

Chapter 7

Part 1 Slides

Warm Up!



Radium was formerly used in self-luminous paints for watches, nuclear panels, aircraft switches, clocks, and instrument dials. This practice stopped because radium is treated the same as Ca in the body, and is deposited in bones where radioactivity degrades marrow and can mutate bone cells.

- Write the electron configuration for radium.
- What period and group is radium in?
- What ion will it form?
- Why does Ra react the same as Ca in the body?

Today's Agenda

- QOTD: How can we predict ions based on electron configurations and the periodic table?
- Review for Quiz!
- Define valence electrons and chemical bond.
- Predict the formation of ions.
- Relate ion formation to electron configuration

Chapter 6 Questions

- If **A is an ion** and **B is an atom**   of the same element is the ion positive or negative?
- If **A and B** are atomic radii of **two elements** in the same **period**, what is their order?
- If **A and B** are atomic radii of **two elements** in the same **group**, what is their order?

Chapter 6 Review

- What is the octet rule? Why do H and He break the octet rule?
- Of Mg, Ca and Ba, which forms an ion with the largest atomic radius? Why?
 - Is the Mg atom smaller or larger than the ion?
- How many valence electrons do elements in group 1 have? Group 18? Why?!

Warm Up!

Think about table salt, NaCl

- What ions do these elements like to form?
- Why do they work so well as a compound?

- Think of two possible rules for forming an ionic compound, like NaCl.

- Would Ca and F form an ionic compound?

Today's Agenda

- QOTD: What is an ionic compound and how do we name these compounds?
- Ch 6 Quiz!
- Ions and forming ionic compounds
- Naming Binary Ionic Compounds

Ion Formation (Ch 7)

- Where are the valence electrons?
- Why are we so interested in how many valence electrons an element has?
- A chemical bond is the force that holds two atoms together.

Bonds!

- Two types
- Covalent – forms because of the attraction between the positive nucleus of one atom and the negative electron cloud of another.
- Ionic – forms because of the positive ions of one element and negative ions of another.

Warm Up!

- What do we call the attraction between atoms that results in compounds?

- What are the ions formed by

Na Cl O Mg Cs Br

Make 3 compounds with the above ions. (Follow the criteria we discussed yesterday!)

Today's Agenda

- QOTD: How do ionic compounds form and how do we name them?
- Predict ions
- Forming and naming ionic compounds
- Naming and formula writing practice

NGC helps us Predict ion

- Elements react to complete their octet
...(what is the octet? **Stable arrangement of 8 valence electrons**)
- Elements react to attain the ideal NGC
- What ion does Na form?

$1s^2 2s^2 2p^6 3s^1$ **Na is a metal – metals are LOSERS**

If Na lost the $3s^1$ electron - 8 valence electrons! NGC!
Looks like Ne $1s^2 2s^2 2p^6$

Ions by Group

| Group | Ion | Example |
|-------|-------|-------------------------------------|
| 1 | +1 | Na ⁺¹ , Li ⁺¹ |
| 2 | +2 | Mg ⁺² , Ca ⁺¹ |
| 13 | +3 | B ⁺³ , Al ⁺³ |
| 14 | +4/-4 | C ⁺⁴ , C ⁻⁴ |
| 15 | -3 | N ⁻³ , P ⁻³ |
| 16 | -2 | O ⁻² , S ⁻² |
| 17 | -1 | Cl ⁻¹ , F ⁻¹ |

Ions by Electron Configuration

- Na [Ne]~~3s~~¹ Lose 1 Na⁺¹ [Ne]
- Mg [Ne]~~3s~~² Lose 2 Mg⁺² [Ne]
- Al [Ne]~~3s~~²~~3p~~¹ Lose 3 Al⁺³ [Ne]
- Si [Ne]~~3s~~¹~~3p~~² Lose/Gain 4 Si^{+4/-4} [Ne], [Ar]
- P [Ne]3s¹3p³ Gain 3 P⁻³ [Ne]3s²3p⁶
- S [Ne]3s¹3p⁴ Gain 2 S²⁻ [Ne]3s²3p⁶
- Cl [Ne]3s¹3p⁵ Gain 1 Cl⁻¹ [Ne]3s²3p⁶

