

Warm up

What ion will each of the following form?

1) Cl

2) Al

3) O

4) Ca

5) P

6) Kr

Two types of ions:

cations are positively charged

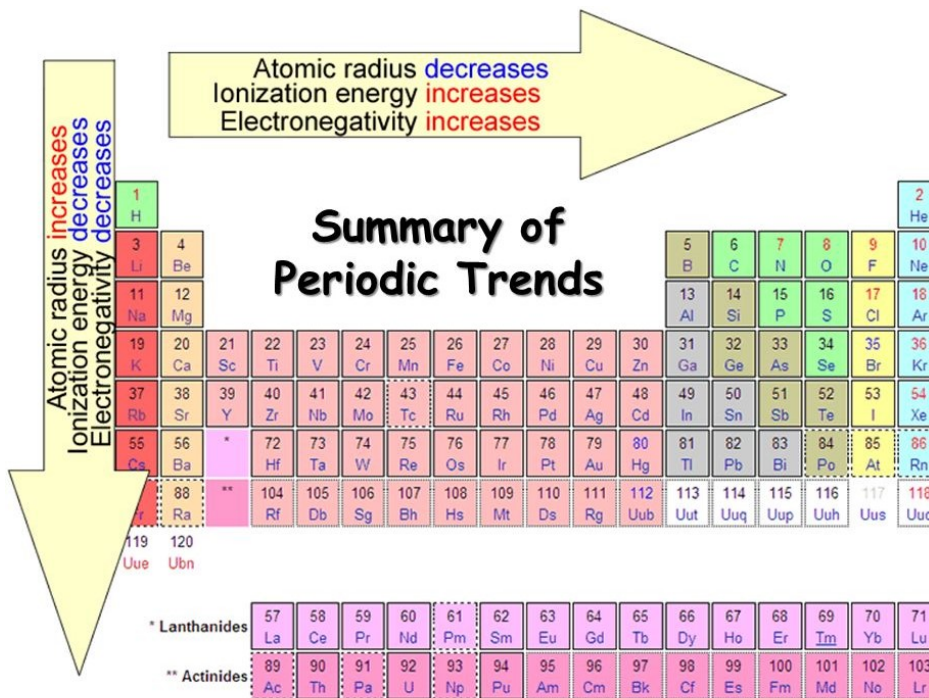
pronounced cat-ion not kay-shun

anions are negatively charged

Periodic Trends

Elements in the same period or group can be compared to one another to determine specific properties.

Some of these properties include atomic radius, ionization energy, electronegativity, and electron affinity.



Atomic Radius defined

-typical distance from the center of the nucleus to the boundary of the surrounding cloud of electrons.

Ionization Energy Defined

-amount of energy required to remove the most loosely bound electron of an isolated gaseous atom to form a cation.

1st through 7th Ionization Energies ($I_1 - I_7$) for Elements Sodium Through Argon

Element	I_1	I_2	I_3	I_4	I_5	I_6	I_7
Na	496	4560					
Mg	738	1450	7730				
Al	578	1820	2750	11,600			
Si	786	1580	3230	4360	16,100		
P	1012	1900	2910	4960	6270	22,200	
S	1000	2250	3360	4560	7010	8500	27,100
Cl	1251	2300	3820	5160	6540	9460	11,000
Ar	1521	2670	3930	5770	7240	8780	12,000

Electronegativity Defined

- measure of the tendency of an atom to attract a bonding pair of electrons.

Element	Symbol	Atomic number	Approximate atomic radius (pm)	Pauling Electronegativity
Fluorine	F	9	50	3.98
Oxygen	O	8	60	3.44
Nitrogen	N	7	65	3.04
Carbon	C	6	70	2.55
Silicon	Si	16	110	1.90
Phosphorus	P	17	100	2.19
Sulfur	S	18	100	2.58
Chlorine	Cl	17	100	3.16
Hydrogen	H	1	75	2.20
Lithium	Li	3	145	0.98
Na	Na	11	180	0.82

Electron Affinity Defined

- the change in energy (in kJ/mole) of a neutral atom (in the gaseous phase) when an electron is added to the atom to form a negative ion. In other words, the neutral atom's likelihood of gaining an electron.

Electron Affinity of the halogens

$$F = -328 \text{ kJ / mol}$$

$$Cl = -349 \text{ kJ / mol}$$

$$Br = -324 \text{ kJ / mol}$$

$$I = -295 \text{ kJ / mol}$$

*negative energy implies that energy is released from the atom

Second Electron Affinity of Oxygen

$$1\text{st EA is } -142 \text{ kJ / mol}$$

$$2\text{nd EA is } +844 \text{ kJ / mol}$$

What does the + sign indicate about the energy in the 2nd EA, why do think it is positive?

Metals, Nonmetals, and Metalloids

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	—	Uuq	—	—	—	—

metals

metalloids

nonmetals

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Metals, Nonmetals, and Metalloids

H																	He	
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Ac	Rf	Ha	Sg	Bh	Hs	Mt										metalloids

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Periodic Table of the Elements
Natural Form

<http://chemistry.about.com>
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About Chemistry

																		Solid Liquid Gas											
1 H ₂ HELIUM																	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 ALUMINUM	14 Si SILICON	15 P PHOSPHORUS	16 S SULFUR	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 YTIUM	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 TELLURUM	53 I IODINE	54 Xe XENON												
55 Cs CAESIUM	56 Ba BARIUM	57-71 Lanthanides	72 Hf HAFNIUM	73 Ta TANTALUM	74 W WOLYBDENUM	75 Re RHENIUM	76 Os OSMIUM	77 Ir IRIDIUM	78 Pt PLATINUM	79 Au GOLD	80 Hg MERCURY	81 Tl THALLIUM	82 Pb LEAD	83 Bi BISMUTH	84 Po POLONIUM	85 At ASTATINE	86 Rn RADON												
87 Fr FRANCIUM	88 Ra RADIUM	89-103 Actinides																											

*** Elements > 104 exist only for very short half-lives and the data is unknown.***

Most stable crystalline structure of solids																		
CUBIC	Simple Cubic	FCC	Face Centered Cubic	ORTHO	Orthorhombic	TETRA	Tetragonal	UNK	Unknown									
BCC	Body Centered Cubic	HEX	Hexagonal	RHOM	Rhombohedral	MONO	Monoclinic											

Complete the worksheet on Periodic Trends

<http://www.gpb.org/files/pdfs/gpbclassroom/chemistry/periodicTableTrendsWkst.pdf>

