Name _____
Teacher_____
Class _____ Block ___
Date _____

Word Equations Worksheet

Write the balanced chemical equations for each of the following chemical reactions. If there is a solid formed in a double replacement reaction, give the **complete ionic equation** and the **net ionic equation.**

1) When dissolved beryllium chloride reacts with dissolved silver nitrate in water, aqueous beryllium nitrate and silver chloride powder are made.

2) When isopropanol (C_3H_8O) burns in oxygen, carbon dioxide, water, and heat are produced.

3) When dissolved sodium hydroxide reacts with sulfuric acid (H_2SO_4), aqueous sodium sulfate, water, and heat are formed.

4) When fluorine gas is put into contact with calcium metal at high temperatures, calcium fluoride powder is created in an exothermic reaction.

5) When sodium metal reacts with iron (II) chloride, iron metal and sodium chloride are formed.

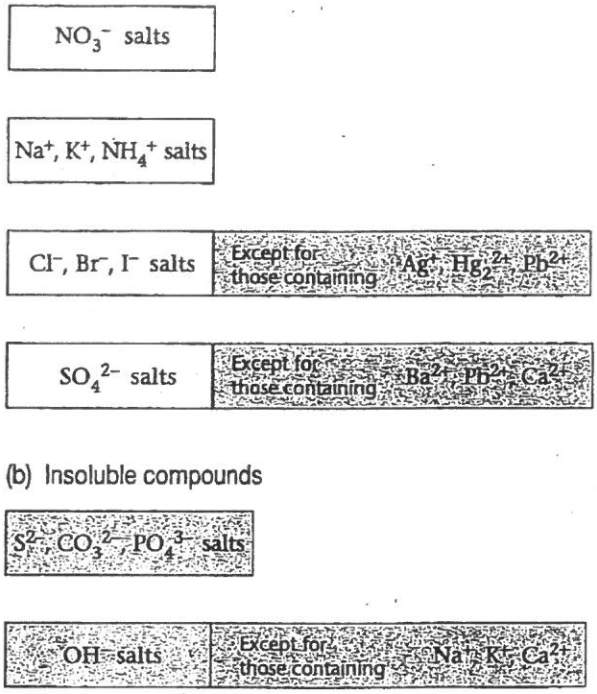
Table 8.1

General Rules for Solubility of Ionic Compounds (Salts) in Water at 25 °C

1. Most nitrate (NO_3^-) salts are soluble.
2. Most salts of Na^+, K^+, and NH_4^+ are soluble.
3. Most chloride salts are soluble. Notable exceptions are AgCl, $PbCl_2$, and Hg_2Cl_2.
4. Most sulfate salts are soluble. Notable exceptions are $BaSO_4$, $PbSO_4$, and $CaSO_4$.
5. Most hydroxide compounds are only slightly soluble.* The important exceptions are NaOH and KOH. $Ba(OH)_2$ and $Ca(OH)_2$ are moderately soluble.
6. Most sulfide (S^{2-}), carbonate (CO_3^{2-}), and phosphate (PO_4^{3-}) salts are only slightly soluble.*

*The terms *insoluble* and *slightly soluble* really mean the same thing: such a tiny amount dissolves that it is not possible to detect it with the naked eye.

(a) Soluble compounds



(b) Insoluble compounds

Figure 8.3
Solubilities of common compounds

TABLE 8-3 *Activity Series of the Elements*

Activity of metals		Activity of halogen nonmetals
Li Rb K Ba Sr Ca Na	React with cold H_2O and acids, replacing hydrogen. React with oxygen, forming oxides.	F_2 Cl_2 Br_2 I_2
Mg Al Mn Zn Cr Fe Cd	React with steam (but not cold water) and acids, replacing hydrogen. React with oxygen, forming oxides.	
Co Ni Sn Pb	Do not react with water. React with acids, replacing hydrogen. React with oxygen, forming oxides.	
H_2 Sb Bi Cu Hg	React with oxygen, forming oxides.	
Ag Pt Au	Fairly unreactive, forming oxides only indirectly.	

Solubility Table

	acetate	arsenate	bromide	carbonate	chloride	chromate	hydroxide	iodide	nitrate	dichromate	oxide	phosphate	sulfate	sulfide	sulfite
Al	S	I	S		S		I	S	S		I	I	S		
NH_4^+	S	S	S	S	S	S	S	S	S	S		S	S	S	S
Ba	S	I	S	I	S	I	s	S	S	I	s	I	I	d	I
Bi		s	d	I	d		I	I	d	I	I	s	d	I	
Ca	S	I	S	I	S		I (s)	S	S	I	I	I	I	d	I
Co^{2+}	S	I	S	I	S	I	I	S	S	I	I	I	S	I	I
Cu^{2+}	S	I	S	I	S	I	I		S	I	I	I	S	I	
Fe^{2+}	S	I	S	s	S		I	S	S	I	I	I	S	I	s
Fe^{3+}	I	I	S	I	S		I		S	S	I	I	S	I	
Pb^{2+}	S	I	I	I	I	I	I	I	S	I	I	I	I	I	I
Mg	S	d	S	I	S	S	I	S	S	I	I	I	S		s
Hg^{2+}	S	I	I	I	S	s		I	S	I	I	I	d	I	
K	S	s	S	S	S	S	S	S	S	S	S	S	S	S	S
Ag^+	I	I	I	I	I	I	d	I	S	I	I	I	I (s)	I	I
Na	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Zn^{2+}	S	I	S	I	S	I	I	S	S	I	I	I	S	I	I

Solubility Table
Common Ionic Compounds

	Group 1				Group 2				Transition Metals				
	NH_4^+	Li^+	Na^+	K^+	Mg^{2+}	Ca^{2+}	Ba^{2+}	Al^{3+}	Fe^{3+}	Cu^{2+}	Ag^+	Zn^{2+}	Pb^{2+}
F^-	sol	sol	sol	sol	insol	insol	sl sol	sol	sl sol	sol	sol	sol	insol
Cl^-	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	insol	sol	sol
Br^-	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	insol	sol	sol
I^-	sol	sol	sol	sol	sol	sol	sol	sol			insol	sol	insol
OH^-	sol	sol	sol	sol	insol	sl sol	sol	insol	insol	insol		insol	insol
S^{2-}	sol	sol	sol	sol		sol			insol	insol	insol	insol	insol
SO_4^{2-}	sol	sol	sol	sol	sol	sl sol	insol	sol	sol	sol	sl sol	sol	insol
CO_3^{2-}	sol	sol	sol	sol	insol	insol	insol				insol	insol	insol
NO_3^-	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol
PO_4^{3-}	sol	sol	sol	sol	insol	insol	insol	insol	insol	insol	insol	insol	insol
CrO_4^{2-}	sol	sol	sol	sol	sol	sol	insol		insol	insol	insol	insol	insol
$CH_3CO_2^-$	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol	sol

sol — soluble
sl sol — slightly soluble
insol — insoluble
(blank) — compound does not exist

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SOLUBILITY of THINGS

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solubility of alcohol
water solubility
solubility of salts

Water solubiltiy table (chart)

