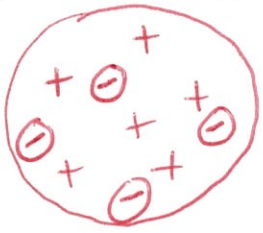
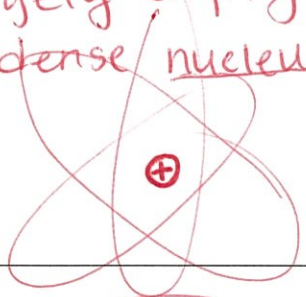
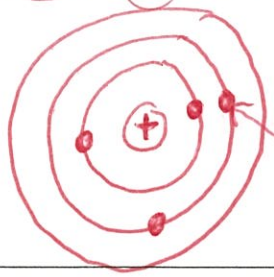
UNIT **3.1**

History of the Atom

How has our understanding of the atom changed over time?

Scientist	*Observations or experimental evidence for atomic model*	*Atomic Model Diagram*
 Democritus ~ 440 B.C.	n/a	△ □ ○ "atomos"
 John Dalton ~ 1808	$H_2O \rightarrow O + H + H$	o o o
 JJ Thompson ~ 1897	Cathode ray tube experiment	
 Ernest Rutherford ~ 1910	Gold Foil Experiment	① largely empty space ② ⊕ dense nucleus 
 Niels Bohr ~ 1913	atoms emitted specific amounts of energy	 planetary model electrons move in orbits
 Erwin Schrödinger ~ 1926	electrons acted like waves & particles	quantum model 

WARM UP AND LEARNING TARGETS LOG

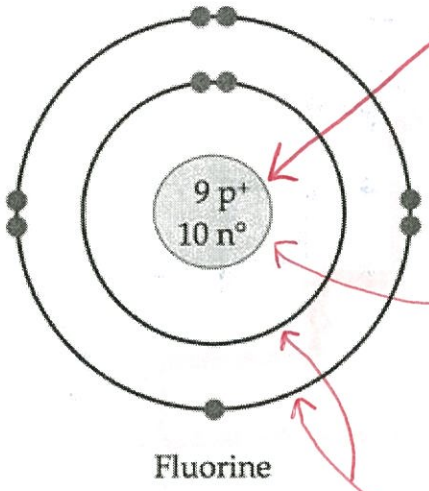
Date	*Learning Target*	*Warm Up*

UNIT **3.2**

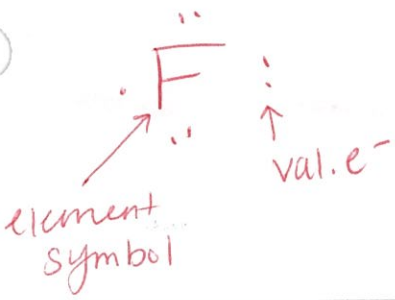
Subatomic Particles

How are elements organized on the Periodic Table?

Bohr Model:



Lewis Dot Diagram:



Key Information

Nucleus:

- contains protons & neutrons
- Responsible for the mass and radioactivity of the atom.

Atomic mass:

ex: 10+9=19

- The sum of protons + neutrons

Atomic number:

ex: 9

- The number of protons in the nucleus.
- Identifies the element.

Electron Shells: 2-7 (e^- configuration)

- Orbit the nucleus; where electrons are found.
- Electrons in last shell:

  VALENCE electrons

  - Responsible for the chemical properties of an element

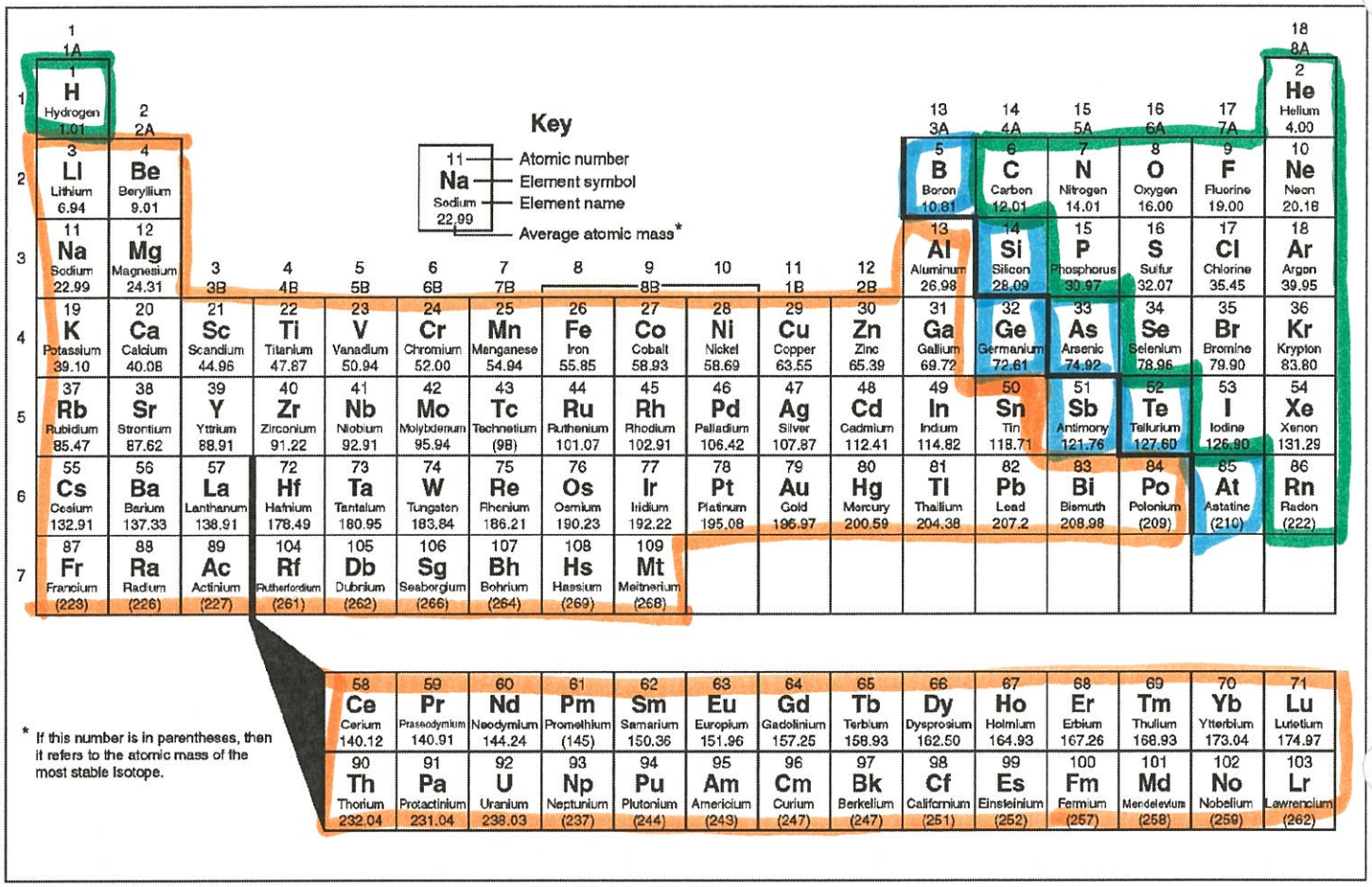
Subatomic Particle	Charge	Mass amu	Location	How to determine the # of this subatomic particle for a given atom
Proton	+1	1	nucleus	atomic #
Neutron	0	1	nucleus	atomic mass − atomic #
Electron	−1	0	orbiting nucleus	equal to the # of protons

Atoms on the Periodic Table are arranged in order of increasing atomic number.

UNIT **3.3**

Metals, Nonmetals, and Metalloids

How are elements organized on the Periodic Table?



Property	Metals	Nonmetals
Physical appearance • Shiny (Luster) • Dull	shiny	dull
Conductivity • Poor • Good	good	poor
Malleability • Malleable (can bend or flatten) • Brittle (breaks easily)	malleable	brittle
Reaction with acid • Does react • Does not react	does react	does NOT react

An element with characteristics of *both* metals and nonmetals is called a metalloid.

