

Electronic structure

Schweitzer

Monatomic vs. Polyatomic

- Monatomic ion: single atom ion
 - Na^+

- Polyatomic Ion (Family)
 - NH_4^+ Ammonium

Ion Quizzes

- You will be quizzed on the names and formulas of these common ions
- Quiz
- All Cations
- -1 anions
- -2/-3 anions
- All ions

IONS... THINGS TO REMEMBER

- Some metals have more than one charge we denote this charge by the Name as a Roman Numeral
- Copper (I) Cu^{+1}
- Copper (II) Cu^{+2}
- Iron (II) Fe^{2+}
- Iron (III) Fe^{3+}

IONS... THINGS TO REMEMBER

- F^{-1} Flouride is an anion. It has a special ending “ide”
- Flourine: F_2 is a very deadly gas!
- Flouride: F^{-1} is in your tooth paste!
- This special ending is for a anions specific charge

IONS... THINGS TO REMEMBER

- Nitrate vs. Nitrite
 - NO_3^- vs. NO_2^-
 - ate vs. ite
 - Both contain oxygen
 - ate contains one more oxygen than ite

Example:

- Sulfate: SO_4^{-2}
- Sulfite: SO_3^{-2}

IONS... THINGS TO REMEMBER

- Some prefixes also give you information as well.
- “per” 1 more oxygen
- “hypo” 1 less oxygen

Perchlorate ClO_4^{-1}

Chlorate ClO_3^{-1}

Chlorite ClO_2^{-1}

Hypochlorite ClO^{-1}

Typical Practice Questions

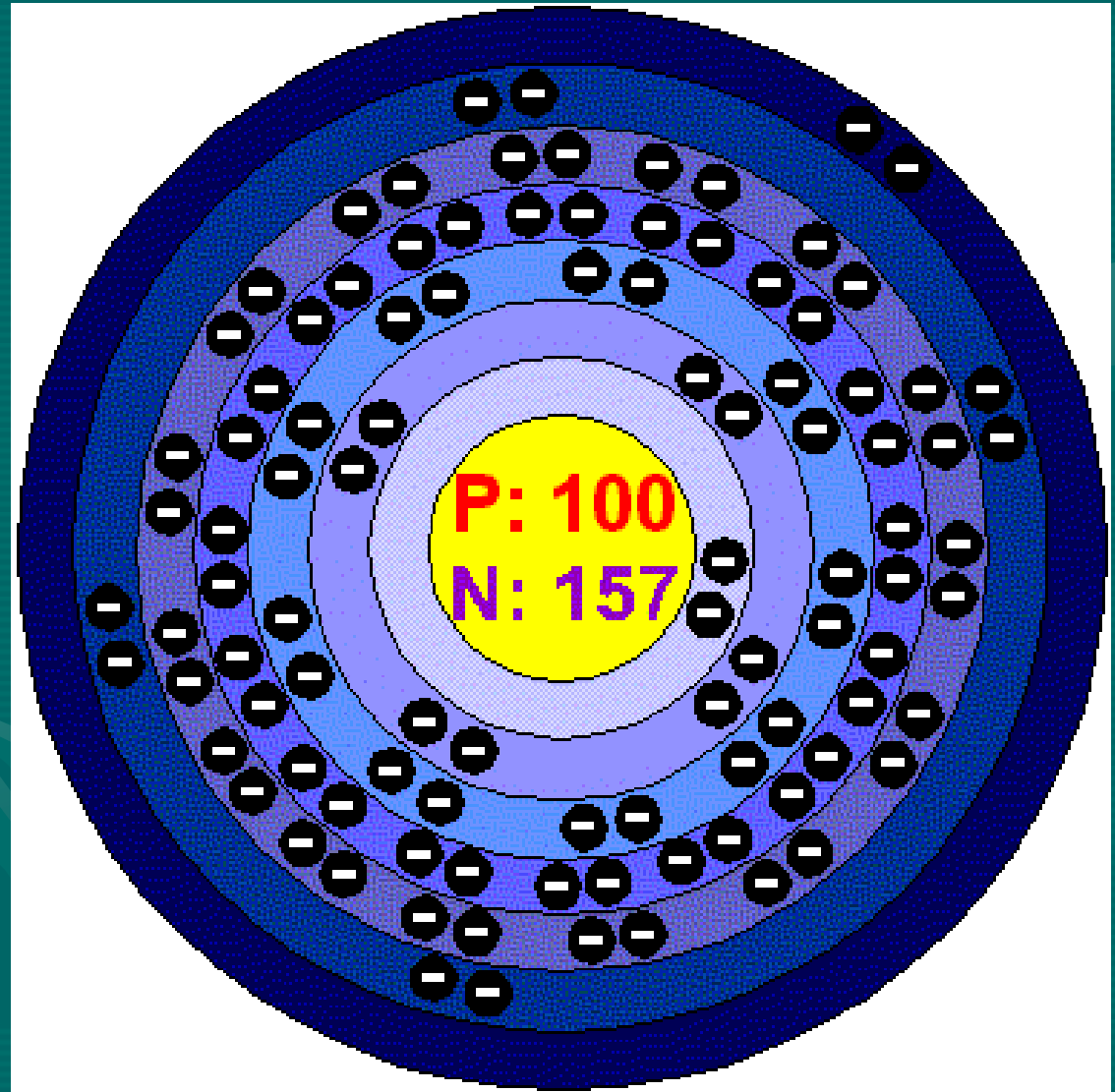
- Ammonium:
- Lead (IV):
- $\text{C}_2\text{H}_3\text{O}_2^{-1}$:
- ClO_4^{-1} :

