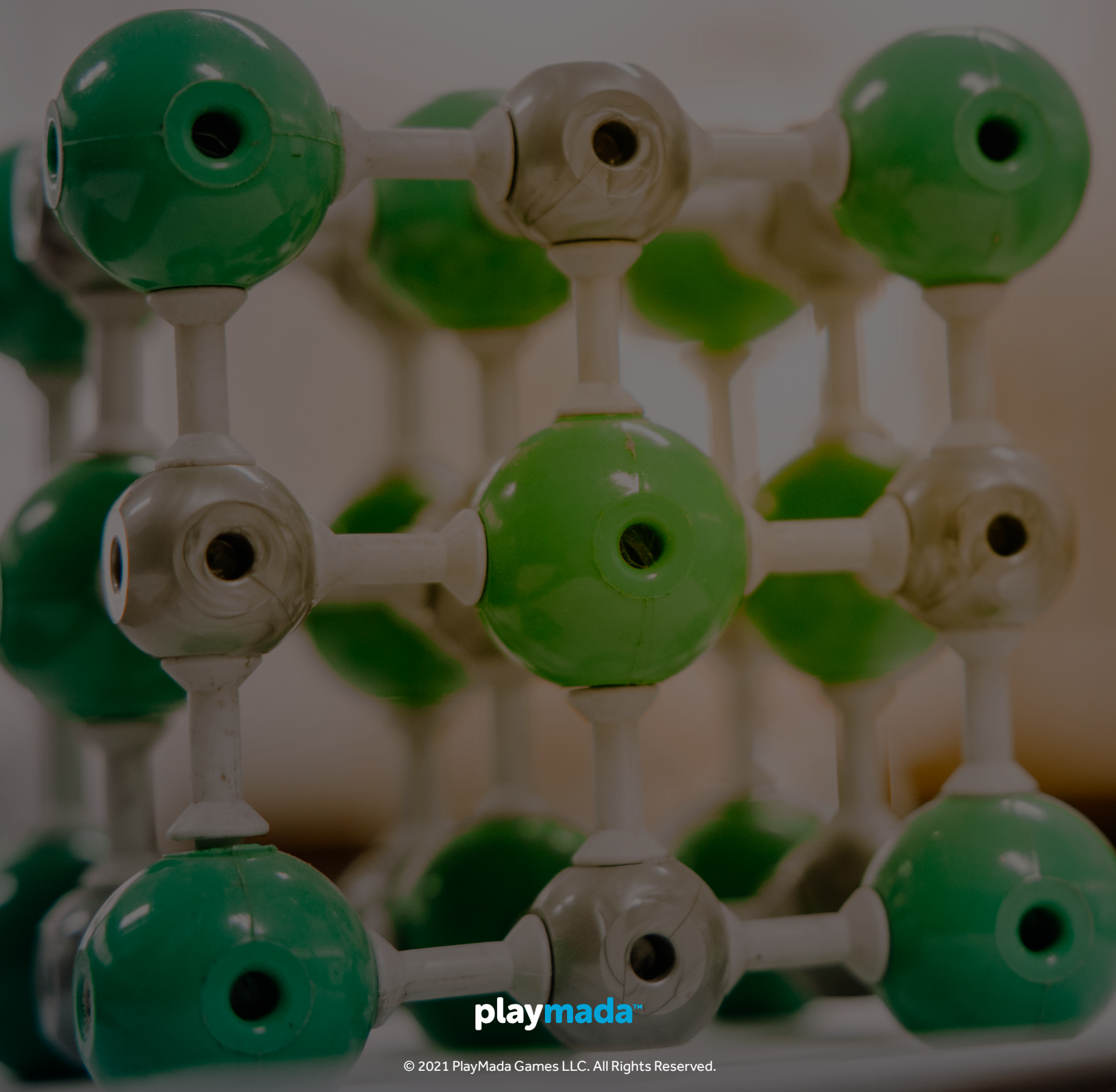




CONTENT AREA OVERVIEW

Ionic Bonding



playmada™

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SNAPSHOT

Challenges

- The Challenge Levels increase in rigor and complexity.
- The first 4 levels are tutorial levels.
 - 10 core levels
 - 3 Connected Levels to Ionization Energy
 - 3 Connected Levels to Acid Strength

Sandbox

- The Sandbox is an exploratory learning space for extended practice and review of ionic bonding.
- 10 Achievements

