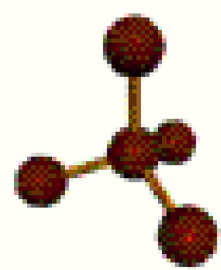
Science 10 Review

Part 1: Chemical Compounds



Ionic Compounds

Ionic Compounds

- Metal and non-metal combination

PERIODIC TABLE OF THE ELEMENTS

METALS ← | → NON-METALS

Atomic Number →	22 +4 +3	← Common combining capacities
Symbol →	Ti	
Name →	Titanium	
Atomic Mass →	47.9	

1 +1 H Hydrogen 1.0																1 −1 H Hydrogen 1.0	2 0 He Helium 4.0
3 +1 Li Lithium 6.9	4 +2 Be Beryllium 9.0											5 +3 B Boron 10.8	6 +4 C Carbon 12.0	7 −3 N Nitrogen 14.0	8 −2 O Oxygen 16.0	9 −1 F Fluorine 19.0	10 0 Ne Neon 20.2
11 +1 Na Sodium 23.0	12 +2 Mg Magnesium 24.3											13 +3 Al Aluminum 27.0	14 +4 Si Silicon 28.1	15 −3 P Phosphorus 31.0	16 −2 S Sulphur 32.1	17 −1 Cl Chlorine 35.5	18 0 Ar Argon 39.9
19 +1 K Potassium 39.1	20 +2 Ca Calcium 40.1	21 +3 Sc Scandium 45.0	22 +4 +3 Ti Titanium 47.9	23 +5 +4 V Vanadium 50.9	24 +3 +2 Cr Chromium 52.0	25 +2 +3 +4 Mn Manganese 54.9	26 +3 +2 Fe Iron 55.8	27 +2 +3 Co Cobalt 58.9	28 +2 +3 Ni Nickel 58.7	29 +2 +1 Cu Copper 63.5	30 +2 Zn Zinc 65.4	31 +3 Ga Gallium 69.7	32 +4 Ge Germanium 72.6	33 −3 As Arsenic 74.9	34 −2 Se Selenium 79.0	35 −1 Br Bromine 79.9	36 0 Kr Krypton 83.8
37 +1 Rb Rubidium 85.5	38 +2 Sr Strontium 87.6	39 +3 Y Yttrium 88.9	40 +4 Zr Zirconium 91.2	41 +3 +5 Nb Niobium 92.9	42 +2 +3 Mo Molybdenum 95.9	43 +7 Tc Technetium (98)	44 +3 +4 Ru Ruthenium 101.1	45 +3 +4 Rh Rhodium 102.9	46 +2 +4 Pd Palladium 106.4	47 +1 Ag Silver 107.9	48 +2 Cd Cadmium 112.4	49 +3 In Indium 114.8	50 +4 +2 Sn Tin 118.7	51 +3 +5 Sb Antimony 121.8	52 −2 Te Tellurium 127.6	53 −1 I Iodine 126.9	54 0 Xe Xenon 131.3
55 +1 Cs Cesium 132.9	56 +2 Ba Barium 137.3	57 +3 La Lanthanum 138.9	72 +4 Hf Hafnium 178.5	73 +5 Ta Tantalum 180.9	74 +6 W Tungsten 183.8	75 +4 +7 Re Rhenium 186.2	76 +3 +4 Os Osmium 190.2	77 +3 +4 Ir Iridium 192.2	78 +4 +2 Pt Platinum 195.1	79 +3 +1 Au Gold 197.0	80 +2 +1 Hg Mercury 200.6	81 +1 +3 Tl Thallium 204.4	82 +2 +4 Pb Lead 207.2	83 +3 +5 Bi Bismuth 209.0	84 +2 +4 Po Polonium (209)	85 −1 At Astatine (210)	86 0 Rn Radon (222)
87 +1 Fr Francium (223)	88 +2 Ra Radium (226)	89 +3 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)									
Alkali Metals	Alkaline Earth Metals															Halogens	Noble Gases

