

Answer Key

Charges of Ions Worksheet

Name _____

- What is an ion?
a charged element
- How does an atom become an ion?
it either gains or loses electrons
- What is the charge on a cation? (circle one) positive or negative
a. What type of elements become cations? (circle one) metals or nonmetals
- What is the charge on an anion? (circle one) positive or negative
a. What type of elements become anions? (circle one) metals or nonmetals
- What does a roman numeral tell you when it is written after an element?
the charge of a transition metal ~~is~~ Fe^{III} has a +3 charge
- Write the symbols and charges for the atoms given below and then identify it as anion/cation and metal/nonmetal...

| element | symbol and charge | metal or nonmetal | anion or cation |
|---------------|-------------------|-------------------|-----------------|
| calcium | Ca ⁺² | metal | cation |
| bromine | Br ⁻¹ | nonmetal | anion |
| nitrogen | N ⁻³ | nonmetal | anion |
| iron (III) | Fe ⁺³ | metal | cation |
| tin (II) | Sn ⁺² | metal | cation |
| fluorine | F ⁻¹ | nonmetal | anion |
| cesium | Cs ⁺¹ | metal | cation |
| iodine | I ⁻¹ | nonmetal | anion |
| phosphorus | P ⁻³ | nonmetal | anion |
| copper (I) | Cu ⁺¹ | metal | cation |
| lithium | Li ⁺¹ | metal | cation |
| aluminum | Al ⁺³ | metal | cation |
| sulfur | S ⁻² | nonmetal | anion |
| manganese(IV) | Mn ⁺⁴ | metal | cation |
| chlorine | Cl ⁻¹ | nonmetal | anion |
| oxygen | O ⁻² | nonmetal | anion |

Name: _____

Valence electrons

1. What is a valence electron and why are they important to a chemist?
 the outermost s and p electrons. They help us determine chemical properties.
2. What is the periodic trend for valence electrons when looking at the representative elements?
 they increase and you move right to different groups. 1A has 1 valence, 2A has 2, 3A has 3, etc.
3. How many valence electrons are there an atom of oxygen? 6
4. Valence electrons can be shown using Lewis structure. What is another name for a Lewis structure?
 Dot structure
5. Draw out the Lewis structure for...
 - a. calcium
 $\cdot \text{Ca} \cdot$
 - b. oxygen
 $\cdot \ddot{\text{O}} \cdot$

Structure of an ion

6. Elements that are classified as metals tend to form cations and those elements that are classified as non-metals tend to form anions.
7. A cation loses electrons causing the ion to have a positive charge and an anion gains electrons causing it to have a negative charge.
8. Fill in the information missing from the table below.

| Atom | Atomic # | # of protons | # of neutrons | Mass # | # of Valence e ⁻ | Electrons are lost or gained | # of e ⁻ lost or gained | Cation or Anion |
|-----------|----------|--------------|---------------|--------|-----------------------------|--------------------------------------|------------------------------------|-----------------|
| Potassium | 19 | 19 | 20 | 40 | 1 | lost | 1 | Cation |
| Sulfur | 16 | 16 | 16 | 32 | 6 | gained | 2 | anion |
| Copper | 29 | 29 | 36 | 64 | 2 | lost | 2 | cation |
| Thallium | 81 | 81 | 44 | 125 | 2 | lost | 2 | cation |
| Aluminum | 13 | 13 | 14 | 22 | 3 | lost | 3 | cation |
| Lead | 82 | 82 | 124 | 206 | 4 | typically lose because it is a metal | 4 | cation |

Notation and naming of ions

When naming ions you will first have to determine if the ion is a cation or an anion. If it is a cation, from the representative elements its name does not change you just simply say ion (ie lithium becomes lithium ion). If it is a cation from the transition metals you will need to look on the back of your periodic table (copper becomes copper II ion). If the ion is an anion its names ending changes from to -ide (ie sulfur becomes sulfide).

