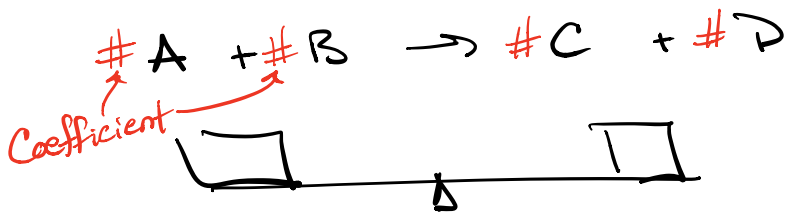


Chapter 7

- Balancing Chemical Eq
- Classifying Chemical Rxn
 - Acid/Base
 - double displacement
 - Redox
 - Combustion
- Stoichiometry w/ Rxns
- Reaction yields

Balancing Chemical Equations



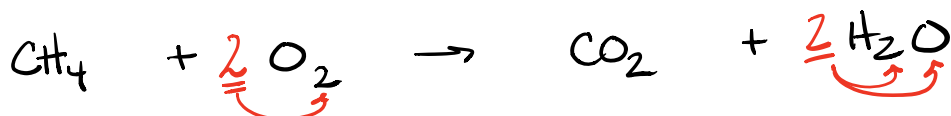
Conservation of matter. Matter cannot be destroyed or created.

Molar Coefficients - Coefficients count as either single molecules or as moles in a larger sense

Rules for balancing

- 1) you may only change the coefficients
- 2) Start left to right balancing any element that does not appear more than 3 times in the reaction.
- 3) Save diatomics for last (O_2, H_2, N_2, Cl_2, S_8)
- 4) You may use a fractional coefficient to balance an odd number of diatomics \Rightarrow But must clear the fraction at the end.

Should be able to balance any equation in 4 steps or less.



Stoichiometry (mass to mole conversions) are only valid with a balanced chemical rxn



C 2

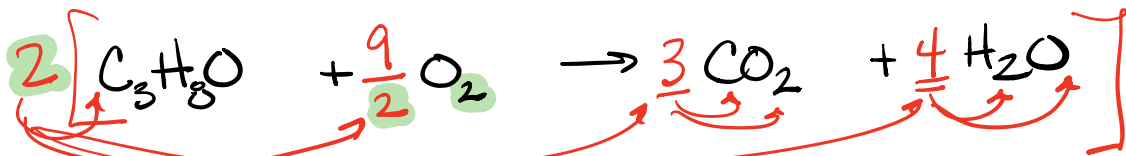
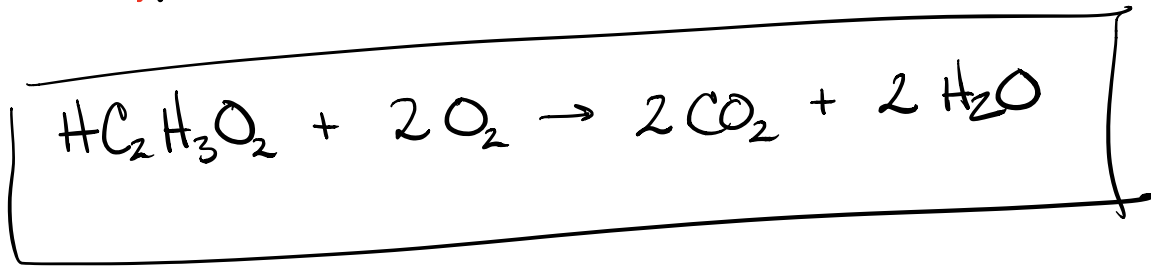
H 4

