

Atomic Structure and Properties
1.8 Valence Electrons and Ionic Bonding
Worksheet Key

1) Write ionic formulas for the following compounds:

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|----------------------------|------------------------------|------------------------|-------------------------|
| a. Sodium Acetate | NaCH_3CO_2 | h. Silver Chloride | AgCl |
| b. Tin (II) Chloride | SnCl_2 | i. Nickel (II) Bromide | NiBr_2 |
| c. Calcium Hydroxide | Ca(OH)_2 | j. Lead (II) Nitrate | $\text{Pb(NO}_3)_2$ |
| d. Zinc Sulfate | ZnSO_4 | k. Sodium Iodide | NaI |
| e. Ammonium Sulfate | $(\text{NH}_4)_2\text{SO}_4$ | l. Lithium Fluoride | LiF |
| f. Manganese (II) Chloride | MnCl_2 | m. Potassium Sulfide | K_2S |
| g. Copper (I) Nitrate | CuNO_3 | o. Aluminum Oxide | Al_2O_3 |

2) Do metals gain or lose electrons in order to acquire a full octet?

Metals lose electrons to acquire a full octet. In doing so, they form positive ions.

3) Do non-metals gain or lose electrons in order to acquire a full octet?

Non-metals gain electrons to acquire a full octet. In doing so, they form negative ions.

4) What charge do Group 2A elements acquire as ions?

2+

5) What charge do Group 7A elements acquire as ions?

1-

6) What charge do Group 1A elements acquire as ions?

1+

7) What charge do Group 6A elements acquire as ions?

2- for non-metals and 2+ or 4+ for metals

8) What charge do Group 3A elements acquire as ions?

3+ (Tl can be 3+ or 1+)

9) What charge do Group 4A elements acquire as ions?

Ge is 4+. Pb and Sn can be 2+ or 4+.

10) What possible charge(s) can lead acquire as an ion?

Pb^{2+} and Pb^{4+}

11) What possible charge(s) can iron acquire as an ion?

Fe^{3+} and Fe^{2+}

12) Is energy released or absorbed when neutral sodium atoms react with chlorine gas to form solid sodium chloride, NaCl ?

Energy is released. It is an exothermic process.

13) The following questions pertain to ionic compounds of Mg^{2+} .

- a. Write the ionic formula for every compound that can be formed between magnesium and an element from Group 7A.

MgF_2 , MgCl_2 , MgBr_2 , MgI_2 , MgAt_2

- b. Provide an explanation for the ratio of bonding for the compounds of Mg^{2+} in part (a).

All of the compounds in part (a) bond in a 1:2 ratio of Mg^{2+} to Group 7A anion. This occurs because Mg has a 2+ charge as a cation and all Group 7A anions carry a 1- charge. For each ionic solid to be neutral, the ratio of cation to anion in the formula unit must be 1:2.

- c. Will the ratio of cation to anion be the same or different for when other Group 2A cations form ionic compounds with the anions of Group 7A? Justify your answer.

The ratio of cation to anion will be the same when other Group 2A cations form ionic compounds with the anions of Group 7A – 1:2 (Group 2A cation to Group 7A anion). All of the cations in Group 2A carry a 2+ charge and all of the anions in Group 7A carry a 1- charge. For each ionic solid to be neutral, the ratio of cation to anion in the formula unit must be 1:2.