9. Fill in the information missing from the table below.

| Name | Symbol | Proton # | Electron # | Neutron # | Charge |
|-----------------|-------------------------------|---------------------|------------|-----------|--------|
| iron (III) | ${}^{57}_{26}\text{Fe}^{3+}$ | 26 26 | 23 | 31 | 3+ |
| sulfide ion | ${}^{33}_{16}\text{S}^{2-}$ | 16 | 18 | 17 | 2- |
| Fluoride ion | ${}^{19}_9\text{F}$ | 9 | 10 | 10 | 1- |
| potassium ion | ${}^{37}_{19}\text{K}^{+1}$ | 19 | 18 | 18 | 1+ |
| Nitride ion | ${}^{14}_7\text{N}^{-3}$ | 7 | 10 | 7 | 3- |
| copper (II) ion | ${}^{64}_{29}\text{Cu}^{+2}$ | 29 | 27 | 34 | +2 |
| Silver ion | ${}^{108}_{47}\text{Ag}^{+1}$ | 47 | 46 | 61 | 1+ |
| Oxide ion | ${}^{16}_8\text{O}$ | 8 | 10 | 8 | 2- |
| iron (II) | ${}^{57}_{26}\text{Fe}^{+2}$ | 57 | 55 | 31 | +2 |

Naming Ionic Compounds

Chem Worksheet 8-2

Name _____

An **ionic compound** is a combination of oppositely charged ions. Ionic compounds generally contain a metal bonded to a non-metal (or non-metals). When naming ionic compounds we simply name the cation (the positive ion) then the anion (the negative ion). The cations generally retain the name of the element, so Na^+ is named sodium. The **monatomic anions** are formed when a non-metal gains an electron and these ions have an -ide ending, so S^{2-} is named sulfide. There are a group of **polyatomic ions** as well that have their own unique names. A list of these appears below.

Some metals can form more than one positive ion. Copper for example forms Cu^{1+} and Cu^{2+} ion. These ions are named using Roman numerals: copper (I) and copper (II) respectively. Most metals that form more than one type of cation are found in the transition metal family or below the non-metals in the *p*-block.

Rules for naming Molecular Compounds

1. Name the positive ion. Most cations have the same name as their elements.
2. Name the negative ion. Monatomic anions have an -ide ending. Polyatomic anions names' must be memorized.
3. If the positive ion is a transition metal or located on the right side of the table it may have more than one charge. In this case use Roman numerals to designate the charge.

Common Polyatomic Ions

| | |
|------------------------------------|-------------|
| NH_4^+ | Ammonium |
| OH^- | Hydroxide |
| CN^- | Cyanide |
| NO_3^- | Nitrate |
| ClO_3^- | Chlorate |
| $\text{C}_2\text{H}_3\text{O}_2^-$ | Acetate |
| SO_4^{2-} | Sulfate |
| CO_3^{2-} | Carbonate |
| PO_4^{3-} | Phosphate |
| HCO_3^- | Bicarbonate |
| HSO_4^- | Bisulfate |

Examples

Name the following compounds:

| Formula | Name |
|--------------------------|-------------------------|
| NaCl | Sodium chloride |
| K_2S | Potassium sulfide |
| MgSO_4 | Magnesium sulfate |
| $\text{Mn}(\text{OH})_2$ | Manganese(II) hydroxide |

Write the names for the following ionic compounds.

| | Formula | Name |
|-----|------------------------------------|---------------------|
| 1. | Li_2S | Lithium Sulfide |
| 2. | KF | Potassium Fluoride |
| 3. | Mg_3N_2 | Magnesium Nitride |
| 4. | $\text{Ca}(\text{OH})_2$ | Calcium Hydroxide |
| 5. | $\text{Ba}(\text{NO}_3)_2$ | Barium Nitrate |
| 6. | CuCl_2 | Copper II chloride |
| 7. | PbO | Lead II oxide |
| 8. | ZnF_2 | Zinc II Fluoride |
| 9. | $\text{NaC}_2\text{H}_3\text{O}_2$ | Sodium Acetate |
| 10. | SrCO_3 | Strontium Carbonate |
| 11. | CrSO_4 | Chromium Sulfate |
| 12. | Na_3PO_4 | Sodium Phosphate |

| | Formula | Name |
|-----|---|--------------------|
| 13. | CaBr_2 | Calcium Bromide |
| 14. | $\text{Ni}(\text{CN})_2$ | Nickel II Cyanide |
| 15. | $\text{Al}(\text{NO}_3)_3$ | Aluminum Nitrate |
| 16. | $\text{Sn}(\text{OH})_2$ | Tin II Hydroxide |
| 17. | HgI_2 | Mercury II Iodide |
| 18. | $\text{Fe}_2(\text{SO}_4)_3$ | Iron Sulfate |
| 19. | $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ | Calcium Acetate |
| 20. | TiCl_3 | Titanium Chloride |
| 21. | KClO_3 | Potassium chlorate |
| 22. | ZnCO_3 | Zinc Carbonate |
| 23. | NaHCO_3 | Sodium Bicarbonate |
| 24. | $\text{Co}(\text{HSO}_4)_2$ | Cobalt Bisulfate |