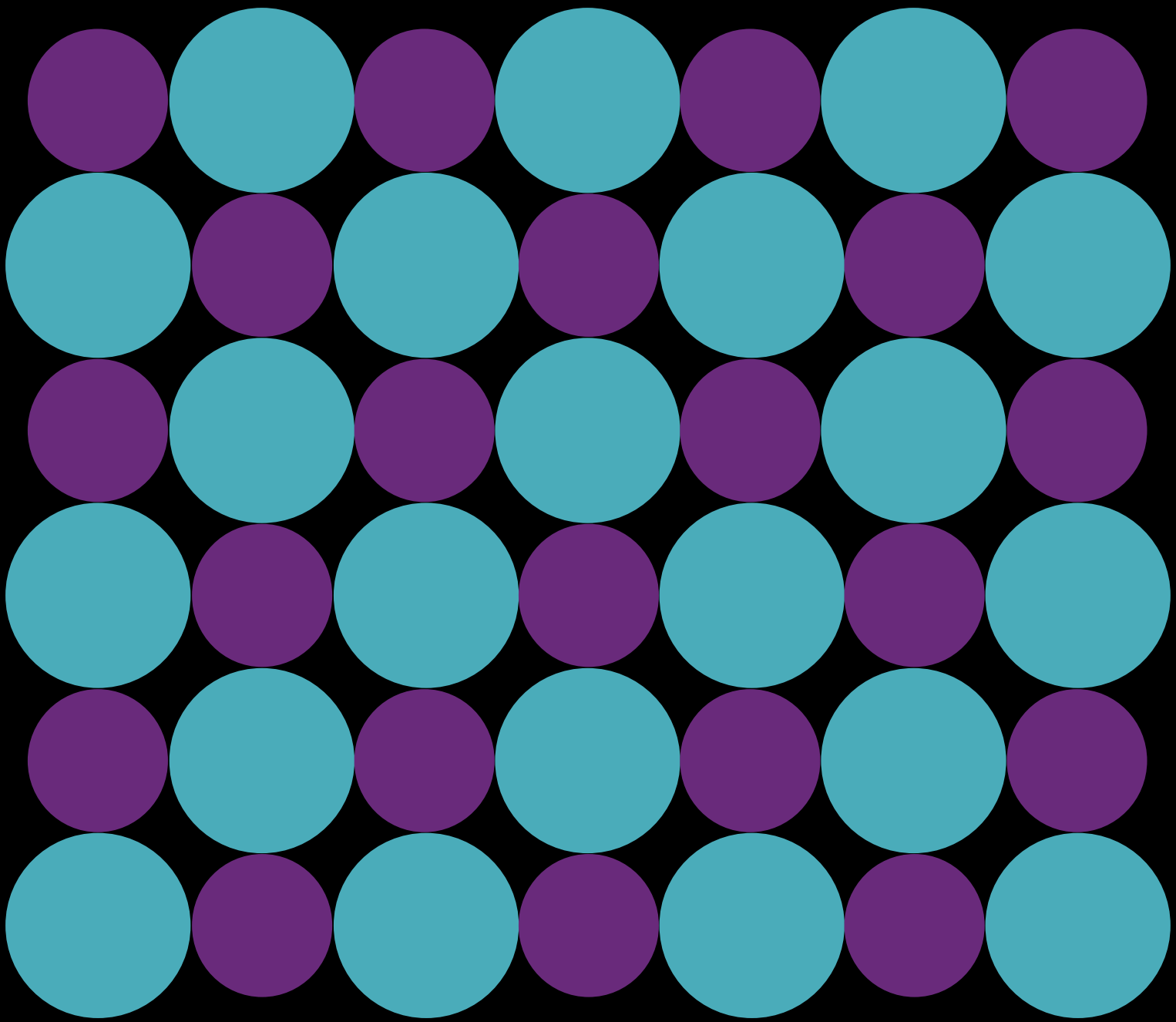
Tactile Ionic Bonding Kit



NEMETH

UEB

Tactile Ionic Bonding Kit

Catalog Numbers: UEB 1-Ø3132-ØØ • Nemeth 1-Ø3133-ØØ

American Printing House for the Blind
Research, Evaluation, and Digital Information Services

