

A graphic showing two overlapping spheres (one light gray, one dark gray) with a black starburst effect behind them, positioned above the word 'collisions'.

# collisions™

IONIC BONDING

# Ionic Bonding Snapshot

## Challenges

The Challenge levels increase in rigor and complexity.

- 6 Levels

## Integrated Chemistry Concepts

- Cations and anions attract
- Ionic compounds contain 1 type of cation and 1 type of anion
- Ionic compounds have an overall neutral charge
- Ionic compounds are found in common ratios

## Sandbox\*

The Sandbox space is an exploratory learning space.

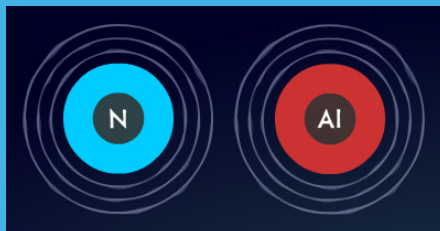
- 3 Skills
- 10 Achievements

\* Available in full version

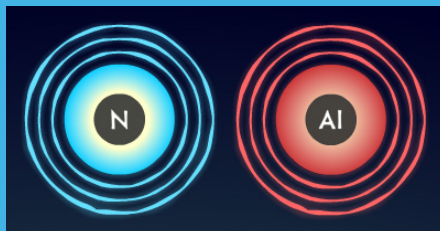
## General Information

### 'Bond mode' ion

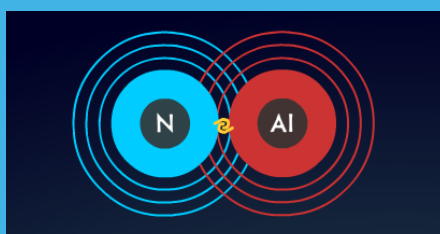
