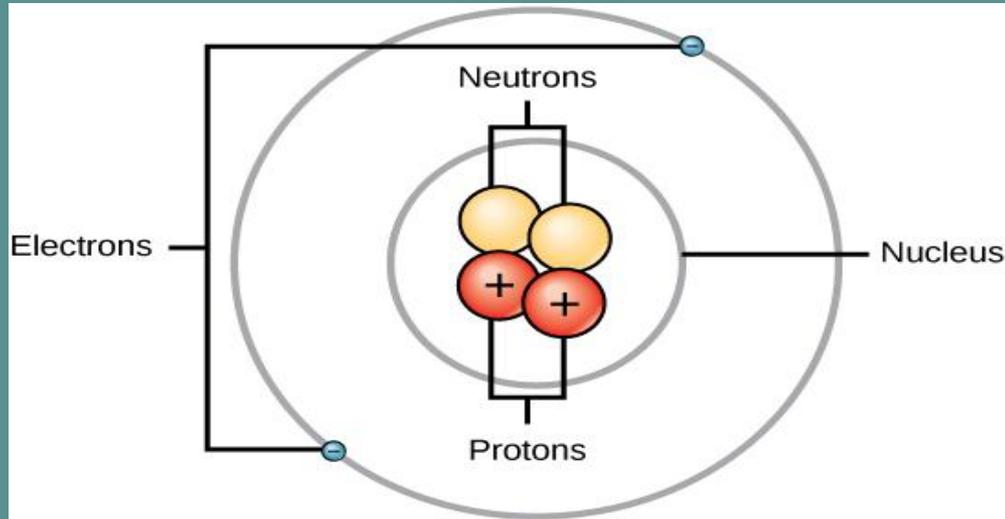


(b)

(a) This photograph shows a gold nugget. (b) A scanning-tunneling microscope (STM) can generate views of the surfaces of solids, such as this image of a gold crystal. Each sphere represents one gold atom. Image credit:- a: modification of work by United States Geological Survey; b: modification of work by "Erwinrossen"/Wikimedia Commons