58 +3 +4 Ce Cerium 140.1	59 +3 +4 Pr Praseodymium 140.9	60 +3 Nd Neodymium 144.2	61 +3 Pm Promethium (145)	62 +3 +4 Sm Samarium 150.4	63 +3 +2 Eu Europium 152.0	64 +3 Gd Gadolinium 157.3	65 +3 +4 Tb Terbium 158.9	66 +3 Dy Dysprosium 162.5	67 +3 Ho Holmium 164.9	68 +3 Er Erbium 167.3	69 +3 +2 Tm Thulium 168.9	70 +3 +2 Yb Ytterbium 173.0	71 +3 Lu Lutetium 175.0
90 +4 Th Thorium 232.0	91 +5 +4 Pa Protactinium 231.0	92 +6 +4 +5 U Uranium 238.0	93 +5 +3 +4 +6 Np Neptunium (237)	94 +4 +6 +3 +5 Pu Plutonium (244)	95 +3 +4 +5 +6 Am Americium (243)	96 +3 Cm Curium (247)	97 +3 +4 Bk Berkelium (247)	98 +3 Cf Californium (251)	99 +3 Es Einsteinium (252)	100 +3 Fm Fermium (257)	101 +2 +3 Md Mendelevium (258)	102 +2 +3 No Nobelium (259)	103 +3 Lr Lawrencium (262)

Based on mass of C-12 at 12.00.

Any value in parentheses is the mass of the most stable or best known isotope for elements which do not occur naturally.

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- Metal and non-metal combination

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- Contains charged **ions** (atoms or group of atoms that have lost or gained electrons)

  e.g O^{2-}, PO_4^{3-}

  K^+ , NH_4^+

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- Ionic bond is a force of attraction between positive and negative ions

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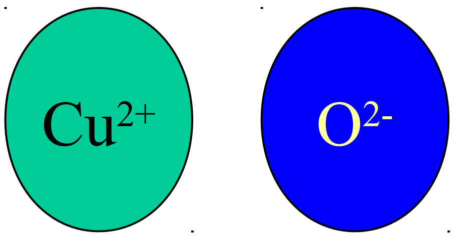

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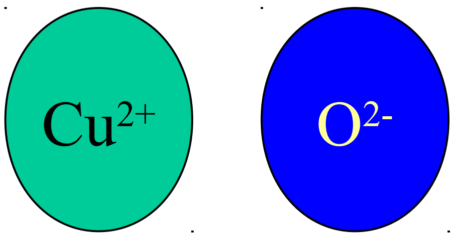

- E.g. CuO, $NaHC_2O_4$

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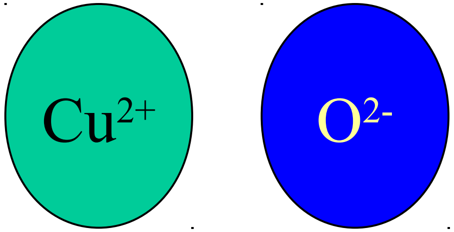

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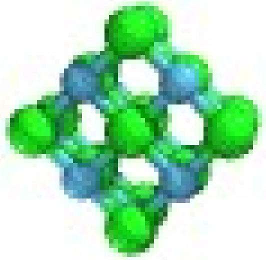

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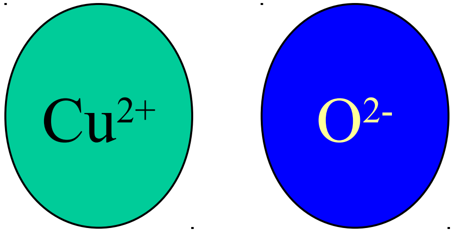

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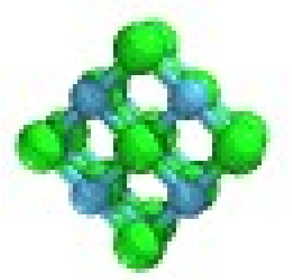