Inactive ions



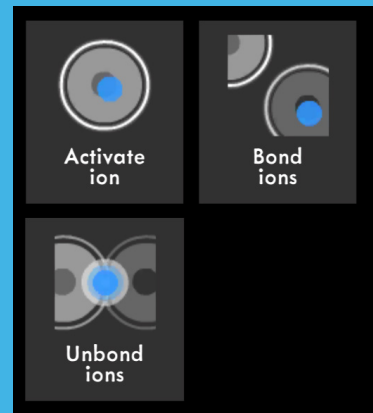
Active ions



Bonded ions



### Skills

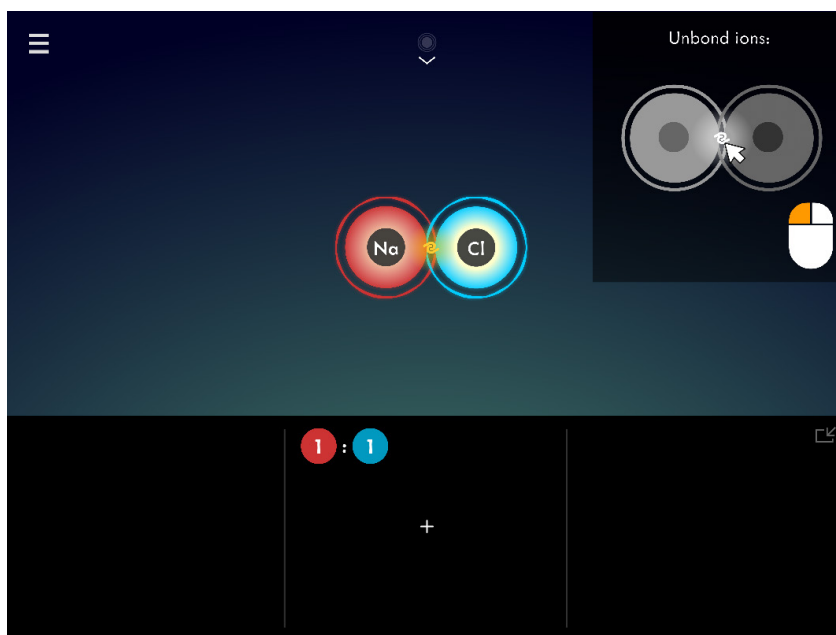


# Ionic Bonding: Overview

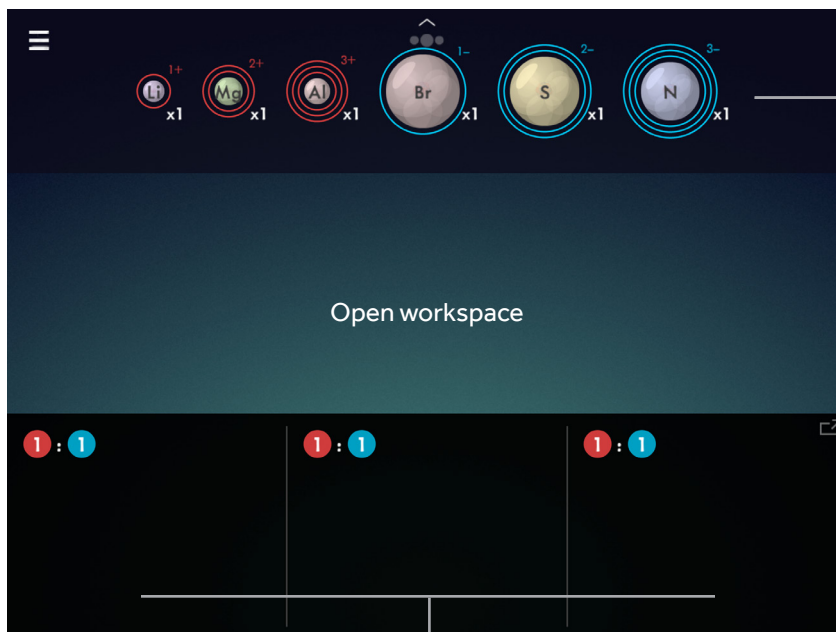
## Ionic Bonding Challenges

LEVELS 1-6 GOAL: Using the ions in the bank, build ionic compounds that satisfy the ratios in the targets.

Level 1:  
Tutorial level



Levels 2-6:

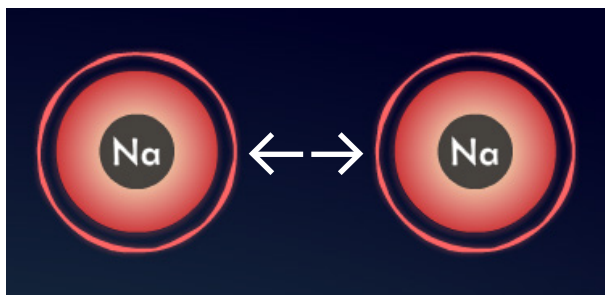


Restricted bank of ions

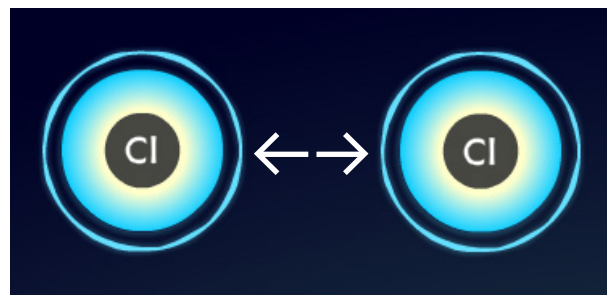
Level targets

# Ionic Bonding: Chemistry Connections

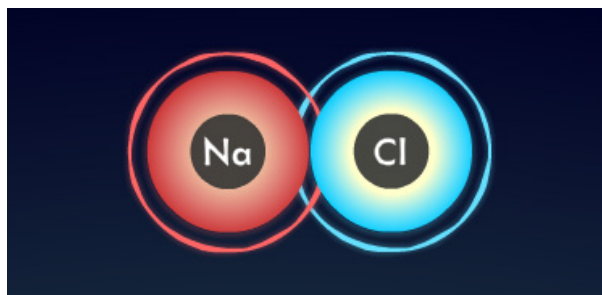
CHEMISTRY CONCEPT: **Similarly charged ions repel and oppositely charged ions attract.**



Positively charged ions *repel* one another.