Typical Practice Questions

- Ammonium: NH_4^{+1}
- Lead (IV): Pb^{+4}
- $\text{C}_2\text{H}_3\text{O}_2^{-1}$: Acetate
- ClO_4^{-1} : Chlorate

Energy levels

- How many electrons are in each energy level?



1st energy level

Energy level	Number of electrons
1	
2	
3	
4	

1st energy level

Energy level	Number of electrons
1	2e ⁻
2	
3	
4	

1st energy level

Energy level	Number of electrons
1	2e-
2	8e-
3	
4	

1st energy level

Energy level	Number of electrons
1	2e-
2	8e-
3	18e-
4	

1st energy level

Energy level	Number of electrons
1	2e-
2	8e-
3	18e-
4	32e-

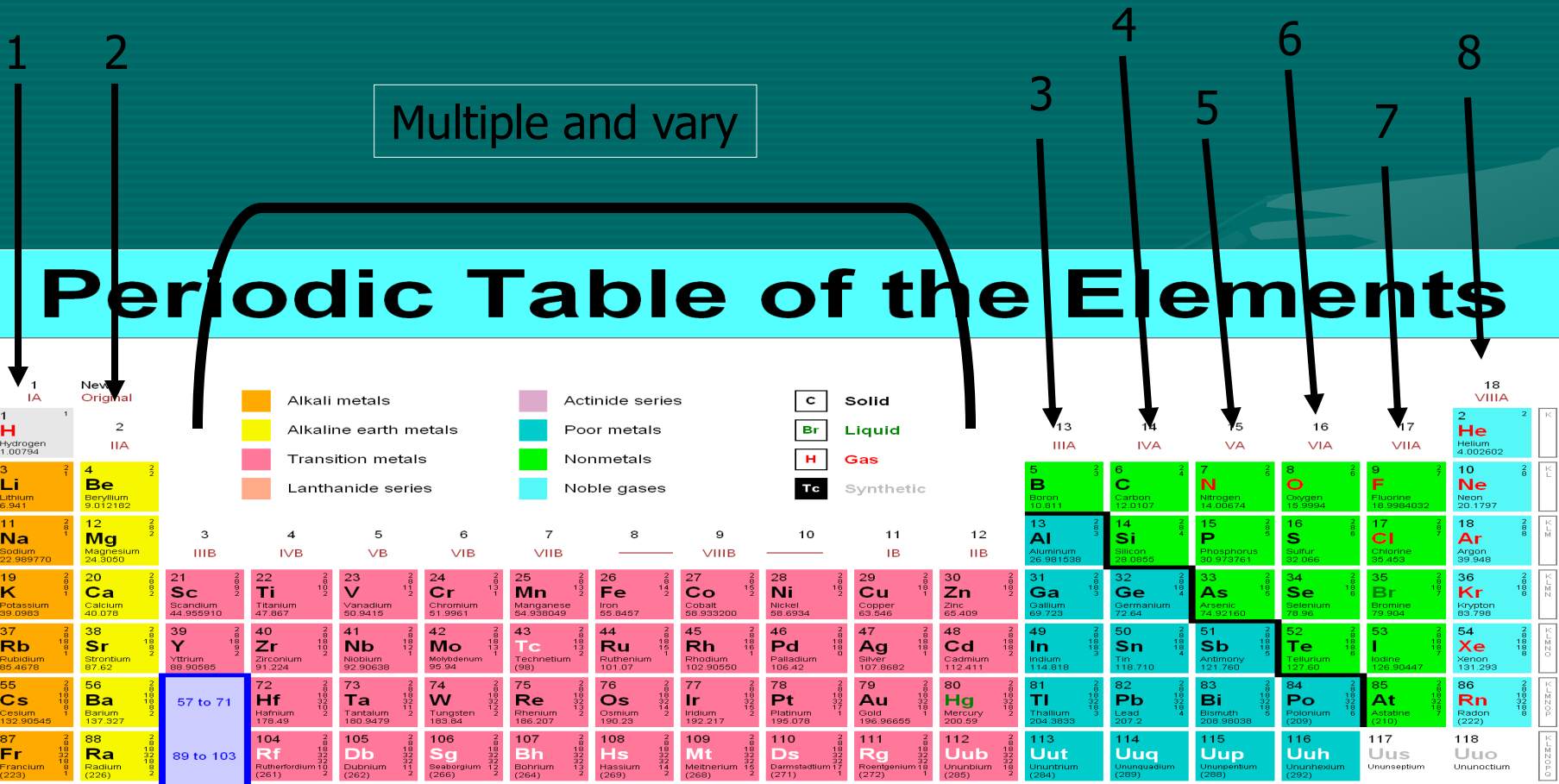
Valence electrons

- Outer most electrons
- Take part in bonding
- Octet rule
 - Atoms are most stable after attaining a full octet or a full outer shell.
 - Will gain or loose or share to attain the same configuration of a noble gas.

How many valence electrons?

Multiple and vary

Periodic Table of the Elements



Atomic masses in parentheses are those of the most stable or common isotope.

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Note: The subgroup numbers 1-18 were adopted in 1954 by the International Union of Pure and Applied Chemistry. The names of elements 112-118 are the Latin equivalents of those

57 La Lanthanum 138.9055	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93032	68 Er Erbium 167.259	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
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

Atomic charges

- Given the opportunity atoms will be gaining or losing electrons to fill the outer shell. They want to be isoelectric with a noble gas
- Isoelectric: Same number of electrons
- Ion: A charged particle
- Anion: gained electrons to be isoelectric with noble gas
- Cation: Lost electrons to be isoelectric with noble gas

What does it mean to be isoelectric?

