

WRITING TOTAL AND NET IONIC EQUATIONS

<http://www.csun.edu/~hcchm001/FreshChemHandouts.html>

1. Write the **overall equation** including the correct designations for the physical state of the substances (s, l, g, aq). Balance this equation. Most of these kinds of equations are double displacement reactions: $AX + BY \rightarrow AY + BX$

2. For the **total ionic equations**, write strong electrolytes in solution in the form of aqueous ions.

(a) **Strong acids.** The common strong acids and their aqueous ions are:

HI	Hydroiodic acid	$H^+(aq) + I^-(aq)$
HBr	Hydrobromic acid	$H^+(aq) + Br^-(aq)$
HCl	Hydrochloric acid	$H^+(aq) + Cl^-(aq)$
HNO ₃	Nitric acid	$H^+(aq) + NO_3^-(aq)$
HClO ₄	Perchloric acid	$H^+(aq) + ClO_4^-(aq)$
H ₂ SO ₄	Sulfuric acid	$2 H^+(aq) + SO_4^{2-}(aq)$

(b) **Strong bases.** Strong bases are the hydroxides of the alkali (Group IA) and alkaline earth (Group IIA) metals ions which are sufficiently soluble. The common strong bases and their aqueous ions are:

LiOH	Lithium hydroxide	$Li^+(aq) + OH^-(aq)$
NaOH	Sodium hydroxide	$Na^+(aq) + OH^-(aq)$
KOH	Potassium hydroxide	$K^+(aq) + OH^-(aq)$
Sr(OH) ₂	Strontium hydroxide	$Sr^{2+}(aq) + 2 OH^-(aq)$
Ba(OH) ₂	Barium hydroxide	$Ba^{2+}(aq) + 2 OH^-(aq)$

(c) **Soluble salts.** Determinations of the solubility of a salt may be made by reference to SOLUBILITIES OF IONIC COMPOUNDS. Soluble salts are written as their aqueous ions:

NaCl(aq)	Sodium chloride	$Na^+(aq) + Cl^-(aq)$
K ₂ SO ₄ (aq)	Potassium sulfate	$2 K^+(aq) + SO_4^{2-}(aq)$
Li ₂ CO ₃ (aq)	Lithium carbonate	$2 Li^+(aq) + CO_3^{2-}(aq)$
Na ₃ PO ₄ (aq)	Sodium phosphate	$3 Na^+(aq) + PO_4^{3-}(aq)$
(NH ₄) ₂ SO ₄ (aq)	Ammonium sulfate	$2 NH_4^+(aq) + SO_4^{2-}(aq)$

3. For the **total ionic equations**, write the weak electrolytes in solution as their (predominantly) **molecular form**. Weak electrolytes, or un-ionized substances, include (with examples):

(a) weak acids	(b) weak bases	(c) water
HC ₂ H ₃ O ₂ (aq)	NH ₃ (aq)	H ₂ O(l)
HCN(aq)	(NH ₄ OH written as NH ₃ (aq) + H ₂ O(l))	

4. For the **total ionic equations**, write insoluble substances as the total compound (in their molecular form). Unstable substances are written in their decomposed forms. These substances include (with examples):

(a) precipitates or insoluble reactants	(b) gases	(c) derived from unstable substances
CaCO ₃ (s)	CO ₂ (g)	If NH ₄ OH, write NH ₃ (aq) + H ₂ O(l)
Zn(OH) ₂ (s)	SO ₂ (g)	If H ₂ CO ₃ , write CO ₂ (g) + H ₂ O(l)
Mg(OH) ₂ (s)	SO ₃ (g)	If H ₂ SO ₃ , write SO ₂ (g) + H ₂ O(l)
Ca(OH) ₂ (s)	O ₂ (g), N ₂ (g)	

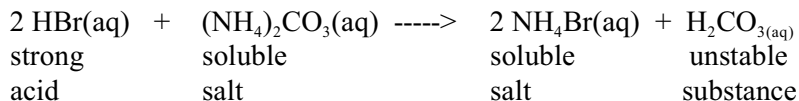
5. For the **net ionic equations**, cancel any substances or ions that appear on **both** sides of the equation.

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EXAMPLES**

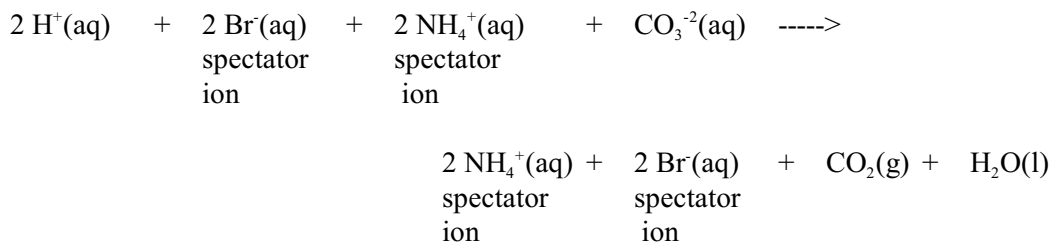
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Reaction of hydrobromic acid and ammonium carbonate in aqueous solution

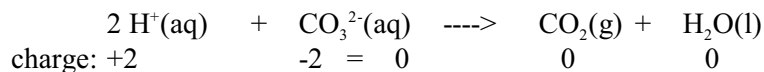
(a) Overall equation:



(b) Total ionic equation:

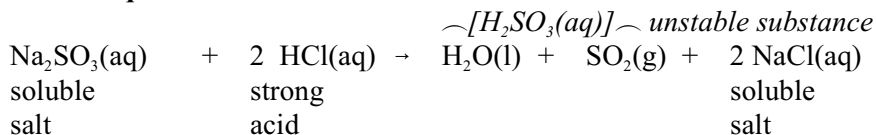


(c) Net ionic equation:

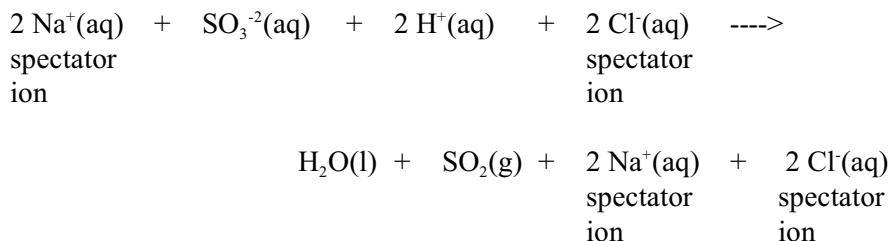


Reaction of sodium sulfite with hydrochloric acid in aqueous solution

(a) Overall equation:



(b) Total ionic equation:



(c) Net ionic equation:

