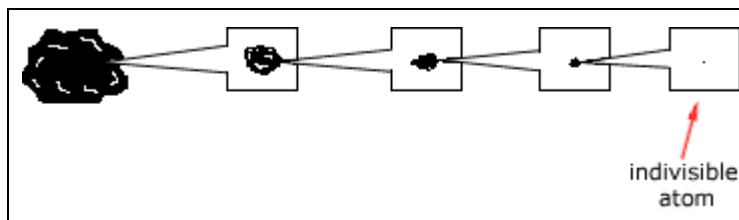


## Early Discoveries and the Atom

### key concepts:

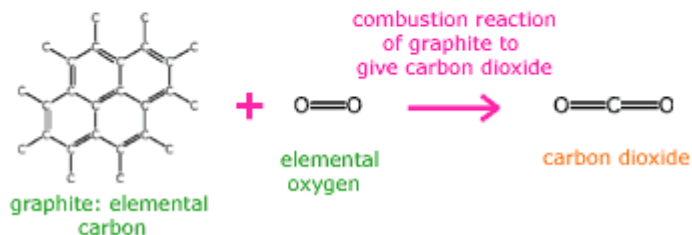
- The Greek philosopher Democritus described matter as being composed of indivisible particles called “**atoms**”.
- Dalton published his **atomic theory of matter** in 1808.
- Atoms consist of **protons**, **neutrons**, and **electrons**.



The Greek philosopher Democritus (460-370 B.C.) described matter as being composed of indivisible particles called “atoms”.

### Dalton's Atomic Theory (published 1808):

1. All matter is composed of indivisible **atoms**.
2. An **element** is a type of matter composed of one type of atom with a characteristic mass.
3. A **compound** is a type of matter composed of two or more elements in fixed ratios.
4. A **chemical reaction** consists of the rearrangement of the atoms in the reactants.



Dalton published his atomic theory of matter in 1808.

Dalton's atomic theory of matter had four parts: 1) All **matter** is composed of indivisible atoms. 2) An **element** (such as carbon or oxygen) is a type of matter composed of one type of atom with a characteristic **mass**. 3) A **compound** (such as carbon dioxide) is a type of matter composed of two or more elements in fixed ratios. 4) A **chemical reaction** consists of the rearrangement of the atoms in the **reactants** (such as the rearrangement of the carbon atoms in graphite and the oxygen atoms in oxygen to form **molecules** of carbon dioxide).

It was later shown that atoms are actually divisible into **subatomic particles**, and elements can have more than one mass (depending on the number of neutrons in an atom of that element).

particle	charge	mass
electron (e <sup>-</sup> )	q = -1	9.11 × 10 <sup>-31</sup> kg
proton (p <sup>+</sup> )	q = +1	1.673 × 10 <sup>-27</sup> kg
neutron (n)	q = 0	1.675 × 10 <sup>-27</sup> kg

Atoms consist of electrons, protons, and neutrons.

Electrons are over 1800 times lighter than protons, and have a negative charge.

Protons have a positive charge. Each element has a characteristic number of protons.

Neutrons are slightly heavier than protons, and have no charge.

J.J. Thompson determined the charge-to-mass ratio for the electron from the behavior of a stream of electrons in a cathode ray tube exposed to electric and magnetic fields.