

Notes: Atoms and Elements

1. Existence of atoms and elements

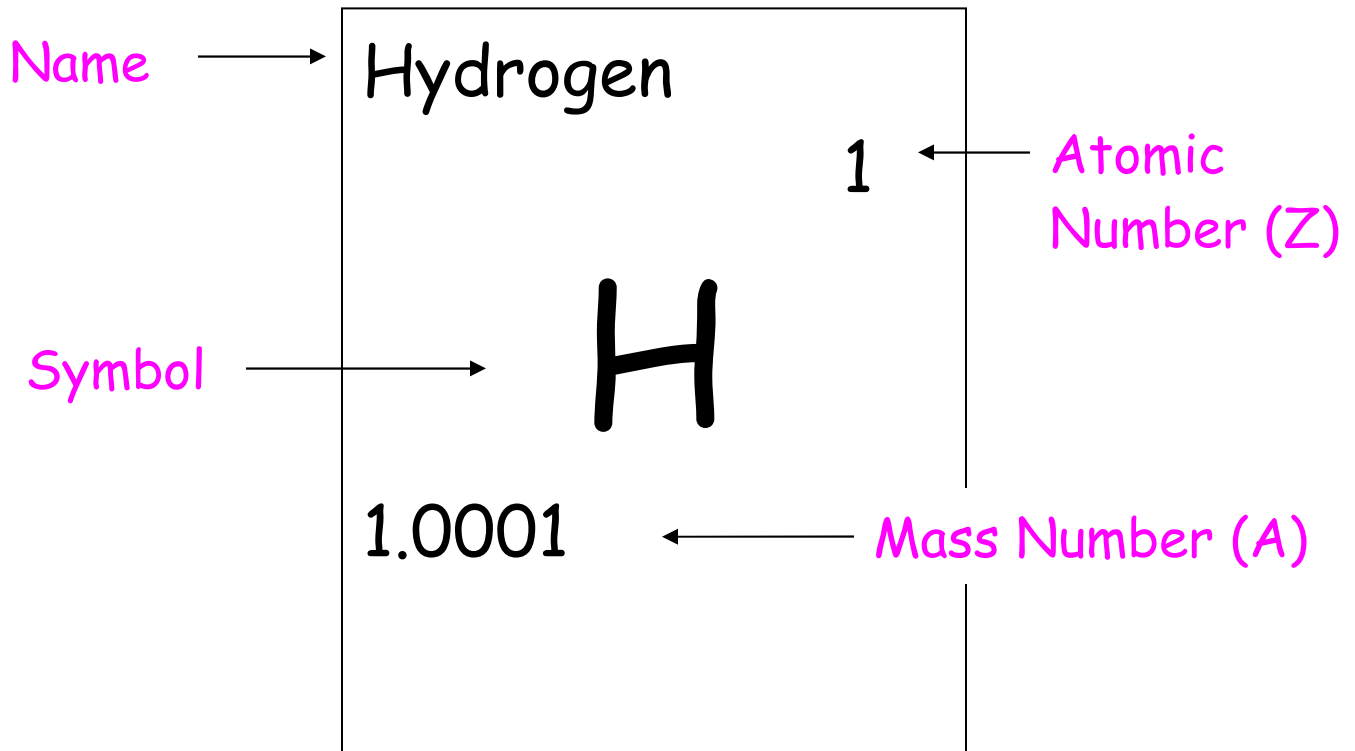
- 400 B.C. Idea of atom proposed around by Democritus who believed there must be small piece of matter that makes up everything else
 - NO EXPERIMENTAL EVIDENCE, though
- Around the same time, people believed in the idea of elements
 - Earth
 - Air
 - Fire
 - Water
 - Aether (Aristotle: heavenly bodies (stars) made of this)
 - "Raging of the elements", "Go out in the elements"
- Those who believed in atoms (not everyone did) believed there may be different kinds of atoms based on elements
 - NO EXPERIMENTAL EVIDENCE, though
- 1662 Boyle:
 - Pointless to guess at what the elements are!
 - Must do experiments!
 - Defined elements: *Any substance which cannot be broken down into a simpler substance by chemical means.*
- Alchemists had, for years, been trying to turn other substances into gold through chemical reactions.
 - Of course this didn't work!
 - But they had identified lots of elements already!
 - Gold
 - Silver,
 - Copper
 - Tin
 - Iron, etc.
- Early 1800's Dalton's Atomic Theory published.
 - Theory has been modified, but never thrown out
 - Modification 1: Electrons, discovered by J.J. Thompson
 - Plum pudding/Watermelon model
 - Electrons (watermelon seeds) in positive cloud (red part of watermelon)
 - Answers: If electrons have negative charge, why are atoms neutral?
 - Modification 2: Nucleus and Protons, discovered by Rutherford
 - Most of mass at center of atom

- Answers: Why don't atoms lose positive charge as easily as negative charge
- Modification 3: Energy levels, hypothesized by Bohr
 - Bohr models of the atom
 - Answers: (Partially) Why don't electrons fall into the nucleus?
 - Answers: Why elements have characteristic spectra
- Modification 4: Neutrons, Atoms can change from one type to another, Chadwick
 - Existence of isotopes
 - Answers: Why are there elements that have same properties but different weights?
 - Answers: Where is all the energy released by radioactivity coming from?
 - $E=mc^2$
- Modification 5: Quantum Mechanics
 - Answers: Why don't electrons fall into the nucleus?

"Schroedinger and Hesienberg and others had developed an almost complete mathematical description of the hydrogen atom. With devastating precision, they could now explain nearly all the properties of the hydrogen atom from pure mathematics!"

- Michio Kaku, Hyperspace

2. Reading Periodic Chart



- Atomic number = Number of protons = Number of electrons
- Mass number (Atomic weight) = Number of protons + Number of neutrons

3. Bohr Models

- The Bohr Model is the most common way to write the structure of the atom
- Rules:
 - The nucleus is made up of neutrons and protons
 - Electrons exist in discrete **orbits** or **energy levels** around the nucleus
 - The first energy level can hold 2 electrons
 - The second energy level can hold 8
 - The third can hold 8
 - Although, this is not entirely accurate, we can use the 2-8-8-2 rule to draw Bohr models for elements 1- 20

