

Atoms, Elements, Molecules, and Compounds

The Atom

Our modern model of the atom comes from the contributions of several scientist over millennia.

1. The Greek scientist **Democritus** (BC 460-370) proposed that there had to be a smallest part of matter, which he called **atomos** (indivisible).

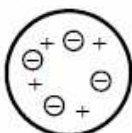


Democritus: Indivisible atoms are hard spheres.

Dalton: Each element's atoms are the same.

2. In 1808 **John Dalton** published a theory of the atom that had these important points:

- All atoms of a particular element are the same.
- Atoms of different elements have different properties, mass, and chemical reactivity.
- Atoms are not changed by chemical reactions, just rearranged in order or number.



Thomson: plum pudding atom: negative plums (electrons) in the positive pudding (atom).

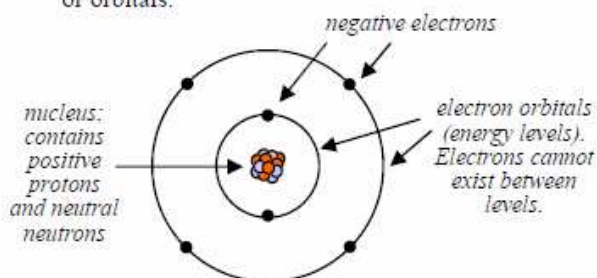
3. Electrons were discovered by **J.J. Thomson** in 1897. By watching streams of particles bend toward positive plates, he realized the particles were negative. Knowing atoms were neutral, he thought that electrons were like negative plums in positive pudding.



Rutherford: the atom is mostly empty space with a solid nucleus.

4. The nucleus was discovered in 1911 when **Ernest Rutherford** shot alpha particles at gold foil. Most of the particles passed thru the foil, since the atom is mostly empty space with a solid, central nucleus.

5. In 1913 **Niels Bohr**, while studying light, realized that electrons can only exist in certain energy levels or orbitals.



Niels Bohr model of the atom.

6. Scientists have now split the atom and even split protons, neutrons, and electrons into even smaller particles called **quarks**.

Subatomic Particles

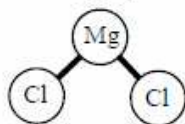
Subatomic means "smaller than the atom". Each particle has different properties and locations.

Particle	Charge	Location	Mass	Tells the
proton	positive	Nucleus	1 amu	element
neutron	neutral	Nucleus	1 amu	isotope
electron	negative	Orbitals	1/2000 amu	ion

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Atoms

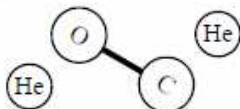
An atom is a single piece of an element that retains the element's properties.



3 atoms
 2 elements
 1 molecule
 1 compound

Elements

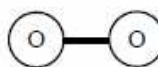
An element has only one kind of atom. All elements are found on the periodic table of elements.



4 atoms
 3 elements
 1 molecule
 1 compound

Molecules

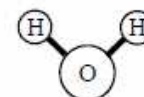
A molecule is any combination of two or more atoms. Not all molecules are compound.




2 atoms
 1 element
 1 molecule
 0 compounds



Compounds

A compound is any combination of two or more different atoms. All compounds are molecules.




3 atoms
 2 elements
 1 molecule
 1 compound


All sections marked with a  are considered essential concepts and must be completed to receive full credit on WS.

1. Proton	A. Particles with no charge found in the nucleus of atoms. 	1. Dalton	A. Discovered that atoms have a nucleus.
2. Neutron	B. Center of the atom; contains protons and neutrons.	2. Bohr	B. Discovered the electron. 
3. Electron	C. Positively charged particle in the nucleus of the atom. Determines the element.	3. Democritus	C. Realized that there was a smallest part of matter.
4. Nucleus	D. The smallest part of an element or molecule. Building block of all things.	4. Rutherford	D. Discovered that electrons are in distinct orbits.
5. Atom	E. Negative particles in orbits around the atom.	5. Thompson	E. Theorized that atoms cannot be changed chemically.

Draw a picture of an atom, using the Bohr model. Be sure to label the nucleus, protons, neutrons, electrons, and orbitals.



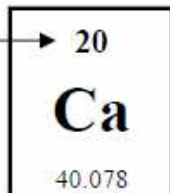
1. Molecule	A. Smallest part of an element. Can only be split by nuclear means. 
2. Compound	B. Any combination of two or more elements.
3. Atom	C. Any combination of two or more atoms, whether the same or different.
4. Element	D. A substance in which all the atoms are the same.

Name the subatomic particles that make up the atom. 

How did the Rutherford experiment prove the existence of the nucleus?

The number of protons tells you the _____
 The number of electrons tells you the _____
 The number of neutrons tells you the _____

Atomic #
(number of protons)



Find the atomic number of:

- A) Fe: _____
 B) K: _____
 C) Ni: _____
 D) Al: _____

Find the elements:

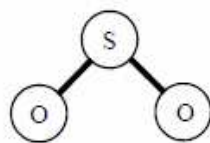
- A) 8 protons: _____
 B) 6 protons: _____
 C) 15 protons: _____
 D) 86 protons: _____



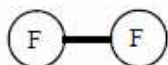
Give the charges for the following:



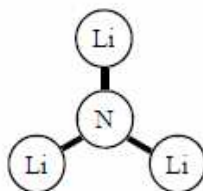
1 electron (e): _____ 2 electrons (2 e): _____ 2 p + 2 e: _____ 3 p + 3 n + 2 e: _____
 1 proton (p): _____ 4 protons (4 p): _____ 4 p + 2 n: _____ 6 p + 7 n + 8 e: _____
 1 neutron (n): _____ 3 neutrons (3 n): _____ 1 n + 3 p: _____ 9 p + 10 n + 10 e: _____



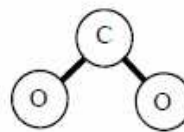
Atoms: _____
 Elements: _____
 Molecules: _____
 Compounds: _____



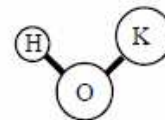
Atoms: _____
 Elements: _____
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Atoms: _____
 Elements: _____
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Atoms: _____
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Atoms: _____
 Elements: _____
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