Name: _____ Period: _____ Role(circle one): S F QC PA

What makes an acid unique and how are acids named?

Read This!

A variety of acids are used in foods, industry, and research. Acids are covalently bonded molecules, but when they are put into water they produce ions. One of the ions produced is always H^+, which immediately combines with a water molecule to form the hydronium ion (H_3O^+). The H_3O^+ ion is what defines the acidic properties of a substance. Because of their special classification, acids have a naming system different from ionic or other molecular (covalent) compounds.

Model 1 –Binary Acids

Acid	Name of Acid in Aqueous Solution (aq)	Cation (+)*	Anion (-)
HCl	Hydrochloric acid	H^+	Cl^-
HBr	Hydrobromic acid		
H_2S	Hydrosulfuric acid	H^+	S^{2-}
HF	Hydrofluoric acid		

***Hydrogen ions (H^+) join with water molecules in solution to form hydronium ions, H_3O^+. For simplicity, we will represent these as H^+.**

1. Complete the cation and anion columns of the table in Model 1. Be careful to show the charges on the ions.
2. Why does hydrosulfuric acid contain two hydrogens?

3. Look at the formulas and names of the binary acids in Model 1.
   a. What prefix is used at the beginning of the name for all binary acids?
   b. What suffix is used at the end of the name for all binary acids?
4. The prefix "bi-" means "two". Propose a reason that the acids in Model 1 are all referred to as "binary" acids.

5. Write a rule (or set of rules) for naming binary acids.

One way to remember the naming system for binary acids:

"MY RIDE HAS HYDROLICS"

Model 2—Ternary Acids (Oxyacids)

Acid	Name of Acid in Aqueous Solution (aq)	Cation (+)*	Polyatomic Ion (-)	Polyatomic Anion Name
$HClO_3$	Chloric acid	H^+		
H_2SO_3	Sulfurous acid			
H_2SO_4	Sulfuric acid			Sulfate
H_3PO_3	Phosphorous acid	H^+		Phosphite
H_3PO_4	Phosphoric acid		PO_4^{3-}	
HNO_3	Nitric acid			
HNO_2	Nitrous acid		NO_2^{1-}	nitrite
H_2CO_3	Carbonic acid		CO_3^{2-}	

***Hydrogen ions (H^+) join with water molecules in solution to form hydronium ions, H_3O^+. For simplicity, we will represent these as H^+.**

6. Look at the formulas of the ternary acids in Model 2.
    a. How are ternary acids different from binary acids in their structure?
    b. What number do you think the prefix "ter-" refers to?
7. When ternary acids are mixed with water, ions will form. Fill in the table above with the formulas and names of the anions.
8. Examine the pairs of ternary acids in Model 2 that contain sulfur, phosphorous, and nitrogen. Each pair has one acid that ends in "-ic" and another that ends in "-ous". These endings are related to the name of the polyatomic ion found in the acid ("-ate" or "-ite"). Complete the statements below with the correct acid name ending.

    Polyatomic anion ending is "-ate" → acid name ending is _____

    Polyatomic anion ending is "-ite" → acid name ending is _____
9. If the prefix "hydro-" were used to name a ternary acid, what problem would this create when naming $HClO_3$?

10. Write a rule for naming ternary acids.

11. Predict the formula for chlorous acid.
12. Circle the acid(s) below that would be named beginning with the prefix "hydro-".

H_2SO_3 HF H_2S H_2CO_3 HNO_2

A way to remember the naming rules for ternary acids:

"I ATE SOMETHING ICKY"

"SPRITE IS DELICIOUS"

Model 3—Halogen Oxyacid Acid Families

Acid	Name of Acid	Cation (+)	Anion (–)	Anion Name
$HClO_4$	Perchloric acid			Perchlorate
$HClO_3$	Chloric acid	H_3O^+		
$HClO_2$	Chlorous acid			Chlorite
HClO	Hypochlorous acid			
$HBrO_4$				Perbromate
HIO_3				
HFO_2				
HIO			IO^-	Hypoiodite

13. Write the formulas of the cations and anions for each acid in the table in Model 3.
14. Consider the names of the oxyacids in Model 3 that contain chlorine. All halogens form similar oxyacids that use the same naming convention. Fill in the names of the halogen oxyacids to complete the table.
15. The table below includes both binary and ternary acis. Using what you have learned in this activity, fill in the missing formula and name for the anion in each acid, and give the formula of the acid.

Acid name	Anion	Anion Name	Acid Formula
Hydroiodic acid			
Chlorous acid			
Hypobromous acid			
Phosphoric acid			
Sulfurous acid			