

Unit 2 - Atomic Theory and The Periodic Table of Elements

8th Grade Science Learning Intentions

Rate Yourself: 1-I am unclear about 2- I have the basics down
3- I know it, but need a little practice 4-I am an expert, I can teach it

- 1. Recognize that atoms are the smallest unit of an element

- 2. Recognize that atoms are composed of subatomic particles:
 - o Electrons o Neutrons o Protons

- 3. Create a model or diagram of an atom (nucleus and subatomic particles)
 - o discuss the benefits and limitations of various atomic models
 - o NOS Focus- benefits and limitations of models

- 4. Explain that theories may be modified based on new evidence, but are rarely discarded (in the context of atomic theory)
 - o NOS Focus- Scientific Theories; Technology is essential to science

- 5. Recognize that elements are grouped in the periodic table according to similar properties

- 6. Predict properties of an element using a periodic table when given information about other elements in the same column
 - o NOS Focus- Science is open to change with new evidence

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1. Recognize that atoms are the smallest unit of an element

Atoms are the smallest unit of matter; they make up everything! When you break a pure substance apart as small as you possibly can, you will have an atom of that substance; you can't break a substance apart any more, and still have that same substance.

Atoms make up elements, which make up molecules, and molecules make up compounds.

A **molecule** is formed when two or more atoms join together chemically. A **compound** is a **molecule** that contains at least two different elements. All **compounds** are **molecules**, but not all molecules are compounds.

2. Recognize that atoms are composed of subatomic particles:

Subatomic Particles: Protons, electrons, and neutrons

o Electrons (-) negative charge

Smallest subatomic particle

Located outside the nucleus

o Neutrons (neutral –no charge)

Same mass as a proton, more mass than electron

Located in the nucleus

o Protons (+) positive charge

Same mass as a neutron, more mass than electron

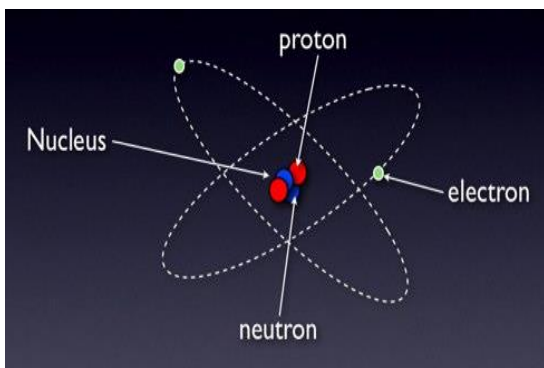
Located in the nucleus

** All atoms have a different number of protons; the proton # determines the type of element. **

Electrons, protons and neutrons are parts of the atom and the nuclei of atoms are composed of protons and neutrons which experience forces of attraction and repulsion consistent with their charges and masses

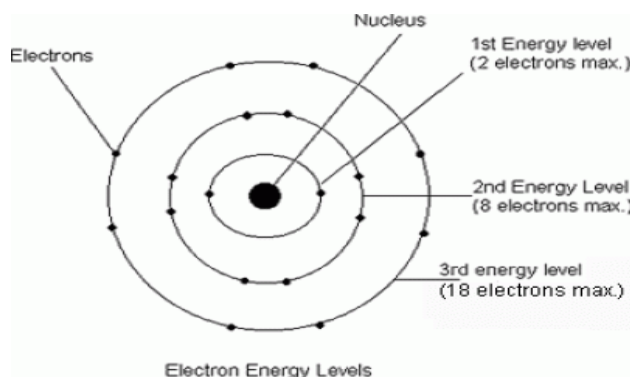
3. Create a model or diagram of an atom (nucleus and subatomic particles)

o discuss the benefits and limitations of various atomic models



Nucleus – contains protons and neutrons

Electrons are found outside the nucleus



Bohr Model

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Models develop over time as technological advances give access to further data. Theories or models put forward are equally valid until new evidence appears that the model cannot explain. Atomic models are helpful because atoms are too small to study with the naked eye, just as solar system models are helpful because the solar system is so big.

Dalton's Model – Benefit is that elements are made of atoms, however it had a limitation, the discovery of sub-atomic particles, electrons, neutrons and protons.

Thompson's Model – Benefit is that it could account for negative electrons, but a limitation was it couldn't account for the gold scattering experiment by Rutherford.

