

LAST NAME _____

FIRST NAME _____

PERIOD _____ DATE _____

4.2 Solubility Rules

The solubility Rules shown above represent a great number of Chemical Compounds. Fill in the chart with the Chemical Formula for the combination of the Ions at each box and designate each as I for INSOLUBLE or S for SOLUBLE.

Soluble Compounds	Exceptions (Insoluble)
<ul style="list-style-type: none"> * Compounds containing Alkali Metal Ions (Li^+, Na^+, K^+, Rb^+ & Cs^+) & the Ammonium Ion (NH_4^+) * Nitrates (NO_3^-) * Bicarbonates (HCO_3^-) * Chlorates (ClO_3^-) * Halides (Cl^-, Br^-, I^-) * Sulfates (SO_4^{2-}) * Acetates ($\text{C}_2\text{H}_3\text{O}_2^-$) 	<ul style="list-style-type: none"> * No common exceptions * No common exceptions * No common exceptions * Chlorates of Pb^{2+}, Ag^+ * Halides of Ag^+, Hg^{2+} and Pb^{2+} * Sulfates of Ag^+, Hg^{2+} and Pb^{2+} * Acetates of of Ag^+, Hg^{2+} and Pb^{2+}
INSoluble Compounds	Exceptions (Soluble)
<ul style="list-style-type: none"> * Carbonates (CO_3^{2-}) * Phosphates (PO_4^{3-}) * Chromates (CrO_4^{2-}) * Sulfides (S^{2-}) * Hydroxides (OH^-) 	<ul style="list-style-type: none"> * Compounds containing Alkali Metal Ions & the Ammonium Ion (NH_4^+) * Compounds containing Alkali Metal Ions & the Ammonium Ion (NH_4^+) * Compounds containing Alkali Metal Ions & the Ammonium Ion (NH_4^+) * Compounds containing Alkali Metal Ions & the Ammonium Ion (NH_4^+) * Compounds containing Alkali Metal Ions and the Barium Ion (Ba^{+2})

	Li^+	NH_4^+	Ag^+	Ca^{2+}	Ba^{2+}	Hg^{2+}	Pb^{2+}
Cl^-	<i>LiCl-S</i>	<i>NH₄Cl-S</i>	<i>AgCl-I</i>	<i>CaCl₂-S</i>	<i>BaCl₂-S</i>	<i>HgCl₂-S</i>	<i>PbCl₂-S</i>
Br^-	<i>LiBr-S</i>	<i>NH₄Br-S</i>	<i>AgBr-I</i>	<i>CaBr₂-S</i>	<i>BaBr₂-S</i>	<i>HgBr₂-S</i>	<i>PbBr₂-S</i>
I^-	<i>LiI-S</i>	<i>NH₄I-S</i>	<i>AgI-I</i>	<i>CaI₂-S</i>	<i>BaI₂-S</i>	<i>HgI₂-S</i>	<i>PbI₂-S</i>
OH^-	<i>LiOH-S</i>	<i>NH₄OH-S</i>	<i>AgOH-I</i>	<i>Ca(OH)₂-I</i>	<i>Ba(OH)₂-S</i>	<i>Hg(OH)₂-I</i>	<i>Pb(OH)₂-I</i>
NO_3^-	<i>LiNO₃-S</i>	<i>NH₄NO₃-S</i>	<i>AgNO₃-S</i>	<i>Ca(NO₃)₂-S</i>	<i>Ba(NO₃)₂-S</i>	<i>Hg(NO₃)₂-S</i>	<i>Pb(NO₃)₂-S</i>
HCO_3^-	<i>LiHCO₃-S</i>	<i>NH₄HCO₃-S</i>	<i>AgHCO₃-S</i>	<i>Ca(HCO₃)₂-S</i>	<i>Ba(HCO₃)₂-S</i>	<i>Hg(HCO₃)₂-S</i>	<i>Pb(HCO₃)₂-S</i>
ClO_3^-	<i>LiClO₃-S</i>	<i>NH₄ClO₃-S</i>	<i>AgClO₃-I</i>	<i>Ca(ClO₃)₂-S</i>	<i>Ba(ClO₃)₂-S</i>	<i>Hg(ClO₃)₂-S</i>	<i>Pb(ClO₃)₂-I</i>
S^{2-}	<i>Li₂S-S</i>	<i>(NH₄)₂S-S</i>	<i>Ag₂S-I</i>	<i>CaS-I</i>	<i>BaS-I</i>	<i>HgS-I</i>	<i>PbS-I</i>
SO_4^{2-}	<i>Li₂SO₄-S</i>	<i>(NH₄)₂SO₄-S</i>	<i>Ag₂SO₄-I</i>	<i>CaSO₄-S</i>	<i>BaSO₄-S</i>	<i>HgSO₄-I</i>	<i>PbSO₄-I</i>
CO_3^{2-}	<i>Li₂CO₃-S</i>	<i>(NH₄)₂CO₃-S</i>	<i>Ag₂CO₃-I</i>	<i>CaCO₃-I</i>	<i>BaCO₃-I</i>	<i>HgCO₃-I</i>	<i>PbCO₃-I</i>
CrO_4^{2-}	<i>Li₂CrO₄-S</i>	<i>(NH₄)₂CrO₄-S</i>	<i>Ag₂CrO₄-I</i>	<i>CaCrO₄-I</i>	<i>BaCrO₄-I</i>	<i>HgCrO₄-I</i>	<i>PbCrO₄-I</i>
PO_4^{3-}	<i>Li₃PO₄-S</i>	<i>(NH₄)₃PO₄-S</i>	<i>Ag₃PO₄-I</i>	<i>Ca₃(PO₄)₂-I</i>	<i>Ba₃(PO₄)₂-I</i>	<i>Hg₃(PO₄)₂-I</i>	<i>Pb₃(PO₄)₂-I</i>

