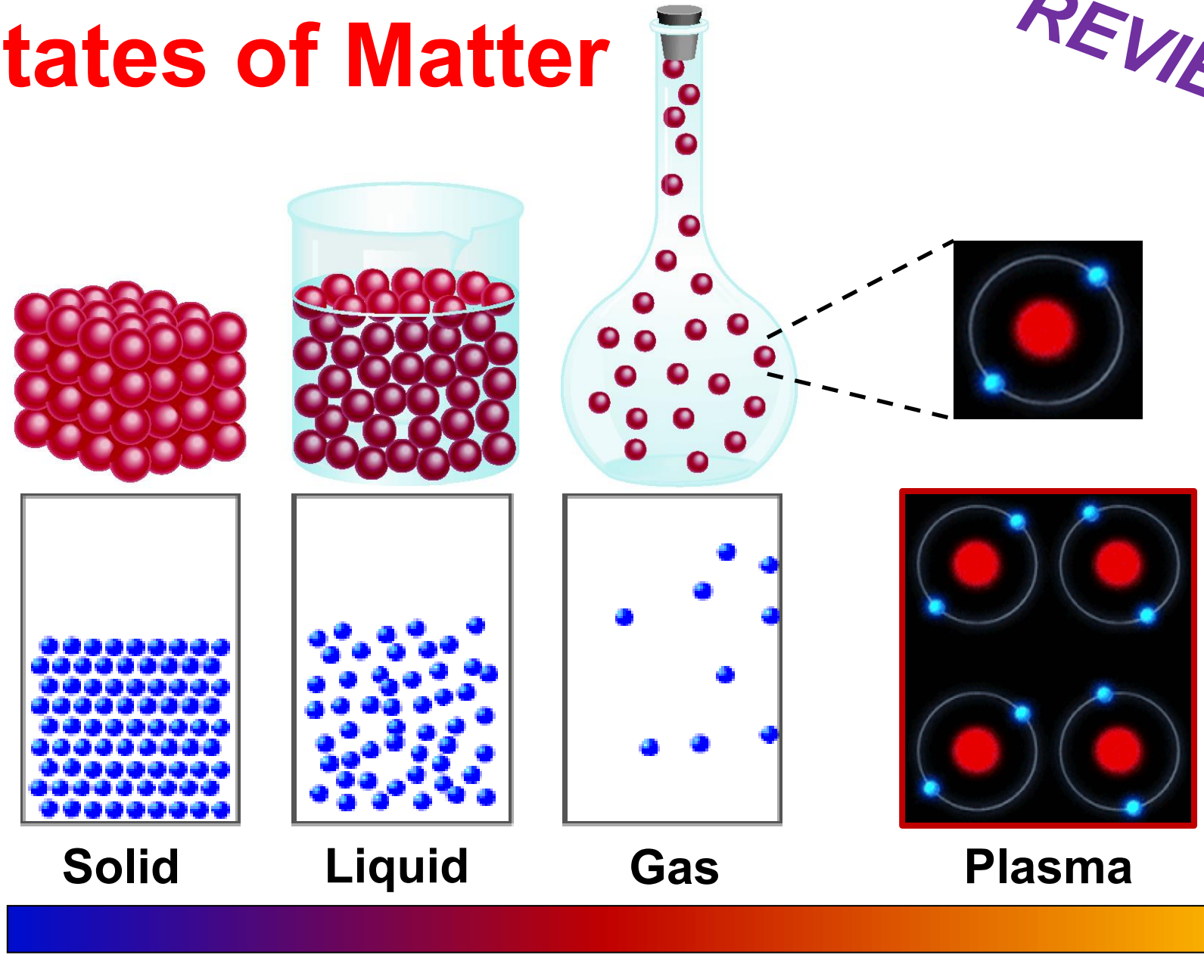
States of Matter

REVIEW

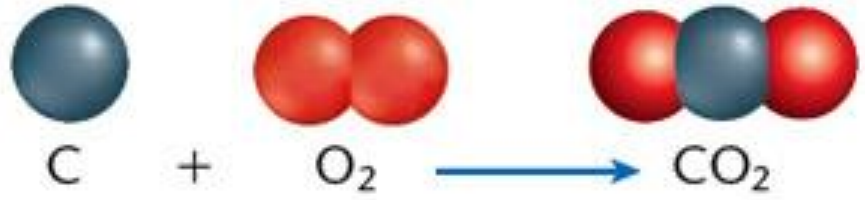


Chemical Reactions

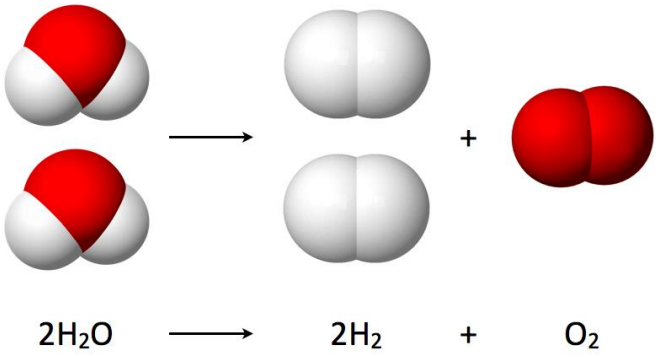
REVIEW

Change of matter that involves *bonding*, *separating* or *rearranging* of two or more atoms.

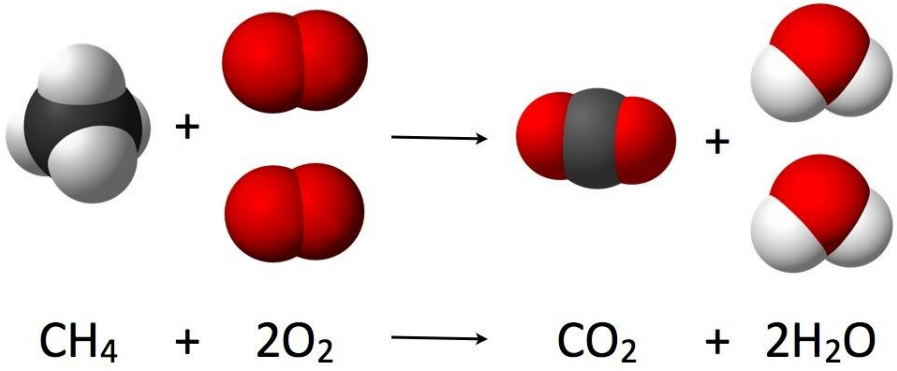
Formation of Carbon Dioxide



Electrolysis of Water



Combustion (burning) of Methane



Nuclear Reactions
involve change of the atomic nucleus