- CuO, a formula unit, represents the lowest ratio of positive to negative ions

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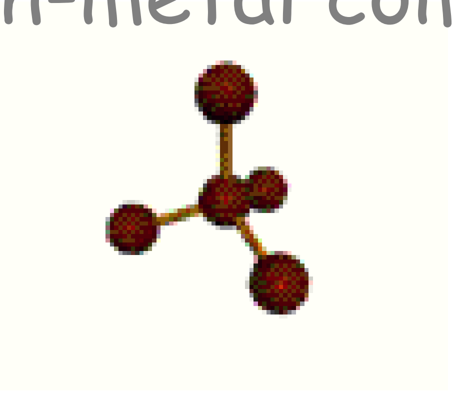

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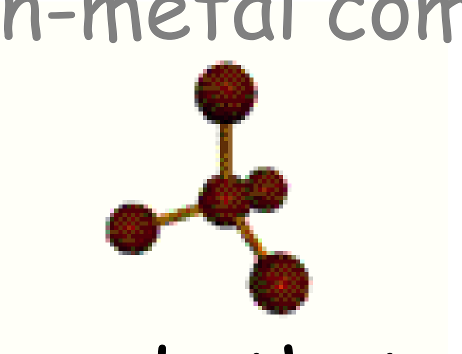

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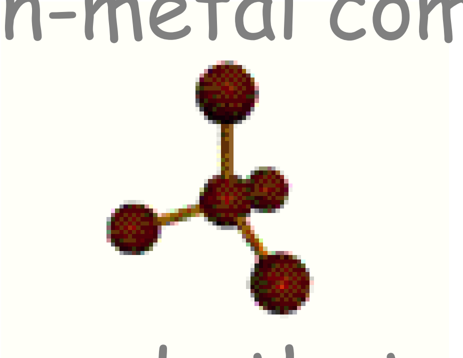

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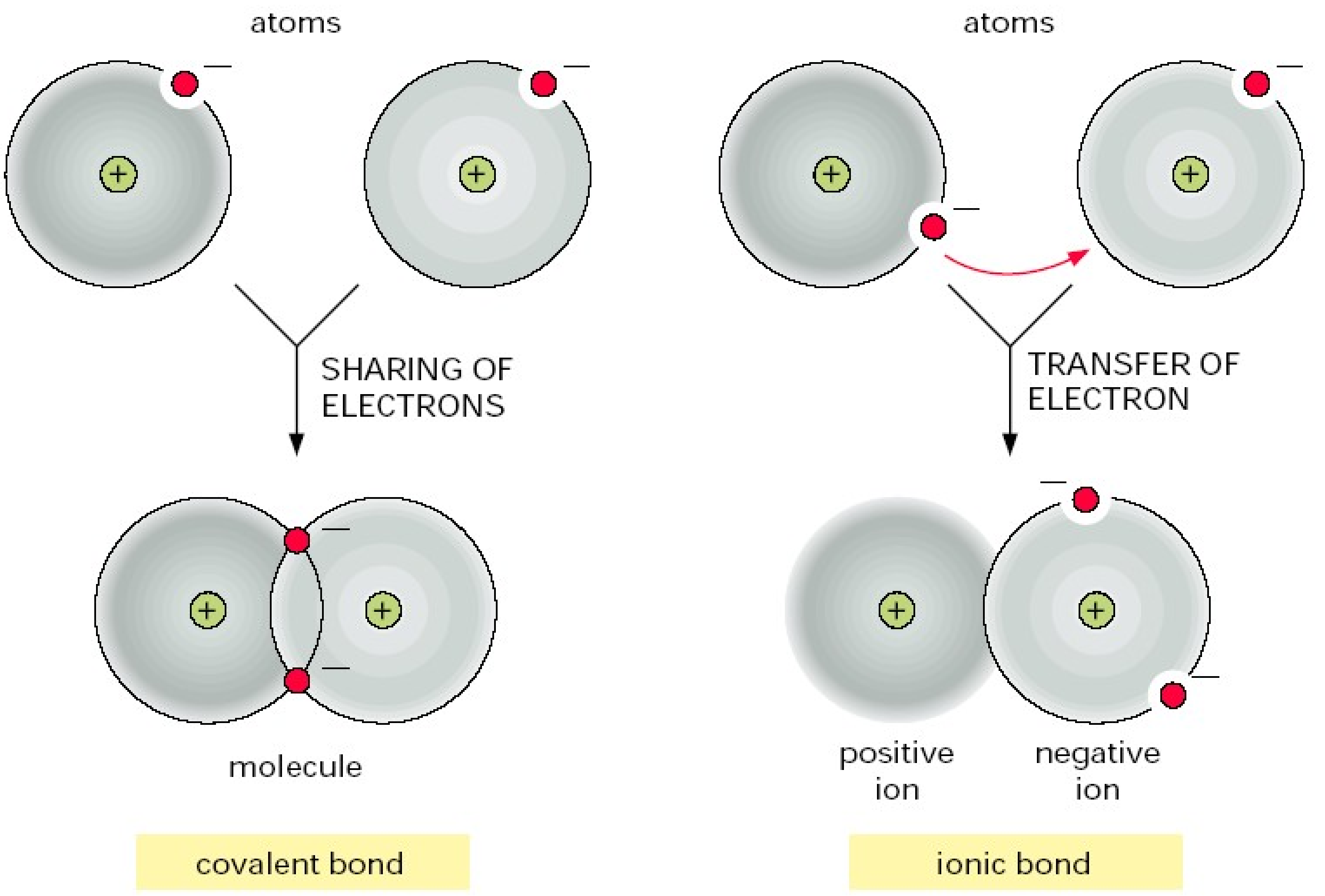
- E.g. CH_4, SO_2