Use the Solubility Rules to answer the Following Questions –

1. Classify the following as Soluble (S) or Insoluble (I)

Sodium Iodide	S	Ammonium Nitrate	S	Copper Hydroxide	I
Silver Nitrate	S	Lead Chloride	S	Aluminum Hydroxide	I

2. Which of the Anions form the most Soluble compounds? (There may be more than one answer)

* Nitrates (NO_3^-), Bicarbonates (HCO_3^-), these have no exceptions.

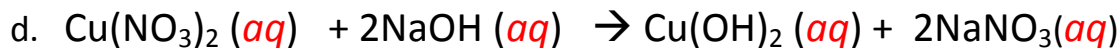
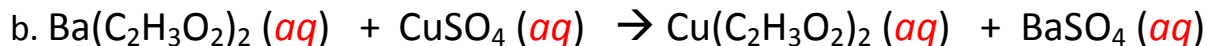
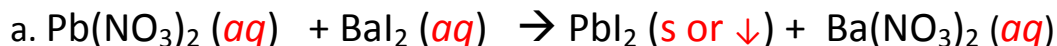
3. Which of the Cations form the most Soluble compounds? (There may be more than one answer)

* Compounds containing Alkali Metal Ions (Li^+ , Na^+ , K^+ , Rb^+ & Cs^+) these have no exceptions.

Definitions: Aqueous – Many compounds will dissolve in water, they are said to be soluble. When mixed with water the compound dissolves and it is described as AQUEOUS. An aqueous solution is signified in a reaction with the following: **(aq)**. If this designation is in a reaction it means the substance dissolves in water.

Solid – When a substance is insoluble it is signified by the following: **(s)**. The s stands for Solid. If this designation is in a reaction it means the substance does not dissolve in water. Often a down arrow will indicate that a substance has precipitated. (\downarrow)

Question 4 – Each of the reactions takes place in water. Signify whether the substances would be aqueous (aq) or solid (s).



e. (You will need to rewrite this with the chemical formulas first) Silver Nitrate and Sodium carbonate react to form silver carbonate and sodium nitrate. AgNO_3 (aq) + Na_2CO_3 (aq) \rightarrow Ag_2CO_3 (s or \downarrow) + NaNO_3 (aq)