# Overview of Atom

- Basic unit of matter
- Made of subatomic particles



Helium Atom

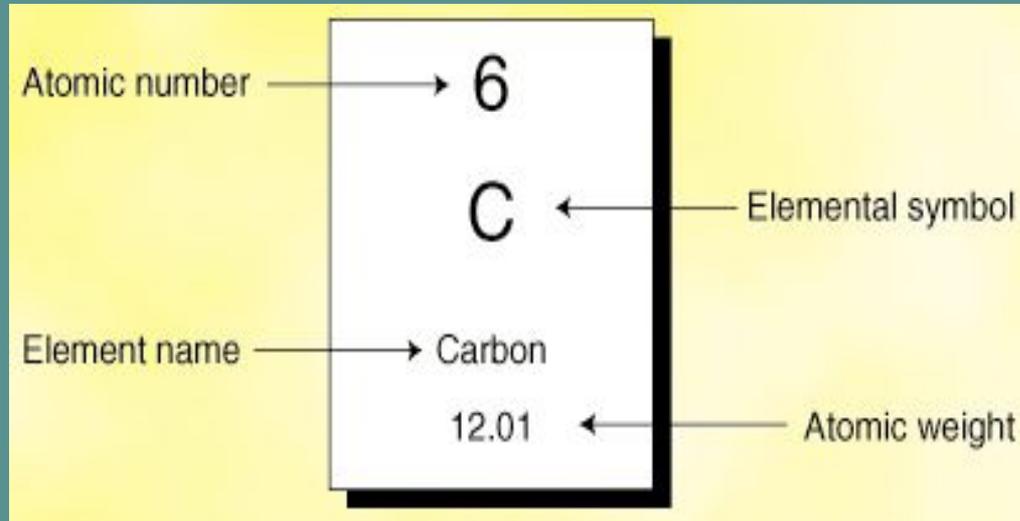


# Atomic Mass Unit

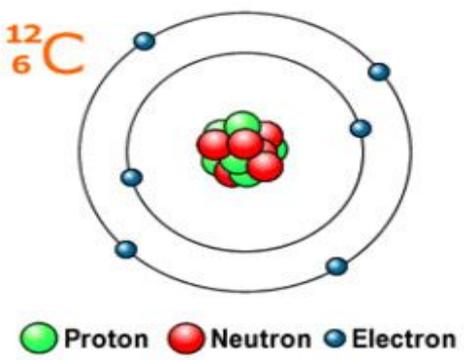
- **Protons- Positively Charged**
- **Neutrons- Neutral (No Charge)**
  - Mass of one proton = Mass of one neutron =  $1.67 \times 10^{-24}$  grams = 1 amu (atomic mass unit)
- **Electrons- Negatively charged**
  - Mass of one electron = 1/1800 amu

# Atomic Number

- The number of protons in an atom is called the *atomic number*.



# Mass Number and Isotope



$^{12}_6\text{C}$

● Proton ● Neutron ● Electron

**Carbon atoms**

Mass Number →  $^{12}\text{C}$ ,  $^{13}\text{C}$

Atomic Number →  ${}_6\text{C}$ ,  ${}_6\text{C}$

**Atomic Number** = The number of protons  
= (The number of electrons)

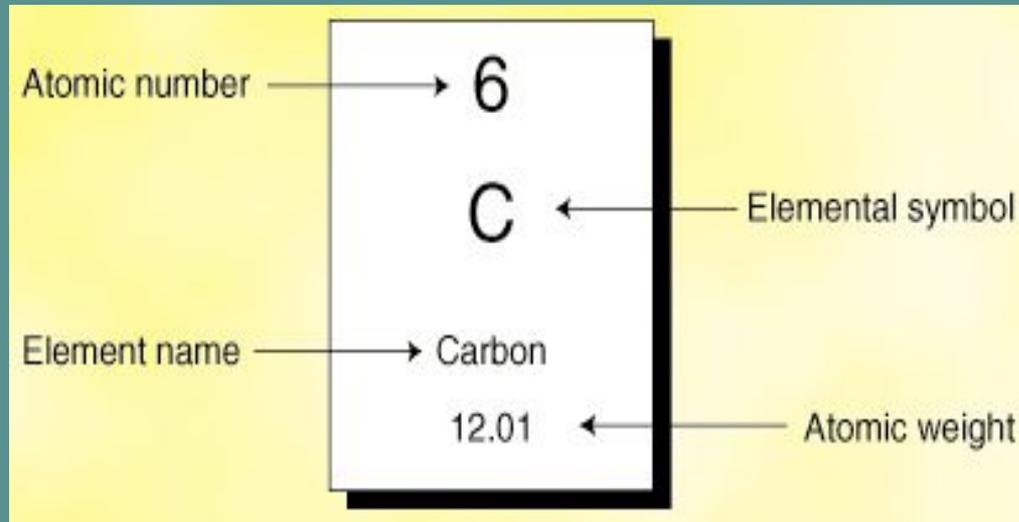
**Mass Number** = The number of protons + The number of neutrons

Carbon has two isotopes:  $^{12}\text{C}$  and  $^{13}\text{C}$ . Both show the same chemical properties because they have the same atomic number 6. But the mass of  $^{13}\text{C}$  is larger than that of  $^{12}\text{C}$ , because  $^{13}\text{C}$  has one more neutron.

[https://www.shimadzu.com/an/gcms/support/fundamentals/mass\\_number\\_isotope.html](https://www.shimadzu.com/an/gcms/support/fundamentals/mass_number_isotope.html)

# Atomic Weight

- The relative atomic mass—sometimes called the *atomic weight*—for an element





# Atomic number, atomic mass, and relative atomic mass

- **Atomic number:**
  - The single most important characteristic of an atom is its atomic number, which is defined as the number of the protons in the nucleus.
- **Mass number:**
  - An element's mass number = protons + neutrons
- **Atomic mass:**
  - The total mass of the atom, expressed in amu (atomic mass unit).
- **Relative atomic mass (atomic weight):**
  - It is an average of the atomic masses of all the different isotopes of the element.