



Review: forming ions

- Ionic (i.e. salt) refers to +ve ion plus -ve ion
- Usually this is a metal + non-metal or metal + polyatomic ion (e.g. NaCl, NaClO₃, Li₂CO₃)
- Polyatomic ions are listed on page 71
- (aq) means aqueous (dissolved in water)
- For salts (aq) means the salt exists as ions
- NaCl(aq) is the same as: Na⁺(aq) + Cl⁻(aq)
- Acids form ions: HCl(aq) is H⁺(aq) + Cl⁻(aq),
Bases form ions: NaOH(aq) is Na⁺ + OH⁻

Q - how is charge determined (+1, -1, +2, etc.)?

- F, Cl electron, thus forming
- Ca electrons, thus forming

Background: valences and formulas

- Charge can also be found via the compound
- E.g. in NaNO₃(aq) if you know Na forms Na⁺, then NO₃ must be NO₃⁻ (NaNO₃ is neutral)
- By knowing the valence of one element you can often determine the other valences

Q - Write the ions that form from Al₂(SO₄)₃(aq)?

Step 1 - look at the formula: Al₂(SO₄)₃(aq)

Step 2 - determine valences: Al³⁺(SO₄)₂⁻

(Al is 3+ according to the periodic table)

Step 3 - write ions: 2Al³⁺(aq) + 3SO₄²⁻(aq)

- Note that there are 2 aluminums because Al has a subscript of 2 in the original formula

Practice with writing ions

Q - Write ions for Na₂CO₃(aq)

- Notice that when ions form from molecules, charge can be separated, but the total charge (and number of each atom) stays constant.

Q - Write ions for Ca₃(PO₄)₂(aq) & Cd(NO₃)₂(aq)

Q - Write ions for Na₂S(aq) and Mg₃(BO₃)₂(aq)

Types of chemical equations

Equations can be divided into 3 types (pg. 333)

1) Molecular, 2) Ionic, 3) Net ionic

- Here is a typical molecular equation:
Cd(NO₃)₂(aq) + Na₂S(aq) → CdS(s) + 2NaNO₃(aq)
- We can write this as an ionic equation (all compounds that are (aq) are written as ions):
Cd²⁺(aq) + 2NO₃⁻(aq) + 2Na⁺(aq) + S²⁻(aq)
→ CdS(s) + 2Na⁺(aq) + 2NO₃⁻(aq)
- To get the NET ionic equation we cancel out all terms that appear on both sides:
Net: Cd²⁺(aq) + S²⁻(aq) → CdS(s)

Equations must be balanced

- There are two conditions for molecular, ionic, and net ionic equations

Materials balance
Both sides of an equation should have the same number of each type of atom

Electrical balance
Both sides of a reaction should have the same net charge

Q- When NaOH(aq) and MgCl₂(aq) are mixed, _____(s) and NaCl(aq) are produced. Write balanced molecular, ionic & net ionic equations

First write the skeleton equation
2 NaOH(aq) + MgCl₂(aq)
→ Mg(OH)₂(s) + 2 NaCl(aq)

Next, balance the equation
Ionic equation:
~~2Na⁺(aq) + 2OH⁻(aq) + Mg²⁺(aq) + 2Cl⁻(aq)~~
→ Mg(OH)₂(s) + ~~2Na⁺(aq) + 2Cl⁻(aq)~~

Net ionic equation:
2OH⁻(aq) + Mg²⁺(aq) → Mg(OH)₂(s)

Write balanced ionic and net ionic equations:
CuSO₄(aq) + BaCl₂(aq) → CuCl₂(aq) + BaSO₄(s)
Fe(NO₃)₃(aq) + LiOH(aq) → _____(aq) + Fe(OH)₃(s)
Na₃PO₄(aq) + CaCl₂(aq) → _____(s) + NaCl(aq)
Na₂S(aq) + AgC₂H₃O₂(aq) → _____(aq) + Ag₂S(s)

Solubility

- Precipitation refers to the formation of a solid from ions. A precipitate is "insoluble"
- Soluble and insoluble are general terms to describe how much of a solid dissolves.
- Solubility can be predicted from rules (pg.399)
- These are general rules, based on observation
- To determine solubility, follow the rules in order
- Note: in rule 4 that sulfate = SO₄²⁻
- You will not have to memorize these rules, you will have to use the rules to predict solubility
- Read over example 11.2 (pg. 400)
- Do 11.26 (435) (list the relevant rule for each)
- Do PE 5 (pg. 400) and 11.28 (pg. 435)