Activity – Ionic Compounds

Purpose: In this activity, you will learn the patterns and purpose of ionic compounds. Also, you should learn how to write formulas and names of ionic compounds.

Introduction: In this lesson, we will be creating ionic compounds using these cards with ions on them. First, we need to determine which ions can be placed together to make compounds. A compound occurs when 2 or more elements come together to form a combination that has different chemical properties from the original two elements. From there, we can then develop patterns of how ions can be placed together, and what compounds are possible and which are not.

Procedure/Questions:

Part 1: Ions

1) Obtain a bag of ions from your teacher. Each bag has 36 ions in them, some of them repeat.

2) Each of the elements in the bag have either a positive sign or negative sign associated with them. What do these positive and negative signs represent?

3) Write a working definition of the word ion.

4) Find all the sodium ions. What can you say about their charge?

5) Find all the molybdenum ions. What can you say about this element's charge?

6) Group the elements into ions that have a constant charge, another group with varying charge, and another that you are unsure. Make 3 lists for these elements below.

7) Find the element ions for sodium, potassium and lithium. What do these three elements have in common? Where are they positioned on the periodic table?

8) A group on the periodic table is an up–and–down column of elements. Elements within groups have similar properties. Knowing this what assumption can be made for hydrogen, rubidium, cesium and francium?

9) Can you find any other groups where this pattern is true?

10) Groups 3 – 12 are known as the transition metals. These metals have varying properties, including varying charge. However, scientists group them together because they do have one thing in common. It has to do with charge. What could this be?

11) If you haven't by this point retrieved your periodic table from your folder, get it out. At this point, you have made some conclusions as to the charges of groups on the periodic table. On your periodic table, write down the charges that you believe each group will form when in a compound. Check these charges with your teacher to make sure your conclusions are correct.

Part 2: Ionic Compounds

12) An ionic compound (in general) has the following physical properties:

- Ionic compounds do not conduct electricity in their solid form
- Most ionic compounds are solids at room temperature
- Ions *within* the compounds have magnetic properties, yet *ionic compounds* are not attracted to a magnet
- Ionic compounds sometimes dissolve in water, and sometimes do not

13) Based on these observed properties, what has to be true about 2 ions for them to combine?

14) Find the potassium ions that are in your packet. Can you make a compound with potassium and sodium? Why or why not?

15) Can you make a compound with potassium and chloride? Why or why not?

16) Can you make a compound with potassium and oxide? Why or why not?

17) Can you make a compound with potassium and phosphide? Why or why not?

18) Write down all of the possible compounds you created for potassium. Then, write down any other possible compounds that potassium can make with other ions in your pile. Write both the names (in words) and the formulas.

19) There are many combinations possible to make compounds, even using the limited number of ions in your pile. Write formulas and names for 20 compounds, trying to use each ion at least once. Make sure that you use at least five transition metals.

20) Based on the cards you have in your pile, why can you not make a compound between calcium and phosphide? What would you need to make the compound?

21) What happens to the name of the element when it is a negative ion?

22) What would the name be for $SrBr_2$? Rb_3As?

23) What is the purpose of the Roman numeral on some of the ions?

24) Why does sodium not have a Roman numeral? Which elements do have roman numerals?

25) What would be the formula for lead (II) chloride? Manganese (V) sulfide?

Part 3: Polyatomic Ions

26) Ask your teacher for the 10 additional polyatomic ions. Look at the formulas and names of these ions. Develop a working definition for a polyatomic ion.

27) Polyatomic ions will not change when put into a compound. However, phosphate and phosphite are two different polyatomic ions. What seems to be the difference in the two ions?

Look at nitrate and nitrite and sulfate and sulfite. Is the difference the same?

28) Now, using all 46 ions, make 20 combinations with the polyatomic ions. Write both names and formulas. Make sure that you use at least five transition metals.

29) What is confusing about this formula: $CaNO_{32}$? How could you make it make more sense based on the ions?

30) Can you put polyatomic ions together to make an ionic compound? Why? What is one example?

31) Using your periodic table (and the polyatomic ions list on the back of it), write the formulas for the following compounds:

1. Silver (I) acetate
2. Rubidium bromate
3. Gallium (III) chloride
4. Magnesium sulfite
5. Cobalt (II) hypochlorite

32) Write the names for the following compounds:

1. $Au(NO_3)_2$
2. $GeBr_4$
3. $Ba_3(PO_4)_2$
4. $Pt(SO_4)_2$
5. $Na_3Fe(CN)_6$