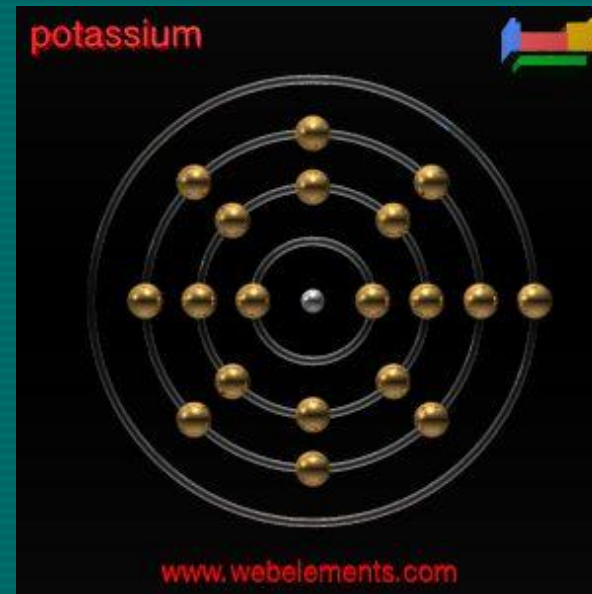
- Isoelectric with a noble gas:
- Na^{+1} Mg^{2+} Al^{3+}
- How many electrons does each of these atoms have?

Periodic Table of the Elements

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1st Family - Alkali metals

- 1 Valence electron
 - Gain 7 electrons
 - Lose 1
- Which is easiest?
- K^+

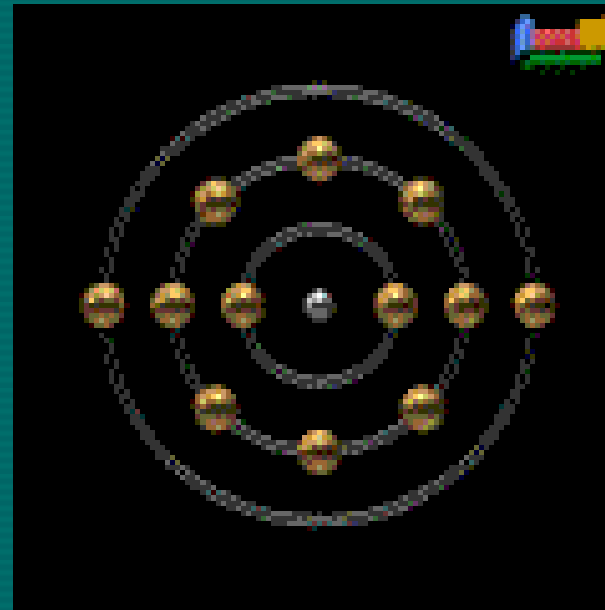


Periodic Table of the Elements

1 IA		New Original		2 IIA		3-12										13-17					18 VIIIA																																																																																																																																																																																																																						
Alkali metals		Alkaline earth metals		Transition metals										Poor metals					Noble gases																																																																																																																																																																																																																								
Actinide series		Lanthanide series																																																																																																																																																																																																																																									
1	H	2	He	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne	11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar	19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr	37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe	55	Ba	56	La	57	Ce	58	Pr	59	Nd	60	Pm	61	Sm	62	Eu	63	Gd	64	Tb	65	Dy	66	Ho	67	Er	68	Tm	69	Yb	70	Lu	71	Hf	72	Ta	73	W	74	Re	75	Os	76	Ir	77	Pt	78	Au	79	Hg	80	Tl	81	Pb	82	Bi	83	Po	84	At	85	Ah	86	Rn	87	Fr	88	Ra	89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Mt	102	Ds	103	Uu	104	Uub	105	Uut	106	Uuq	107	Uubk	108	Uuqk	109	Uubk	110	Uuqk	111	Uubk	112	Uuqk	113	Uubk	114	Uuqk	115	Uubk	116	Uuqk	117	Uubk	118	Uuqk

2nd Family – Alkaline Earth metals

- 2 Valence electron
 - Gain 6 electrons
 - Lose 2
- Which is easiest?