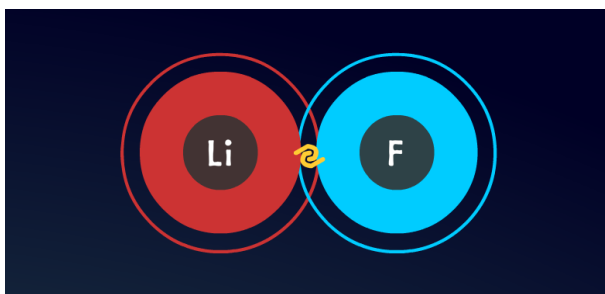


Negatively charged ions *repel* one another

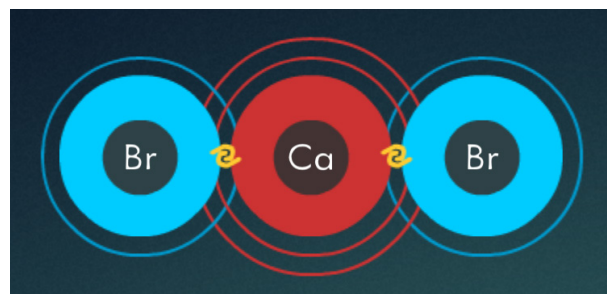


Positively charged ions *attract* to negatively charged ions.

CHEMISTRY CONCEPT: **An ionic compound contains 1 type of cation and 1 type of anion.**



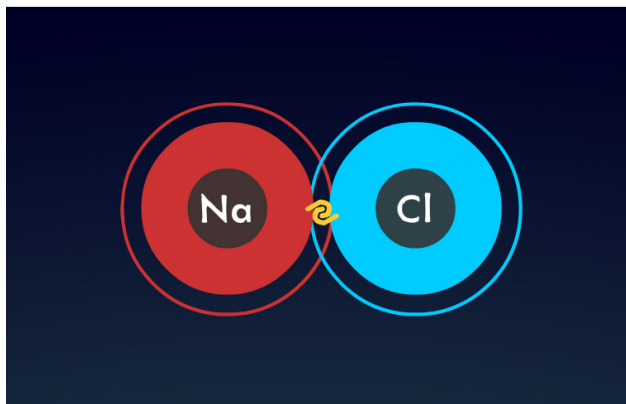
Cation:  $\text{Li}^+$   
Anion:  $\text{F}^-$



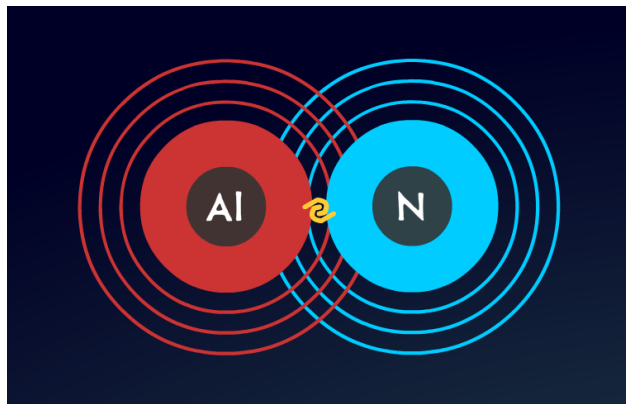
Cation:  $\text{Ca}^{2+}$   
Anion:  $\text{Br}^-$

