

# Lesson 4

Chemistry 0

Fall 2021, L. Tracey Gao

# The Periodic Table

Periodic table of the elements

Legend:

- Alkali metals
- Alkaline-earth metals
- Transition metals
- Other metals
- Other nonmetals
- Halogens
- Noble gases
- Rare-earth elements (21, 39, 57-71) and lanthanoid elements (57-71 only)
- Actinoid elements

period

group 1*											13	14	15	16	17	18				
1	1											5	6	7	8	9	10			
	H											B	C	N	O	F	He			
2	3	4											13	14	15	16	17	18		
	Li	Be											Al	Si	P	S	Cl	Ar		
3	11	12											31	32	33	34	35	36		
	Na	Mg	21	22	23	24	25	26	27	28	29	30	Ga	Ge	As	Se	Br	Kr		
4	19	20	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	In	Sn	Sb	Te	I	Xe		
5	37	38	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86			
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Tl	Pb	Bi	Po	At	Rn		
6	55	56	87	88	89	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
	Cs	Ba	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
7																				
lanthanoid series 6	58	59	60	61	62	63	64	65	66	67	68	69	70	71						
	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu						
actinoid series 7	90	91	92	93	94	95	96	97	98	99	100	101	102	103						
	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr						

Atomic number

\*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).

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# Key Concepts

- An element is a substance made up of only one type of atom.
- The atomic number of an atom is equal to the number of protons in its nucleus.
- The number of electrons surrounding the nucleus of an atom is equal to the number of protons in its nucleus.



# Key Concepts

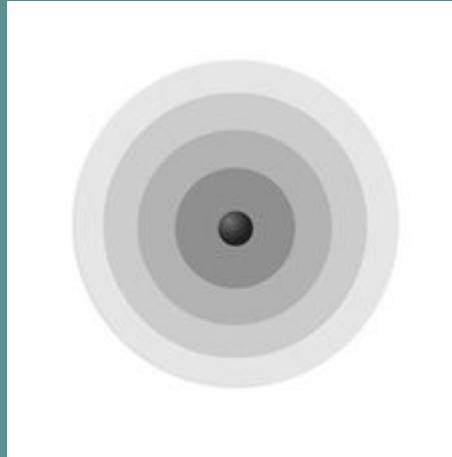
- Different atoms of the same element can have a different number of neutrons.
- Atoms of the same element with different numbers of neutrons are called “isotopes” of that element.
- The atomic weight (average atomic mass) of an element is the average mass of the different isotopes of the element.
- The atoms in the periodic table are arranged to show characteristics and relationships between atoms and groups of atoms.



# Key Concepts

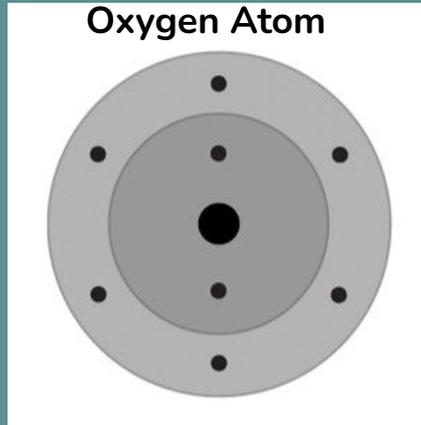
- The periodic table is a chart containing information about the atoms that make up all matter.
- The elements are numbered according to their **atomic number**.
- The elements are organized by their **electron** structure.

# Energy Levels



1. The electrons surrounding an atom are located in regions around the nucleus called “energy levels”.
2. An energy level represents the 3-dimensional space surrounding the nucleus where electrons are most likely to be.
3. The first energy level is closest to the nucleus. The second energy level is a little farther away than the first. The third is a little farther away than the second, and so on.
4. Each energy level can accommodate or “hold” a different number of electrons before additional electrons begin to go into the next level.

# The Arrangement of Electrons on Energy Levels

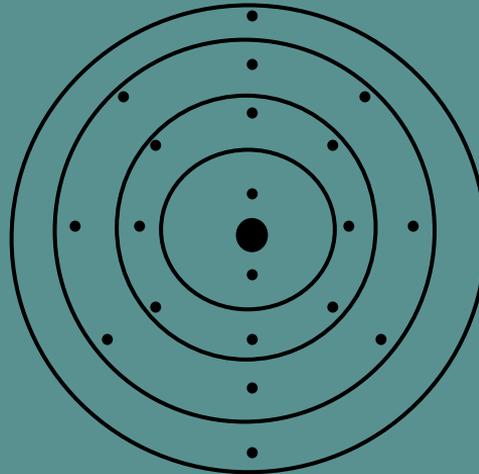


1. When the first energy level has 2 electrons, the next electrons go into the second energy level until the second level has 8 electrons.
2. When the second energy level has 8 electrons, the next electrons go into the third energy level until the third level has 8 electrons.
3. When the third energy level has 8 electrons, the next electrons go into the fourth energy level.

