

Focused Learning Lesson
Science
Grades 9 – 12
PS-H-A2 (*Lesson 1 of 2*)

Overview:

This lesson uses tangible items to help students understand the difference between an atom and an ion. Once students understand these concepts, they can better grasp the concepts of chemical formulas and equations.

Approximate Duration: 45 minutes for day one

Benchmark:

PS-H-A2 understanding the language of chemistry (formulas, equations, symbols) and its relationship to molecules, atoms, ions, and subatomic particles

PS GLE: 3. Distinguish among symbols for atoms, ions, molecules, and equations for chemical reactions.

Benchmark:

SI-H-A4 formulating and revising scientific explanations and models using logic and evidence

SI GLE: 7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations).

Objectives:

1. The learner will differentiate between atoms and ions.
2. The learner will use chemical symbols to represent atoms and ions of different elements.

Teacher Preparation: See *Teacher Background* found in Attachment 1.

Materials:

- aluminum foil – 1 square decimeter per student
- pencil – 1 per student
- sulfur – can be purchased in a drug store
- paper – 1 sheet per student
- periodic table of the elements; one large one which the entire class can view or one small one per student
- paper plates – two per pair of students
- plastic cups – one per pair of students to hold *M* & *M's*®
- four sets of 20 *M* & *M's*® (each set a different color) for a total of 80 *M* & *M's*® per pair of students
- one copy of the worksheet: Atom or Ion?, Attachment 4 for each student

Lesson Procedures:

Set or Opener: (5 minutes)

Provide each student with a piece of aluminum foil one square decimeter in size.

Have students tear the aluminum foil into the smallest pieces possible. Have students use a pencil point to pick up the smallest piece of aluminum. Tell the students that this small piece of aluminum contains many atoms of aluminum. If the aluminum could be broken down to one atom of aluminum, that atom would have all the properties of aluminum.

Give each student a small amount of sulfur (see Teacher Background) on a sheet of paper. Have students use the tip of a pencil to separate the sulfur into the smallest pieces possible. Tell students that this small piece of sulfur contains many atoms of sulfur. If the sulfur could be broken down to one atom of sulfur, that atom would have all the properties of sulfur.

Body of the Lesson:

1. Refer students to a periodic table. Have them find the symbol for aluminum (Al).
2. Ask: “How many protons does an atom of aluminum have?” (13) “How many electrons does an atom of aluminum have?” (13) Lead them to understand that atoms are neutral, that is the positive and negative charges are equal; therefore, they balance each other to produce no net charge.
3. Have students write the symbol for an atom of aluminum (Al).
4. Ask them to find the symbol for sulfur (S). Then ask, “How many protons does an atom of sulfur have?” (16) “How many electrons does an atom of sulfur have?” (16) Reinforce the concept that atoms are neutral.
5. Have students write the symbol for an atom of sulfur (S).
6. For the following activities, use the element Na to demonstrate what students are to do prior to implementing each. You may use a transparency with circles drawn on it so that students can observe where you place the. Sodium has 11 protons in the nucleus, eight electrons in the first energy shell, and 3 electrons in the second energy level.
7. Implement the activity: *M & M[⊗] Atoms*. For directions, see Attachment 2. Students will work in pairs to complete the activities.
8. Implement the activity: *M & M[⊗] Ions*, Attachment 3.
9. Go over the directions for the practice worksheet: *Atom or Ions*, Attachment 4. The worksheet should be completed individually.
10. Observe student performance and use guiding questions as needed while students complete the practice sheet.

Closure:

Refer students to the periodic table. Ask students what is the difference between a potassium atom (K) and a potassium ion (K⁺). *The atom is neutral and ion has a charge due to the loss of an electron.* Ask students what is the difference between a phosphorus atom and a phosphorus ion. *The atom is neutral and ion has a charge due to loss or gain of electrons.* Reinforce the concept that for any of the elements, atoms are neutral and ions have an electrical charge due to the gain or loss of electrons.

Attachments:

- Attachment 1: Teacher Background
- Attachment 2: *M & M[⊗] Atoms*
- Attachment 3: *M & M[⊗] Ions*

Attachment 4: Worksheet, Atom or Ion?

Attachment 5: Worksheet, Atom or Ion? Key

Assessment:

Teacher observation is used for formative assessment.