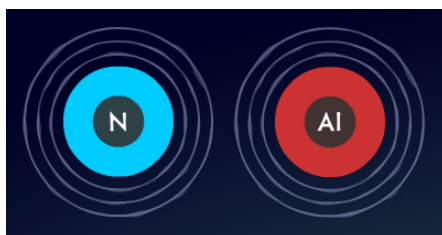
Integrated Chemistry Concepts

- Net Compound Neutrality
- Attraction and Repulsion
- Single Cation/Anion Type
- Cation-to-Anion Ratios
- Polyatomic Ions
- Lattice Structure

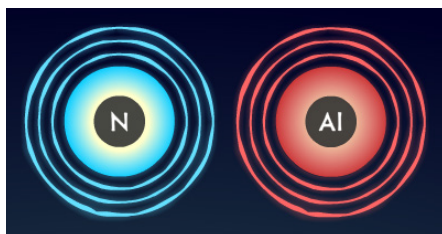


GAMEPLAY BASICS

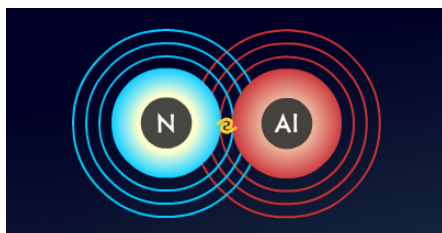
'Bond Mode' Ion



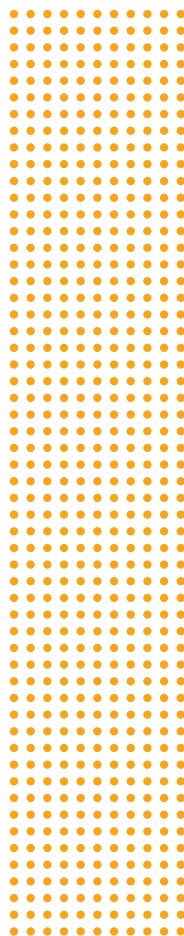
INACTIVE IONS



ACTIVE IONS



BONDED IONS



Skills



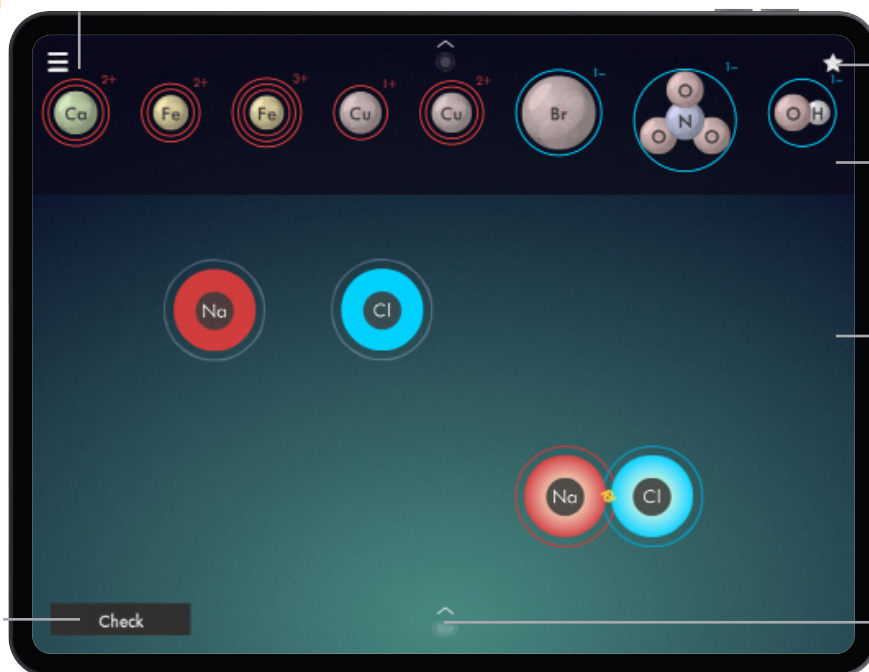
OVERVIEW

Ionic Bonding Sandbox

TO START, PLAYER MUST DRAG ION(S) INTO THE WORKSPACE.

