

Ionic Compound Ratios

Time: 1 -2 class periods



Lesson Description

In this lesson, students will use Collisions to explore the formation of ionic compounds and compound ratios.

Key Essential Questions

1. What makes up an ionic compound?
2. Are ionic compounds found in common ratios?

Learning Outcomes

Students will be able to determine the ionic compound ratio of an ionic compound.

Prior Student Knowledge Expected

Cations are positively charged ions and anions are negatively charged ions.

Lesson Materials

- Individual student access to Collisions on tablet, Chromebook, or computer.
- Projector / display of teacher screen
- Accompanying student resources (attached)

Standards Alignment

| NGSS Alignment | | |
|--|---|--|
| Science & Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| <ul style="list-style-type: none"> • Developing and using models • Constructing explanations and designing solutions | <ul style="list-style-type: none"> • HS-PS-12. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. | <ul style="list-style-type: none"> • Structure and Function |

PART 1: Explore (15 minutes)

Summary

This is an inquiry-driven activity where students will complete the first few levels of the Collisions Ionic Bonding game to become introduced to the concept of ionic bonding and compound ratios.

Activity

1. Direct students to log into Collisions with their individual username and password.
2. Students should enter the Ionic Bonding game and play Levels 1-6 levels.
3. Have your students answer the following questions during gameplay:
 1. What combination of ions did you use to successfully match a target?
 2. How many 'types' of ions are in each compound (target) that you created?
 3. What is different about the 3 compounds that you created in Level 3?
 4. In your own words, what does the target 2:1 mean in Level 5?
 5. In Level 6, how is the 2:1 compound different from 1:2 compound?

PART 2: Explain (15 minutes)

Incorporate the following information into your instruction:

Explain to students that ionic compounds:

- Always contain **1 type of cation and 1 type of anion**
- Have an **overall neutral charge**
- Are found in **common cation to anion ratios**

Using the table below, discuss the common compound ratios with your students and, together as a class, build an example of each in the Collisions Sandbox. Then, have your students record the formula and name for each. **A student version of the table below in on Page 4.**

| Cation to Anion Ratio | Cation | Anion | Compound Formula | Compound Name |
|-----------------------|------------------|-----------------|--------------------------------|--------------------|
| 1:1 | Li ⁺ | F ⁻ | LiF | lithium fluoride |
| | Mg ²⁺ | O ²⁻ | MgO | magnesium oxide |
| | Al ³⁺ | N ³⁻ | AlN | aluminum nitride |
| 2:1 | Li ⁺ | O ²⁻ | Li ₂ O | lithium oxide |
| 1:2 | Mg ²⁺ | F ⁻ | MgF ₂ | magnesium fluoride |
| 3:1 | Li ⁺ | N ³⁻ | Li ₃ N | lithium nitride |
| 1:3 | Al ³⁺ | F ⁻ | AlF ₃ | aluminum fluoride |
| 2:3 | Al ³⁺ | O ²⁻ | Al ₂ O ₃ | aluminum oxide |
| 3:2 | Mg ²⁺ | N ³⁻ | Mg ₂ N ₃ | magnesium nitride |

PART 3: Extend (30 minutes)

Summary

To continue practicing & reviewing ionic compounds and compound ratios, your students can play the **Ionic Compound Challenge Card Game**.

Activity

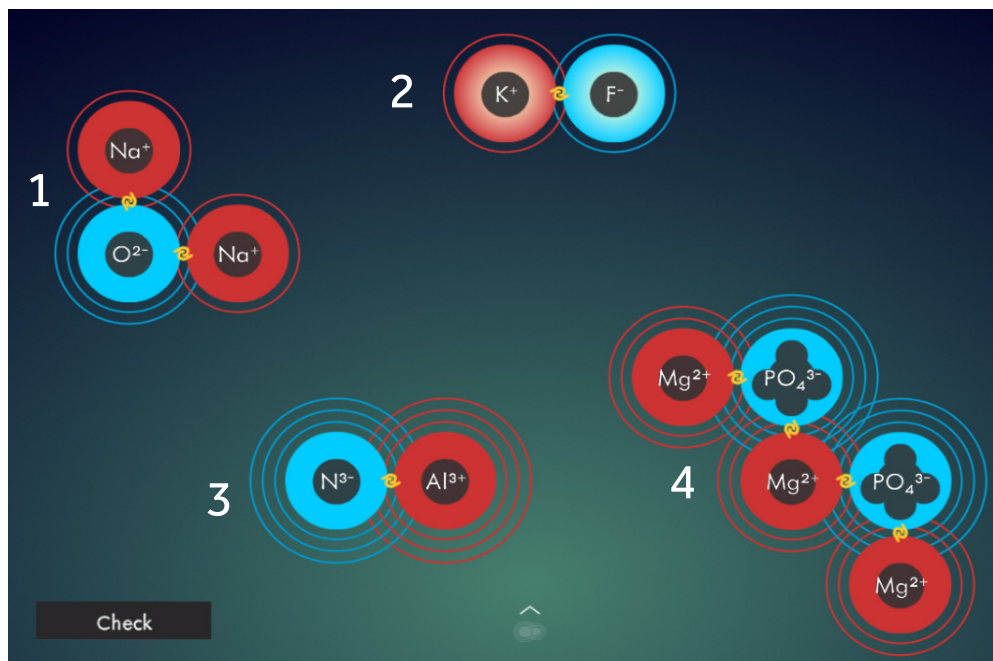
1. Divide your class into groups of 3-4 students and navigate them to the Ionic Bonding Sandbox.
2. Provide each group with a set of **Ionic Compound Challenge Cards** (*printable cards are on page 4-5*).
3. When ready, have each group turn over the top card ONLY and set a timer for 2 minutes*.
4. Each student will have 2 minutes to create as many compounds as possible that satisfy the requirement on the card. These compounds MUST be checked in the Ionic Bonding Sandbox.
5. When time is up, students should share with their group how many correctly created compounds they have. The team member with the most correctly created compounds wins this round.
6. Prompt your students to reset their Sandbox by hitting Reset Level in the top left menu bar.
7. Repeat steps 3 - 6 and continue until time has run out or there are no more cards left.

*As an alternative to you timing students, you could have students within each group rotate each round as the timer/checker.

PART 4: Evaluate (5 minutes)

Project the below image and have students answer the following question on a separate sheet of paper (or create your own compounds in the Ionic Bonding Sandbox).

Determine the cation-to-anion ratio for each compound (1-4) in the image to the right.



Compound Ratios Notes



| Cation to Anion Ratio | Cation | Anion | Compound Formula | Compound Name |
|-----------------------|--------|-------|------------------|---------------|
| 1:1 | | | | |
| | | | | |
| | | | | |
| 1:2 | | | | |
| 2:1 | | | | |
| 1:3 | | | | |
| 3:1 | | | | |
| 2:3 | | | | |
| 3:2 | | | | |

| | | |
|--------------------------|--------------------------|--------------------------|
| 1:1 collisions | 2:1 collisions | 1:2 collisions |
| 1:3 collisions | 2:3 collisions | 3:2 collisions |

| | | |
|---|--|--|
| <p>3:1</p> <p>collisions</p> | <p>Includes Na⁺</p> <p>collisions</p> | <p>Includes O²⁻</p> <p>collisions</p> |
| <p>Includes Br⁻</p> <p>collisions</p> | <p>Includes Al³⁺</p> <p>collisions</p> | <p>Includes a polyatomic ion</p> <p>collisions</p> |