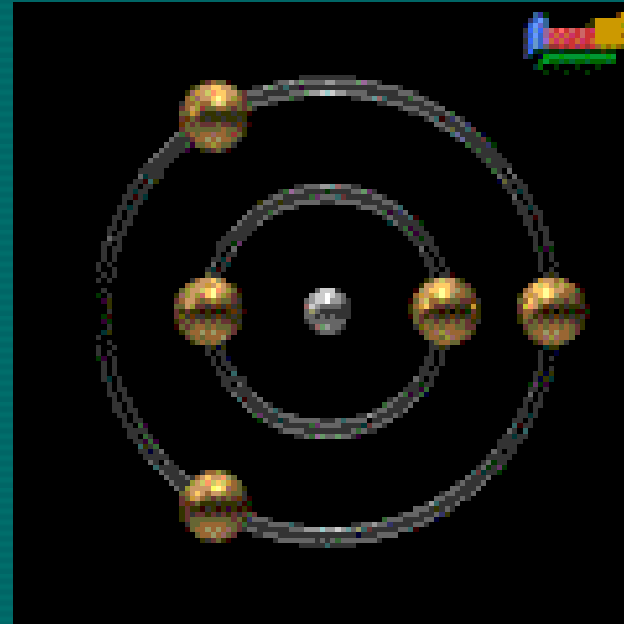


Periodic Table of the Elements

1 IA		New Original										13 IIIA						14 IVA		15 VA		16 VIA		17 VIIA		18 VIIIA									
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3rd Family Boron Family

- 3 Valence electron
 - Gain 5 electrons
 - Lose 3
- Which is easiest?

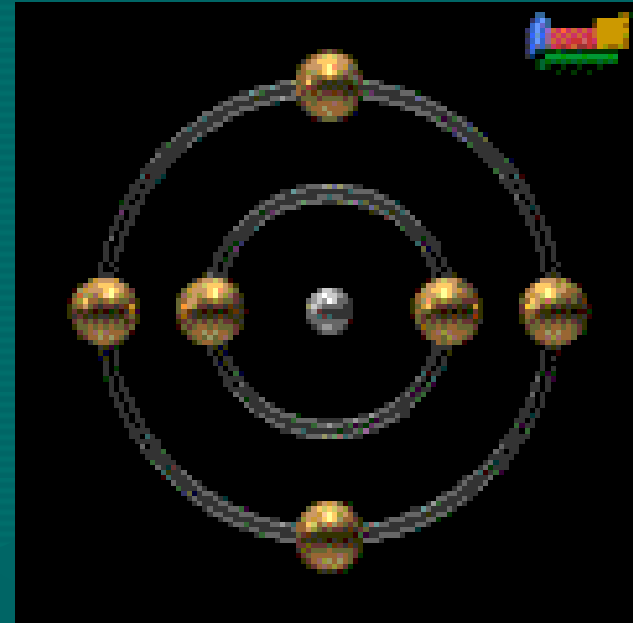


Periodic Table of the Elements

1 IA		New Original										13 IIIA					14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA							
1		2										3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	H Hydrogen 1.00794											13	14	15	16	17	2											
2	3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797										
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4th Family – Carbon Family

- 4 Valence electron
 - Gain 4 electrons
 - Lose 4
- Which is easiest?
C?



Periodic Table of the Elements

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Legend:

- Alkali metals (Orange)
- Alkaline earth metals (Yellow)
- Transition metals (Pink)
- Lanthanide series (Light Orange)
- Actinide series (Purple)
- Poor metals (Cyan)
- Nonmetals (Green)
- Noble gases (Light Blue)
- Solid (C)
- Liquid (Br)
- Gas (H)
- Synthetic (Tc)

Metals vs. Non-metals

- Notice: To this points we have only lost electrons. These were all METALS!!
- METALS LOSE ELECTRONS = CATIONS
- NON-METALS GAIN ELECTRONS = ANIONS

5th Family – Nitrogen Family

- 5 Valence electron
 - Gain 3 electrons
 - Lose 5
- Which is easiest?



Note: Any negative ion will end with the suffix “ide”.

This chemical is called Nitride

P^{-3} is called?



6th Family – Oxygen Family

- 6 Valence electron
 - Gain 2 electrons
 - Lose 6
- Which is easiest?



7th Family – Halogens

- 7 Valence electron
 - Gain 1 electrons
 - Lose 7
- Which is easiest?



What is the charge?

Multiple and vary

Periodic Table of the Elements

+1 +2

+3

?

-3

-2

-1

0

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