CHECK BUTTON

MENU + HELP



ACHIEVEMENTS

BANK OF IONS

WORKSPACE

OPENS COMPLETE AREA

Achievements

★ Ionic compound using an Na^+ and a Cl^- ion

★ Ionic compound using a Ca^{2+} and an O^{2-} ion

★ Ionic compound using Al^{3+} and N^{3-} 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^{3+} and SO_4^{2-} ions

★ Ionic compound: K_2S

★ Ionic compound: $\text{Mg}_3(\text{PO}_4)_2$

Selected Bank of Ions

The bank includes the following ions:

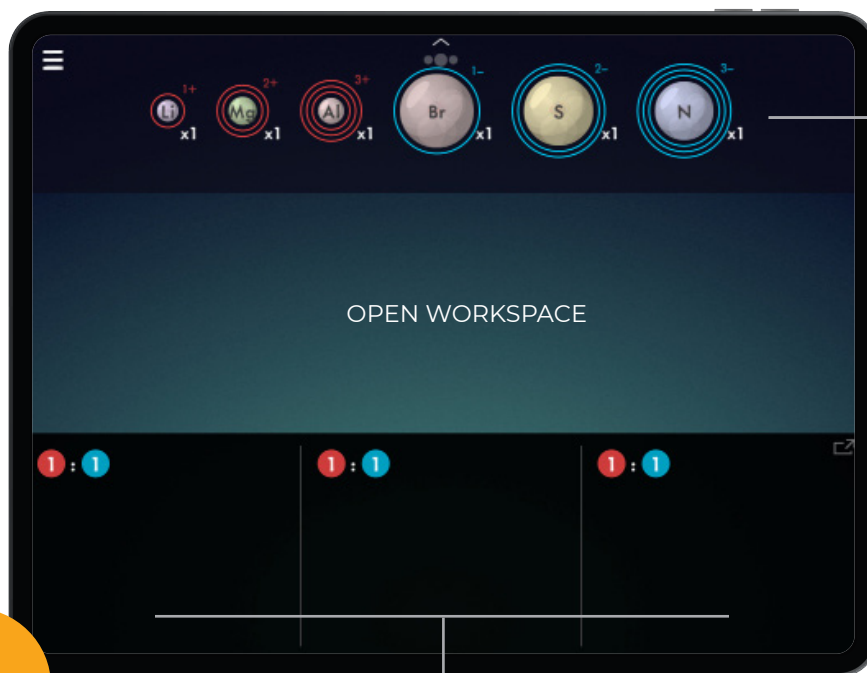
Li^+
 N^{3-}
 O^{2-}
 F^-
 Na^+
 Mg^{2+}
 Al^{3+}
 S^{2-}
 Cl^-
 K^+

Fe^{2+}
 Fe^{3+}
 Cu^+
 Cu^{2+}
 Br^-
 NO_3^-
 OH^-
 PO_4^{3-}
 SO_4^{2-}
 CO_3^{2-}



