

DALTON'S ATOMIC THEORY

- 1808: Publication of Dalton's "A New System of Chemical Philosophy", which contained the atomic theory
 - Dalton's theory attempted to explain two things:
 - 1 CONSERVATION OF MASS
 - 2 LAW OF DEFINITE PROPORTIONS (also called the LAW OF CONSTANT COMPOSITION): All pure samples of a given compound contain the same proportion of elements by mass
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The parts of Dalton's theory

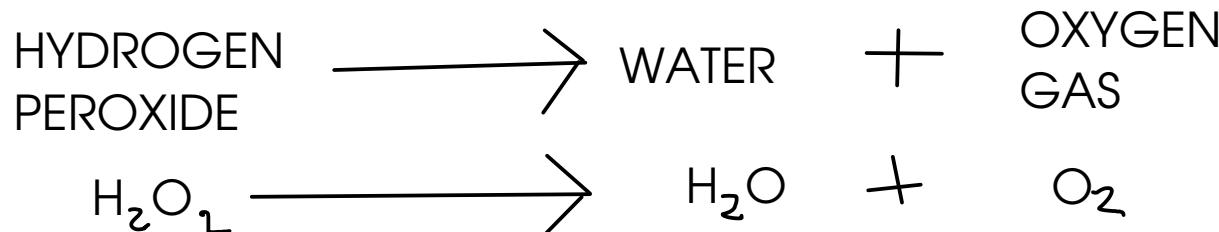
- 1 Matter is composed of small, chemically indivisible ATOMS
- 2 ELEMENTS are kinds of matter that contain only a single kind of atom. All the atoms of an element have identical chemical properties.
- 3 COMPOUNDS are kinds of matter that are composed of atoms of two or more ELEMENTS which are combined in simple, whole number ratios.
 $1:1$ or $1:2$ or $2:3$, etc.

Most importantly,

- 4 CHEMICAL REACTIONS are REARRANGEMENTS of existing atoms to form new compounds.
 - Atoms are not gained or lost during a chemical reaction.
 - Atoms do not change their identity during a chemical reaction.
 - All the atoms that go into a chemical reaction must go out again!

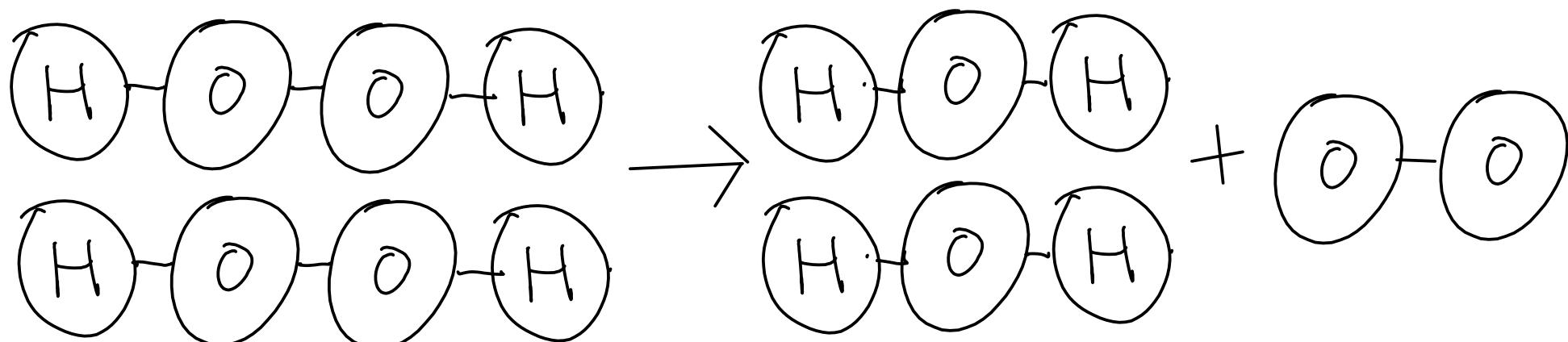
Another look at chemical reactions

You observed this reaction in the oxygen lab:



... but wouldn't this mean that somehow an extra oxygen atom would form?

Not according to Dalton's theory. Dalton's theory would predict a different RATIO of water and oxygen would form:



- Dalton's theory sets LIMITS on what can be done with chemistry. For example:

- ① Chemistry can't convert lead (an element) into gold (another element). Sorry, alchemists!
- ② You can't have a compound form in a chemical reaction that contains an element that was not in your starting materials.
- ③ You can only make a certain amount of desired product from a fixed amount of starting material.

... but Dalton's theory said nothing about WHY atoms behave the way they do. What makes gold ... gold?

Atomic structure

- Until the early 20th century, chemists considered atoms to be indivisible particles.
- The discovery of SUBATOMIC PARTICLES changed the way we view atoms!