1839 Frankfort Avenue
Louisville, Kentucky 4Ø2Ø6
5Ø2-895-24Ø5 • 8ØØ-223-1839
aph.org • info@aph.org

Project Staff

Rosanne Hoffmann
Science & Health Product Manager and Author

Adam Stockhausen
Consultant and Author

Avery Baggett
STEM Product Specialist

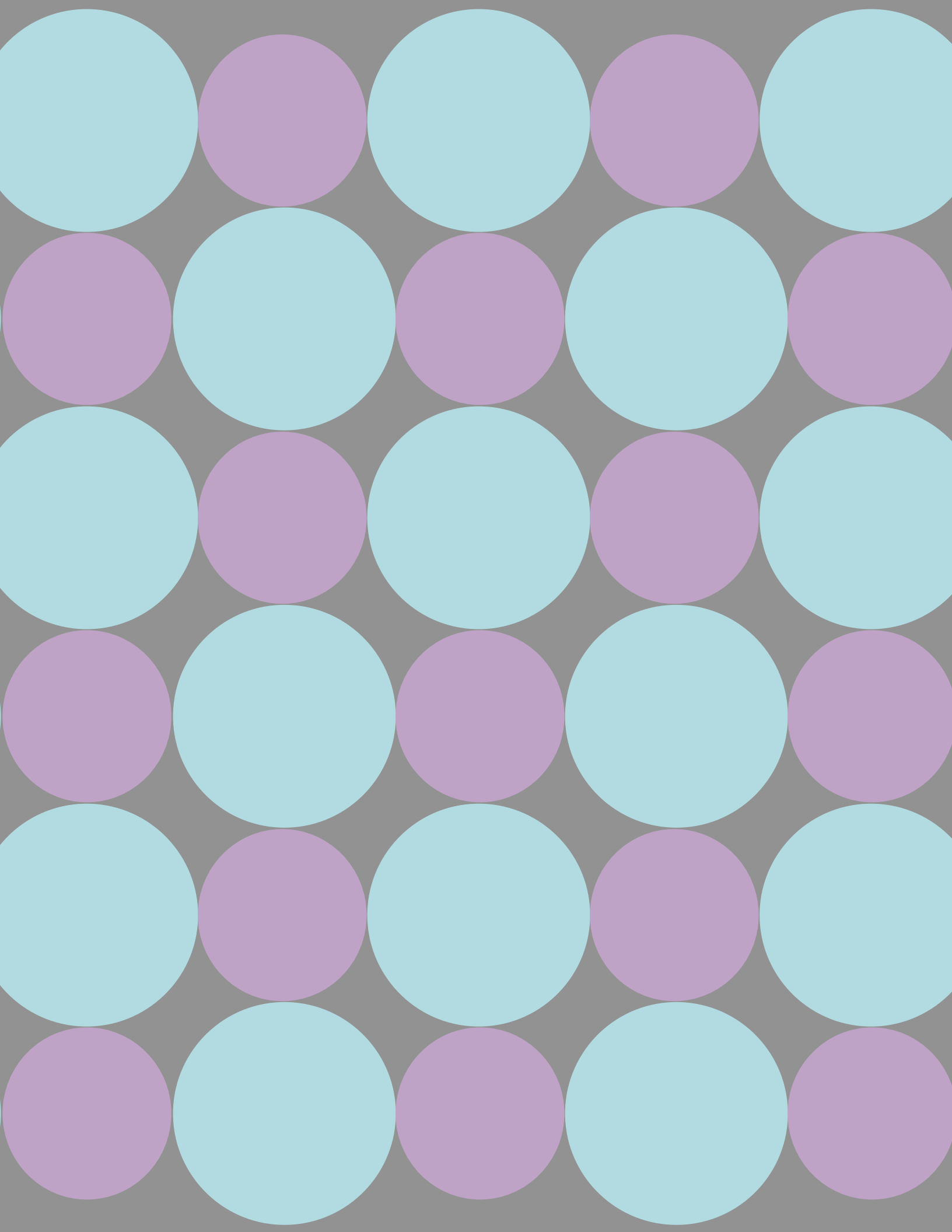
Lara Kirwan
Product Specialist

Andrew Dakin
Model Maker

Andrew Moulton
Technical and Manufacturing Research, Director

Rod Dixon
Technical and Manufacturing Research, Manager

Laura Greenwell
Graphic Designer



Tactile Ionic Bonding Kit

Introduction

The Tactile Ionic Bonding Kit provides tangible manipulatives to illustrate one way elemental atoms might bond. The manipulatives highlight the aspects of an atom's structure that make the element likely to donate or receive electrons during ionic bonding. Bonds formed by donated and received electrons are called ionic bonds.

The manipulatives in this kit represent individual atoms of elements, such as sodium and chlorine. The subunits are designed to demonstrate the difference between atoms that, because of their atomic structure, donate or receive electrons resulting in an ionic bond. *Note that this product does not demonstrate the sharing of electrons between atoms, otherwise known as covalent bonding, for anything other than bonds formed with hydrogen.* The subunits for each atom are large enough to attach a tactile symbol to assist students with blindness or low vision in identifying each element. For example, a piece of aluminum foil can be attached to the aluminum subunit.

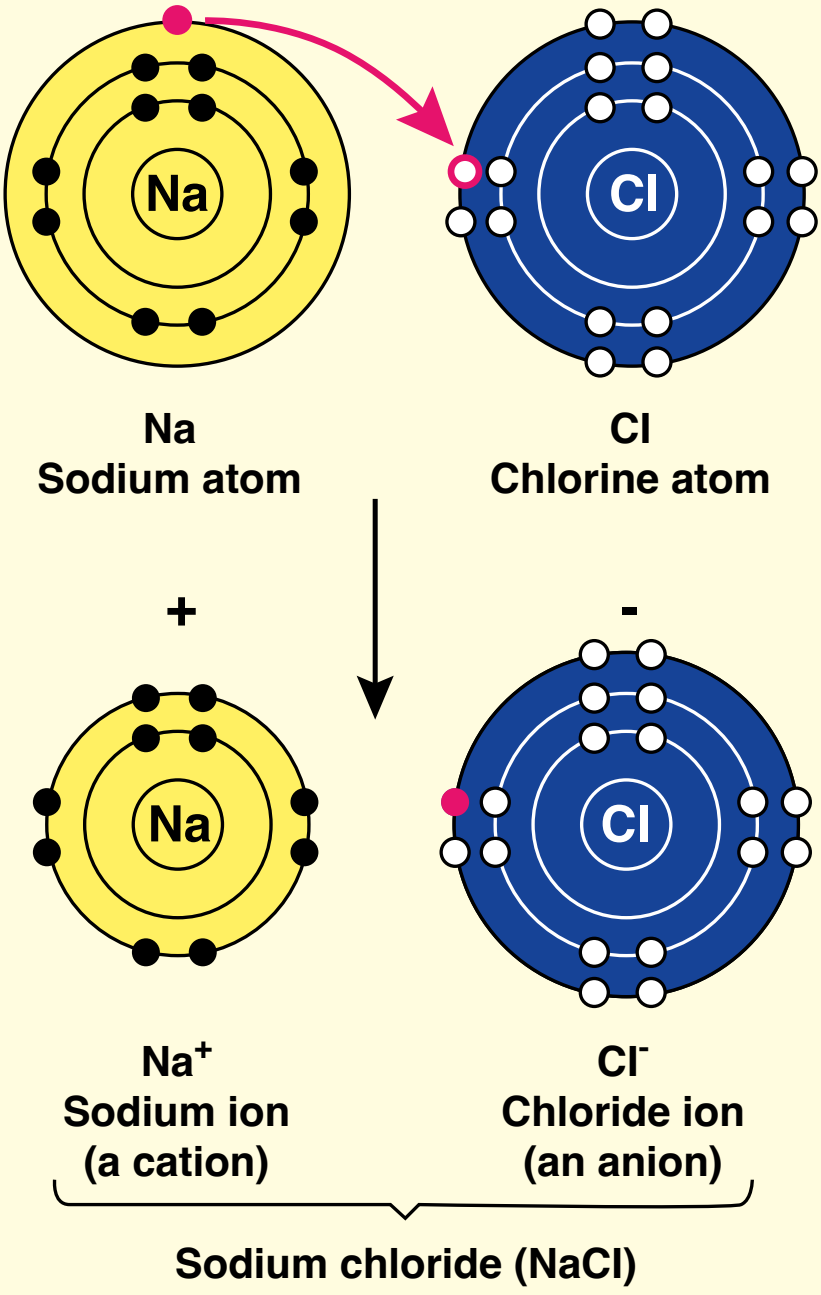
Pre-Teaching Tip

The manipulatives included in this kit connect to each other in a fashion similar to jigsaw puzzle pieces. If your students are unfamiliar with how jigsaw puzzle pieces connect, we recommend providing hands-on instruction on doing this prior to using the subunits in this product.

Background Information

Other than hydrogen and helium, atoms are most stable when their outermost electron shells contain eight electrons, either by transfer or sharing, thus following the octet rule. For example, an atom of sodium has one electron in its outermost shell. Sodium can donate this electron to an atom that requires one electron to complete its outermost shell such as chlorine, which has seven electrons in its outermost shell. This transfer of electrons results in both atoms

having eight electrons in their outermost shells and the formation of a positively charged ion, or cation (Na^+) and a negatively charged ion, or anion (Cl^-, now called "chloride"). The two ions are attracted to each other, forming an ionic bond and the compound NaCl (see figure below).

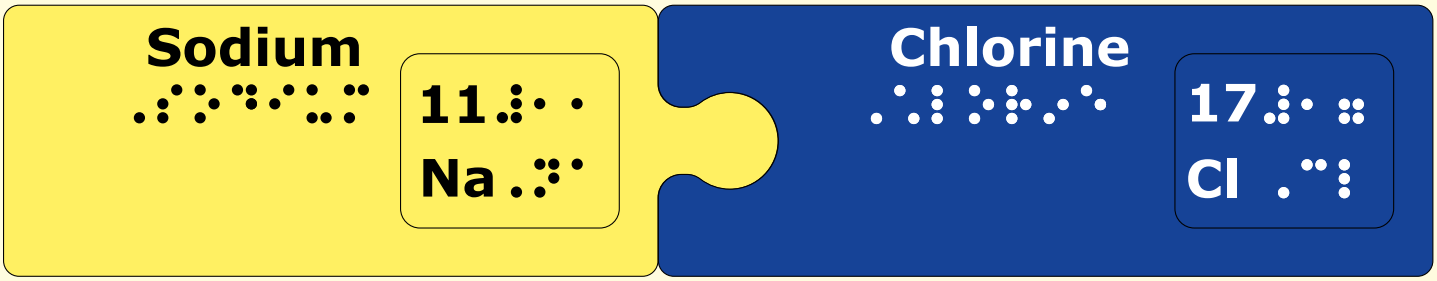


When an ionic bond is formed, the resulting compound takes the combined name of both elements but modifies the ending of the receiving element to have "-ide" at its end. In the example on page 2, chlorine receives the electron from sodium becoming an anion, so the resulting name of the compound is "sodium chloride."