O ~~4~~ 6

C ~~1~~ 2

H ~~2~~ 4

O ~~3~~ ~~6~~



C 3

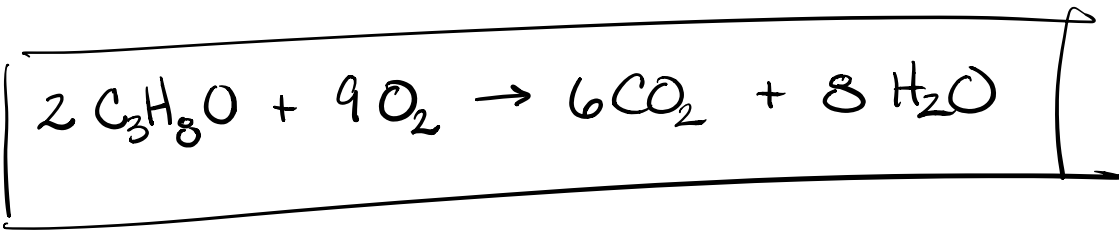
H 8

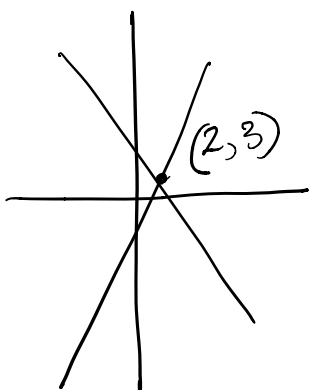
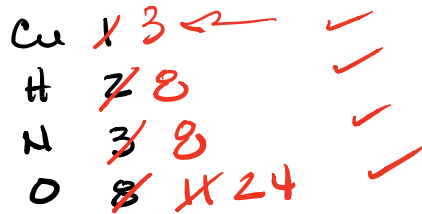
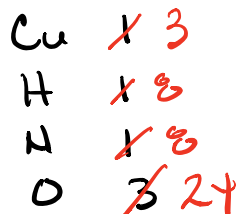
O ~~3~~ 10

C ~~1~~ 3 ✓

H ~~2~~ 8 ✓

O ~~3~~ ~~7~~ 10 ✓





$$2x + y = 8 \quad \# \text{ N}$$

$$6x + y + 4 = 24 \quad \# \text{ O}$$

$$6x + y = 20$$

$$2(3) + y = 8$$

$$-(2x + y = 8)$$

$$6 + y = 8$$

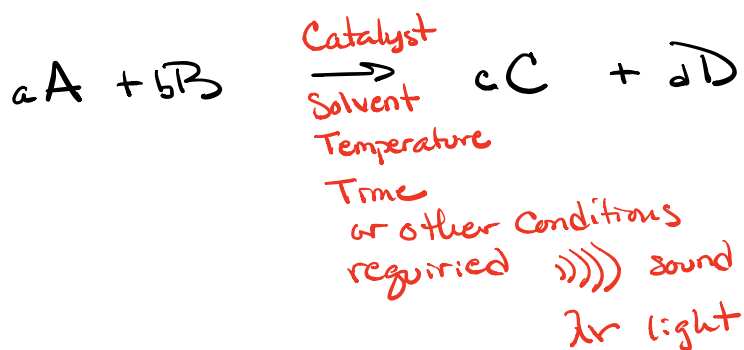
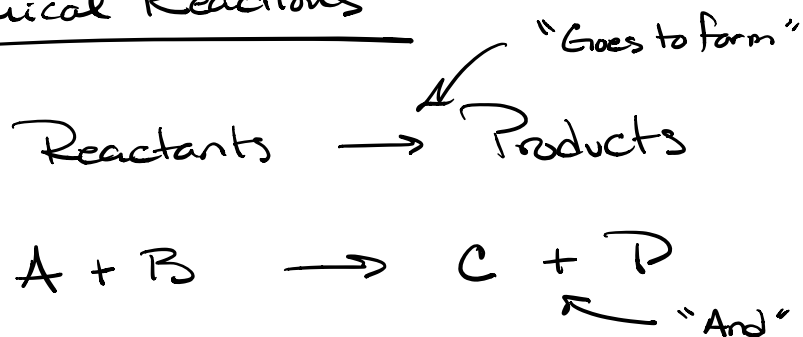
$$y = 2$$