# Ionic Bonding: Chemistry Connections (cont.)

CHEMISTRY CONCEPT: **In an ionic compound, the overall charge is neutral.**

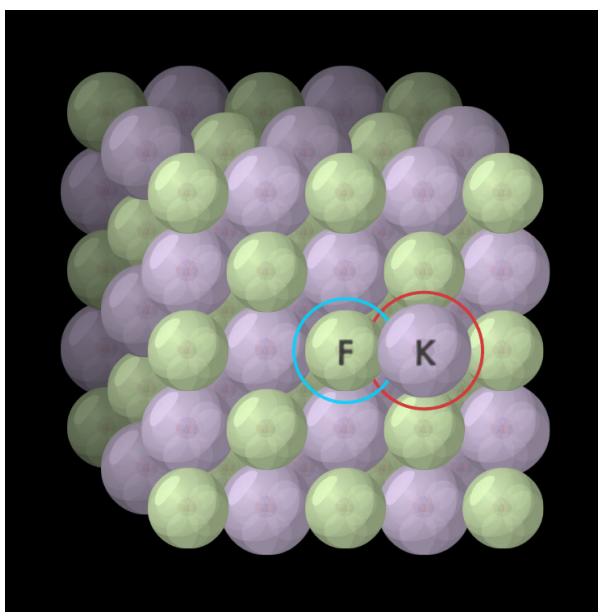


1 = 1



3 = 3

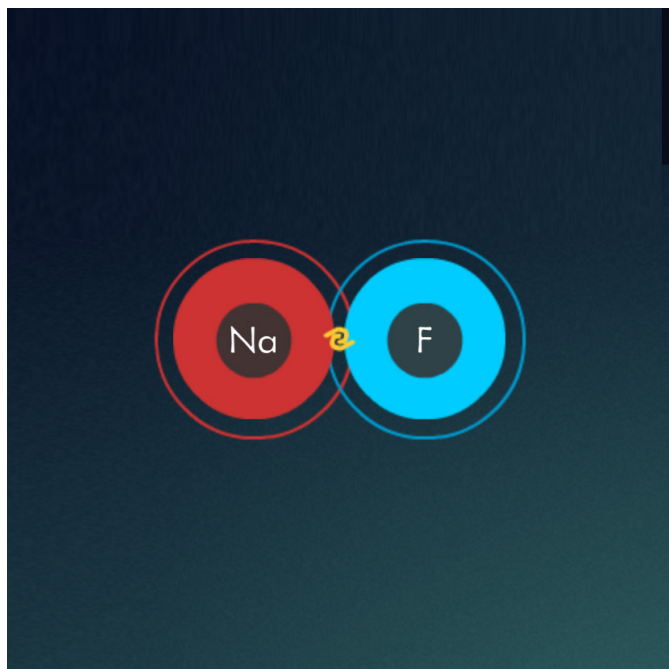
CHEMISTRY CONCEPT: **The individual ions of an ionic compound are arranged in an orderly, closely packed manner.**



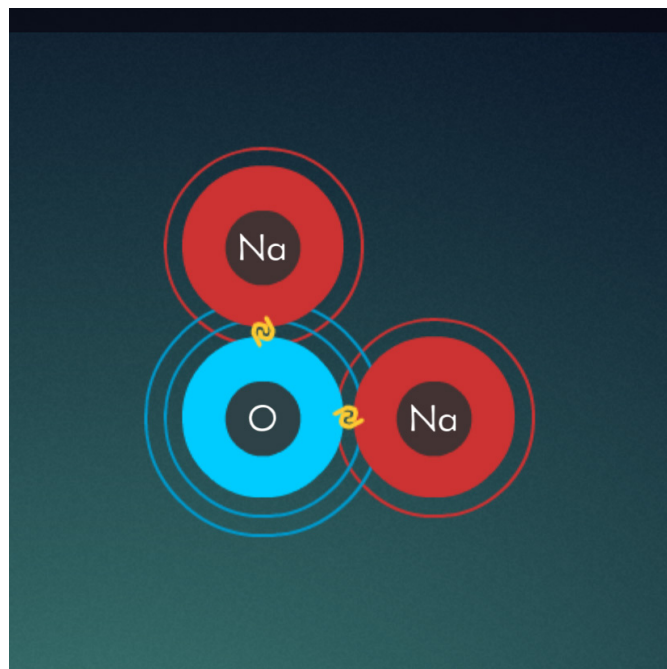
This visual representation appears after each check in the levels.

# Ionic Bonding: Chemistry Connections (cont.)

CHEMISTRY CONCEPT: **Ionic compounds are composed of a specific ratio of cations to anions.**



1:1

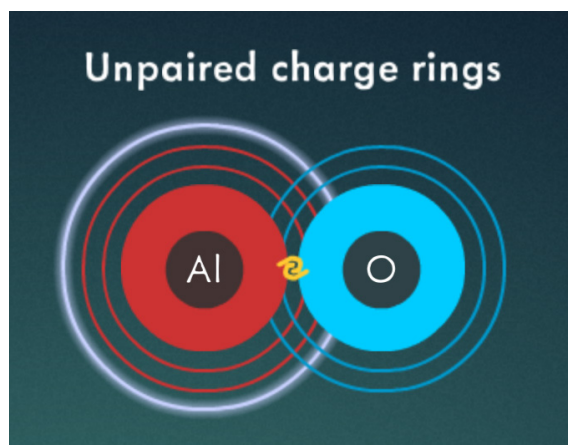


2:1

# Ionic Bonding: In-Game Feedback

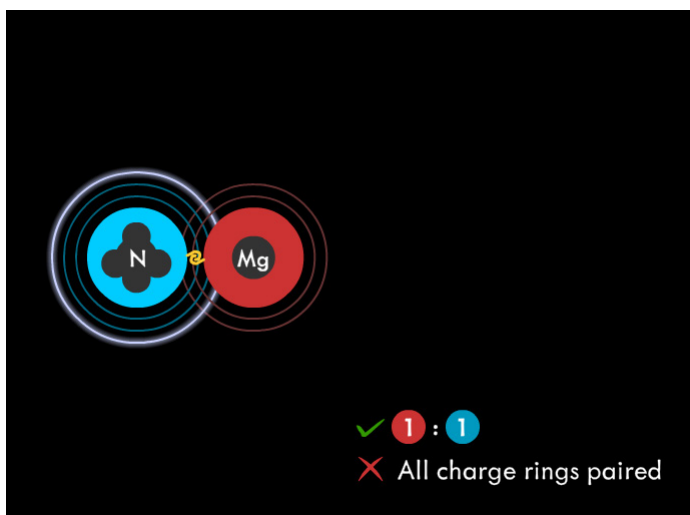
Sandbox Check (Available in full version)

Player can use the **Check** button in Sandbox to receive immediate feedback.

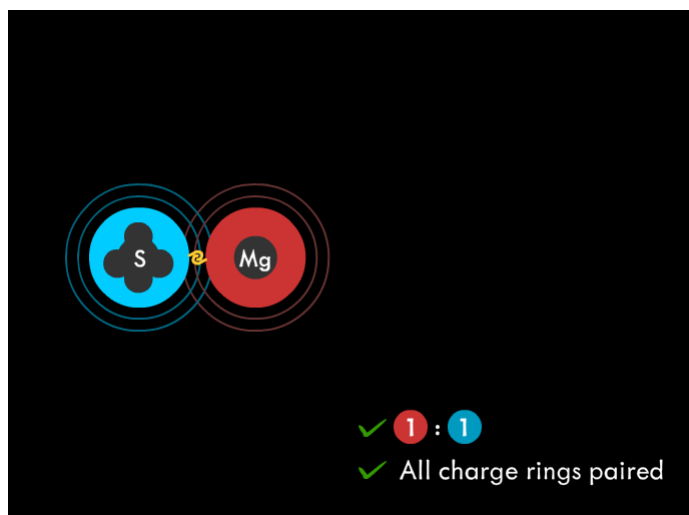


## Challenge Level Check

To check work in a Challenge level, players can drag an ionic compound to a chosen target. The ionic compound will be checked against the target based on key chemistry content, as outlined below.



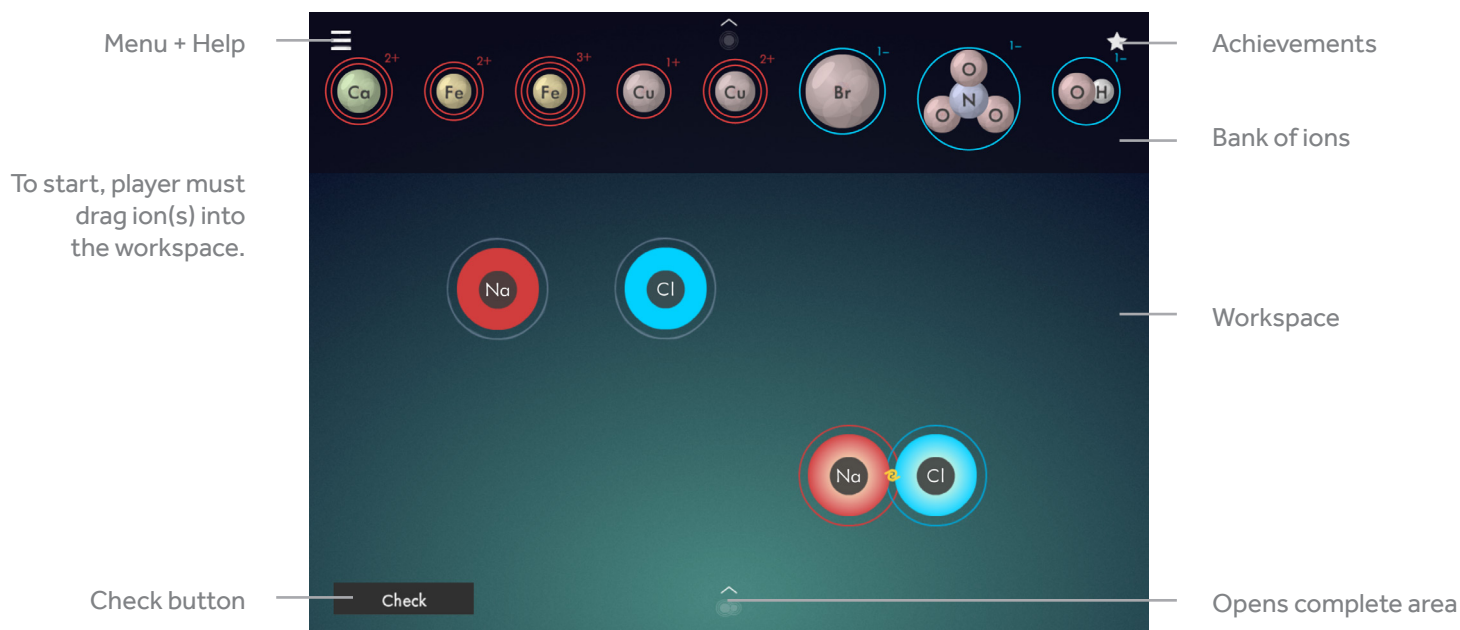
Incorrect



Correct

# Ionic Bonding: Sandbox (Available in full version)

## Ionic Bonding Sandbox



### Achievements

- ★ Ionic compound using an Na and a Cl ion ⓘ
- ★ Ionic compound using a Ca and an O ion ⓘ
- ★ Ionic compound using Al and N ions ⓘ
- ★ Ionic compound using a 2+ ion ⓘ
- ★ Ionic compound using 3+ and 1- ions ⓘ
- ★ Ionic compound using 1+ and 3- ions ⓘ
- ★ Ionic compound using two 1- ions ⓘ

- ★ Ionic compound using Fe<sup>3+</sup> and SO<sub>4</sub><sup>2-</sup> ions ⓘ
- ★ Ionic compound: K<sub>2</sub>S ⓘ
- ★ Ionic compound: Mg<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> ⓘ

### Selected Bank of Ions

The bank includes the following ions:

- |                  |                               |
|------------------|-------------------------------|
| Li <sup>+</sup>  | Fe <sup>2+</sup>              |
| N <sup>3-</sup>  | Fe <sup>3+</sup>              |
| O <sup>2-</sup>  | Cu <sup>+</sup>               |
| F <sup>-</sup>   | Cu <sup>2+</sup>              |
| Na <sup>+</sup>  | Br <sup>-</sup>               |
| Mg <sup>2+</sup> | NO <sub>3</sub> <sup>-</sup>  |
| Al <sup>3+</sup> | OH <sup>-</sup>               |
| S <sup>2-</sup>  | PO <sub>4</sub> <sup>3-</sup> |
| Cl <sup>-</sup>  | SO <sub>4</sub> <sup>2-</sup> |
| K <sup>+</sup>   | CO <sub>3</sub> <sup>2-</sup> |