GENERAL CHEMISTRY STANDARD 6.2

6.2: Use the rules for assigning oxidation numbers to determine the formula for an ionic compound from its chemical name

Types of Chemical Formulas

- A ***molecular formula*** shows the exact number of each element in the smallest unit of a substance.
- An ***empirical formula*** shows the simplest whole-number ratio of atoms in a substance

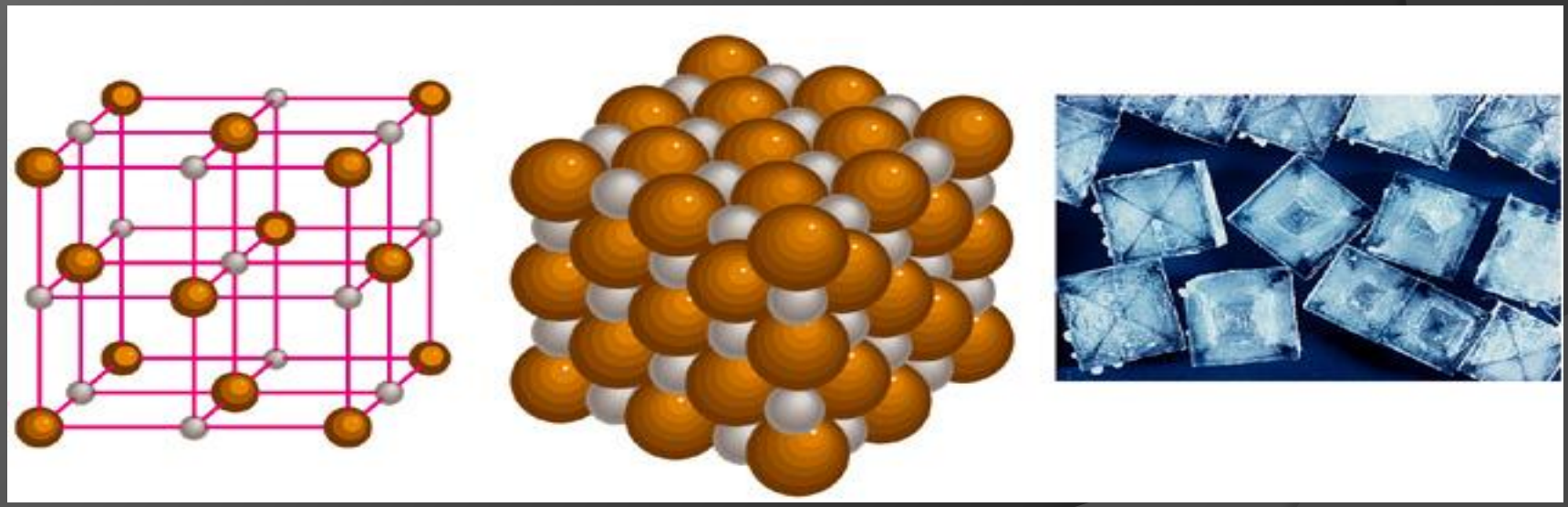
molecular	empirical
H_2O	H_2O
$C_6H_{12}O_6$	CH_2O
O_3	O
N_2H_4	NH_2

6.2: Use the rules for assigning oxidation numbers to determine the formula for an ionic compound from its chemical name

ionic compounds consist of a combination of cation(s) and an anion(s)

- The formula is always the same as the empirical formula
- The sum of the charges on the cation(s) and anion(s) in each formula unit must equal zero

The ionic compound NaCl



Writing Ionic Formulas

- All ionic compounds must be ***neutral***
  - That is, the total oxidation number of the compound must always be zero
- If the cation and anion have exactly the opposite charges (+1 vs -1, +2 vs -2, etc.):
  - The formula of the compound contains one of each ion
  - $Na^{+} + Cl^{-} \rightarrow NaCl$
  - $Ca^{2+} + S^{2-} \rightarrow CaS$
  - $Al^{3+} + N^{3-} \rightarrow AlN$
  - $Fe^{3+} + PO_4^{3-} \rightarrow FePO_4$

Writing Ionic Formulas

- If two monatomic ions have difference charges:
  - Use the ***criss-cross rule*** to get the formula of the compound
  - ***Criss-cross rule:*** Superscript (charge) for the cation becomes subscript (number) for anion while the superscript (charge) for the anion becomes the subscript (number) for cation
  - Don't forget to simplify subscripts to get the lowest ratio of atoms
  - Only the numbers cross down, not the signs of the charge!
  - There will NEVER be any charges in an ionic or covalent (molecular) formula, only ions!
    - $Na^{+} + S^{2-} \rightarrow Na_2S$
    - $Ba^{2+} + N^{3-} \rightarrow Ba_3N_2$
    - $Ti^{4+} + O^{2-} \rightarrow TiO_2$

Writing Ionic Formulas

- If at least one of the ions is a polyatomic ion:
  - Use the ***criss-cross rule*** to get the formula of the compound
  - If more than one of the polyatomic ion is in the formula, use paranthesis
  - Again, simplify subscripts and only the numbers cross down, not the signs of the charge!
    - $NH_4^+ + S^{2-} \rightarrow (NH_4)_2S$
    - $Ca^{2+} + NO_3^- \rightarrow Ca(NO_3)_2$
    - $Pb^{4+} + CO_3^{2-} \rightarrow Pb(CO_3)_2$