$$4x = 12$$

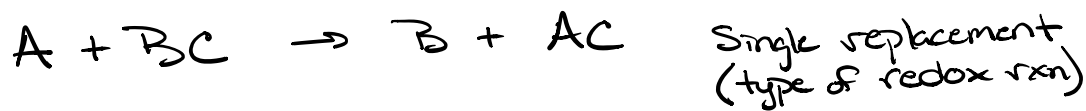
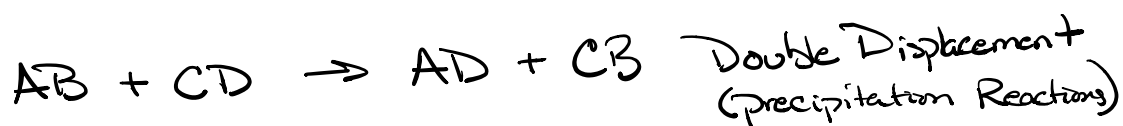
$$x = \frac{12}{4} = 3$$



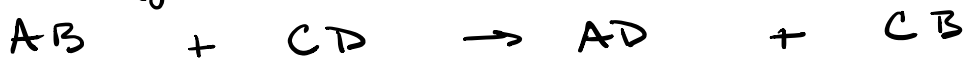
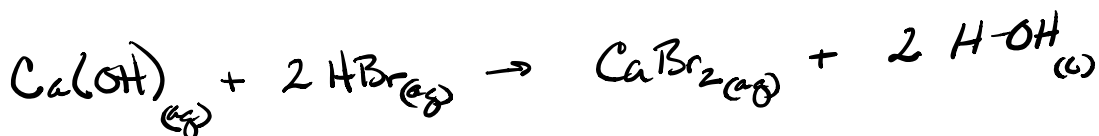
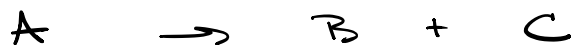
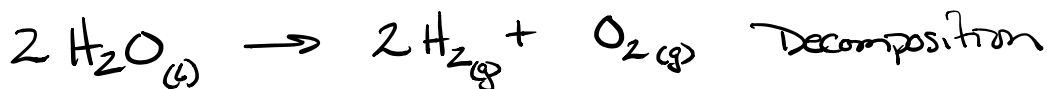
Chemical Reactions



Types of Reactions



Ex



Double displacement

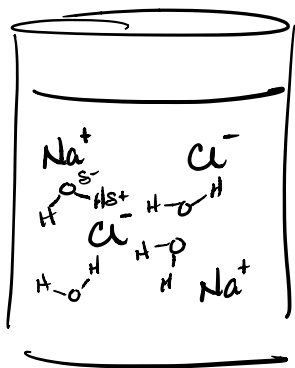
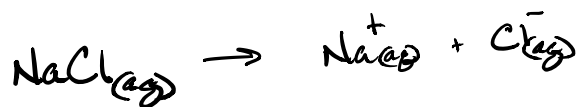
States

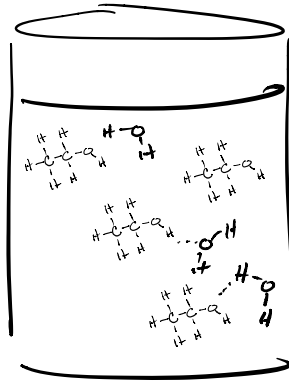
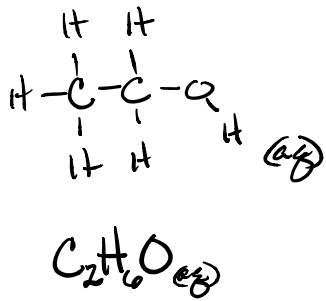
(l) liquid

(s) solid

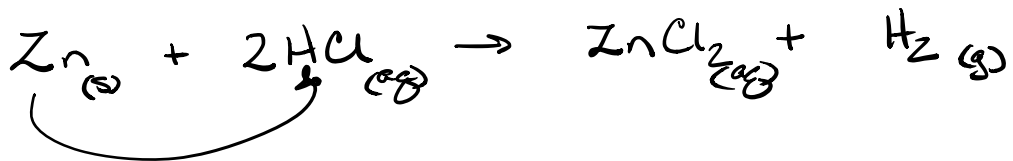
(g) gas

(aq) aqueous \rightarrow dissolved in H_2O





Dissolves as a molecule
and it does not dissociate



Single Replacement

7.2

Double Displacement (Precipitation Reactions)