Note that although sharing electrons is mentioned, this kit does not model covalent bond formation between a majority of elements; the exception to this is a hydrogen atom bonding with any of the notched anion subunit elements.

Subunits in the Kit

The shape of the subunits in this kit allows students to demonstrate the process of electron transfer, or ionic bonding. The sodium subunit has a protruding tab representing its single electron available for donating. The chlorine subunit has a single notch representing its requirement for one electron to complete its outermost electron shell. Both subunits are shown in the figure below.



The name of each element appears in large print and embossed UEB or Nemeth braille on each subunit, along with the atomic number (11 for sodium and 17 for chlorine) and the atomic symbol (Na for sodium and Cl for chlorine).

The components of the Tactile Ionic Bonding Kit and examples of their use are listed on the following pages. The list and examples include elements that have one, two, or three electrons to either donate or accept during ionic bonding, which is reflected in subunits with one, two, or three tabs or notches, respectively.

Cations (Yellow with Black Print)

Monovalent cations (single tab)
3 Hydrogen (H)
3 Lithium (Li)
3 Sodium (Na)
3 Potassium (K)

Divalent cations (two tabs)
3 Beryllium (Be)
3 Magnesium (Mg)
3 Calcium (Ca)

Trivalent cations (three tabs)
2 Aluminum (Al)
2 Boron (B)

Anions (Dark Blue with White Print)

Monovalent anions (one notch)
4 Chlorine (Cl)
4 Fluorine (F)
4 Bromine (Br)
4 Iodine (I)

Divalent anions (two notches)
3 Oxygen (O)
3 Sulfur (S)

Trivalent anions (three notches)
3 Nitrogen (N)
3 Phosphorus (P)

Blank Subunits to Design Your Own Elements

7 single tab cation (yellow)
6 two tab cation (yellow)
4 three tab cation (yellow)
7 one notch anion (blue)
6 two notch anion (blue)
4 three notch anion (blue)

Examples of Ionically Bonded Compounds

Use the following compounds to demonstrate ionic bonding to your students. Note the change in the names of each compound's anion element to "-ide."

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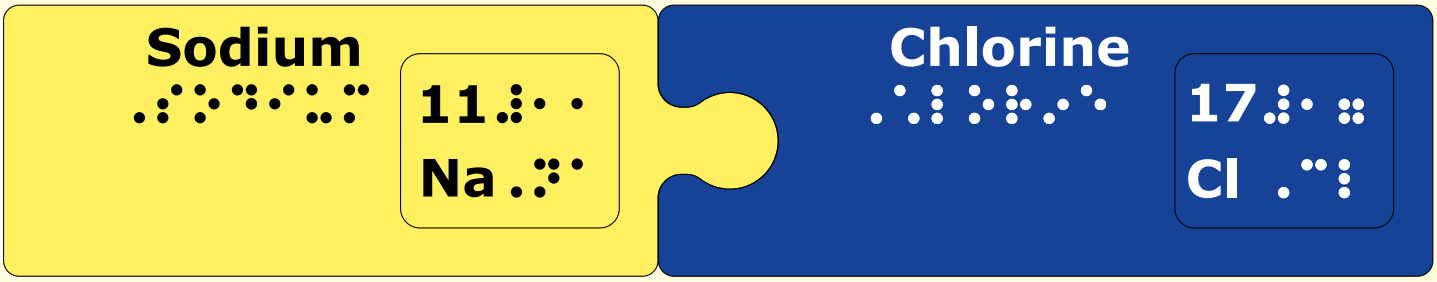
NaCl – Sodium chloride



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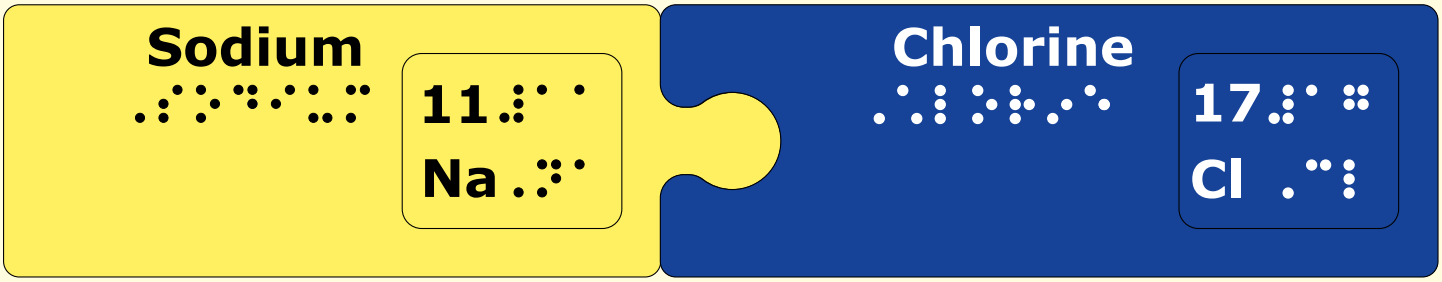
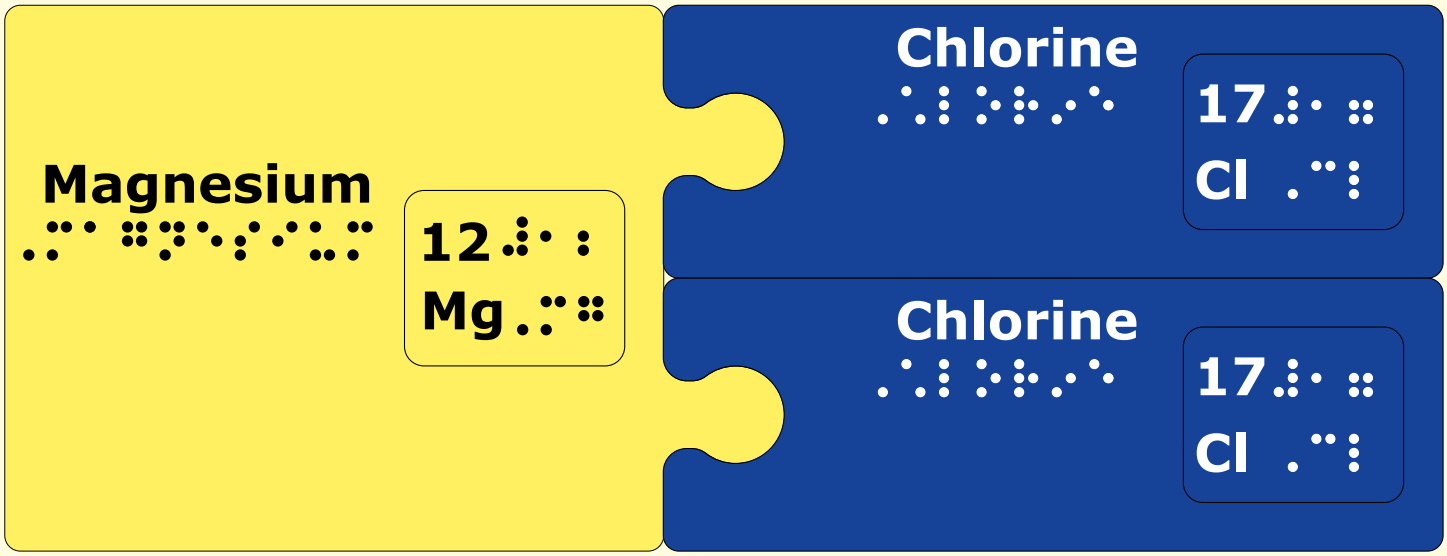
NaCl – Sodium chloride



Nemeth

$MgCl_2$ – Magnesium chloride



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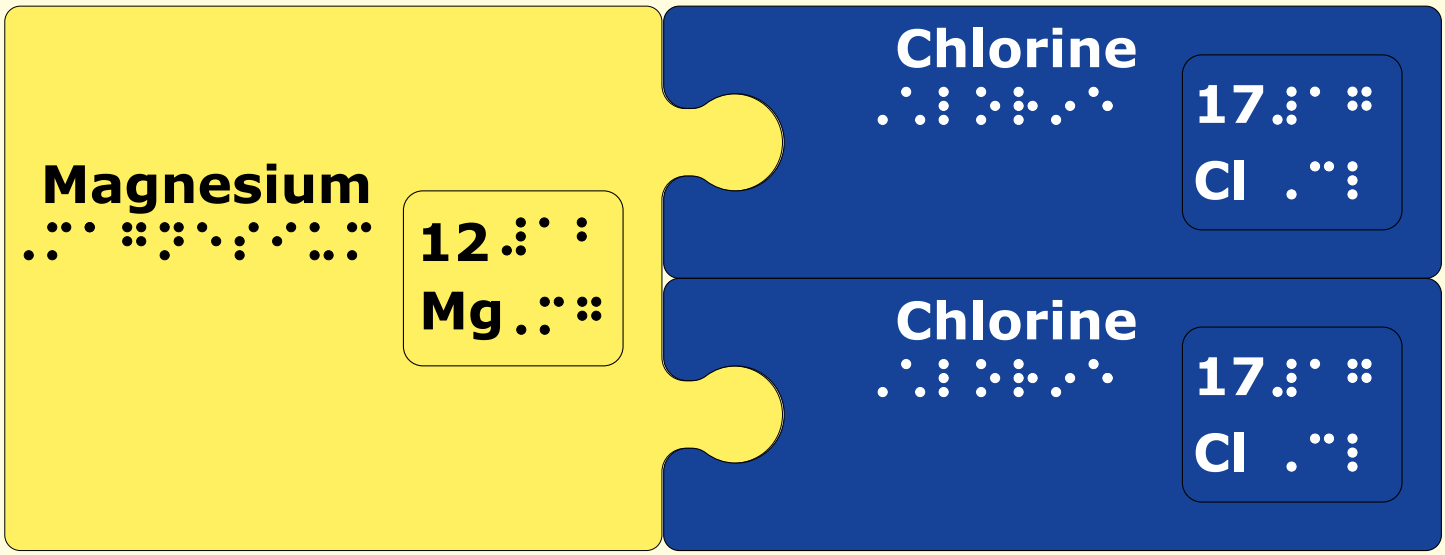
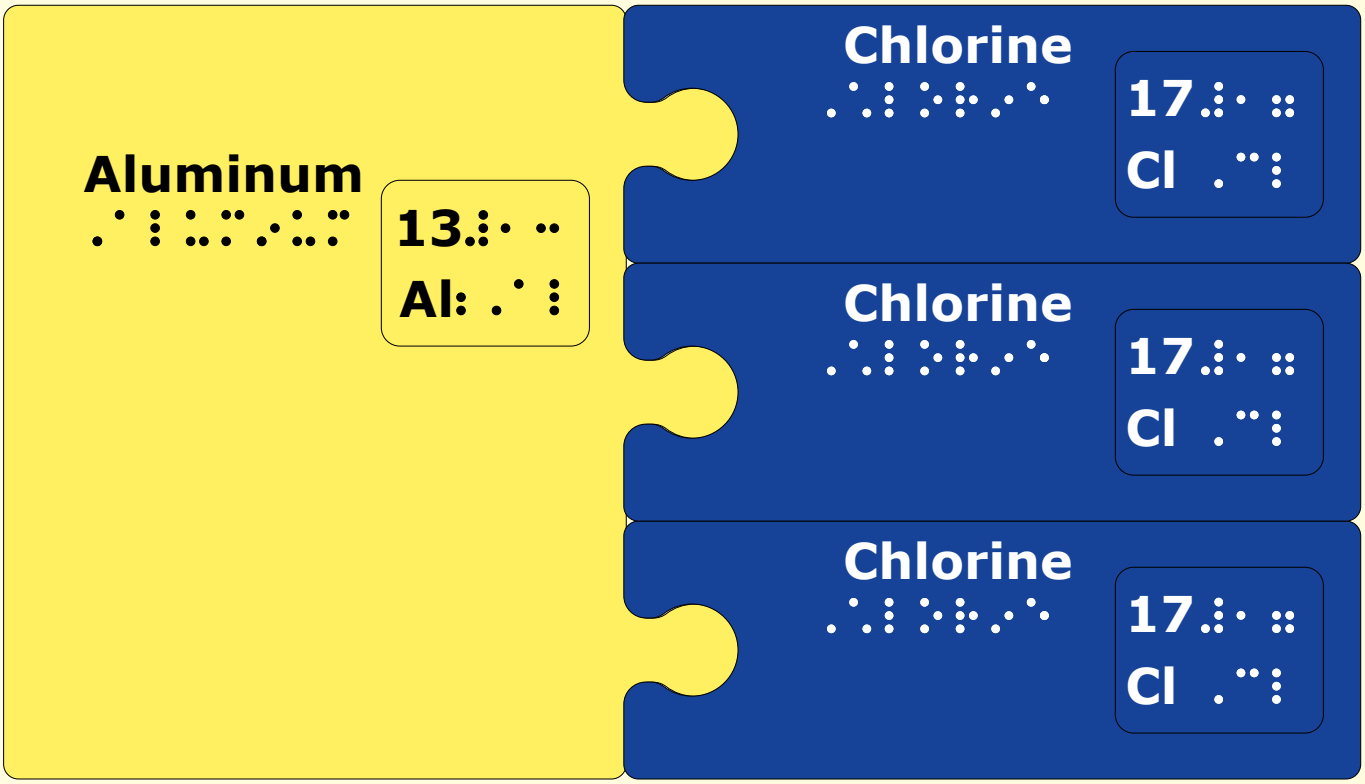
$MgCl_2$ – Magnesium chloride