atoms
SHARING OF
ELECTRONS
molecule
covalent bond
atoms
TRANSFER OF
ELECTRON
positive
ion
negative
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ionic bond

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- Salts are ionic compounds that form from reacting acids and bases. E.g. NaCl

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  E.g (s) solid state; $Fe_{(s)}$
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  (g) gaseous state; $O_{2(g)}$
  (aq) means aqueous or substance is dissolved in water; $NaCl_{(aq)}$

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↑

Polyatomic ion

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- E.g. Ga and S Ga^{3+} S^{2-}

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gallium sulphide

ending change to ide

Science 10 Review

Part 2: Balancing Equations

Writing and Balancing Chemical Equations

Step 1

Write chemical equation with phase symbols if not already done.

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e.g. $Al_{(s)} + I_{2(g)} \rightarrow AlI_{3(s)}$

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e.g. $\underline{1}$ $Al_{(s)}$ + $\underline{1}$ $I_{2(g)}$ → $\underline{1}$ $AlI_{3(s)}$

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Count the number of each atom on reactant and product side of equation (multiply coefficient and subscript).

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$Al_2(SO_3)_3$	$3\ Al_2(SO_3)_3$
2 Aluminum	6 Aluminum
3 Sulphur	9 Sulphur
9 Oxygen	27 Oxygen

Step 4

Increase or change the coefficients to make numbers of atoms balance on both sides of equation.

e.g. $\underline{\ 2\ }\ Al_{(s)} + \underline{\ 3\ }\ I_{2(g)} \rightarrow \underline{\ 2\ }\ AlI_{3(s)}$

Step 5

Always double check your answer.

e.g. $\underline{\ 2\ }\ Al_{(s)} + \underline{\ 3\ }\ I_{2(g)} \rightarrow \underline{\ 2\ }\ AlI_{3(s)}$

Reactants	Products
Al = 2	Al = 2
I = 6	I = 6

Helpful Hints:

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- Balance oxygen and hydrogen last.