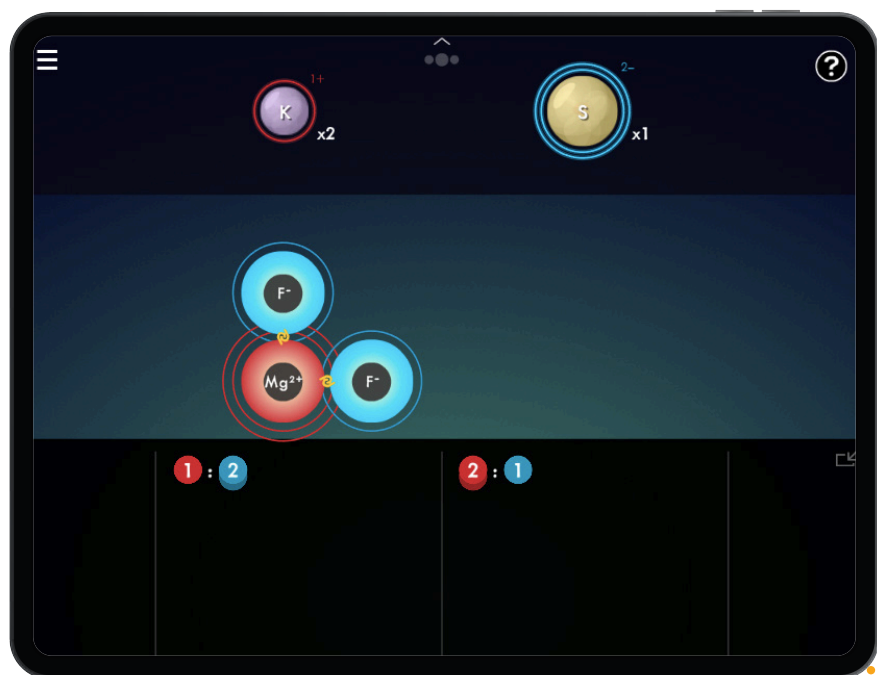
OVERVIEW

Ionic Bonding Challenges



RESTRICTED
BANK
OF IONS

LEVEL TARGETS



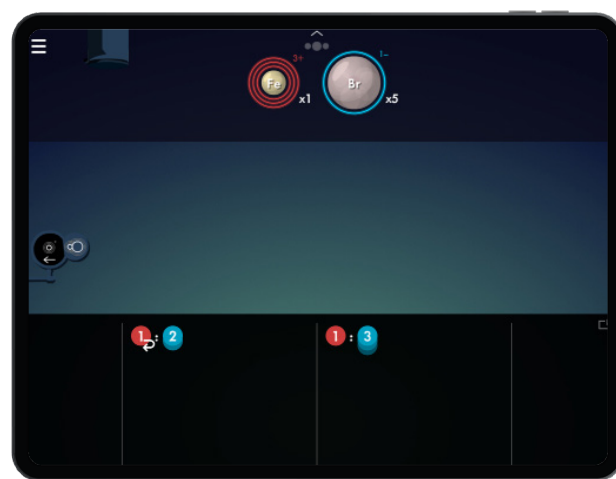
i

LEVELS 1-8 GOAL:

Using the ions in the bank, build ionic compounds that satisfy the ratios in the targets.



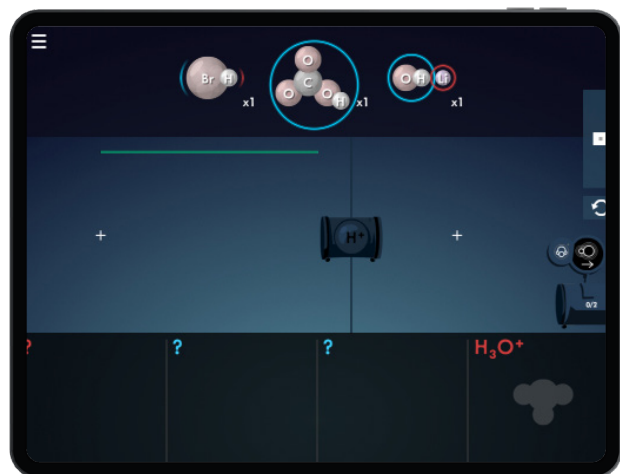
OVERVIEW



i

IONIZATION ENERGY TO IONIC BONDING CONNECTED LEVELS GOAL:

Some ions are missing from the bank. Use the button on the left to go to Ionization Energy. Solve the challenge to bring back the missing ions!



ACID STRENGTH TO IONIC BONDING CONNECTED LEVELS GOAL:

Some ions are missing from the bank. Use the button on the left to go to Acid Strength. Solve the challenge to bring back the missing ions!

i

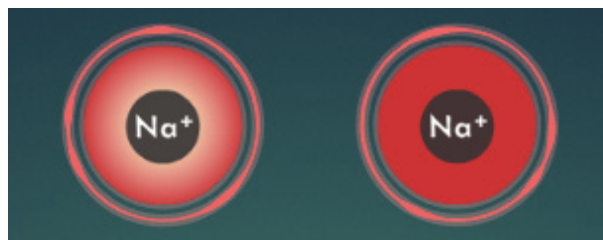


CHEMISTRY CONNECTIONS

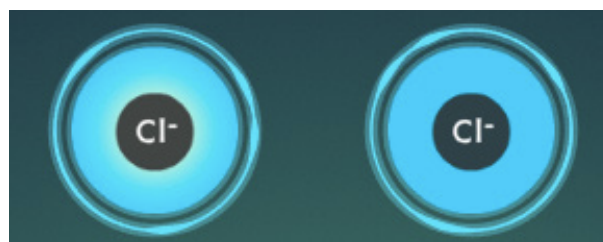
CHEMISTRY CONCEPT:

Similarly charged ions repel and oppositely charged ions attract.

