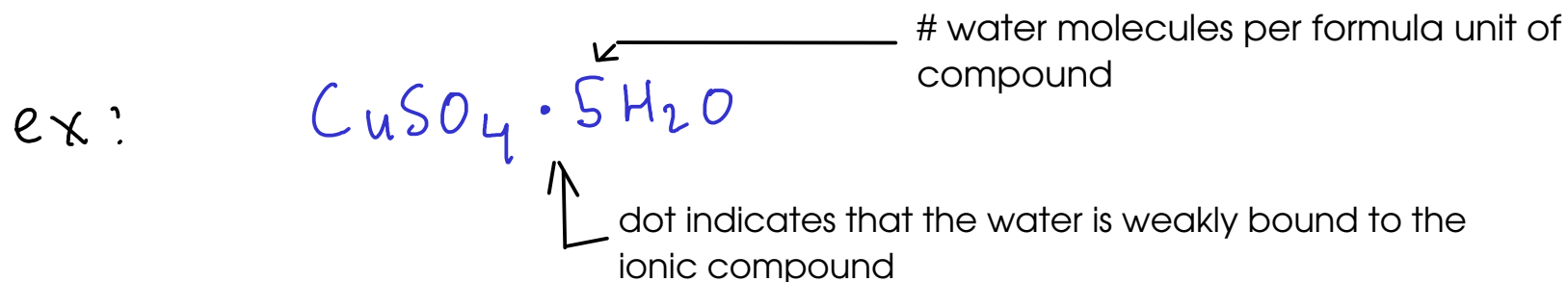


## HYDRATES

- many ionic compounds are formed by crystallizing the compound from water. Sometimes, this causes water molecules to become part of the crystal structure.

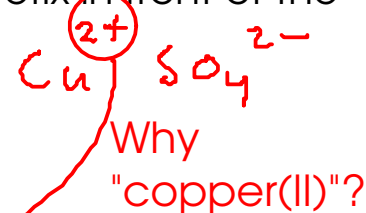
- This water is present in a definite ratio to the ions in the compound. Can be removed by heating, but will NOT evaporate if the compound is left standing.



- many DESSICANTS are hydrates that have had their water molecules driven off. They will slowly reabsorb water from the air (and keep the environment in a dessicator at a low humidity)

- Hydrates are named using the name of the ionic compound, and a Greek prefix in front of the word "hydrate" to indicate how many water molecules are associated

Copper (II) sulfate pentahydrate



## MOLECULAR COMPOUNDS

- There are several kinds of molecular compound. We will learn to name two simple but important classes

### ① BINARY MOLECULAR COMPOUNDS

- molecular compounds containing only two elements

### ② ACIDS

- molecular compounds that dissolve in water to release  $H^+$  ions
- corrosive to metals (react with many to produce hydrogen gas)
- contact hazard: can cause chemical burns to eyes and skin
- sour taste
- turn litmus indicator RED
- two kinds of acids:

#### ① BINARY ACIDS

- contain hydrogen and one other element

#### ② OXYACIDS

- contain hydrogen, OXYGEN, and another element

Usually from  
Group VIIA

## BINARY MOLECULAR COMPOUNDS

- Named based on the elements they contain, plus prefixes to indicate the number of atoms of each element in each molecule

### ① FIRST ELEMENT

- Add a GREEK PREFIX to the name of the element.
- Omit the "MONO-" (1) prefix if there is only one atom of the first element

### ② SECOND ELEMENT

- Add a GREEK PREFIX to the STEM NAME of the element
- Add the suffix "-ide" (as if you were naming an anion)
- DO NOT omit the "mono-" prefix if there is only one atom of the second element

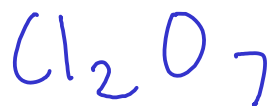
SEE COURSE WEB SITE FOR A LIST OF GREEK PREFIXES!  
THESE ARE THE SAME PREFIXES USED FOR THE HYDRATES!

## BINARY MOLECULAR COMPOUNDS

Examples:



boron trifluoride

dichlorine  
heptaoxidecarbon  
monoxidecarbon  
dioxide

\*Note: metalloids like boron behave chemically like nonmetals do.

carbon tetrachloride



dihydrogen monoxide



dinitrogen tetrafluoride



$\text{MgCl}_2$ : magnesium CHLORIDE, not magnesium DICHLORIDE. We use the ionic naming system for this compound because it's ionic - not binary molecular.