1. **Radioactive decay** – an unstable nucleus spontaneously emits a small particle of **ionizing radiation** to become a **different isotope** of the same element or a **different element** (the latter process is called ***transmutation***).

2. **Nuclear Fusion** – the **joining** of two atomic nuclei to form a larger one.

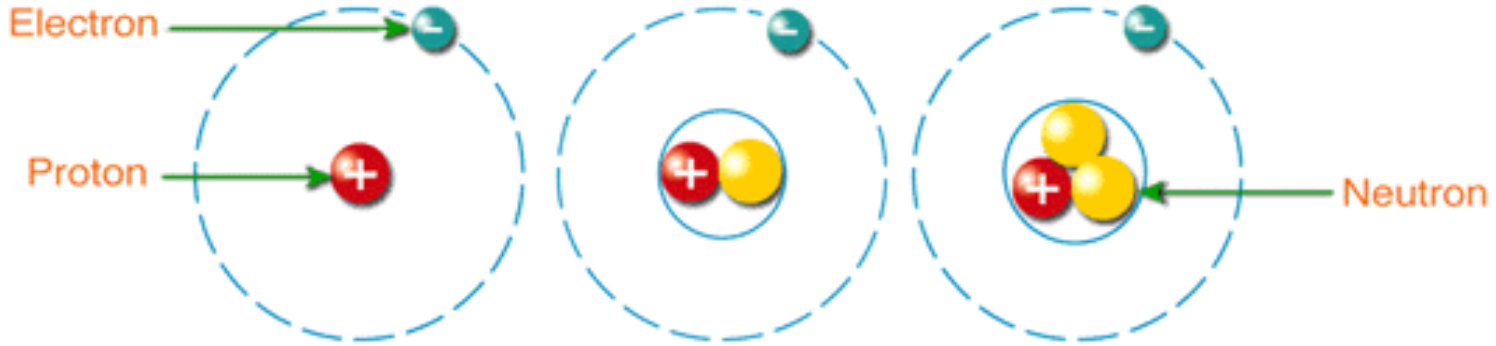
3. **Nuclear Fission** – the **splitting** of an atomic nucleus into two smaller ones.