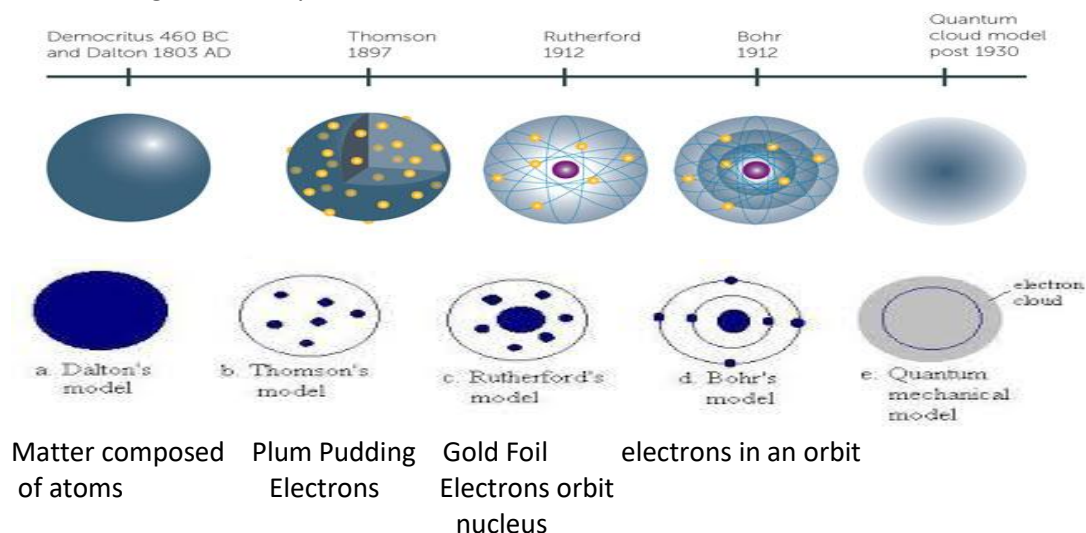
Rutherford's Model – Benefit is that it accounts for a positively charged central mass, the nucleus, and a surrounding negative cloud of electrons, but a limitation is it does not show true movement of orbitals or electron arrangement.

Bohr's model - Benefit is that it shows us subatomic particles that are too small to be seen with the naked eye. We can use the model to see that protons and neutrons are in the nucleus, and electrons orbit the nucleus, however it has limitations because it doesn't show the exact location of the subatomic particles at all times.

4. Explain that theories may be modified based on new evidence, but are rarely discarded (in the context of atomic theory)

- o NOS Focus- Scientific Theories; Technology is essential to science

Scientists replicate one another's findings to make sure their findings are accurate and precise. As new evidence that doesn't support current thinking is discovered, theories are modified or changed. As scientists discovered new findings about the atom, the atomic theory was modified or changed several times throughout history.



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Theories may be modified based on new evidence, specifically new types of technology help scientists make new discoveries/observations, which can lead to changes in our current thinking. Science and technology feed off of one another, propelling both forward. Scientific knowledge allows us to build new technologies, which often allow us to make new observations, about the world, which, in turn, allow us to build even more scientific knowledge, which then inspires another technology ... and so on. Lots of equipment like Cathode Rays, x-rays, particle accelerators, and electron microscopes have been used to study the make-up of atoms, and to make new discoveries so that current thinking can continue or be modified based on new findings.

5. Recognize that elements are grouped in the periodic table according to similar properties

The periodic table is broken into 3 different sections:

- **Metals - Physical Properties:** Good conductors of electricity and heat (elements with these similar properties are in the same column), Solid at room temperature (Except Hg), Malleable and ductile (easily formed into shapes), Lustrous (shiny)
- **Non-Metals – Physical Properties:** Poor conductors of electricity and heat, Solid, Liquid or Gas at room temperature, Solids are generally brittle, Kind of dull, though can be colorful!
- **Metalloids (semi-metal) – Physical Properties:** Metalloids have mixed properties which are difficult to characterize. They have properties of both the metals and non-metals. There are 7 metalloids on the periodic table, and they separate the metals and non-metals.

The periodic table organizes the elements in horizontal rows, or periods (horizontal, side-to-side), by order of increasing atomic number, which equals the number of protons in the nucleus of each element. It also organizes the elements in columns, or groups (vertical, up-down), which has elements with similar properties.

6. Predict properties of an element using a periodic table when given information about other elements in the same column

Elements that are listed in the same column of the periodic table have similar properties. For example: Nitrogen(N) and Phosphorus (P) are in in the same column, so similar properties, Fluorine(F) and Chlorine(C) are in the same column on the periodic table, which means they have similar properties. Lithium(Li), Sodium (Na), and Potassium (K) are also in the same column, thus they have similar properties (alkali metals that are highly reactive). Helium (He), Neon (Ne), Argon (Ar), and Krypton (Kr) are all in the same column, similar property... they are all Noble Gases that are stable and exist in nature.