Nemeth

$AlCl_3$ – Aluminum chloride



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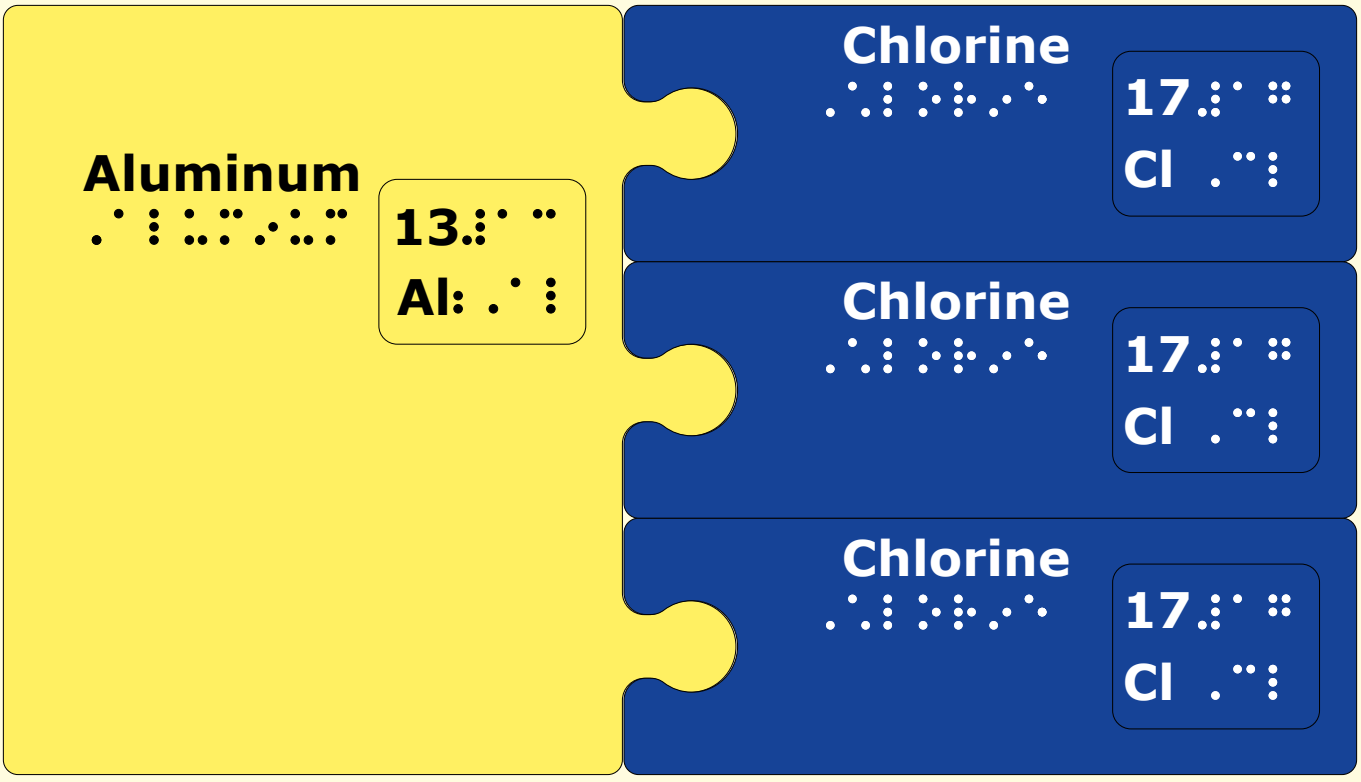
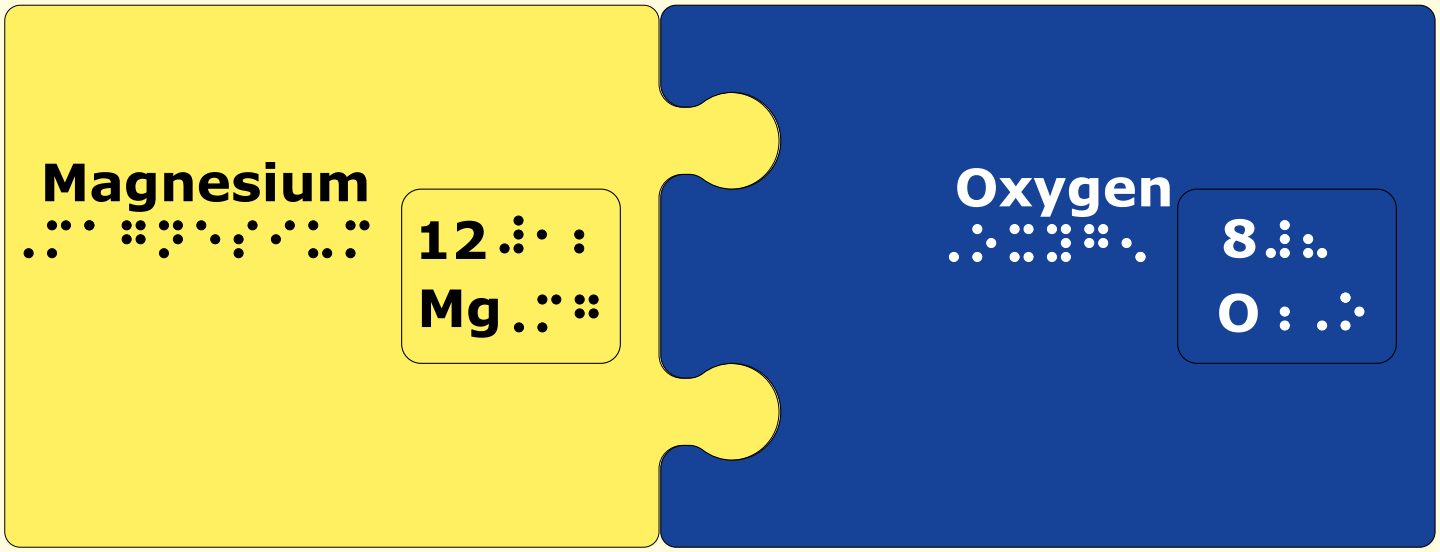
$AlCl_3$ – Aluminum chloride