Naming and Formula Writing

- Binary Ionic Compounds

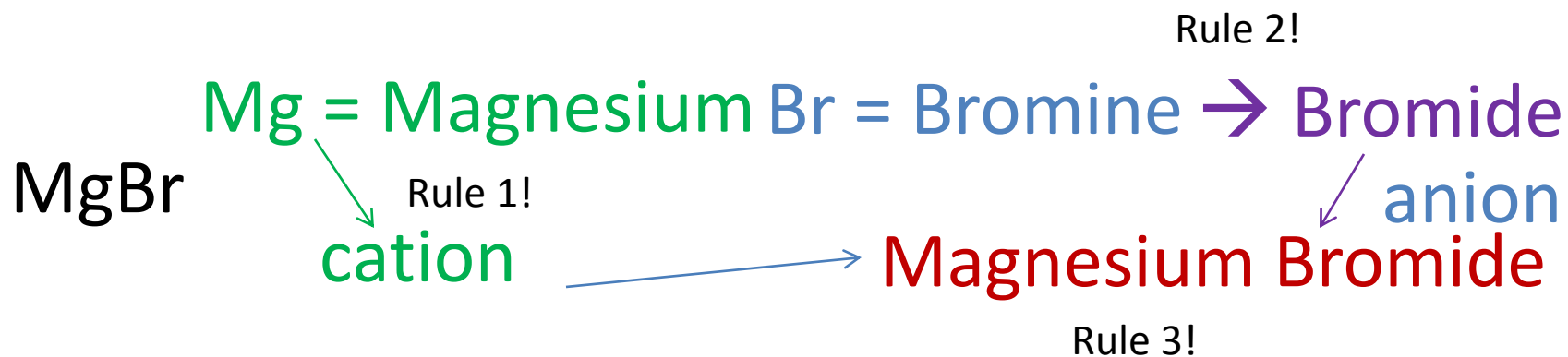
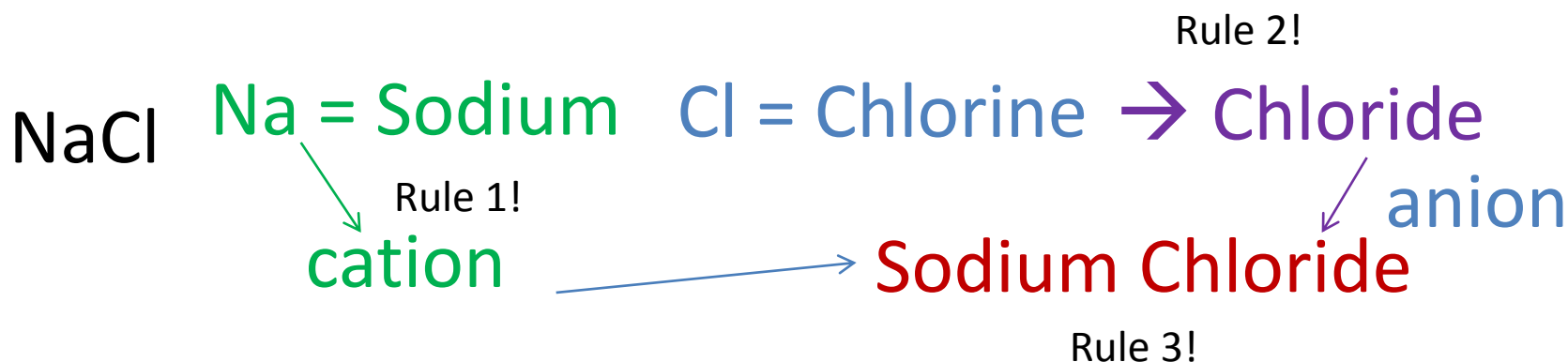
Two ions of opposite charge

- Metals LOSE and become cations
- Nonmetals GAIN and become anions

- Both want to have NGC!

Naming Rules

1. Metal (cation) keeps its name
2. Non-metal (anion) changes its ending to -ide
3. Name is cation first followed by anion!



Formula Writing Rules

1. Identify the cation symbol and charge.
2. Identify the anion symbol and charge.
3. Balance the cation and anion charge so resultant formula is ZERO.

Aluminum Fluoride

Rule 1!
↓
cation



Rule 2!
→

anion



Rule 3!
→



Potassium Oxide

Rule 1!
↓
cation



Rule 2!
→

anion



Rule 3!
→



Try These!

Write the formulas for these:

1. Sodium Iodide:
2. Calcium Fluoride:
3. Potassium Sulfide:

Write the charges of ions and names of compounds:

1. NaF
2. SrBr₂
3. Cs₂O

Warm Up!!

- Write Formulas for:
- Rubidium Phosphide
- Barium Fluoride
- Indium Oxide

- Write names for :
- BaS
- Al_2O_3
- Na_2Te

Agenda for Today

- Question of the Day: How do we name and write formulas for multi atom ions (a.k.a. polyatomics)?
- Review Binary Ionic formulas and naming
- Recognizing polyatomic ions
- Practice writing formulas and naming polyatomic ion containing compounds.

Balancing!

- What about a formula for aluminum selenide?

| Ion | Common Multiple | Charge | Needed for Neutrality | Final Charges |
|------------------|-----------------|--------|-----------------------|---------------|
| Al^{3+} | 6 | +3 | 2 | +6 |
| Se^{2-} | 6 | -2 | 3 | -6 |

- Magnesium phosphide?

| Ion | Common Multiple | Charge | Needed for Neutrality | Final Charges |
|------------------|-----------------|--------|-----------------------|---------------|
| Mg^{2+} | 6 | +2 | 3 | +6 |
| P^{3-} | 6 | -3 | 2 | -6 |

Names and Formulas for Compounds of Polyatomic Ions

- What's a polyatomic ion?

Poly – many Atomic – atoms Ion – charged species

You will have to make a 3x5 polyatomic ion card.

This card will be TURNED IN TO ME next
Wednesday, 12/14.