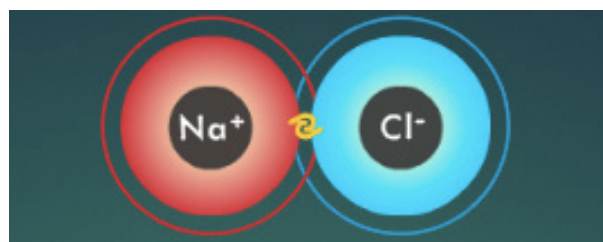
i



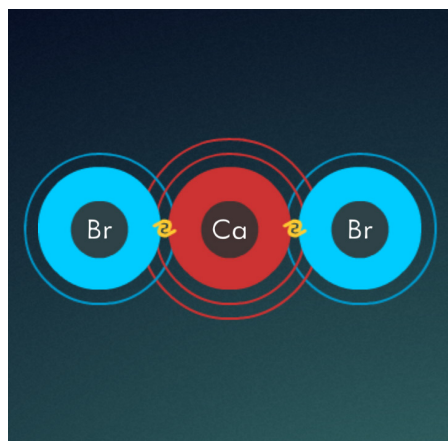
POSITIVELY CHARGED IONS REPEL ONE ANOTHER.



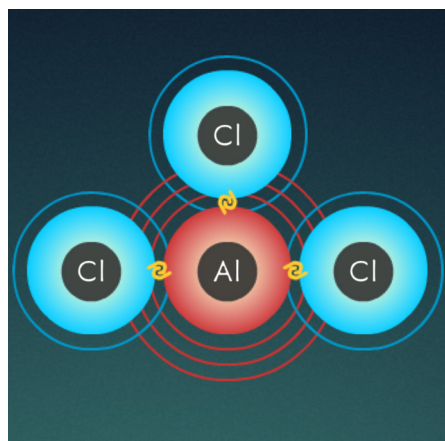
NEGATIVELY CHARGED IONS REPEL ONE ANOTHER.



POSITIVELY CHARGED IONS ATTRACT TO NEGATIVELY CHARGED IONS.



CATION: Ca^{2+}
ANION: Br^-



CATION: Al^{3+}
ANION: Cl^-

i

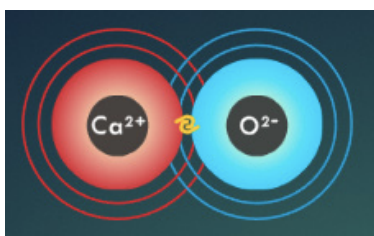
CHEMISTRY CONCEPT:

An ionic compound contains a single cation type and a single anion type.

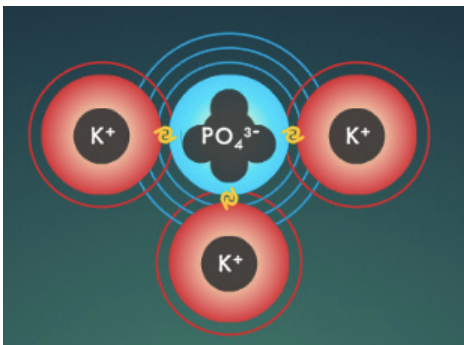


CHEMISTRY CONNECTIONS

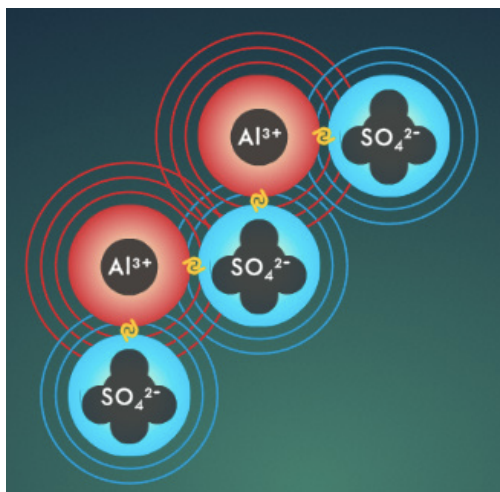
CHEMISTRY CONCEPT:
In an ionic compound, the overall charge is neutral.



