

Parts of the Atom and The Periodic Table

- Atoms are made of _____, _____, and _____.
- The number of protons in the nucleus of the atom is its _____.
- A neutral atom must contain the _____ number of positive and negative charges, so the number of _____ equals the number of _____.
- The total number of _____ and _____ in an atom is called its _____.

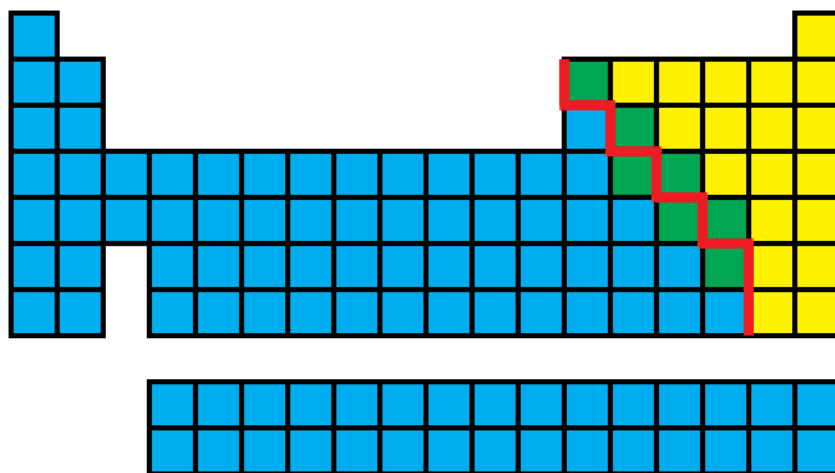
Atomic number (Z) = _____

Mass number (A) = _____

A-Z = _____

- Atoms are electrically _____ if they contain the _____ number of positively charged _____ and negatively charged _____.
- When the numbers of these subatomic particles are _____ equal, the atom is electrically charged and is called an _____.

- The periodic table arranges the elements in increasing order of their _____ and groups atoms with similar _____ in the same vertical column.



Periodic Table of the Elements

Group 1	Main group elements															18	
2											13	14	15	16	17		
Alkali metals	2	3	4	5	6	7	8	9	10	11	12			P n i c t o g e n s	C h a l c o g e n s	H a l o g e n s	N o b l e g a s e s
	e a r t h a l l i n e m e t a l s	Transition metals															
		Lanthanides															
		Actinides															

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- Atoms have a _____ (containing protons and neutrons) surrounded by electrons.
 - The electrons exist at various _____.
- The electrons in the outermost energy level are called _____.
- For example, oxygen has a total of _____ electrons.
 - _____ in the first energy level
 - _____ in the second energy level
 - Therefore, oxygen has _____ valance electrons.
- The periodic table is designed such that elements in the same _____ have the same number of _____ electrons.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen	2 He Helium	3 Li Lithium	4 Be Beryllium	5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon	11 Na Sodium	12 Mg Magnesium	13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulphur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	72 Hf Hafnium
87 Fr Francium	88 Ra Radium	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	104 Rf Rutherfordium
105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson	119 Nh Nihonium	120 Lv Livermorium	121 Ts Tennessine	122 Og Oganesson

Lanthanides

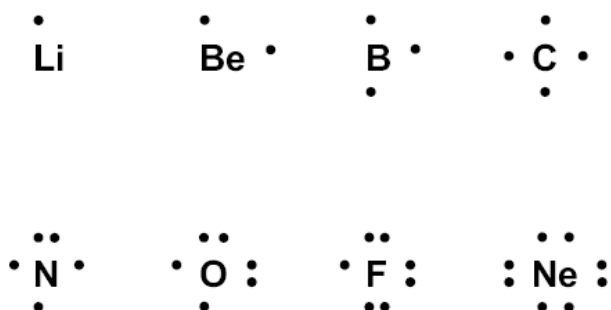
Actinides

Lewis Structures (Electron Dot Diagrams)

- A Lewis structure is a convenient shorthand way to represent an atom and its _____ electrons.
 - Dots are placed around the _____ of an element to illustrate the _____ electrons.

