Nomenclature inorganic compounds pdf

Generally, there are two types of inorganic compounds that can be formed: ionic compounds and molecular compounds. Nomenclature is the process of naming chemical compounds with different names so that they can be easily identified as separate chemicals. Inorganic compounds are compounds that do not deal with the formation of carbohydrates, or just all other compounds that do not fit into the description of organic compounds. For example, organic compounds include molecules with carbon rings and/or chains with hydrogen atoms (see image below). Inorganic compounds, the topic of this section, are any other molecules that do not include this distinctive structure of carbon and hydrogen. Compounds made of metal and nonmetal are commonly known as Ionic Compounds, where compound names have an end to ideas. Cations have a positive cost while anion has a negative cost. The net charge of any ionic compound must be zero which also means it must be electrically neutral. For example, one Na+ is paired with one Cl-; one Ca2+ paired with two Br-. There are two rules to follow: Cation (metal) is always named first with its name unchanged Anion (nonmetal) written after cation, modified to end in –ideas Table 1: Cations and Anion: +1 Cost +2 Cost -1 Cost -2 Cost -3 Cost -4 Cost Group 1A element Group 2A Element Group 7A Group 6A element Group 5A Element Group 4A Hydrogen: H + Beryllium: Be2 + Hydride: H- Oxide: O2- Nirida: N3- Carbide: C4 - Lithium: Li+ Magnesium: Mg2+ Fluoride: F- Sulfide: S2- Phosphide: P3- Soduim: Na + Calcium: Ca2+ Chloride: Cl- Potassium: K+ Strontium: Sr2+ Bromide: Br- Rubidium: Rb+ Barium: Ba2+ Iodide: I- Cesium: Cs+ Example 1 Na+ + Cl- = NaCl; Ca2+ + 2Br- = CaBr2 Sodium + Chlorine = Sodium Chloride; Calcium + Bromine = Calcium Bromide Metal transition can form more than one ion, so it is necessary to determine the specific ions that we are talking about. This is indicated by establishing Roman numerals after metal. Roman numerals indicate the charge and oxidation status of transitional metal ions. For example, iron can form two common ions, Fe2+ and Fe3+. To distinguish, Fe2+ will be named iron (II) and Fe3+ will be named iron (III). Transition Metal and Metal Cations Table: +1 Charge +2 Charge +3 Charge +4 Charge Copper(I): Cu+ Copper(II): Cu2+ Aluminum: Al3+ Lead(IV): Pb4+ Silver: Ag+ Iron(II): Fe2+ Iron(III): Fe3+ Tin(IV): Sn4+ Cobalt(II): Co2+ Cobalt(III)): Co3+ Tin(II): Sn2+ Lead(II): Pb2+ Nickel: Ni2+ Zinc: Zn2+ Example 2 Ion: Fe2++ 2Cl- Fe3++ 3Cl- Compound: FeCl2 FeCl3 Nomenclature Iron (II) Chloride Iron (III) Chloride However, some transition metal costs have a specific Latin name. Just like other nomenclature rules, transitional metal ions that have a lower charge have a Latin name that ends with -ous and the one with the higher charge has a Latin name that ends with -ic. The most common shown in the table below: Transition metal ions with Latin Roman Numeral Copper name (I): Cu + Cuprous Copper (II): Cu2 + Cupric Iron (II): Fe2 + Iron Iron (III): Fe3 + Ferric Lead (II): Pb2 + Plumbous Lead (IV): Pb4+ Plumbic Mercury (I): Hg22+ Mercurous Mercury (II): Hg2+ Mercuric Tin (II): Sn2+ Stannous Tin (IV): Sn4+ Stannic Some exceptions apply to Roman numeral assignments: Aluminum, Zinc, and Silver. Although they fall into the category of transitional metals, they do not have Roman numerals written after their names because they exist in only one ion. Instead of using Roman numerals, different ions can also be presented with plain words. The metal is converted into an end of -ous or –ic. -ous ending used for lower oxidation state -ic ending used for higher oxidation state Example 3 Cu2O Compound CuO FeCl2 FeCl3 Charge Charge copper is +1 Copper charge is +2 Iron charge is +2 Iron charge is +3 Nomenclature Cuprous Oxide Cupric Oxide Ferrous Chloride Ferric Chloride However, This -ous/-ic system was inadequate in some cases, so the Roman numeral system was preferred. This system is used generally in the naming of acids, where H2SO4 is commonly known as Sulfuric Acid, and H2SO3 is known as SulfurIc Acid. Compounds consisting of nonmetal to nonmetal bonds are commonly known as Molecular Compounds, in which elements with a positive oxidation state are written first. In many cases, nonmetals form more than one binary compound, so prefixes are used to distinguish them. # of Atom 1 2 3 4 5 6 7 8 9 10 Prefix Mono- Di- Tri- Tetra- Penta- Hexa- Hepta- Octa- Nona- Deca- Example 4 CO = carbon monoxide BCl3 = borontrichloride CO2 = carbon dioxide N2O5 =dinitrogen pentoxide The prefix mono- is not used for If there is no prefix before the first element, it is assumed that there is only one atom of that element. Although HF can be named hydrogen fluoride, HF is given a different name for the emphasis that it is acidic. Acid is a substance associated with hydrogen ions (H+) and anions in water. A quick way to identify acids is to see if there is H (annotating hydrogen) in front of the