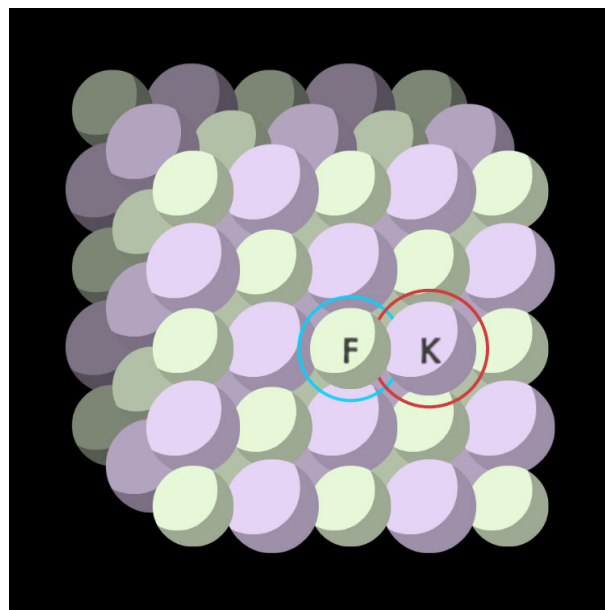
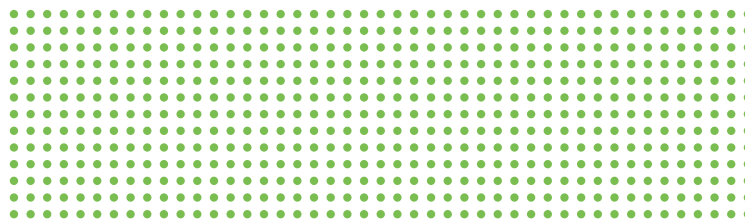
2 = 2



3 = 3



6 = 6



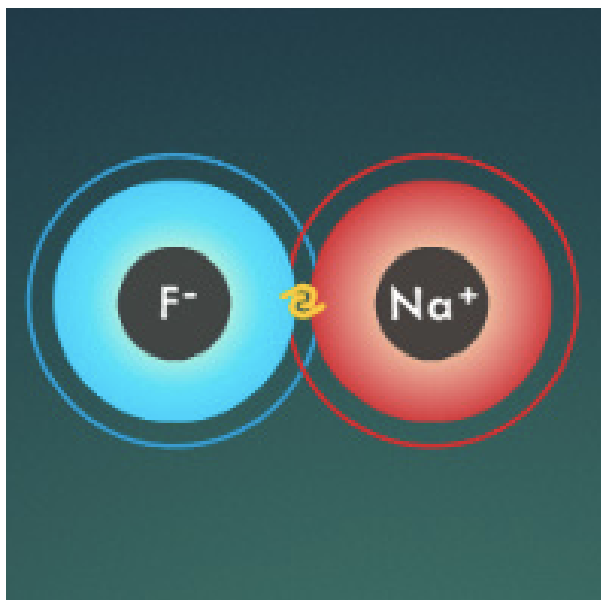
THIS VISUAL REPRESENTATION APPEARS AFTER EACH CHECK IN THE LEVELS.

CHEMISTRY CONCEPT:

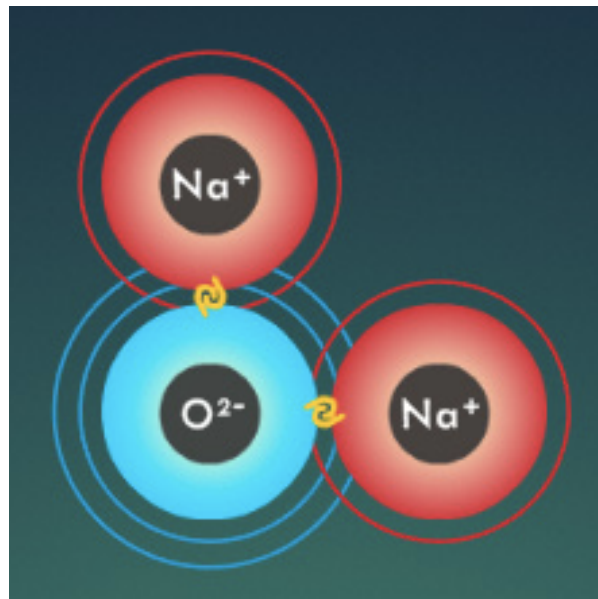
The individual ions of an ionic compound are arranged in an orderly, closely packed manner, called a lattice structure.