- Solubility Rules to predict outcome of these reactions \Rightarrow predict products
- \Rightarrow Lab experiment

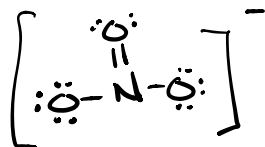
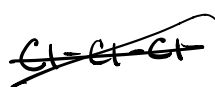
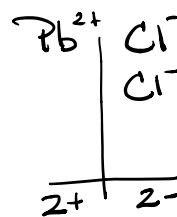
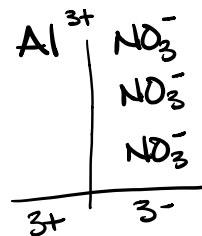
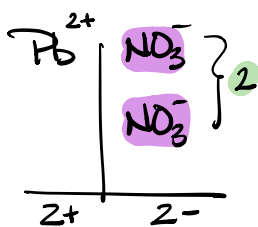
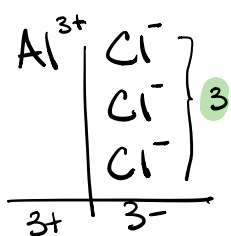
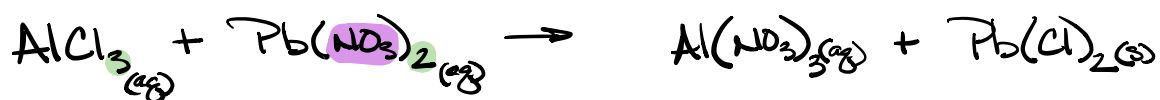
Table 7.1 Solubility Rules

<u>Ions</u>	<u>Rule</u>	<u>Exception</u>
Group 1A cations (Na^+ , K^+ , Li^+) & ammonium NH_4^+	Always Soluble	None
$\text{C}_2\text{H}_3\text{O}_2^-$ & NO_3^-	Always Soluble	None
Cl^- , Br^- , I^-	Usually Soluble	Pb^{2+} , Hg_2^{2+} , Ag^+
F^- , SO_4^{2-}	Usually Soluble	Pb^{2+} , Ba^{2+} , Ca^{2+}
CO_3^{2-} , PO_4^{3-} , OH^-	Usually Insoluble	Group 1A cation & NH_4^+

	<u>Soluble/Insoluble</u>	<u>Reason</u>
LiCl	Soluble	<ul style="list-style-type: none"> - Li^+ is group IA \Rightarrow always soluble. - Cl^- usually soluble & Li^+ not one of its exceptions
$\text{Fe}(\text{OH})_3$	Insoluble	<ul style="list-style-type: none"> - OH^- usually insoluble Fe^{3+} not an exception
$(\text{NH}_4^+)_3\text{PO}_4$	Soluble	<ul style="list-style-type: none"> NH_4^+ always Soluble Cation
MgCO_3	Insoluble	<ul style="list-style-type: none"> CO_3^{2-} is usually insoluble Mg^{2+} not an exception

Double Displacement Reaction

Give the products of the following reaction with their state of matter (s, l, g, or aq)