The practice worksheet, Atoms or Ions, should be evaluated for completeness and to check for level of student understanding.

Reference Links:

Information on Atoms is available online at

http://www.chem4kids.com/files/atom_structure.html

Information on Ions is available online at

http://www.chem4kids.com/files/atom_ions.html

Attachment 1

Teacher Background

Definitions

An *atom* is the smallest particle of matter that still retains the properties of an element.

An *ion* is a charged particle; the charge results from an atom either having more or less electrons than protons.

Preparation of *M & M*® Cups

For each pair of students prepare a plastic cup place 80 *M & M*'s® in four different colors.

In each cup, place 20 *M & M*'s® of each color. Collect and save the *M & M*'s® for use in the second lesson. Disks of colored paper or plastic may be substituted for *M & M*'s®.

Sulfur

Some students may be allergic to sulfur. Survey the students prior to giving out the sulfur. An alternative could be to use charcoal for carbon.

After activity is completed, return sulfur to the container and store. Do not throw the sulfur into a trashcan.

Protons, Neutrons, Electrons

Protons and neutrons occupy the nucleus of an atom.

Protons have a positive electrical charge and are essential to identifying the element. The number of protons in a nucleus identifies the element. For example, if an element has six protons, then the element is carbon. It cannot be anything else with six protons in the nucleus. If an element has 22 protons, then the element is titanium. The number of protons in the nucleus determines identity of the atom.

Neutrons are electrically neutral; i.e., they do not have an electrical charge. Neutrons are not essential to identifying an element. The number of neutrons in an atom of the same element may vary. Atoms having different numbers of neutrons are called isotopes. The concept of isotopes is not part of this lesson.

Electrons are found outside the nucleus. Electrons have a negative electrical charge and are essential to chemical bonding. The number of electrons for a specific element can vary depending on if the element is a neutral atom or an electrically charged ion.

Outermost Electrons, Metals and Nonmetals

The periodic table contains a fountain of information. Elements are organized into groups (vertical columns) on the periodic table. For example, the elements of group two include beryllium, magnesium, calcium, strontium, barium, and radium.

There are 18 groups of elements. Elements in the same group tend to have similar properties due to their electron configurations. One important item of information given by the group number of an element is the number of electrons found in the outermost shell of that element (called valence electrons). For example, all the atoms of the

elements in Group Two have two valence electrons. The electrons found in the outermost shell of an element are very important when it comes to chemical bonding.

Electrons Found in the Outermost Shell of an Element

Group Number	1	2	3-12 Transition Elements	13	14	15	16	17	18*
Number of Electrons in the Outermost Shell	1	2	varies	3	4	5	6	7	8

* Helium is an exception because it only has 2 electrons

Elements found in groups three through 12 are transition elements. These elements may vary in the number of electrons involved in chemical bonding.

Another item of information provided by the periodic table is whether an element is a metal or a nonmetal (or a semi-metal). Elements to the left of the zigzag line are metals, elements to the right of the zigzag line are nonmetals. Elements that touch the zigzag line (there are exceptions) are semi-metals.

Metals tend to lose electrons when bonding. Nonmetals tend to gain electrons when bonding. Elements tend to gain or lose electrons in order to have a full outer shell. A full outer shell consists of 8 electrons (hydrogen, helium, and a few other elements are exceptions).

Metals (in general, have 1, 2, or 3 electrons in the outermost shell) will give up the outermost electrons. The shell beneath the outer shell is already full. Nonmetals (in general, have 5, 6, 7, or 8 electrons in the outermost shell) will gain electrons in its outermost shell. The number of electrons gained will aid the element in achieving a full outer shell of electrons (8).

Electrons Found in the Outermost Shell, What Happens During Bonding

Group Number	1	2	13	14	15	16	17	18*
Number of Electrons - Outermost Shell	1	2	3	4	5	6	7	8
Electrons Gained or Lost in Bonding	Loses 1	Loses 2	Loses 3	Exceptions	Gains 3	Gains 2	Gains 1	Neither Inert

* Helium is an exception because it only has 2 electrons.

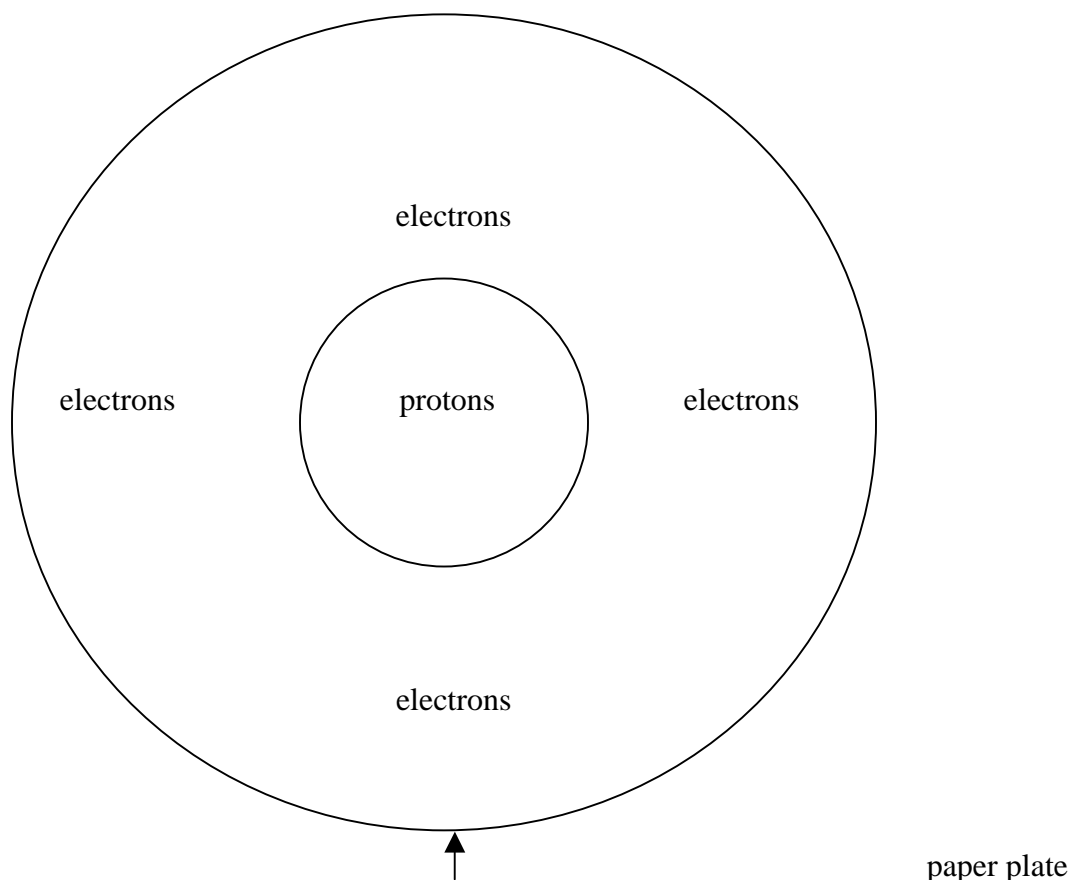
Attachment 2

M & M[®] Atoms

Divide the class into cooperative pairs of students. Provide each pair with two paper plates and with *M & M*[®] (see Teacher Background). Have students write the symbol for an atom of aluminum on one paper plate. Have students draw a circle in the center of the paper plate. This circle represents the nucleus of the atom and will hold the protons. Have students choose a color *M & M*[®] to represent the protons of aluminum. Then, have students place the appropriate number of *M & M*[®] to represent the protons in an atom of aluminum in the center of the paper plate. Next, have students choose a color *M & M*[®] to represent the electrons of aluminum. Have students place the appropriate number of *M & M*[®] to represent the electrons in an atom of aluminum surrounding the nucleus of the atom on the paper plate. Reinforce the concept that an atom of aluminum is neutral.

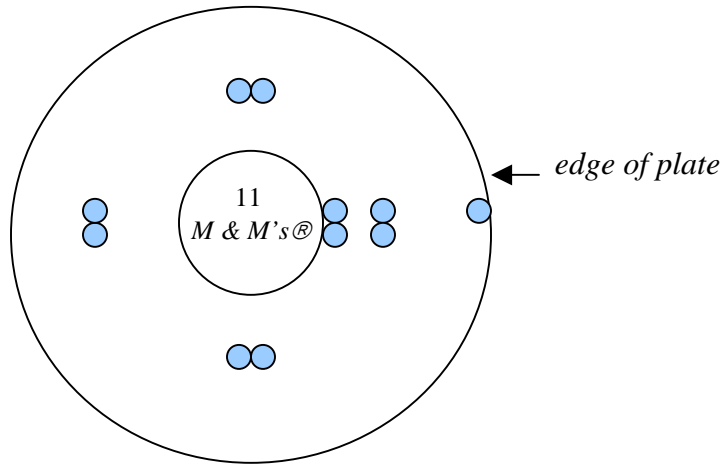
Repeat the above process on the second paper plate for an atom of sulfur.

Discuss the presence of neutrons (see Teacher Background) in the nucleus and explain that they are not represented in the *M & M*[®] atoms. Have students set the *M & M*[®] atoms aside for future use in the lesson.



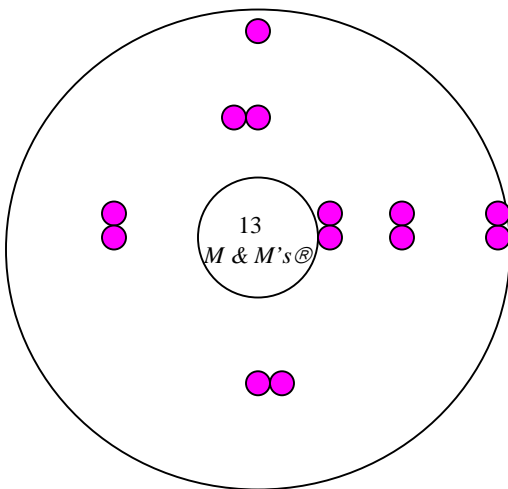
Key for Models

Model atom of sodium (Na) for teacher demonstration.

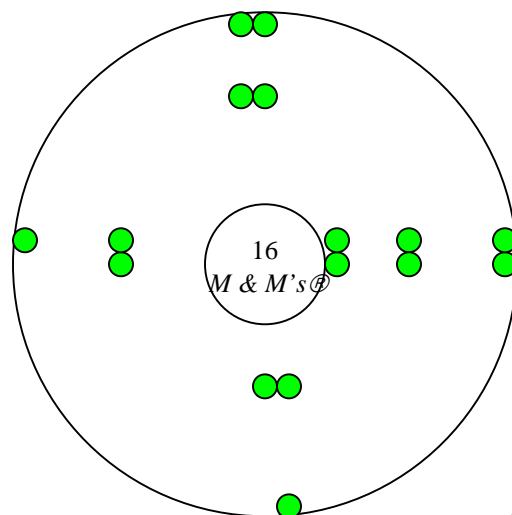


Below are models of how the student's atoms should appear when constructed correctly. Emphasize that there are two electrons in the first energy level and up to eight in the second energy level. The electrons in the outer level are valence electrons which are involved in bonding.

Aluminum Atom



Sulfur Atom



Attachment 3

M & M[⊗] Ions

Explain to students that when a metal element forms a bond with a nonmetal element to create a compound (two or more elements chemically bonded), the metal tends to give up some of its electrons to the nonmetal. The electrons that are given up are in the outermost shell of the atom. You can tell how many electrons are in the outermost shell of many atoms by information provided on the periodic table (see Teacher Background). Aluminum is a metal element that is located in group 13 on the periodic table. An element in group 13 has three electrons in the outermost shell and tends to give up these three electrons when bonding to form a compound.

Have students remove three *M & M[⊗]* electrons from the atom of aluminum that was constructed in the previous activity, *M & M[⊗] Atoms*. The atom (which was neutral) has now become an ion (which has a charge). Have the students count the number of protons (13) and the number of electrons (10). Say, “Protons are positive, +, and electrons are negative, –, so what would be the overall charge for the ion?” (*13 + charges plus 10 – charges = an overall 3+ charge*) The symbol for the aluminum ion is written as Al³⁺. The formula for the ion indicates that there are three more positive charges than negative charges.

Explain to students that when a metal element forms a bond with a nonmetal element to create a compound, the nonmetal tends to gain the electrons given up by the metal. The number of electrons the nonmetal element can gain depends on the number of electrons in the outermost shell of the element. You can tell how many electrons are in the outermost shell of many atoms by information provided on the periodic table. Sulfur is a nonmetal element that is located of group 16 on the periodic table. Elements of group 16 have six electrons in the outermost shell and tend to gain two electrons when bonding to form a compound.

Have students add two of the three *M & M[⊗]* electrons that were removed from the aluminum atom to the electrons of the sulfur atom. The atom (which was neutral) has now become an ion (which has a charge). Have students count the number of protons (16) and the number of electrons (18) for sulfur. Say, “Protons are positive and electrons are negative, so what would be the overall charge for the ion?” (*16 + charges plus 18 – charges = an overall 2- charge*) The symbol for the sulfur ion is written as S²⁻. This symbol now indicates that there are two more negative charges than positive charges.

Note: The “extra” electron is not floating around in space. This electron will be addressed when chemical bonding and formulas are addressed in the second lesson.

Attachment 4
Worksheet: Atom or Ion?

Indicated with an **A** or an **I** whether each of the following symbols is an atom (A) or an ion (I).

_____ 1. Na

_____ 2. K

_____ 3. Mg²⁺

_____ 4. P³⁻

_____ 5. C

_____ 6. Li¹⁺

For the particles above that were identified as ions, write the symbol below and indicate whether electrons were gained or lost. Also, indicate how many electrons were gained or lost for each ion.

Attachment 5
Worksheet: Atom or Ion?
Key

Indicated with an A or an I whether each of the following is an atom (A) or an ion (I).

 A 1. Na

 A 2. K

 I 3. Mg²⁺

 I 4. P³⁻

 A 5. C

 I 6. Li¹⁺

For the particles above that were identified as ions, indicate whether electrons were gained or lost. Also, indicate how many electrons were gained or lost for each ion.

Mg²⁺ Two electrons were lost.

P³⁻ Three electrons were gained.

Li¹⁺ One electron was lost.

PS-H-A2

Lesson 2 of 2

Overview:

This lesson uses tangible items to help students understand the formation of compounds. Students then engage in formula writing.

Approximate Duration: Two 45-minute class periods.

Benchmarks:

PS-H-A2 understanding the language of chemistry (formulas, equations, symbols) and its relationship to molecules, atoms, ions, and subatomic particles

PS GLEs:

3. Distinguish among symbols for atoms, ions, molecules, and equations for chemical reactions.
4. Name and write chemical formulas using symbols and subscripts.

Benchmark:

SI-H-A4 formulating and revising scientific explanations and models using logic and evidence

SI GLE: 7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations).

Objectives:

1. The learner will use chemical symbols to represent atoms and ions of different elements.
2. The learner will write chemical formulas for binary ionic compounds.

Teacher Preparation: See *Teacher Background* found in Attachment 1.

Materials:

- A plain apple
- A peeled apple
- A caramel-apple
- Periodic table of the elements – one large one which the entire class can view or one small one per student
- Paper plates – five per pair of students
- Plastic cups – one per pair of students – to hold *M* & *M's*[®]
- Four sets of 20 *M* & *M's*[®] (each set a different color) – a total of 80 *M* & *M's*[®] per pair of students. Colored paper disks may be substituted for the *M* & *M's*[®].
- One worksheet, *Writing Chemical Formulas* for each student
- One copy of Attachment 5, Assessment for PS-H-A2 for each student

Lesson Procedures:

Set Induction: (5 minutes)

See Teacher Background, Attachment 1 for directions. Display apples for all students to view. Ask students to determine whether each apple represents an atom or an ion.

Body of the Lesson:

Atoms and Ions

1. As a review, pose the following questions. Ask, “Do metals tend to gain or lose electrons?” (*lose*) Where are metals located on the periodic table? (*left of the zigzag line*) Do nonmetals tend to gain or lose electrons? (*gain*) Where are nonmetals located ? (*right of the zigzag line*)
2. Demonstrate how to diagram a molecule for a simple compound such as CaCl_2 . Use diagrams on the board or a transparency. See Attachment 2 for directions.
3. Implement the activity, *M & M[®]* Compounds.

Chemical Formulas

4. Demonstrate and discuss the writing of formulas for binary ionic compounds using aluminum and sulfur. See directions in Attachment 3. Be sure to provide a good explanation on the use of subscripts in formula writing. You may demonstrate writing formulas for several simple compounds if students have difficulty understanding.
5. Work remaining practice problems found on Attachment 3 with students.
6. Have students complete the practice problems found on Attachment 4 individually.

Closure: Discuss correct formulas for Attachment 4, *Writing Chemical Formulas*.

Use Attachment 5 to conduct summative assessment.

Attachments:

Attachment 1: Teacher Background

Attachment 2: *M & M[®]* Compounds

Attachment 3: Writing Chemical Formulas

Attachment 4: Worksheet: Writing Chemical Formulas

Attachment 5: Assessment for PS-H-A2

Assessment:

See attachment 5.

Reference Links and Technology Connections:

Chemical Bonding:

http://www.chem4kids.com/files/atom_bonds.html

<http://www.middleschoolscience.com/bonding.pdf>

Extensions:

Formulas Poker: <http://www.science-house.org/learn/CountertopChem/exp26.html>

Attachment 1 Teacher Background

Definitions

An *atom* is the smallest particle of matter that still retains the properties of an element

An *ion* is a charged particle; the charge results from an atom either having gained or lost electrons from its neutral state.

Preparation of *M* & *M*[⊗] Cups

Per Pair of Students

In one plastic cup place 80 *M* & *M*[⊗]:

- Use four different colors.
- Place 20 *M* & *M*[⊗] of each color in each cup.

Disks of colored paper or plastic disks may be substituted for *M* & *M*[⊗].

Set Induction

The peeled apple represents a positive ion; i.e., it represents an atom that has lost its outermost electrons or energy shell. The caramel apple represents a negative ion; i.e., it has gained electrons in its outermost shell. The apple represents a neutral atom; i.e., it hasn't gained or lost electrons.

Outermost Electrons, Metals and Nonmetals

Elements are organized into groups (vertical columns) on the periodic table. For example, the elements of group two include beryllium, magnesium, calcium, strontium, etc. One item of information given by the group number of an element is the number of electrons found in the outermost shell of that element (valence electrons) that are very important when it comes to chemical bonding.

Metals (usually have 1, 2, or 3 valence electrons) will give up the outermost electrons. Nonmetals (usually, have 5, 6, 7, or 8 electrons in the outermost shell) will gain electrons in their outermost energy shell. The number of electrons gained will aid the element in achieving a full outer shell of electrons. Eight electrons equal a full outer shell.

Electrons Found in the Outermost Shell, What Happens During Bonding

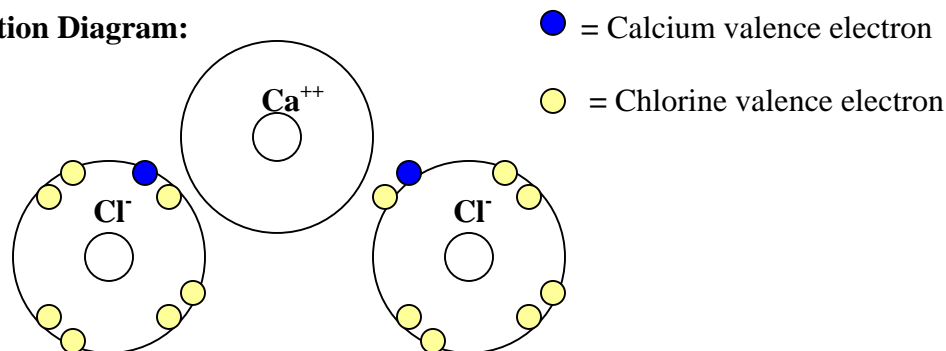
Group Number	1	2	13	14	15	16	17	18*
Number of Electrons - Outermost Shell	1	2	3	4	5	6	7	8
Electrons Gained or Lost in Bonding	Loses 1	Loses 2	Loses 3	Exceptions	Gains 3	Gains 2	Gains 1	Neither
Oxidation Number	1 ⁺	2 ⁺	3 ⁺	Exceptions	3 ⁻	2 ⁻	1 ⁻	0

* Helium is an exception in that it only has two electrons, a complete first shell.

Attachment 2

M & M[®] Compounds

Demonstration Diagram:



Activity Directions:

Place students into cooperative pairs. Provide each pair with five paper plates and with M & M's[®] or paper disks. (see Teacher Background).

Have students reconstruct the M & M[®] atoms of aluminum and sulfur (see Lesson 1). Have students remove all M & M[®] electrons except for the outermost electrons. Next have students draw the small circles (to represent the electrons they removed) on the paper plate, indicating the permanence of these electrons. The only electron M & M's[®] remaining on the paper plates should be the valence or outermost electrons (for aluminum – 3 electrons, for sulfur – 6 electrons). Have students remove all M & M[®] protons. Have students draw small circles (to represent the protons they removed) on the paper plate indicating the permanence of these protons. No M & M[®] protons should remain on the paper plates.

Ask: “What will happen to the electrons in aluminum’s outer shell?” (*They will be given up or lost.*) “What will happen to the electrons in sulfur’s outer shell?” (*Electrons will be gained until there are eight electrons in the outer energy shell.*)

Ask: “How many electrons will be gained in sulfur’s outer shell?” (*Sulfur has six electrons in its outermost shell, so it needs two more to reach the number eight which will make the shell full.*) Have students move two of aluminum’s outer electrons to sulfur’s outer energy shell. Have students write the symbol for the sulfur ion (S²⁻). Students should note that there is one electron left over from the aluminum particle.

Have students put together a second sulfur atom, with M & M's[®] representing the outer electrons and small circles representing the remaining electrons as well as the protons. Transfer the one remaining aluminum electron to this model. Have students write the symbol for the aluminum ion (Al³⁺). Ask, “Is the sulfur ion complete?” (*No, it still needs another electron.*) Ask, “Any suggestions on what we could do to get another

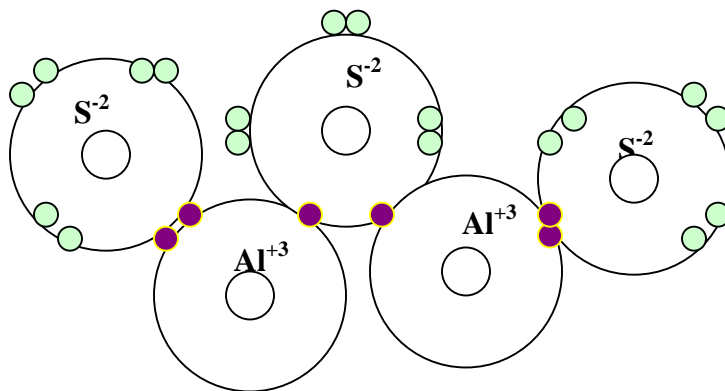
electron?” Use guiding questions to probe until students respond that another aluminum atom is needed.

Have students put together a second aluminum atom, with M & M 's® representing the outer electrons and small circles representing the remaining electrons as well as the protons. Transfer one of the three outer electrons to the sulfur outer energy shell which is still in need of an electron. Have students write the symbol for the sulfur ion (S^{2-}) Ask, “What is the problem now?” (*The aluminum particle still has two outer electrons to give away.*) Ask, “Any suggestions?” (*Another sulfur atom is needed.*) Have students put together a third sulfur atom. Transfer the two remaining aluminum electrons to the third sulfur atom. Have students write the symbols for the new aluminum and sulfur ions. Ask, “Is everything as it should be?” (*Yes.*) Tell students that aluminum and sulfur combine to form a compound. Ask, “How many aluminum atoms and how many sulfur atoms will it take to form this compound?” (*Two aluminum atoms and three sulfur atoms.*) “Does the compound have an electrical charge?” (*No, it is neutral – 2 aluminum ions with a 3^+ charge = 6^+ (2×3); 3 sulfur ions with a 2^- charge = 6^- (3×2); $6^+ + 6^- = 0$) All binary ionic compounds, metal with a nonmetal, are neutral.*

Demonstration Diagram:

● = Aluminum valence electron

○ = Sulfur electron



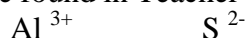
Attachment 3

Writing Chemical Formulas

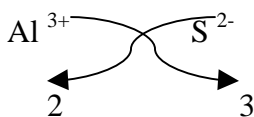
Step 1: Write the symbols for the metal (first) and the nonmetal (second).