How do we tell? The first element in the formula is a metal. (Ionic compounds usually contain metals...)

## ACIDS

## ① BINARY ACIDS

- named after the element (other than hydrogen) they contain
- common binary acids include a Group VIIA element
- named: "Hydro-" + STEM NAME OF ELEMENT+ "-ic acid"

Four  
common  
binary  
acids

$\text{HF}$  : hydrofluoric acid ✖ dissolves glass!

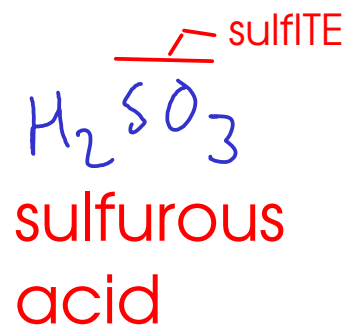
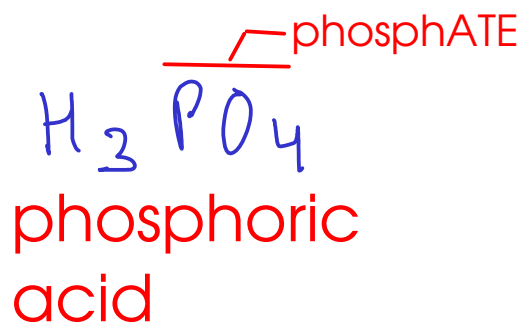
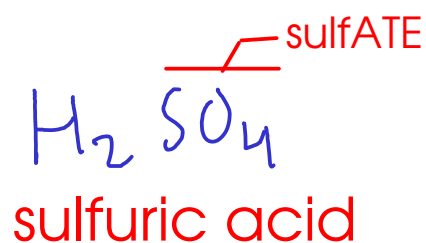
$\text{HCl}$  : hydrochloric acid ✖ most common binary acid!

$\text{HBr}$  : hydrobromic acid

$\text{HI}$  : hydroiodic acid

## ② OXYACIDS

- Easy to think about as HYDROGEN IONS combined with POLYATOMIC IONS
- These acids are not true ionic compounds, but they interact with water to PRODUCE ions!
- named based on the polyatomic ion they contain, with an ending change:
  - ① - ions ending in -ATE form acids ending in -IC
  - ② - ions ending in -ITE form acids ending in -OUS



## OXYACID EXAMPLES

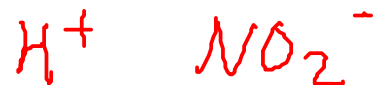
acetic acid

based on acetate



nitrous acid

based on nitrite



carbonic acid

based on carbonate



The number of hydrogen atoms at the beginning of the formula equals the charge of the anion the acid is based on!

## SUMMING UP CHEMICAL NOMENCLATURE

- You need to be able to tell, by looking at a name OR a formula, what kind of compound you are working with!

DON'T GET THE NAMING SYSTEMS MIXED UP! EACH KIND OF COMPOUND IS NAMED WITH ITS OWN SYSTEM!

FROM A CHEMICAL NAME

- If the name has a Roman numeral, the name of a metal, or "ammonium", the compound is likely IONIC
- If the name has a Greek prefix AND the prefix is NOT in front of the word "hydrate", the compound is BINARY MOLECULAR
- If the name contains the word "acid":
  - ... and starts with "hydro-", then the compound is a BINARY ACID
  - ... and does not start with "hydro-", the compound is an OXYACID



78 FROM A CHEMICAL FORMULA

- if the formula contains a metal or the  $\text{NH}_4^+$  ion, it is likely IONIC

- If the formula starts with H and is not either water or hydrogen peroxide, the compound is likely an ACID. Which kind?



- BINARY ACIDS contain only two elements

- OXYACIDS contains oxygen

- If the formula contains only nonmetals (and is not an ammonium compound or an acid), the compound is likely MOLECULAR

Examples:

$\text{PCl}_3$  : BINARY MOLECULAR  
Name: phosphorus trichloride

$\text{NH}_4\text{Cl}$  : IONIC (ammonium ion)  
Name: ammonium chloride

$\text{H}_3\text{PO}_4$  : OXYACID (hydrogen, phosphate)  
Name: phosphoric acid