Nemeth

MgO – Magnesium oxide



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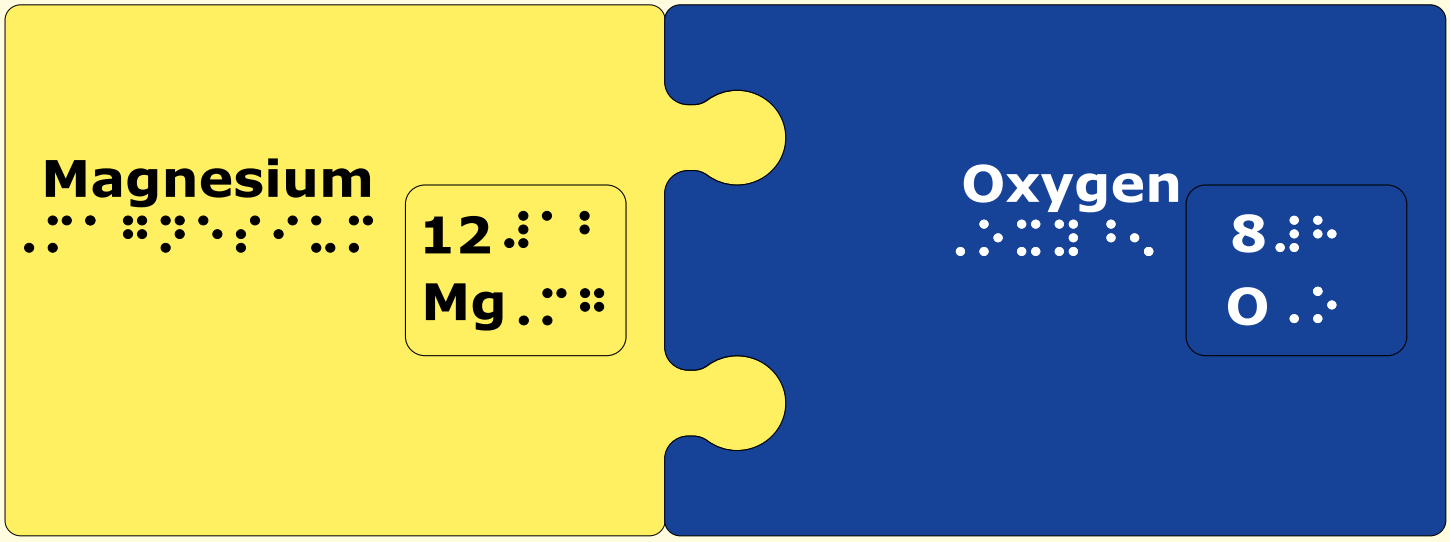
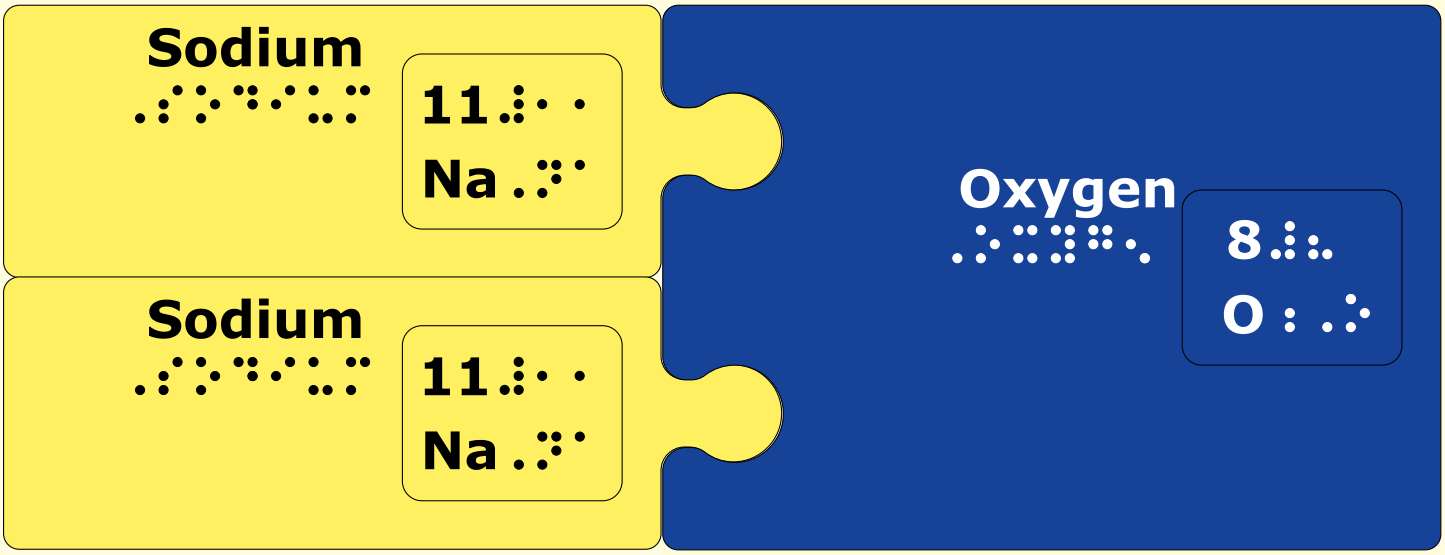
MgO – Magnesium oxide



Nemeth

Na_2O – Sodium oxide



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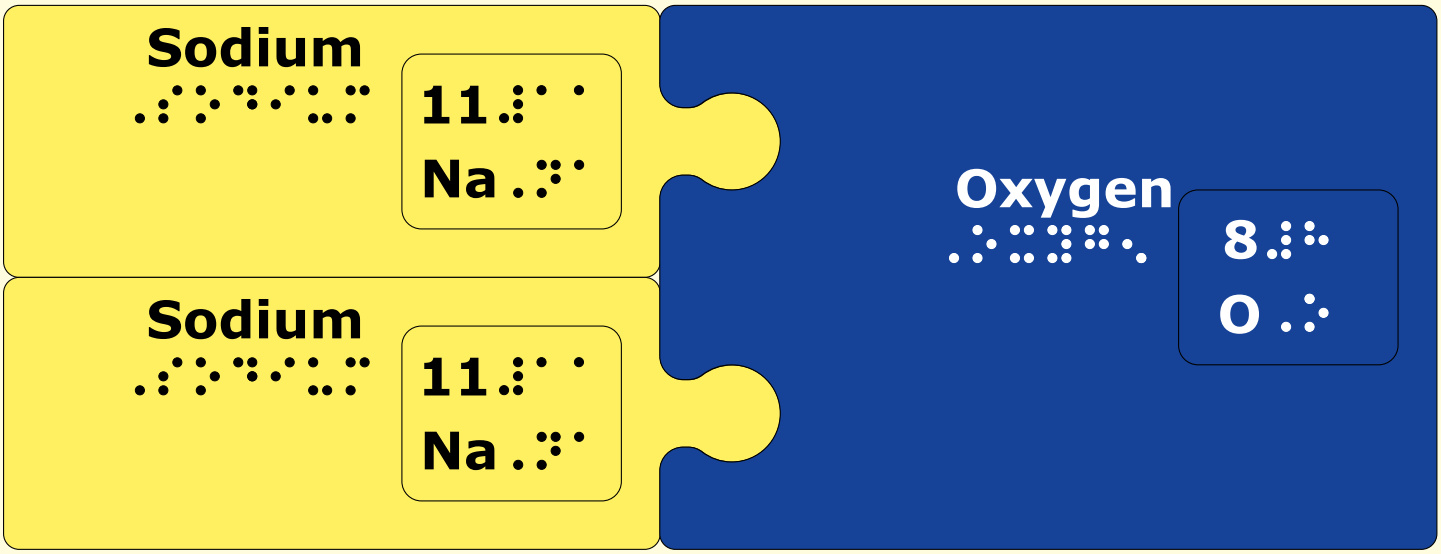
Na_2O – Sodium oxide