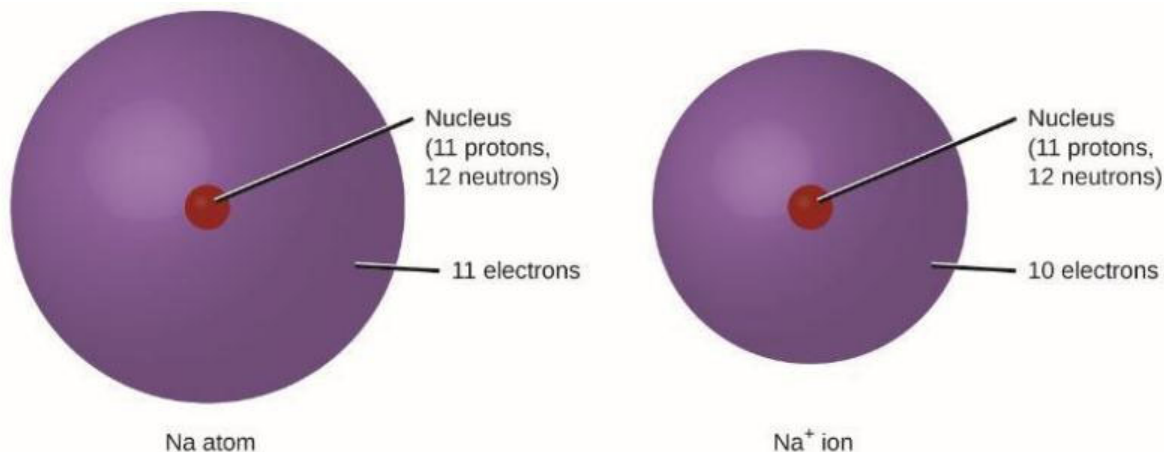
Drawing Lewis Structures

- Write the _____ for the atom.
- Place dots around the outside representing the _____ electrons.
 - The first 4 valence electrons are placed one on each side of the chemical symbol starting at the _____ and going _____.
 - The next 4 valence electrons are placed such that there are now _____ electrons on each side, again starting at the _____ and going _____.
- Draw the Lewis structure for magnesium.
- Draw the Lewis structure for fluorine.
- The Lewis structure for the elements in the second period are as follows:



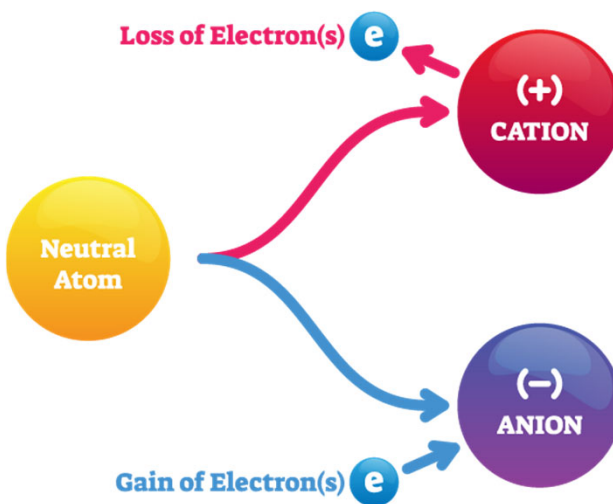
Ionic and Molecular Compounds

- In ordinary chemical reactions, the nucleus of each atom (and thus the identity of the element) remains _____.
- During the formation of some compounds, atoms _____ or _____ electrons, and form electrically charged particles called _____.



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- You can use the periodic table to predict whether an atom will form an _____ or a _____, and you can often predict the _____ of the resulting ion.
- **Metals**
 - _____ electrons
 - Form _____
 - _____ charge
- **Non-Metals**
 - _____ electrons
 - Form _____
 - _____ charge



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- Most atoms lose or gain electrons to get _____ valance electrons.
- Atoms are most stable when they have _____ valance electrons.
- This is known as the _____.

Magnesium

Sulfur

- The symbol for an ion is the symbol for the element with the charge.

Al^{3+}

O^{2-}

Note:

If the number of electrons gained or lost is 1, we only write the sign.

Example: _____

- Some elements exhibit a regular _____ of ionic charge when they form ions.