Late cards NOT accepted, lost cards may NOT be
replaced.

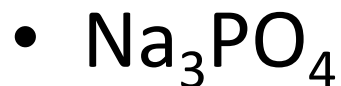
You can use this card for the rest of the year on
tests/quizzes

Naming Compounds of Polyatomic Ions

- Treat all representative element metals and non-metals the same as before.
- Metals loses all valence e⁻'s, forms cation
- Non-metal gains enough electrons to fill their valence shell, form anion

- Polyatomic ions
- Made from more than one atom.
- Most are anions (except ammonium)
- Names are cation first then anion

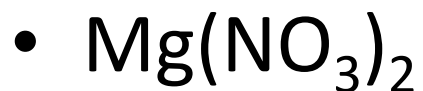
Naming Practice



ID cation – Sodium

ID anion – (polyatomic) – Phosphate

Sodium Phosphate



ID cation – Magnesium

ID anion – (polyatomic) - Nitrate

Magnesium Nitrate

Polyatomic Ion Formula Writing Rules

1. ID the cation symbol and charge
2. ID the anion symbol and charge
3. Balance the cation and anion charge so the resultant formula is neutral.
4. If more than one of the polyatomic ion is required to balance charges, parenthesis are required.

Formula Writing Practice

- Aluminum Phosphate

ID cation – Al^{+3}

ID anion – (polyatomic) PO_4^{-3}

Balance ions to be neutral



- Strontium Bromate

ID cation – Sr^{2+}

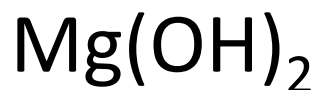
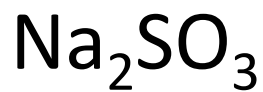
ID anion – (polyatomic) BrO_3^-

Balance ions to be neutral



Polyatomic Naming and Formula Writing Practice

Name these:



List ions and write formulas for:

Potassium Chromate

Sodium Hydroxide

Calcium Sulfate

Challenge!!

- Break up into groups of 4.
- Rules:
 - You have 5 minutes to come up with (4) naming and (4) formula writing questions and their solutions. Each student makes up 1 of each!
 - Your goal: Stump your classmates!
 - After 5 minutes swap questions with other groups, see who can stump the class!

Warm Up!

- Identify the formulas for:
- Sodium sulfate
- Magnesium nitrate
- Ammonium Iodide
- Name These!

CsClO

LiOH

$(\text{NH}_4)_3\text{P}$

Today's Agenda

- How do we name and write formulas for transition metals and acids?
- Return and go over quiz
- Review work from Friday
- Work on Transition Metals and acid naming

Mixed Review!

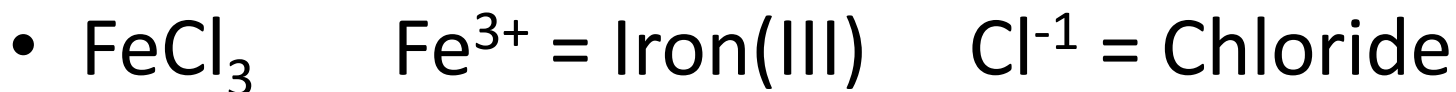
- Write formulas:
- Sodium oxide –
- Lithium chromate –
- Cesium selenide –
- Magnesium phosphate –
- Name these:
- NH_4Cl –
- $\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2$ –
- Ba_3P_2 –
- CaCO_3 –

Transition Metal Ion Containing Compounds

- Treat all **representative** element metals, **non-metals** and **polyatomic** ions as before.
- Naming Rules!
 1. There is **more than one** possible charge!
 2. The charge is denoted in **roman numerals** after the name of the metal.
 3. See **periodic table** for common ionic charges!
 4. If periodic table lists only **1** charge, treat it as **representative** element metal.

Transition Metals can be Tricky!

- Examples:



We call this Iron(III) chloride

- Iron can also exist as a +2 ion!



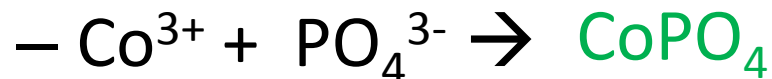
We call this Iron(II) chloride

- Note that we treat the anion the same as before – **change its name** and list it **second!**

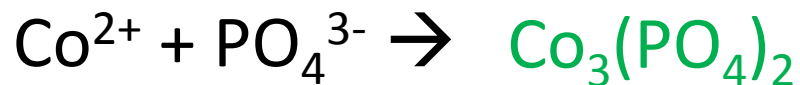
Transition Metal Formula Writing Rules

- There is **more than one possible charge** for most transition metal cations.
- The charge is denoted in **roman numerals** after the name of the metal.

- Cobalt(III) Phosphate



- Cobalt(II)Phosphate



Try These!!

- Name the following:
- AgCl
- $\text{Pb}(\text{NO}_3)_2$
- FeSO_4
- $\text{Fe}_2(\text{SO}_4)_3$
- Write the formulas for
- Tin(IV) bromide
- Nickel(II) nitrate
- Cobalt (III) oxide
- Manganese (II) perchlorate