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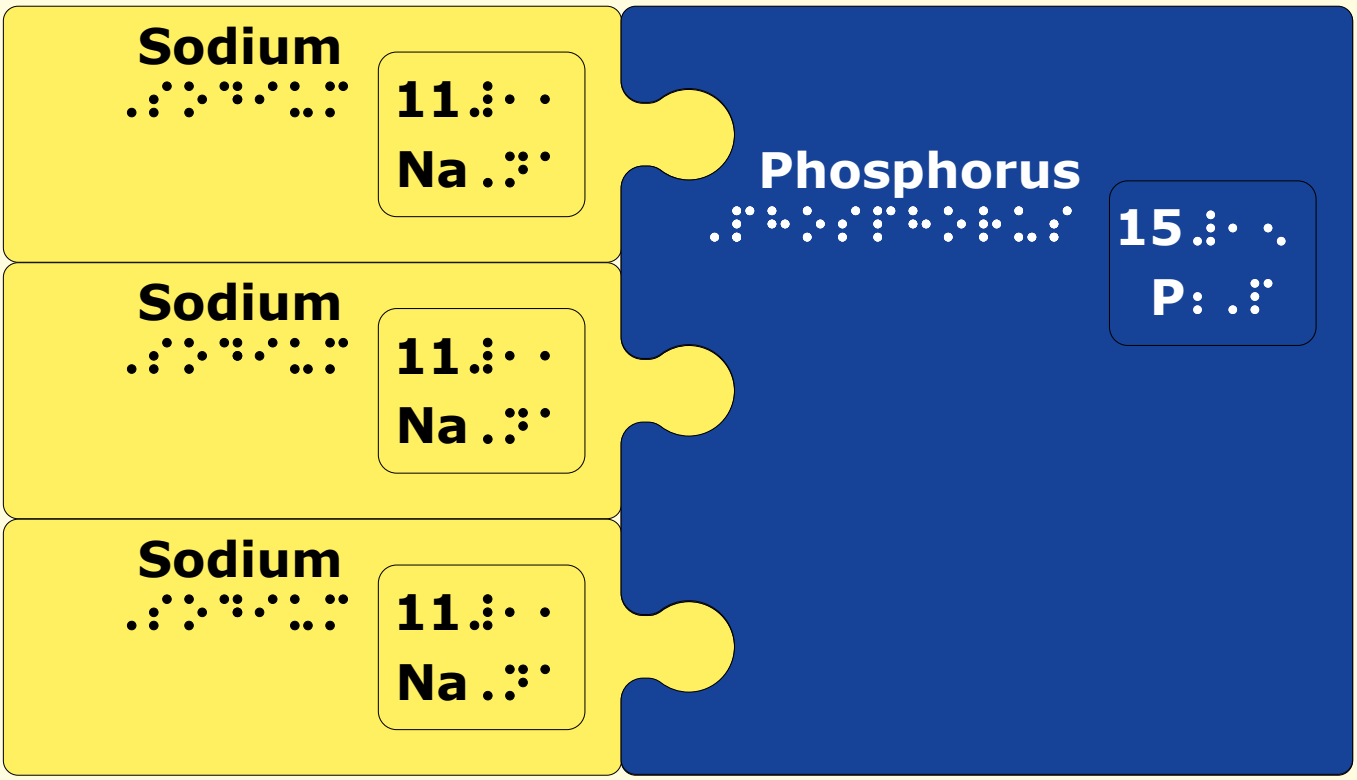
Na_3P – Sodium phosphide



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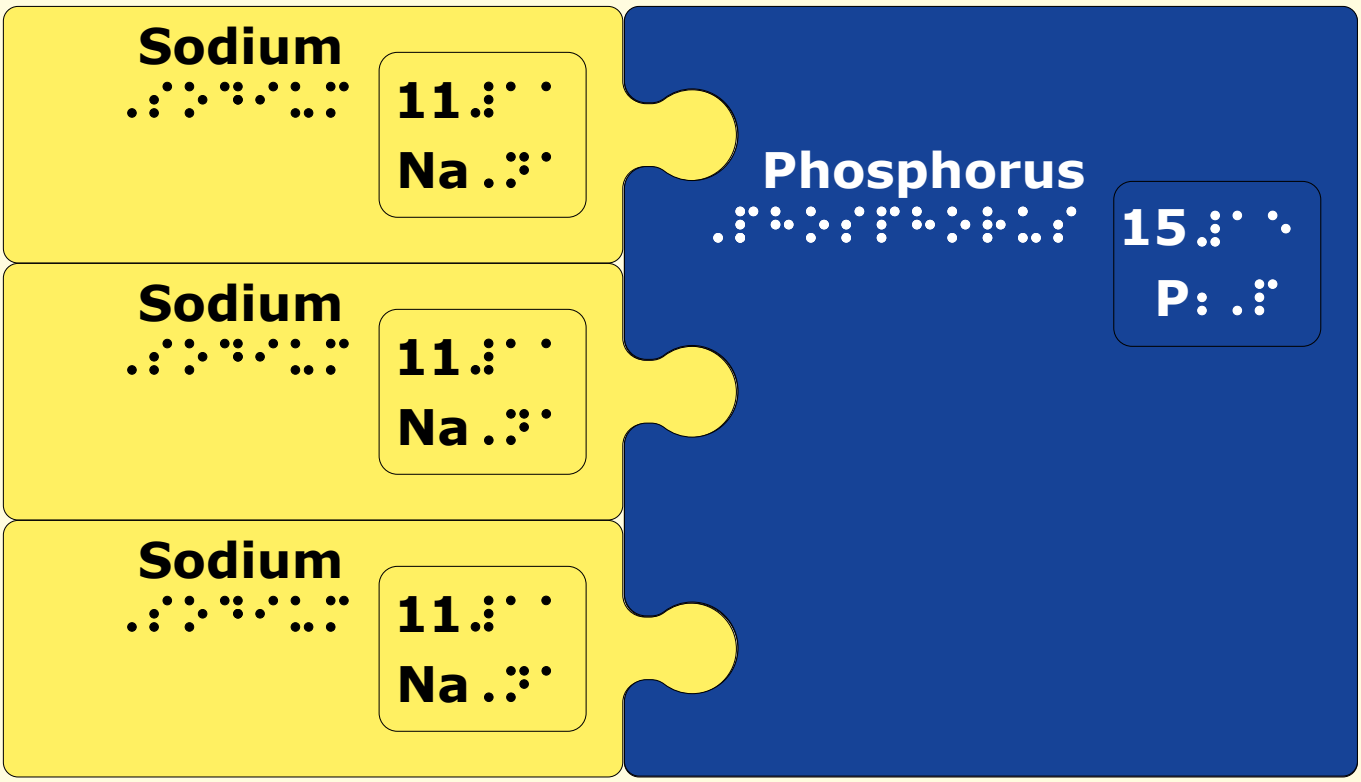
Na_3P – Sodium phosphide