The subatomic particles

PROTON

- a small, but relatively massive particle that carries an overall unit POSITIVE CHARGE

NEUTRON

- a small, but relatively massive, particle that carries NO CHARGE
- slightly more massive than the proton

ELECTRON

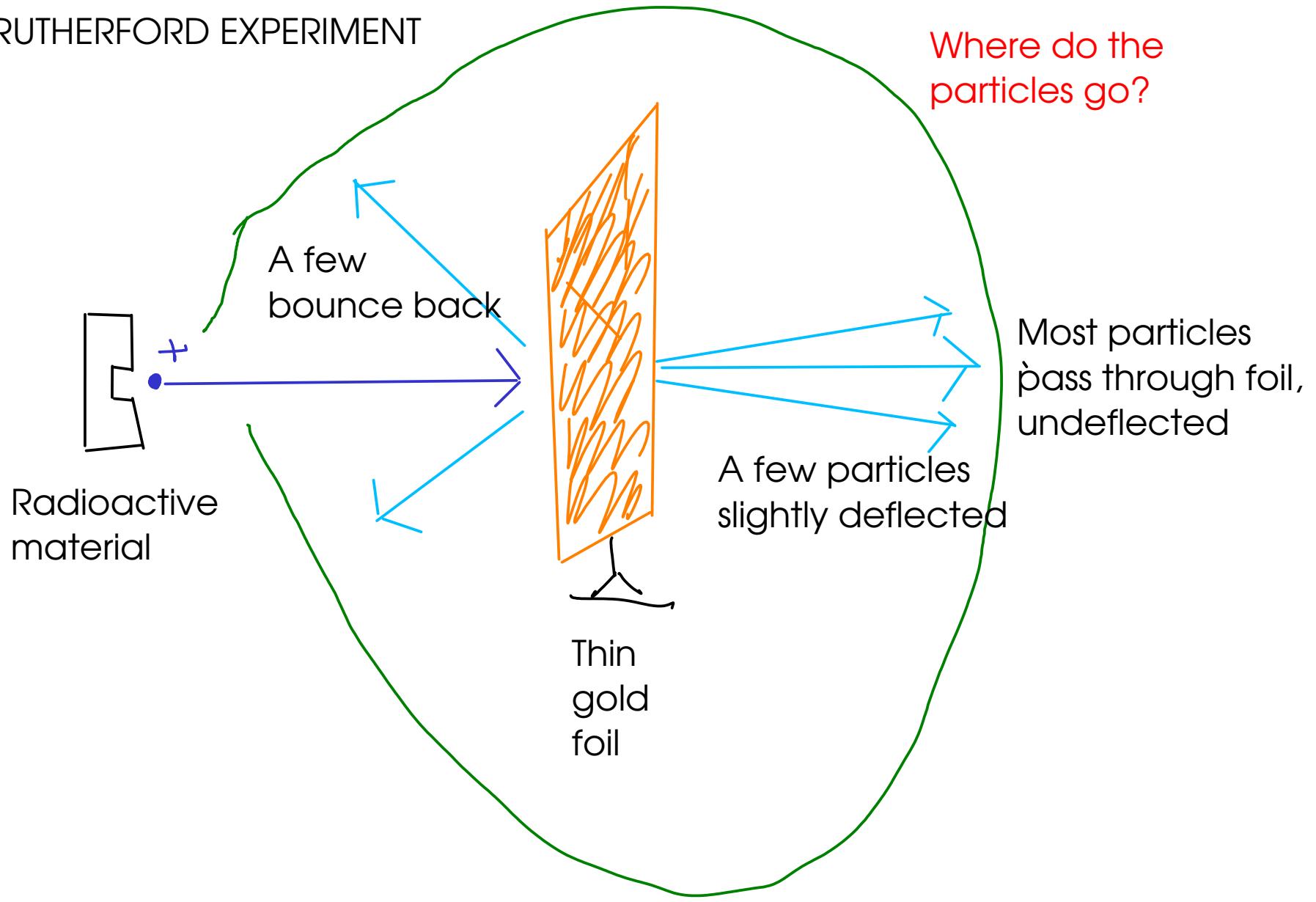
- a small particle that carries an overall unit NEGATIVE CHARGE
- about 2000 times LESS massive than either protons or neutrons

... So these particles were all thought to be parts of the atom. But how were these parts put together?

Putting it together...

- In the early 20th century, there was a debate on how the newly discovered subatomic particles actually made an atom.

RUTHERFORD EXPERIMENT



NUCLEAR MODEL

- Atoms are mostly empty space
- NUCLEUS, at the center of the atom, contains protons and neutrons. This accounts for almost all the mass of an atom
- Electrons are located in a diffuse ELECTRON CLOUD surrounding the nucleus