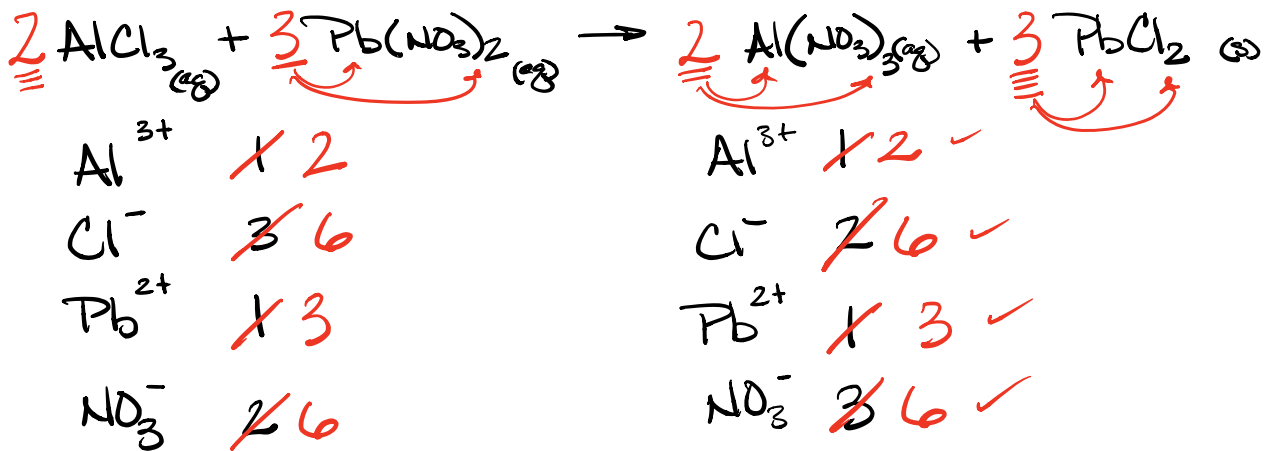


- Broken the reactants into ions ✓
- Swapped ion pairs & balance the formulas for charge ✓
- Decide on state ✓

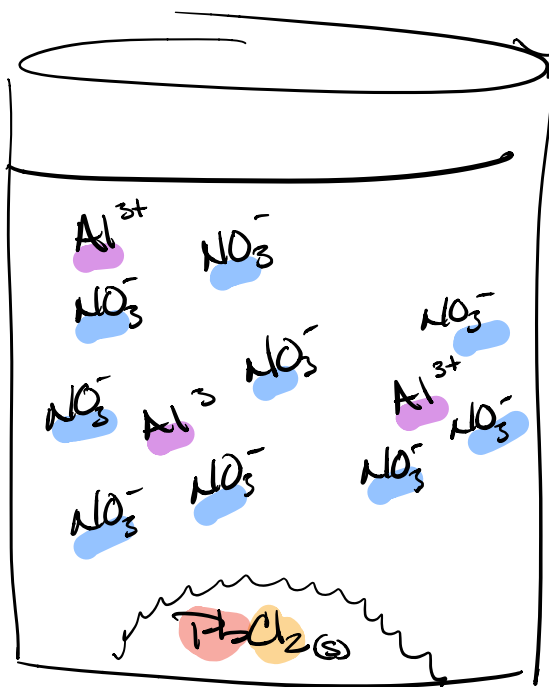
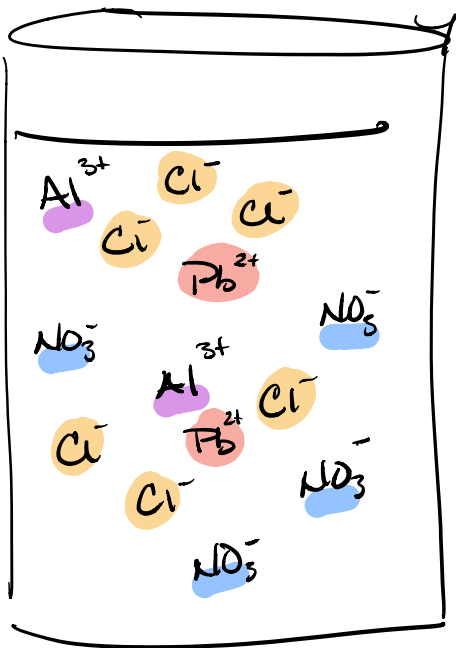
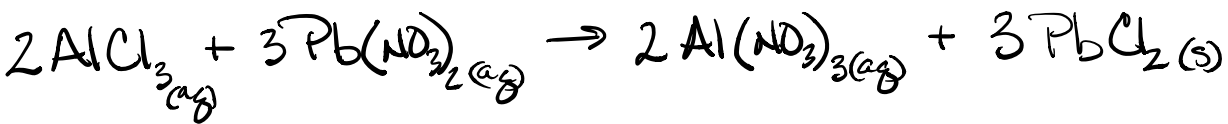
soluble = (aq) aqueous

insoluble = (s) solid

- Balance the Coefficients



Complete Balanced Equation



Chemical Formula

Reactants & products shown as "associated" written together as cation - Anion pairs