Step 2: Assign oxidation numbers to each symbol (refer to table in Teacher Background). Have students determine the oxidation number (also called valence number) using the table found in Teacher Background and a periodic table.



Step 3: Crisscross the oxidation numbers, leaving out the positive and negative charges to determine the subscripts for each element's symbol in a formula. If the oxidation number is a 1, it is understood and is omitted. If the oxidation number for both elements is the same number, they are left out.

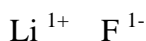


Step 4: Write the formula.



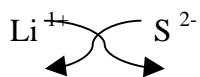
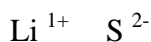
Practice:

1. Write the formula for the compound formed between lithium and fluorine.

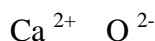


The oxidation numbers are the number 1 so they are omitted.
The formula is written as **LiF**

2. Write the formula for the compound formed between lithium and sulfur.



3. Write the formula for the compound formed between calcium and oxygen.



The oxidation numbers are the same so they are omitted.
Formula = **CaO**

Attachment 4

Worksheet: Writing Chemical Formulas

Rules for writing formulas for binary ionic compounds (metal with a nonmetal):

1. Write the symbol for the metal first. Then, write the symbol for the nonmetal.
2. Write the oxidation numbers for each element above each symbol.
3. Crisscross the oxidation numbers, leaving out the positive and negative charges to write the subscripts for the formula.
 - a. If the number is a one, omit it.
 - b. If the number for the metal and the nonmetal is the same, omit it.

Note: Names of binary ionic compounds name the metal first, then the nonmetal, changing the ending of the nonmetal to *-ide*. Example: aluminum and sulfur chemically combined would be called aluminum sulfide.

Name the metal and the nonmetal found in each of the following compounds. Then, write the chemical formula for the compound.

1. sodium oxide
 - a. metal =
 - b. nonmetal =
 - c. formula =

2. magnesium chloride
 - a. metal =
 - b. nonmetal =
 - c. formula =

3. barium fluoride
 - a. metal =
 - b. nonmetal =
 - c. formula =

4. calcium nitride
 - a. metal =
 - b. nonmetal =
 - c. formula =

5. aluminum iodide
 - a. metal =
 - b. nonmetal =
 - c. formula =

Key for Attachment 4: Writing Chemical Formulas

Name the metal and the nonmetal found in each of the following compounds. Then, write the chemical formula for the compound.

6. sodium oxide
 - a. metal = *Na or sodium*
 - b. nonmetal = *O₂ or oxygen*
 - c. formula = *Na₂O*

7. magnesium chloride
 - a. metal = *Mg or magnesium*
 - b. nonmetal = *Cl or Chlorine*
 - c. formula = *MgCl₂*

8. barium fluoride
 - a. metal = *Ba or barium*
 - b. nonmetal = *Cl or Chlorine*
 - c. formula = *BaCl₂*

9. calcium nitride
 - a. metal = *Ca or calcium*
 - b. nonmetal = *N or nitrogen*
 - c. formula = *Ca₃N₂*

10. aluminum iodide
 - a. metal = *Al or aluminum*
 - b. nonmetal = *I₂ or iodine*
 - c. formula = *AlI₃*

Attachment 5 Assessment for PS-H-A2

1. Why are atoms electrically neutral?
 - a. Subatomic particles have no charge.
 - b. The number of negative electrons equals the number of positive protons.
 - c. Atoms contain only neutrons, which have no charge.
 - d. Protons are found in the nucleus, while electrons are found outside the nucleus.

2. Which of the following is neutral?
 - a. Li
 - b. LiF
 - c. Li^{1+}
 - d. Both a and b

3. Which of the following is an atom?
 - a. K
 - b. K^{1+}
 - c. KBr
 - d. Br^{1-}

4. Which of the following is an ion?
 - a. F
 - b. F^{1-}
 - c. NaF
 - d. Na

5. Which of the following is a compound?
 - a. Mg
 - b. Mg^{2+}
 - c. MgO
 - d. O^{2-}

6. Which of the following is an atom that has gained an electron?
 - a. Negative ion
 - b. Positive ion
 - c. Neutral atom
 - d. Molecule

*Key: 1 – b, 2 – d, 3 – a, 4 – b, 5 – c, 6 – a
Delete the key prior to copying for students.*