UNIT **3.4**

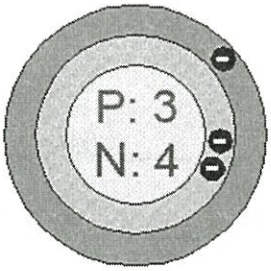
Atoms and Ions

What happens to net charge when atoms gain or lose electrons?

Recall that the charge of a proton is +1 and the charge of an electron is −1.

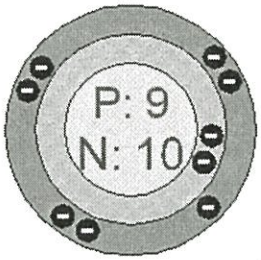
The **net charge** represents the overall charge of the atom. It can be determined by subtracting the number of electrons from the number of protons.

Lithium atom



Net charge: 0

Fluorine atom



Net charge: 0

Atoms are always NEUTRAL!

In your reflection from 3.2, you learned that atoms with 8 valence electrons are stable, and those who aren't will either gain or lose electrons to become stable. Let's use Lewis Dot Diagrams to demonstrate these changes.

When electrons are lost or gained, **net charge** changes, and the atom becomes an ion!

ATOM	Gain/lose electrons	ION
Li·	loses 1 e^- →	$[Li]^{+1}$
#p: 3 #e: 3 Net charge: 0		#p: 3 #e: 2 Net charge: +1
$\cdot\ddot{F}:$	gains 1 e^- →	$[:\ddot{F}:]^{-1}$
#p: 9 #e: 9 Net charge: 0		#p: 9 #e: 10 Net charge: −1

UNIT 3.5

Oxidation and Reduction

What happens to net charge when atoms gain or lose electrons?

To get from **Al to Al^{3+}**, what has to happen? the atom loses 3 e^- to become an ion

- Draw a diagram:

$Al^{\circ} \longrightarrow [Al]^{+3}$

- This is called: oxidation (charge goes up)

To get from **Cu^{2+} to Cu**, what has to happen? the ion gains 2 e^- to become an atom

- Draw a diagram:

$Cu^{2+} \longrightarrow Cu^{\circ}$

- This is called: reduction (charge goes down)

SUMMARIZE:

Process	Change in Electrons	Change in Charge
Oxidation (oxidized)	losing	up
Reduction (reduced)	gaining	down

Losing electrons = Oxidation

Gaining electrons = Reduction

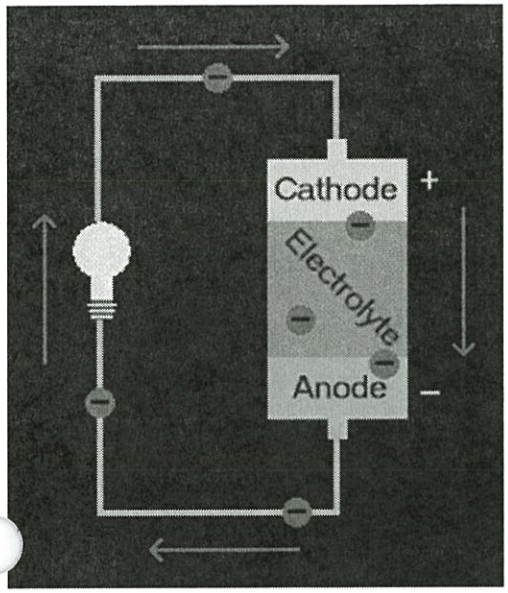
UNIT 3.6

Batteries

How do oxidation and reduction reactions power your cellphone?

Electricity is the flow of electrons through a conductive path like a wire. This path is called a *circuit*.

Batteries have three parts: (1) cathode (2) anode (3) electrolyte



The chemical reactions in the battery are a result of oxidation and reduction (aka redox):

Reduction occurs at the cathode

Oxidation occurs at the anode

Electrons travel through the wire from the anode to the cathode. The electdyte prevents the electrons from going directly from anode to cathode.

The electrical current through the wire can power a variety of objects, such as a light bulb, cell phone, or laptop!