# Energy Levels for Element 1-20

1. When the first energy level has 2 electrons, the next electrons go into the second energy level until the second level has 8 electrons.
2. When the second energy level has 8 electrons, the next electrons go into the third energy level until the third level has 8 electrons.
3. When the third energy level has 8 electrons, the next electrons go into the fourth energy level.

Calcium Atom

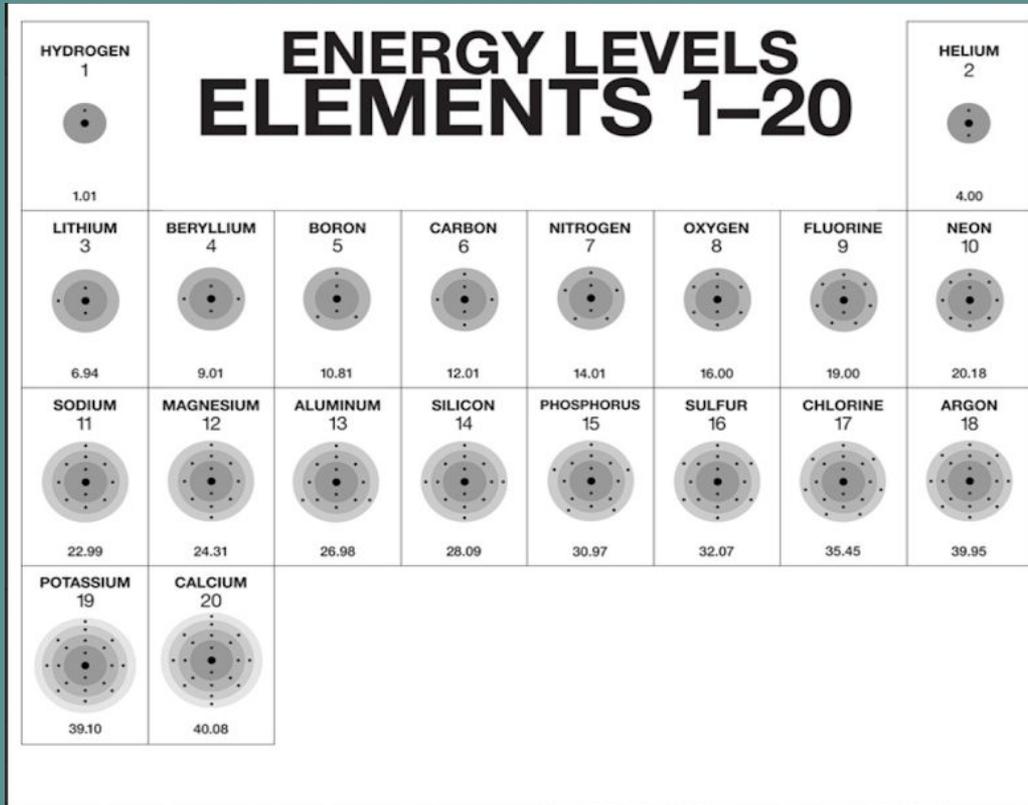


# Energy Levels for Element 1-20

ENERGY LEVELS ELEMENTS 1-20							
<b>HYDROGEN</b> 1  1.01							<b>HELIUM</b> 2  4.00
<b>LITHIUM</b> 3  6.94	<b>BERYLLIUM</b> 4  9.01	<b>BORON</b> 5  10.81	<b>CARBON</b> 6  12.01	<b>NITROGEN</b> 7  14.01	<b>OXYGEN</b> 8  16.00	<b>FLUORINE</b> 9  19.00	<b>NEON</b> 10  20.18
<b>SODIUM</b> 11  22.99	<b>MAGNESIUM</b> 12  24.31	<b>ALUMINUM</b> 13  26.98	<b>SILICON</b> 14  28.09	<b>PHOSPHORUS</b> 15  30.97	<b>SULFUR</b> 16  32.07	<b>CHLORINE</b> 17  35.45	<b>ARGON</b> 18  39.95
<b>POTASSIUM</b> 19  39.10	<b>CALCIUM</b> 20  40.08						

1. Electron structure is the chief factor in determining chemical behavior of an element.
2. Specifically, it is the number of **valence electrons** that is most important.
3. Valence electrons are the electrons in the outer shell.

# Energy Levels for Element 1-20



Why are valence electrons so important?

Because atoms tend to gain, lose or share their valence electrons.