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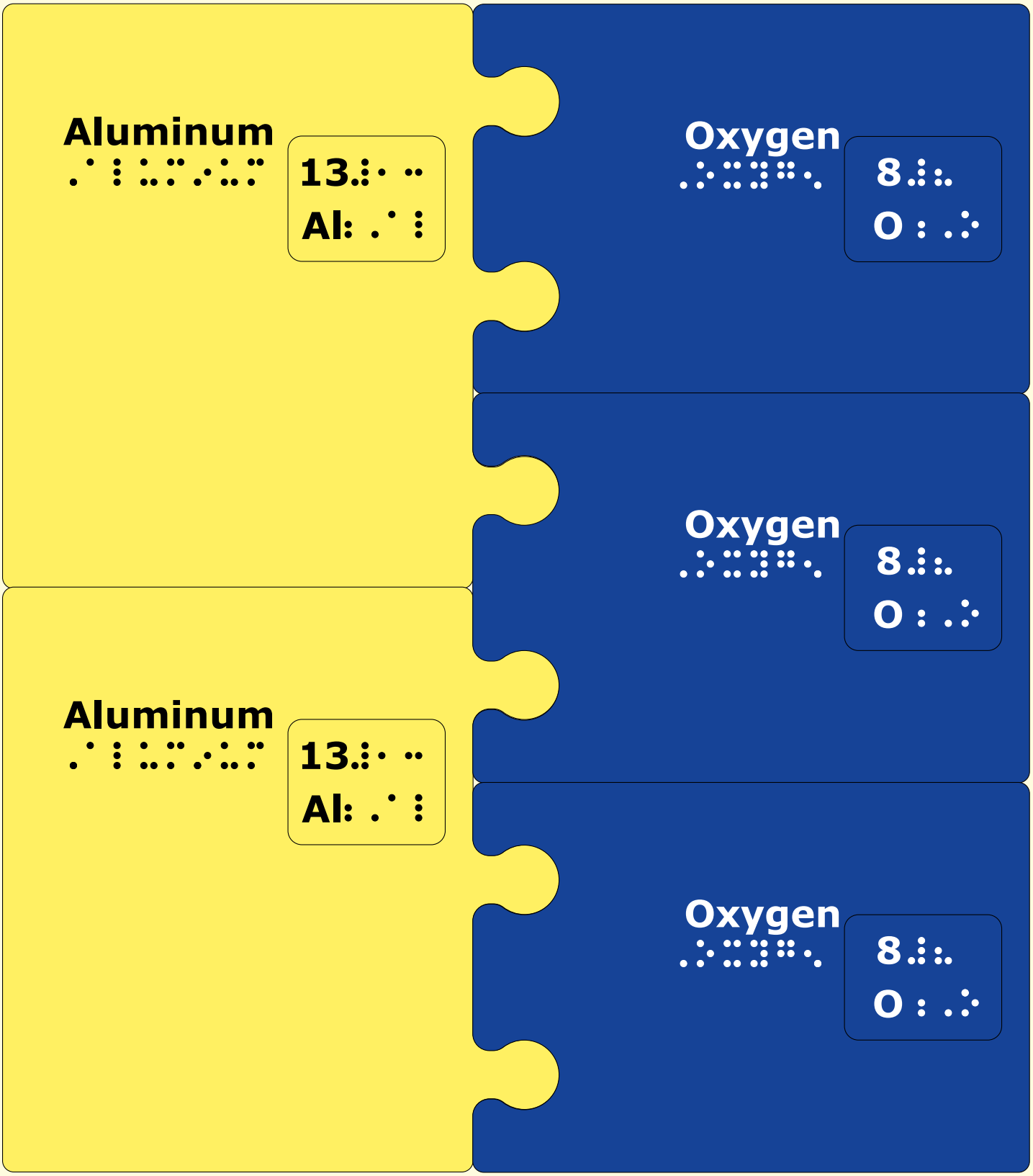
Al_2O_3 – Aluminum oxide



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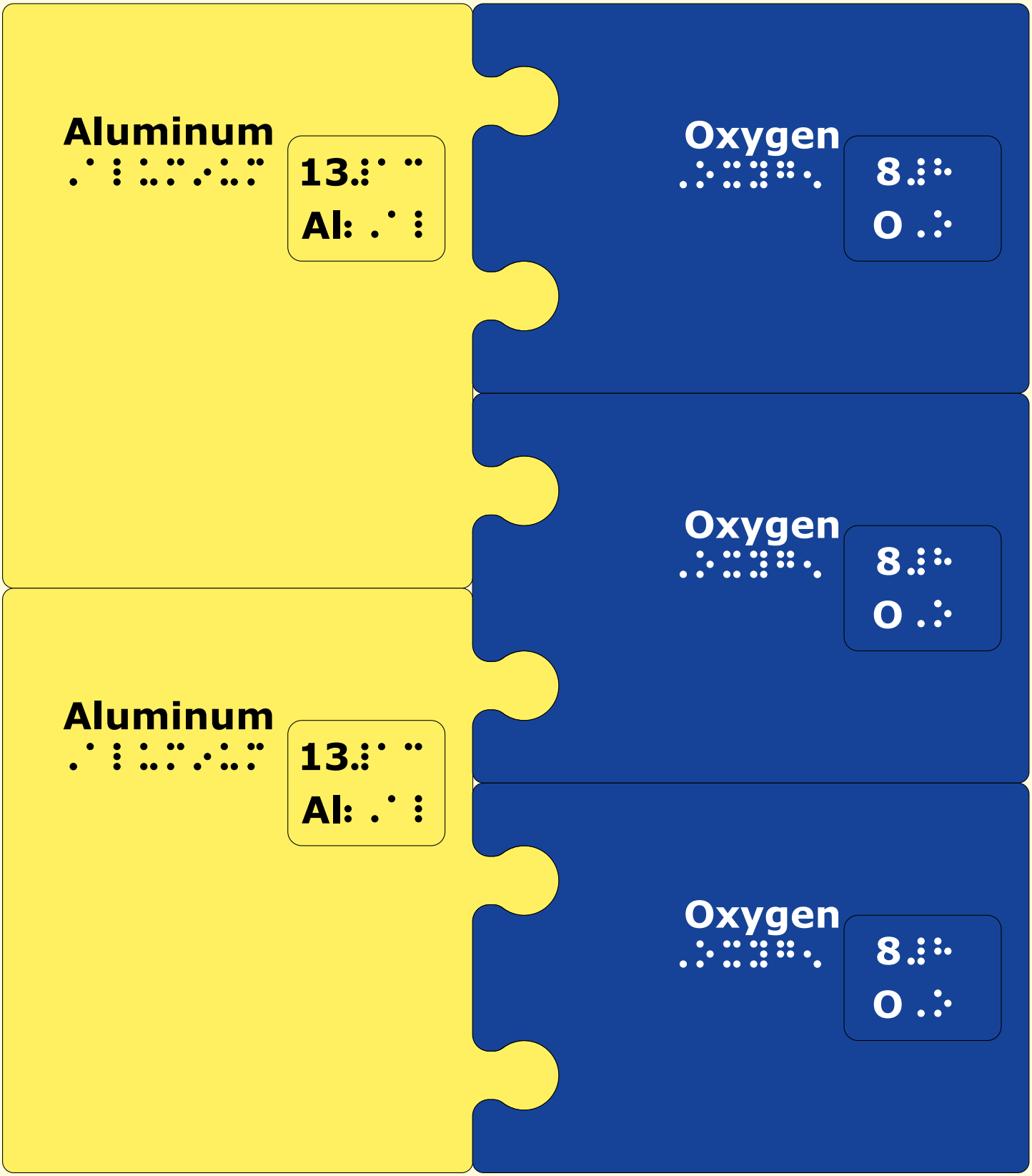
Al_2O_3 – Aluminum oxide



Alignment with the Next Generation Science Standards*

HS-PS1-2 Matter and its Interactions

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.

Grade: High School (9-12)

*NGSS Lead States. 2Ø13. ***Next Generation Science Standards: For States, By States.*** Washington, DC; The National Academies Press.

Notes

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AMERICAN PRINTING HOUSE

1839 Frankfort Avenue, Louisville, Kentucky 40206
502-895-2405 • 800-223-1839
aph.org • info@aph.org

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