compound's molecular formula. To name the acid, the hydro-preceding is placed in front of a modified nonmetal to end with -ic. The state of prickly acid (aq) because acid is found in water. Some common binary acids include: HF(g) = hydrogen fluoride -> HF(aq) = HBr hydrochloric acid (g) = hydrogen bromide -> HBr (aq) = hydrobromic acid HCl (g) = hydrogen chloride -> HCl (aq)) = hydrochloric acid H2S (g) = hydrogen sulfide -> H2S (aq) = hydrosulfuricacid It is important to enter (aq) after the acid because the same compound can be written in a gas phase with hydrogen named first followed by anion ending with –idea. Example 5 hypo____ite ____ite ____ate per____ate ClO- ClO2- ClO3- ClO4- hypochlorite chlorate perchlorate ---------------- > As shown by the arrow, move to the right, right, The following trend occurs: Increasing number of oxygen atoms Increases the state of nonmetal oxidation (The use of this example can be seen from the set of compounds containing Cl and O) This occurs because the number of oxygen atoms increases from hypochlorite to perchlorate, but the overall charge of polyatomic ions is still -1. To correctly determine how many oxygen atoms are in ions, preces and sy endings are re-used. In polyatomic ions, polyatomics (meaning two or more atoms) are joined together by valen bonds. While there may be elements with positive charge such as H+, it does not join other elements with ionic bonds. This happens because if an atom forms an ionic bond, then it is already a compound, so there is no need to get or release any electrons. Polyaatomic ani is more common than polyatomic paints as shown in the chart below. Polyaatomic ani has a negative cost while polyatomic cats have a positive cost. To indicate different polyatomic ions made up of the same elements, the name of the ion is modified according to the example below: Table: Common Polyatomic ions Name: Cation/Anion Formula Ammonium ion NH4+ Hydronium ion H3O+ Acetate ion C2H3O2- Arsenate ion AsO43- Carbonate ion CO32- Hypochlorite ion ClO- Chlorite ion ClO2- Chlorate ion ClO3- Perchlorate ion ClO4- Chromate ion CrO42- Dichromate ion Cr2O72- Cyanide ion CN- Hydroxide ion OH- Nitrite ion NO2- Nitrate ion NO3- Oxalate ion C2O42- Permanganate ion MnO4- Phosphate ion PO43- Sulfite ion SO32- Sulfate ion SO42- Thiocyanate ion SCN- Thiosulfate ion S2O32- To combine the topic of acids and polyatomic ions, there is nomenclature of aqueous acids. These include sulphuric acid (H2SO4) or carbonic acid (H2CO3). To give their name, follow this quick and simple rule: If the ions end up in -eat and are added with acid, the acid name will have an -ic s ending. Example: nitric ion (NO3-) + H+ (denoting acid formation) = nitric acid (HNO3) If the ion ends -ite and is added with acid, then the acid name will have the sydant -ous. Example: nitit ion (NO2-) + H+ (indicates acid formation) = nitro acid (HNO2) Reference Pettrucci, Ralph H. General Chemistry: Modern Principles and Applications. 9th. Upper Saddle River: Pearson Prentice Hall, 2007 Nomenclature of Inorganic Chemistry, Recommendations 1990, Oxford:Blackwell Scientific Publications. (1990) International Union of Pure and Applied Chemistry (2005). Inorganic Chemical Nomenclature (IUPAC Recommendation 2005). Cambridge (UK): RSC–IUPAC. ISBN 0-85404-438-8. Electronic version.. Biochemistry Nomenclature and Related Documents, London:Portland Press, 1992. 1. What is the correct formula for Calcium Carbonate? J. Ca+ + CO2- b. CaCO2- c. CaCO3 d. 2CaCO3 2. What's the correct name for FeO? A. Iron oxide b. Iron dioxide c. Iron(III) oxide d. Iron(II) oxide 3. What is the correct name for Al(NO3)3? J. Aluminum nitrate b. Aluminum(III) nitrate c. Aluminum nitrite d. Aluminum trioxide 4. What is the correct phosphorus trichloride formula? a. P2Cl2 b. PCl3 c. PCl4 d. P4Cl2 5. What is the correct perchlorate lithium formula? a. Li2ClO4 b. LiClO2 c. LiClO d. None of these 6. Write the correct name for this compound. a. BeC2O4: b. NH4MnO4: c. CoS2O3: 7. What is W(HSO4)5? 8. How do you write trioxide diphosphorus? 9. What is H3P? 10. By adding oxygen to the molecule at number 9, do we now have H3PO4? What's the name of this molecule? 1.C; Calcium + Carbonate --> Ca2+ + CO32- --> CaCO3 2.D; FeO --> Fe + O2- --> Iron must have a charge of +2 to make neutral compounds --> Fe2+ + O2- --> Iron(II) Oxide 3.A; Al(NO3)3 --> Al3+ + (NO3-)3 --> Aluminum nitrate 4.B; Phosphorus trichloride --> P + 3Cl --> PCl3 5.D, LiClO4; Lithium perchlorate --> Li+ + ClO4- --> LiClO4 6. a. Beryllium Oxytolic; BeC2O4 --> Be2+ + C2O42- --> Beryllium Oksatur b. Ammonium Permanganate; NH4MnO4 --> NH4+ + MnO4- --> Ammonium Permanganate c. Cobalt (II) Thiosulfate; CoS2O3 --> Co+ S2O32- --> Cobalt must have a payload of +2 to create a neutral compund --> Co2+ + S2O32- --> Cobalt(II) Thiosulfate 7. Tungsten (V) hydrogen sulfate 8. P2O3 9. Hydrophosphate acid 10. Contributors to phosphoric acid and attribution Pui Yan Ho (UCD), Alex Moskaluk (UCD), Emily Nguyen (UCD) (UCD)