CHEMISTRY CONNECTIONS



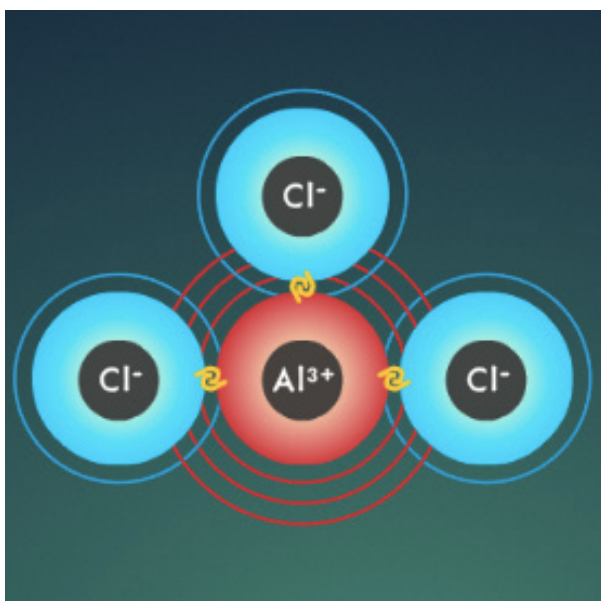
1:1



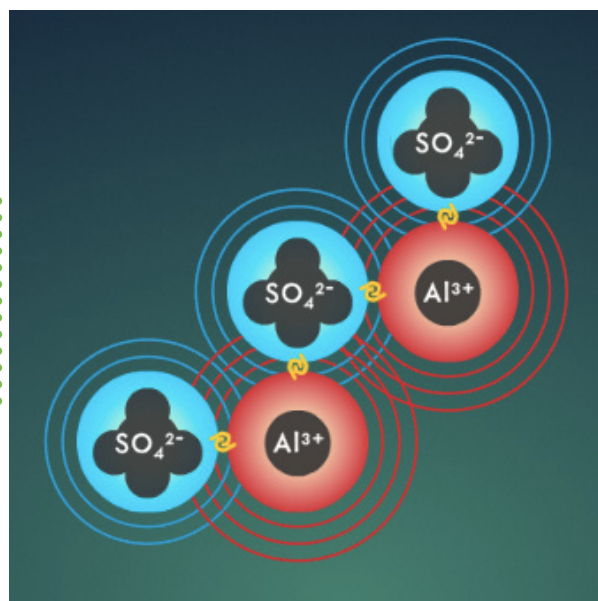
2:1



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



1:3



2:3

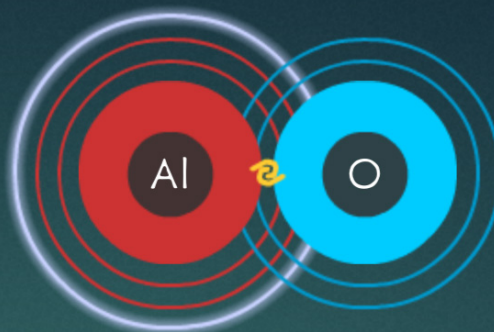


IN-GAME FEEDBACK

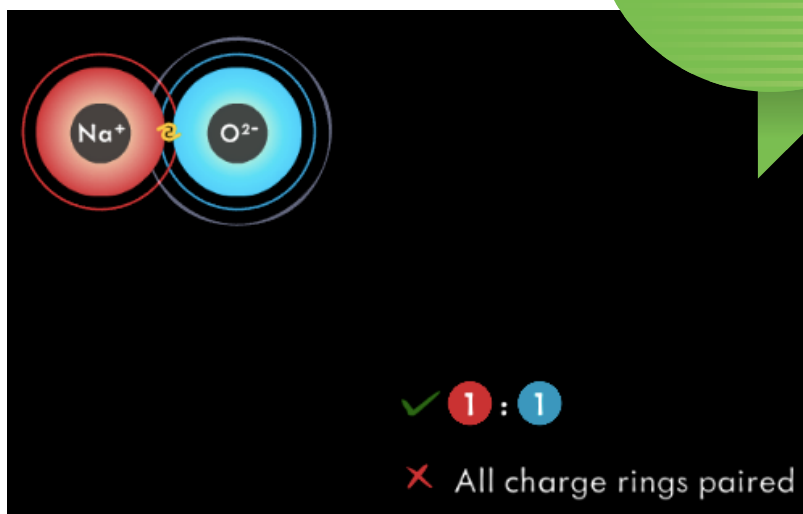
Sandbox
Check

Players can use the
CHECK
button in Sandbox
to receive immediate
feedback.

Unpaired charge rings



Challenge
Level Check



INCORRECT



CORRECT