Example:

$$\_\_C_8H_{18(s)} + \underline{12.5}O_{2(g)} \rightarrow \underline{\ 8\ } CO_{2(g)} + \underline{\ \ 9}H_2O_{(g)}$$

25 Oxygen

16 Oxygen

\+ 9 Oxygen

25 Oxygen

Must double all coefficients to remove fraction

Example:

$\underline{2}\ C_8H_{18(s)}$ + $\underline{25}\ O_{2(g)} \rightarrow \underline{16}\ CO_{2(g)}$ + $\underline{18}\ H_2O_{(g)}$

50 Oxygen	**50 Oxygen**
16 Carbon	**16 Carbon**
36 Hydrogen	**36 Hydrogen**

Science 10 Review

Part 3: Names & Formulas of Compounds

Formulas of Ionic Compounds

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+3 or +2 O^{2-}

chromium (III) oxide

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Formulas of Molecular Compounds

- Binary compounds use prefix system to indicate the number atoms of each element
- The element furthest to the left or farthest down the periodic table is written first

Greek prefixes

1 - mono
2 - di
3 - tri
4 - tetra
5 - penta
6 - hexa
7 - hepta
8 - octa
9 - nona
10 - deca

Formulas of Molecular Compounds

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sulphur dioxide

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e.g. carbon monooxide → carbon monoxide

Naming Molecular Compounds

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SiO_2

Naming Molecular Compounds

SiO_2 silicon dioxide

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SiO_2 silicon dioxide

N_2S

Naming Molecular Compounds

SiO_2	silicon dioxide
N_2S	dinitrogen monosulphide

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P_4Cl_6	

Naming Molecular Compounds

SiO_2	silicon dioxide
N_2S	dinitrogen monosulphide
P_4Cl_6	tetraphosphorus hexachloride

Science 10 Review

Part 4: Chem/Phys Change
Chemical Equations

Chemical & Physical Change

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- Physical change: no new substance is formed

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Chemical & Physical Change

- Physical change: no new substance is formed
- Chemical change: new substance is formed
- Evidence for chemical change:

  energy change
  colour change
  formation of a precipitate (solid)
  formation of a gas

Energy Changes

- Endothermic Rxns : energy absorbed

  e.g ice pack

- Exothermic Rxns: energy released

  e.g. combustion

Chemical equations from Word Equations

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- Must include phase symbols and balance the equation

Chemical equations from Word Equations

- In Chemistry 11, a solution means something is dissolved in water. Therefore the phase is aqueous.
- Must include phase symbols and balance the equation
- Diatomic molecules: H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2

PERIODIC TABLE OF THE ELEMENTS

METALS ← | → NON-METALS

Atomic Number →	22 +4 +3	← Common combining capacities
Symbol →	Ti	
Name →	Titanium	
Atomic Mass →	47.9	

