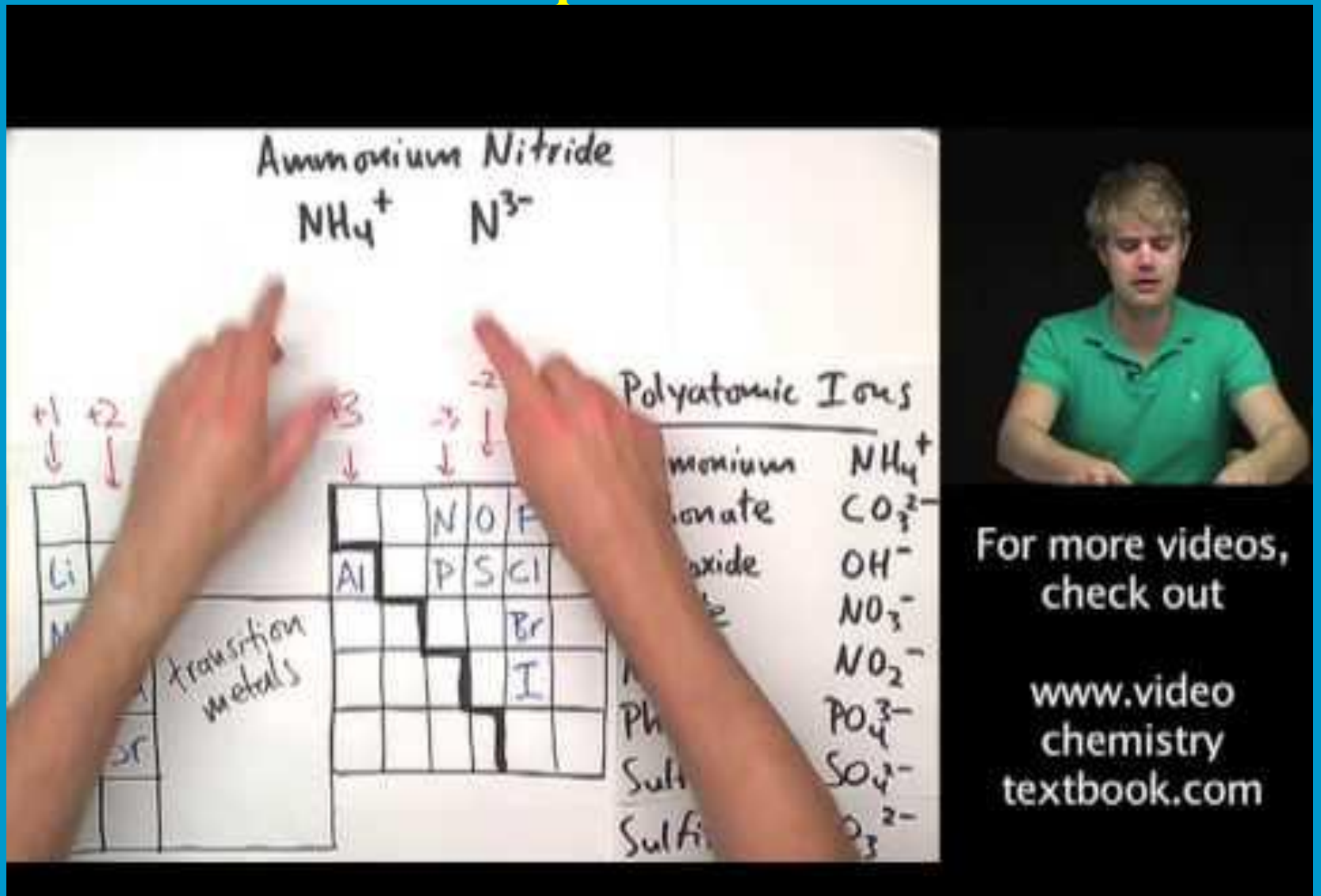
# Review: What are the questions to ask when naming?

Instructions: Depending on your comfort level with naming and forming compounds already and your recall of polyatomics from grade 10, you can choose to watch the video on the next slide (best to complete this if you are not as confident) or skip straight to the written review grade 10 content and extending to the grade 11. This primarily involves understanding the variants of the “-ate” polyatomics.

# Video version OR skip for written if preferred



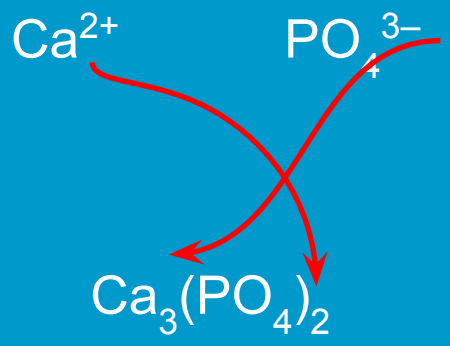
## *Covalent Bonding in Ionic Species (polyatomic ions)*