		Silver	Aluminum	Arsenic	Barium	Bismuth	Calcium	Cadmium	Cobalt	Chromium (III)	Copper (I)	Copper (II)	Iron (II)	Iron (III)	Hydrogen	Lithium	Mercury (I)	Mercury (II)	Potassium	Magnesium	Manganese (II)	Sodium	Ammonium	Nickel (II)
		Ag^{+}	Al^{+3}	As^{+3}	Ba^{+2}	Bi^{+3}	Ca^{+2}	Cd^{+2}	Co^{+2}	Cr^{+3}	Cu^{+}	Cu^{+2}	Fe^{+2}	Fe^{+3}	H^{+}	Li^{+}	Hg_2^{+2}	Hg^{+2}	K^{+}	Mg^{+2}	Mn^{+2}	Na^{+}	NH_4^{+}	Ni^{+2}
Acetate	CH_3COO^{-1}	S	S	U	U	S	I	S	S	S	U	S	U	S	S	S	S	S	S	S	sS	I	S	S
Arsenate	AsO_4^{-3}	I	I	X	I	I	I	I	I	I	X	I	I	I	X	X	I	I	S	I	I	S	S	I
Arsenite	AsO_3^{-3}	I	U	X	I	U	I	U	I	U	X	I	I	I	X	X	I	I	S	I	I	S	S	I
Bromide	Br^{-1}	S	S	D	D	S	D	S	S	S	S	S	S	S	S	S	I	S	S	I	S	I	S	S
Carbonate	CO_3^{-2}	U	S	U	U	I	U	I	I	U	I	I	U	I	I	sS	I	S	I	I	I	I	I	S
Chlorate	ClO_3^{-1}	S	S	U	U	S	U	S	S	U	U	S	U	S	U	S	S	S	S	S	X	S	I	S
Chloride	Cl^{-1}	S	S	S	D	S	D	S	S	S	I	S	S	S	S	S	I	S	S	S	S	S	S	S
Ferricyanide	$Fe(CN)_6^{-3}$	I	U	X	sS	U	S	I	I	U	X	I	I	S	X	X	U	I	S	S	I	S	S	I
Ferrocyanide	$Fe(CN)_6^{-4}$	I	sS	X	sS	sS	S	U	I	U	X	I	I	I	X	X	U	I	S	S	I	S	S	I
Fluoride	F^{-1}	S	S	X	I	S	I	S	S	S	X	I	I	sS	S	S	X	X	S	I	S	S	S	I
Hydroxide	OH^{-1}	I	U	U	U	S	D	I	I	I	I	I	I	I	I	S	I	H2O	I	U	I	U	I	S
Iodide	I^{-1}	S	S	D	S	S	I	S	S	I	I	S	U	U	S	S	I	S	S	I	S	I	S	S
Nitrate	NO_3^{-1}	S	S	U	U	S	D	S	S	S	U	S	S	S	S	S	S	S	S	S	S	D	S	S
Oxalate	$C_2O_4^{-2}$	I	I	I	U	I	D	I	I	S	I	I	S	I	I	S	I	S	I	I	sS	I	I	S
Oxide	O^{-2}	I	U	I	I	S	I	I	I	I	I	I	I	I	I	S	I	H2O	I	I	I	I	I	D
Phosphate	PO_4^{-3}	I	S	U	U	I	I	I	I	I	U	I	I	I	I	sS	I	S	I	U	I	U	I	S
Silicate	$Si(OH)_6^{-2}$	I	U	U	U	S	I	I	I	U	X	I	U	U	I	X	I	I	I	U	I	U	U	S
Sulfate	SO_4^{-2}	S	S	D	U	I	D	S	I	S	D	S	S	S	S	S	I	S	S	D	S	I	S	S
Sulfide	S^{-2}	D	S	D	I	D	I	I	I	I	I	I	I	I	I	S	I	S	D	I	I	I	I	S
Sulfite	SO_3^{-2}	U	S	U	U	I	U	I	I	I	X	I	Ss	U	I	X	I	S	S	U	I	U	I	S
Thiocyanate	SCN^{-1}	I	U	X	S	U	S	sS	S	S	sS	I	S	S	X	X	I	S	S	S	S	S	S	S
Thiosulfate	$S_2O_3^{-2}$	Ss	U	X	sS	U	sS	U	U	U	X	U	S	U	X	X	U	U	S	S	U	S	S	U

‹ Ksp solubility constant for common salts

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solubility basics
solubility of alcohol
water solubility
solubility of salts

Water solubiltiy table (chart)

		Lead (II)	Lead (IV)	Antimony	Tin (II)	Tin (IV)	Strontium	Zinc
		Pb^{+2}	Pb^{+4}	Sb^{+3}	Sn^{+2}	Sn^{+4}	Sr^{+2}	Zn^{+2}
Acetate	CH_3COO^{-1}	I	D	S	U	U	S	S
Arsenate	AsO_4^{-3}	I	X	I	I	I	I	I
Arsenite	AsO_3^{-3}	I	X	I	I	U	I	I
Bromide	Br^{-1}	I	U	S	U	S/D	S	S
Carbonate	CO_3^{-2}	I	U	S	U	U	I	I
Chlorate	ClO_3^{-1}	S	U	S	U	U	S	S
Chloride	Cl^{-1}	I	U	S	S	S/D	S	S
Ferricyanide	$Fe(CN)_6^{-3}$	Ss	X	U	I	U	S	I
Ferrocyanide	$Fe(CN)_6^{-4}$	I	X	U	I	I	S	I
Fluoride	F^{-1}	I	X	S/D	S	X	I	I
Hydroxide	OH^{-1}	U	U	S	I	I	I	I
Iodide	I^{-1}	I	U	S	S	S	S	S
Nitrate	NO_3^{-1}	S	U	S	U	S	S	S
Oxalate	$C_2O_4^{-2}$	I	I	S	I	S	I	I
Oxide	O^{-2}	I	I	D	I	I	I	I
Phosphate	PO_4^{-3}	I	U	S	U	I	I	I
Silicate	$Si(OH)_6^{-2}$	U	X	S	U	U	I	I
Sulfate	SO_4^{-2}	I	U	S	S	S	I	S
Sulfide	S^{-2}	I	U	S	I	I	I	I
Sulfite	SO_3^{-2}	I	X	S	U	U	I	I
Thiocyanate	SCN^{-1}	I	X	U	U	S	S	S
Thiosulfate	$S_2O_3^{-2}$	I	X	U	U	U	S	U