Periodic Table of the Elements

Period	Group 1	Group 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		He
2	Li ⁺	Be ²⁺												C ⁴⁻	N ³⁻	O ²⁻	F ⁻	Ne
3	Na ⁺	Mg ²⁺											Al ³⁺		P ³⁻	S ²⁻	Cl ⁻	Ar
4	K ⁺	Ca ²⁺				Cr ³⁺ Cr ⁶⁺	Mn ²⁺	Fe ²⁺ Fe ³⁺	Co ²⁺	Ni ²⁺	Cu ⁺ Cu ²⁺	Zn ²⁺			As ³⁻	Se ²⁻	Br ⁻	Kr
5	Rb ⁺	Sr ²⁺									Ag ⁺	Cd ²⁺				Te ²⁻	I ⁻	Xe
6	Cs ⁺	Ba ²⁺								Pt ²⁺	Au ⁺ Au ³⁺	Hg ₂ ²⁺ Hg ²⁺					At ⁻	Rn
7	Fr ⁺	Ra ²⁺																

*
**

- Cations are named by adding the word _____ onto the name of the element.
 - Mg²⁺ - _____
 - Na⁺ - _____
 - Al³⁺ - _____
- Anions are named by adding the suffix _____ to the first syllable of the element name.
 - N³⁻ - _____
 - O²⁻ - _____
 - Cl⁻ - _____

- Ions formed from only one atom are called _____ ions.
- There are also _____ ions.
- These ions, which act as discrete units, are electrically charged molecules (a group of bonded atoms with an overall charge).
 - SO_4^{2-} (_____)
 - OH^- (_____)
 - NO_3^- (_____)

Example

Magnesium and nitrogen react to form an ionic compound. Predict which forms an anion, which forms a cation, and the charges of each ion. Write the symbol for each ion and name them.

Noble Gases

- Noble gases (group 18) have _____ electrons.
 - Helium is an exception as it can only have _____ valance electrons.
- Noble gases usually _____ form ions.

Ionic Compounds

- When an element composed of atoms that readily lose electrons (_____) reacts with an element composed of atoms that readily gain electrons (_____), a _____ of electrons usually occurs, producing _____.
- The compound formed by this transfer is stabilized by the electrostatic _____ (ionic bonds) between the ions of opposite charge present in the compound.

Example

Sodium reacts with chlorine

- A compound that contains ions and is held together by ionic bonds is called an _____.
- When a metal is combined with one or more nonmetals, the compound is usually _____.
- You can often recognize ionic compounds because of their _____.
 - Ionic compounds are _____ that typically _____ at high temperatures and _____ at even higher temperatures.
- In every ionic compound, the total number of _____ charges of the _____ equals the total number of _____ charges of the _____.
- The formula of an ionic compound must have a ratio of ions such that the numbers of _____ and _____ charges are _____.

Example

Sodium reacts with oxygen

Example

Magnesium reacts with chlorine

- Many ionic compounds contain polyatomic ions as the _____, the _____, or _____.
- These compounds must be electrically _____, so their formulas can be predicted by treating the polyatomic ions as discrete units.
- We use parentheses in a formula to indicate a group of atoms that behave as a _____.

Example

Calcium reacts with phosphate

Predict the formula for the ionic compound formed between

sodium and sulfur _____

calcium and oxygen _____

potassium and iodine _____

magnesium and the sulfate ion (SO_4^{2-}) _____

Molecular Compounds

- Many compounds do not contain _____ but instead consist solely of discrete, neutral _____.
- These _____ compounds (covalent compounds) result when atoms _____ electrons.
 - Each _____ of shared electrons is referred to as a _____.
- Molecular compounds are usually formed by a combination of _____.
- We can often identify molecular compounds based on their _____ properties.
 - Under normal conditions, molecular compounds often exist as _____, low-boiling _____, and low-melting _____.

Example



Example



Diatomic Molecules

- A diatomic molecule consists of _____ of the _____ atoms.
- Seven elements exist naturally as _____ molecules.
 - _____

Are the following ionic or molecular compounds?

KI _____

H₂O₂ _____

CHCl₃ _____

Li₂CO₃ _____

SO₂ _____

CaF₂ _____

N₂H₂ _____

Al₂(SO₄)₂ _____