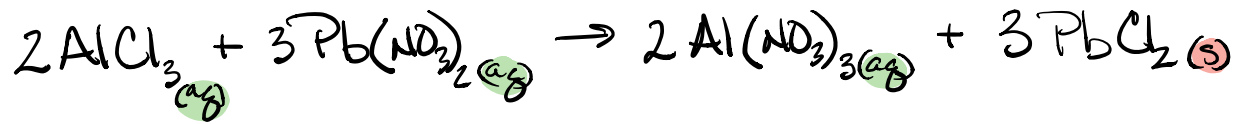
Ionic Formula

Reactants & Products in aqueous state written as dissociated ions w/ charge & state.

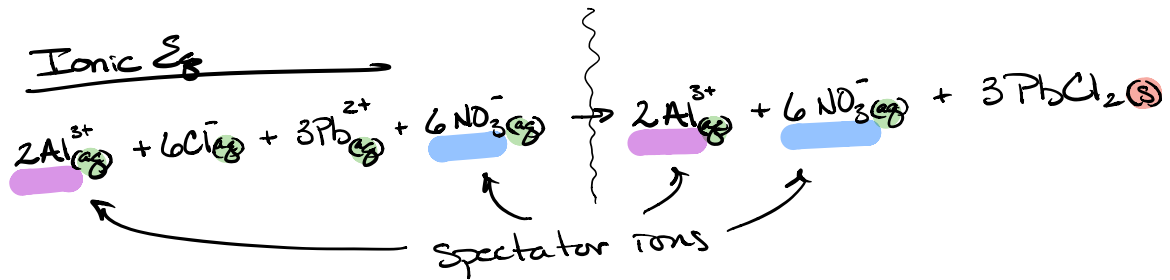
Net Ionic Formula

Reactants & products without spectator ions \Rightarrow Those things that remain in solution after the reaction.

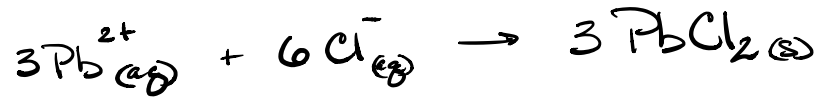
Chemical Eq



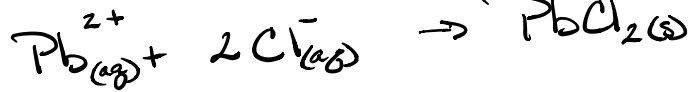
Ionic Eq



Net Ionic Eq



|||



Lowest Whole #
Ratios

1A s-block

p-block

18
8A

1 H Hydrogen 1.008	2 He Helium 4.003	13 3A	14 4A	15 5A	16 6A	17 7A											
3 Li Lithium 6.941	4 Be Beryllium 9.012	5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18										
11 Na Sodium 22.99	12 Mg Magnesium 24.30	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.84	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 97.91	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3
55 Cs Cesium 132.9	56 Ba Barium 137.3	57 La Lanthanum 138.9	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium 145	62 Sm Samarium 150.4	63 Eu Europium 152.0	64 Gd Gadolinium 157.2	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.0	
87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227	90 Th Thorium 232.0	91 Pa Protactinium 231.0	92 U Uranium 238.0	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 251	99 Es Einsteinium 252	100 Fm Fermium 257	101 Md Mendelevium 258	102 No Nobelium 259	103 Lr Lawrencium 262	
		104 Rf Rutherfordium 261	105 Db Dubnium 262	106 Sg Seaborgium 263	107 Bh Bohrium 262	108 Hs Hassium 265	109 Mt Meitnerium 266	110 Ds Darmstadtium 269	111 Rg Roentgenium 272	112 Cn Copernicium 277	113 Nh Nihonium 289	114 Fl Flerovium 289	115 Mc Moscovium 289	116 Lv Livermorium 289	117 Ts Tennessine 289	118 Og Oganesson 289	

d-block

Lanthanides

Actinides

