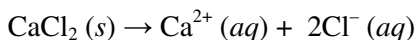


Dissolution & Precipitation

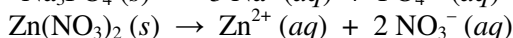
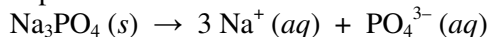
Chem Worksheet 15-2

Name _____

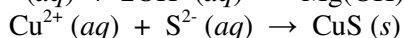
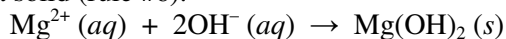
Many ionic compounds dissolve in water to form aqueous solutions. When this occurs the ionic compound dissociates into separate cations and anions. **Dissociation** describes the process by which an ionic compound is separated into its component ions. For example, when calcium chloride is mixed with water, the resulting solution contains calcium ions and chloride ions.



You can predict which ionic compounds dissolve using a list of solubility rules, such as the table found below. Using this table you can see that the compound sodium phosphate will dissolve (rule #2) and the compound zinc nitrate will dissolve (rule #1). Both of these compounds are described as soluble.



When ions in a solution combine to form a solid this reaction is known as **precipitation**. For example, if there are magnesium precipitation ions and hydroxide ions in a solution a solid forms (rule #5). A solution containing copper (II) ions and sulfide ions will also form a solid (rule #6).



Solubility Rules

Rule 1 supercedes rule 2, rule 2 supercedes rule 3, etc.

1. **Nitrate** (NO_3^{-}) salts are soluble
2. Salts containing the **alkali metal** ions (Li^{+} , Na^{+} , K^{+} , Rb^{+} , Cs^{+}) and the **ammonium** ion (NH_4^{+}) are soluble
3. Most **chloride**, **bromide**, and **iodide** salts are soluble. Notable exceptions are salts containing the ions Ag^{+} , Pb^{2+} , Hg_2^{2+}
4. Most **sulfate** salts are soluble. Notable exceptions are BaSO_4 , PbSO_4 , Hg_2SO_4 and CaSO_4 .
5. Most **hydroxide** salts are slightly soluble (insoluble). Exceptions include $\text{Ba}(\text{OH})_2$, $\text{Sr}(\text{OH})_2$, and $\text{Ca}(\text{OH})_2$.
6. Most **sulfide** (S^{2-}), **carbonate** (CO_3^{2-}), **chromate** (CrO_4^{2-}), and **phosphate** (PO_4^{3-}) salts are insoluble.

Predict which of the following are soluble (s) and which are insoluble (i). List the rule used to predict the solubility for each.

- | | | |
|--|--|---|
| 1. potassium chloride, KCl | 5. iron (II) carbonate, FeCO_3 | 9. aluminum hydroxide, $\text{Al}(\text{OH})_3$ |
| 2. cobalt hydroxide, $\text{Co}(\text{OH})_2$ | 6. lithium phosphate, Li_3PO_4 | 10. ammonium hydroxide, NH_4OH |
| 3. silver bromide, AgBr | 7. lead (II) sulfate, PbSO_4 | 11. barium hydroxide, $\text{Ba}(\text{OH})_2$ |
| 4. mercury (I) nitrate, $\text{Hg}_2(\text{NO}_3)_2$ | 8. calcium chromate, CaCrO_4 | 12. chromium (II) nitrate, $\text{Cr}(\text{NO}_3)_2$ |

Write balanced equations for the following processes.

13. The dissolution of potassium carbonate, K_2CO_3 .
14. The precipitation of silver sulfate, Ag_2SO_4 .
15. The dissolution of ammonium phosphate, $(\text{NH}_4)_3\text{PO}_4$.
16. The precipitation of lead (II) bromide, PbBr_2
17. The dissolution of strontium nitrate, $\text{Sr}(\text{NO}_3)_2$
18. The precipitation of mercury (I) iodide, Hg_2I_2 .

Label the following compounds with an (aq) for soluble compounds and an (s) for insoluble compounds.

19. $\text{NaCl} () + \text{AgNO}_3 () \rightarrow \text{AgCl} () + \text{NaNO}_3 ()$
20. $2\text{NH}_4\text{Cl} () + 2\text{Pb}(\text{NO}_3)_2 () \rightarrow 2\text{NH}_4\text{NO}_3 () + \text{PbCl}_2 ()$
21. $\text{Ca}(\text{OH})_2 () + \text{MgSO}_4 () \rightarrow \text{Mg}(\text{OH})_2 () + \text{CaSO}_4 ()$
22. $\text{K}_2\text{S} () + \text{CoI}_2 () \rightarrow \text{CoS} () + 2\text{KI} ()$
23. $\text{BaSO}_4 () + \text{Rb}_2\text{CO}_3 () \rightarrow \text{Rb}_2\text{SO}_4 () + \text{BaCO}_3 ()$
24. $\text{SrBr}_2 () + \text{Pb}(\text{NO}_3)_2 () \rightarrow \text{Sr}(\text{NO}_3)_2 () + \text{PbBr}_2 ()$