1 +1 H Hydrogen 1.0																1 −1 H Hydrogen 1.0	2 0 He Helium 4.0
3 +1 Li Lithium 6.9	4 +2 Be Beryllium 9.0											5 +3 B Boron 10.8	6 +4 C Carbon 12.0	7 −3 N Nitrogen 14.0	8 −2 O Oxygen 16.0	9 −1 F Fluorine 19.0	10 0 Ne Neon 20.2
11 +1 Na Sodium 23.0	12 +2 Mg Magnesium 24.3											13 +3 Al Aluminum 27.0	14 +4 Si Silicon 28.1	15 −3 P Phosphorus 31.0	16 −2 S Sulphur 32.1	17 −1 Cl Chlorine 35.5	18 0 Ar Argon 39.9
19 +1 K Potassium 39.1	20 +2 Ca Calcium 40.1	21 +3 Sc Scandium 45.0	22 +4 +3 Ti Titanium 47.9	23 +5 +4 V Vanadium 50.9	24 +3 +2 Cr Chromium 52.0	25 +2 +3 +4 Mn Manganese 54.9	26 +3 +2 Fe Iron 55.8	27 +2 +3 Co Cobalt 58.9	28 +2 +3 Ni Nickel 58.7	29 +2 +1 Cu Copper 63.5	30 +2 Zn Zinc 65.4	31 +3 Ga Gallium 69.7	32 +4 Ge Germanium 72.6	33 −3 As Arsenic 74.9	34 −2 Se Selenium 79.0	35 −1 Br Bromine 79.9	36 0 Kr Krypton 83.8
37 +1 Rb Rubidium 85.5	38 +2 Sr Strontium 87.6	39 +3 Y Yttrium 88.9	40 +4 Zr Zirconium 91.2	41 +3 +5 Nb Niobium 92.9	42 +2 +3 Mo Molybdenum 95.9	43 +7 Tc Technetium (98)	44 +3 +4 Ru Ruthenium 101.1	45 +3 +4 Rh Rhodium 102.9	46 +2 +4 Pd Palladium 106.4	47 +1 Ag Silver 107.9	48 +2 Cd Cadmium 112.4	49 +3 In Indium 114.8	50 +4 +2 Sn Tin 118.7	51 +3 +5 Sb Antimony 121.8	52 −2 Te Tellurium 127.6	53 −1 I Iodine 126.9	54 0 Xe Xenon 131.3
55 +1 Cs Cesium 132.9	56 +2 Ba Barium 137.3	57 +3 La Lanthanum 138.9	72 +4 Hf Hafnium 178.5	73 +5 Ta Tantalum 180.9	74 +6 W Tungsten 183.8	75 +4 +7 Re Rhenium 186.2	76 +3 +4 Os Osmium 190.2	77 +3 +4 Ir Iridium 192.2	78 +4 +2 Pt Platinum 195.1	79 +3 +1 Au Gold 197.0	80 +2 +1 Hg Mercury 200.6	81 +1 +3 Tl Thallium 204.4	82 +2 +4 Pb Lead 207.2	83 +3 +5 Bi Bismuth 209.0	84 +2 +4 Po Polonium (209)	85 −1 At Astatine (210)	86 0 Rn Radon (222)
87 +1 Fr Francium (223)	88 +2 Ra Radium (226)	89 +3 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)								Halogens	Noble Gases
Alkali Metals	Alkaline Earth Metals																

58 +3 +4 Ce Cerium 140.1	59 +3 +4 Pr Praseodymium 140.9	60 +3 Nd Neodymium 144.2	61 +3 Pm Promethium (145)	62 +3 +4 Sm Samarium 150.4	63 +3 +2 Eu Europium 152.0	64 +3 Gd Gadolinium 157.3	65 +3 +4 Tb Terbium 158.9	66 +3 Dy Dysprosium 162.5	67 +3 Ho Holmium 164.9	68 +3 Er Erbium 167.3	69 +3 +2 Tm Thulium 168.9	70 +3 +2 Yb Ytterbium 173.0	71 +3 Lu Lutetium 175.0
90 +4 Th Thorium 232.0	91 +5 +4 Pa Protactinium 231.0	92 +6 +4 +5 U Uranium 238.0	93 +5 +3 +4 +6 Np Neptunium (237)	94 +4 +6 +3 +5 Pu Plutonium (244)	95 +3 +4 +5 +6 Am Americium (243)	96 +3 Cm Curium (247)	97 +3 +4 Bk Berkelium (247)	98 +3 Cf Californium (251)	99 +3 Es Einsteinium (252)	100 +3 Fm Fermium (257)	101 +2 +3 Md Mendelevium (258)	102 +2 +3 No Nobelium (259)	103 +3 Lr Lawrencium (262)

Based on mass of C-12 at 12.00.

Any value in parentheses is the mass of the most stable or best known isotope for elements which do not occur naturally.

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Chemical equations from Word Equations

E.g.

A solution of barium phosphate is mixed with aqueous sodium sulphate to yield solid barium sulphate and aqueous sodium phosphate.

$$Ba_3(PO_4)_{2(aq)} + 3Na_2SO_{4(aq)} \rightarrow 3BaSO_{4(s)} + 2Na_3PO_{4(aq)}$$