Elements and Isotopes

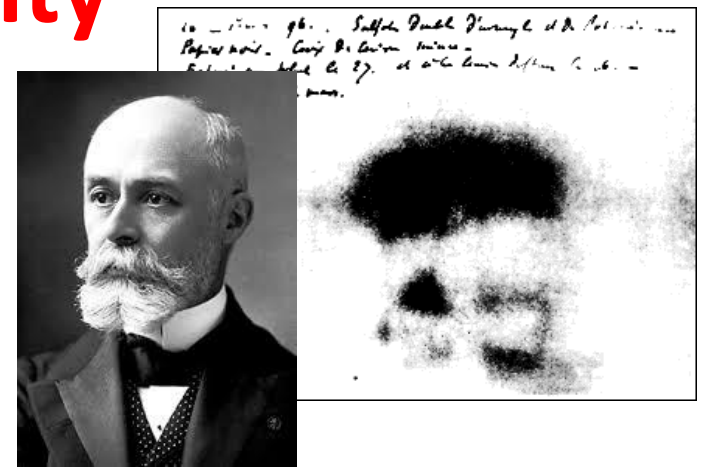
REVIEW

- **The <u>number of protons</u> in the atomic nucleus (aka *atomic number*) defines the "kind of atom", or the <u>identity of a chemical element</u>.**

- **<u>Isotopes</u> are different <u>forms of a given element</u> that have the same number of *protons* in each atom but differ in number of *neutrons*.**



Discovery of Radioactivity



- **Henri Becquerel, 1896:**

  - radioactivity was first discovered in uranium salts during his work on phosphorescence.

- **Marie Sklodowska-Curie and Pierre Curie, 1898:**

  - conducted a systematic study to determine which other elements and compounds emitted "mysterious radiation" that they called "radioactivity";

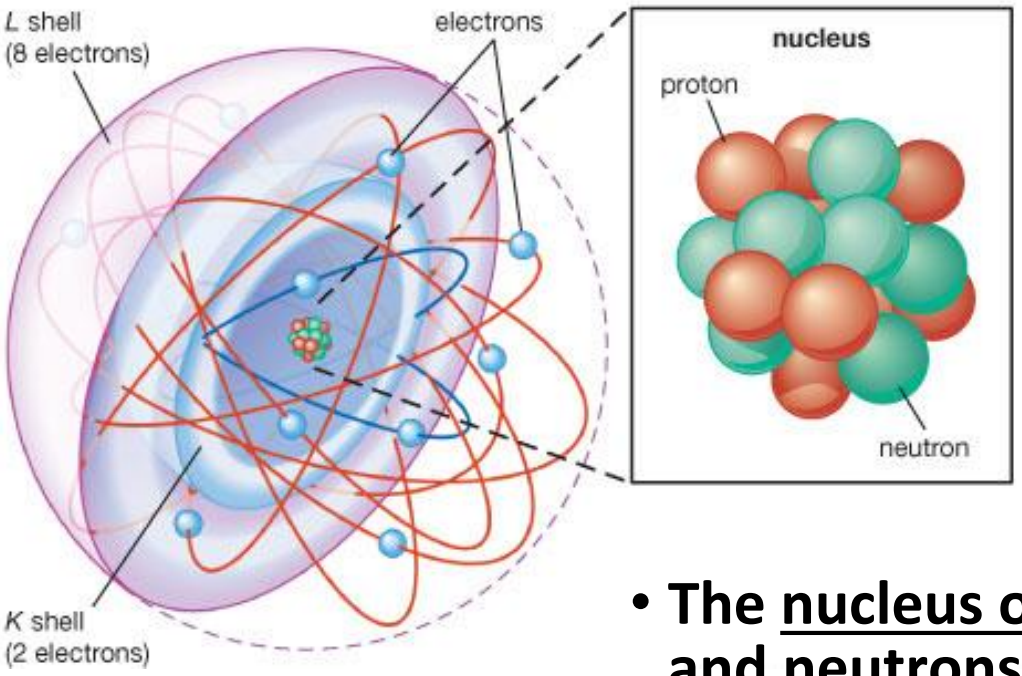
  - isolated a new radioactive element, *polonium* (named in honor of Marie's home country);

  - four years later, discovered an even more intensely radioactive substance, which they called *radium*.

- **Ernest Rutherford and Frederick Soddy, 1899-1903:**

  - discovered three different types of radiation "rays" with very different powers of penetration, introduced the term "half-life", and proposed that atoms were not conserved in radioactive emissions.

What Holds an Atom Together?



- **The <u>electrons</u> are kept in orbit around the nucleus due to an <u>electromagnetic field</u> of attraction between the positive (+) charge of the protons and the negative (-) charge of the electrons.**

- **The <u>nucleus of protons and neutrons</u> is kept together by the <u>nuclear (strong) force</u>, which *opposes and overcomes the electromagnetic repulsion when particles are very close to each other (~1 fm!)*.**