Ionic Bonding: Jigsaw Puzzle

Worksheet

Name: _____ **Class:** _____ **Date:** _____

Part A — Deriving Rules

What are some things we should keep in mind when writing names and formulae of ionic compounds? Try the guided activity and suggest some rules!

The first one has been done for you.

#	Rule	Correct Example	Wrong Example
1	An ionic compound must have both positive and negative ions.	Na^+ and Cl^-	Na^+ and Na^+ Cl^- and Cl^-
2			
3			
4			
5			

Part B — Guided Practice

For each pair of ions below, work out the simplest ratio needed so that total positive charge equals total negative charge, then write the resulting formula.

#	Cation	Anion	Simplest Ratio (cation : anion)	Formula
1	Na^+ (charge 1+)	Cl^- (charge 1–)		
2	Mg^{2+} (charge 2+)	Cl^- (charge 1–)		
3	Al^{3+} (charge 3+)	Cl^- (charge 1–)		
4	Na^+ (charge 1+)	O^{2-} (charge 2–)		
5	Mg^{2+} (charge 2+)	O^{2-} (charge 2–)		
6	Al^{3+} (charge 3+)	N^{3-} (charge 3–)		
7	Mg^{2+} (charge 2+)	N^{3-} (charge 3–)		
8	Al^{3+} (charge 3+)	O^{2-} (charge 2–)		

Part C — Build Your Own

Choose any cation and any anion from the table below. Work out the simplest ratio and write the formula. Try to find four different compounds.

Cations	Na^+	K^+	Li^+	Mg^{2+}	Ca^{2+}	Al^{3+}
Anions	Cl^-	F^-	Br^-	O^{2-}	S^{2-}	N^{3-}

#	Cation Chosen	Anion Chosen	Ratio Used	Formula
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Part D — Naming and Formulas

Answer each question using what you know about ionic compound naming and charge balancing.

#	Given	Your Answer
1	Formula: $CaCl_2$ — write its name	
2	Formula: Al_2O_3 — write its name	
3	Formula: MgO — write its name	
4	Al^{3+} and sulfate (SO_4^{2-}) — write the formula for aluminium sulfate	
5	K^+ and F^- — write the formula and name for potassium fluoride	

Part E — Check Your Understanding

Circle the letter of the correct answer for each question.

1. Which pair of elements is most likely to form an ionic bond?

A. Carbon and hydrogen B. Sodium and chlorine
C. Oxygen and oxygen D. Nitrogen and hydrogen

2. How many Cl^- ions bond to one Al^{3+} ion?

A. 1 B. 2 C. 3 D. 4

3. What is the correct name for $CaCl_2$?

A. Calcium dichloride B. Calcium chloride C. Dicalcium chloride D. Calcium(II) chloride

4. What is the correct name for Al_2O_3?

A. Aluminium(III) oxide B. Aluminium oxide C. Aluminium trioxide D. Alum trioxide

5. Aluminium forms Al^{3+} and sulfate forms SO_4^{2-}. What is the correct formula for aluminium sulfate?

A. $AlSO_4$ B. $Al_2(SO_4)_3$ C. $Al_3(SO_4)_2$ D. $Al(SO_4)_3$

Answer Key

Part A

1. The cation must be written before the anion.
2. The total number of positive charges = the total number of negative charges.
3. Positive ions are typically the name of the metals.
4. Negative ions typically end with -ide.
5. The number of ions are written as subscripts (not superscripts/ not in front of the symbols).

Part B

1. $Na^{+} + Cl^{-} \rightarrow NaCl$
2. $Mg^{2+} + Cl^{-} \rightarrow MgCl2$
3. $Al^{3+} + Cl^{-} \rightarrow AlCl3$
4. $Na^{+} + O^{2-} \rightarrow Na2O$
5. $Mg^{2+} + O^{2-} \rightarrow MgO$
6. $Al^{3+} + N^{3-} \rightarrow AlN$
7. $Mg^{2+} + N^{3-} \rightarrow Mg3N2$
8. $Al^{3+} + O^{2-} \rightarrow Al2O3$

Part C

Answers will vary — check that each pair of ions balances in charge and is written in its simplest ratio.

Part D

1. Calcium chloride
2. Aluminium oxide
3. Magnesium oxide
4. $Al_2(SO_4)_3$
5. KF — potassium fluoride

Part E

1. B
2. C
3. B
4. B
5. B