



### Cycle 4 Chemistry I Lesson 4

#### **WARMUP:** Manganese oxide scenario

You own a factory that produces alkaline batteries. One of the ingredients in your batteries is manganese oxide,  $\text{MnO}_2$ , a black powder. However, once when you ordered 'manganese oxide', the chemical supplier sent you a green crystalline substance that did not work in the batteries. Once they even sent you a red, explosive liquid! They insisted these were also 'manganese oxide'. Please explain this. HINT: Mn has +2, +3, +4, +7 states listed on your P.T.



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### Cycle 4 Chemistry I Lesson 4

**WARMUP:** Manganese oxide scenario

There are 4 oxides of Manganese:

MnO	“Manganese (II) Oxide”
Mn <sub>2</sub> O <sub>3</sub>	“Manganese (III) Oxide”
MnO <sub>2</sub>	“Manganese (IV) Oxide”
Mn <sub>2</sub> O <sub>7</sub>	“Manganese (VII) Oxide”

Your battery factory can only use Manganese (IV) Oxide.



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### Cycle 4 Chemistry I Lesson 4

**WARMUP:** Manganese oxide scenario

**CLASSWORK:**

Formula Writing Worksheet 4A – writing formulas for transition metal compounds.

(HONORS ONLY) Formula Writing Worksheet 4B – naming transition metal compounds



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### Cycle 4 Chemistry I Lesson 4

**AGENDA:** Get out homework for points (Name to Formula)

**CLASSWORK:**

Formula Writing Worksheet 4A – writing formulas for transition metal compounds.

(HONORS ONLY) Formula Writing Worksheet 4B – naming transition metal compounds



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# Chapter 5

## Writing Names and Formulas of Compounds Containing Transition Metals



How many different ionic compounds exist that consist of only iron and chlorine?



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# Chapter 5

## Writing Names and Formulas of Compounds Containing Transition Metals



How many different ionic compounds exist that consist of only iron and chlorine?

Answer: 2



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### Naming Ionic Compounds Rules for Naming Simple Ions

- When an element forms two or more ions, the ion names include roman numerals to indicate charge.
  - For example, the names of the two copper ions are:

$\text{Cu}^+$  copper(I) ion

$\text{Cu}^{2+}$  copper(II) ion

- There are two chlorides of copper, one for each ion
  - $\text{CuCl}$  - copper (I) chloride - a white, colorless solid
  - $\text{CuCl}_2$  - copper (II) chloride - a blue/green solid.
- Beware! (I) and (II) do NOT refer to the number of chlorides. They refer to the CHARGE on the copper cation!



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# Chapter 5

## Writing Names and Formulas of Compounds Containing Transition Metals



### Some Stable Ions Formed by the Transition Elements and Other Metals (from book)

Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14
<b>Ti<sup>2+</sup></b> <b>Ti<sup>3+</sup></b>	<b>V<sup>2+</sup></b> <b>V<sup>3+</sup></b>	<b>Cr<sup>2+</sup></b> <b>Cr<sup>3+</sup></b>	<b>Mn<sup>2+</sup></b> <b>Mn<sup>3+</sup></b>	<b>Fe<sup>2+</sup></b> <b>Fe<sup>3+</sup></b>	<b>Co<sup>2+</sup></b> <b>Co<sup>3+</sup></b>	<b>Ni<sup>2+</sup></b>	<b>Cu<sup>+</sup></b> <b>Cu<sup>2+</sup></b>	<b>Zn<sup>2+</sup></b>	<b>Ga<sup>2+</sup></b> <b>Ga<sup>3+</sup></b>	<b>Ge<sup>2+</sup></b>
		<b>Mo<sup>3+</sup></b>	<b>Tc<sup>2+</sup></b>			<b>Pd<sup>2+</sup></b>	<b>Ag<sup>+</sup></b> <b>Ag<sup>2+</sup></b>	<b>Cd<sup>2+</sup></b>	<b>In<sup>+</sup></b> <b>In<sup>2+</sup></b> <b>In<sup>3+</sup></b>	<b>Sn<sup>2+</sup></b>
<b>Hf<sup>4+</sup></b>			<b>Re<sup>4+</sup></b> <b>Re<sup>5+</sup></b>			<b>Pt<sup>2+</sup></b> <b>Pt<sup>4+</sup></b>	<b>Au<sup>+</sup></b> <b>Au<sup>3+</sup></b>	<b>Hg<sub>2</sub><sup>2+</sup></b> <b>Hg<sup>2+</sup></b>	<b>Tl<sup>+</sup></b> <b>Tl<sup>3+</sup></b>	<b>Pb<sup>2+</sup></b>



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**EXAMPLE:** Write a formula for technetium (VII) oxide

- The technetium cation must be  $\text{Tc}^{+7}$
- Oxygen forms one anion –  $\text{O}^{-2}$
- Balance charges! Least common multiple of 7 and 2 is 14. 14 positive charges require 2  $\text{Tc}^{+7}$  ions. 14 negative charges require 7  $\text{O}^{-2}$  ions.
- Formula is therefore  $\text{Tc}_2\text{O}_7$





### Honors Chemistry I 12/16/2014

**EXAMPLE:** Name the compound with formula  $\text{Cu}_2\text{CO}_3$

- We recognize  $\text{CO}_3^{-2}$  as the 'carbonate' anion
- To balance the charge, the 2 copper cations share a charge of +2
- Therefore each individual copper cation has a charge of +1 – they are  $\text{Cu}^+$
- The compound's name is copper (I) carbonate





### Honors Chemistry I 12/16/2014

**HONORS TOPIC:** -ic and -ous suffixes

There is an older scheme for naming metal cations with suffixes. For metals with 2 common charge states, the lower state is suffixed with an -ous and the higher state suffixed with an -ic

Example: Ferric chloride is  $\text{FeCl}_3$ . Ferrous chloride is  $\text{FeCl}_2$ .

Discussion – examine labels on chemical bottles.

Although this naming scheme is officially obsolete, it is still used in industry.



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