***Polyatomic ions*** consist of a combination of two or more atoms.

$$OH^-,\ CN^-,\ NH_4^+,\ NO_3^-$$

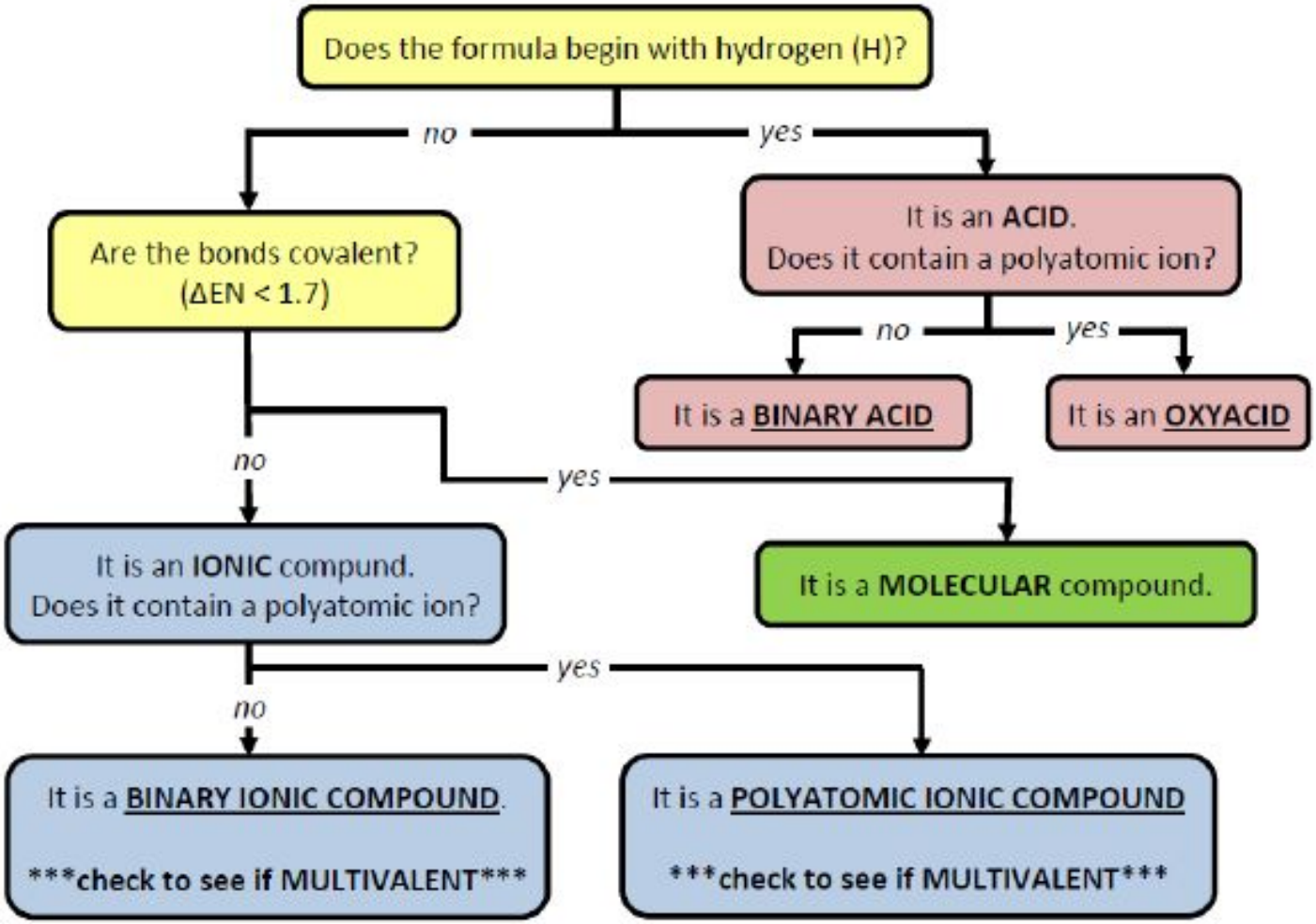
Formulas are determined following the same rule as for ionic compounds containing only monatomic ions: ions must combine in a ratio that give a neutral formula overall.

Calcium phosphate:




Sum of charges: $3(+2) + 2(-3) = 0$

## Nomenclature Decision Flowchart



Some Polyatomics → see lists on periodic table and on website. Try to memorize as many as you can.

You will have access in both grade 10 and 11 to a list of common polyatomic ions for assessments, however, memorization speeds up the writing of assessments and is advisable

**TABLE 5.10** Common Polyatomic Ions

| Name | Formula/Charge |
|---|---|
| **Cations** | |
| ammonium | $NH_4^+$ |
| hydronium | $H_3O^+$ |
| mercury(I) | $Hg_2^{2+}$ |
| **Anions** | |
| acetate | $C_2H_3O_2^-$ |
| azide | $N_3^-$ |
| carbonate | $CO_3^{2-}$ |
| chlorate | $ClO_3^-$ |
| chlorite | $ClO_2^-$ |
| chromate | $CrO_4^{2-}$ |
| cyanide | $CN^-$ |
| dichromate | $Cr_2O_7^{2-}$ |
| dihydrogen phosphate | $H_2PO_4^-$ |
| hydrogen carbonate or bicarbonate | $HCO_3^-$ |
| hydrogen phosphate | $HPO_4^{2-}$ |
| hydrogen sulfate or bisulfate | $HSO_4^-$ |

# *More Polyatomics!*

**TABLE 5.10** Common Polyatomic Ions

| Name | Formula/Charge |
|---|---|
| hydroxide | $OH^-$ |
| hypochlorite | $ClO^-$ |
| nitrate | $NO_3^-$ |
| nitrite | $NO_2^-$ |
| oxalate | $C_2O_4^{2-}$ |
| perchlorate | $ClO_4^-$ |
| permanganate | $MnO_4^-$ |
| peroxide | $O_2^{2-}$ |
| phosphate | $PO_4^{3-}$ |
| phosphite | $PO_3^{3-}$ |
| sulfate | $SO_4^{2-}$ |
| sulfite | $SO_3^{2-}$ |
| thiocyanate | $SCN^-$ |

The Following are Grade 11 Extensions from Grade 10! Please ensure you understand!

## *Covalent Bonding in Ionic Species - Oxyanions*

***Oxyanions*** are polyatomic anions that contain one or more oxygen atoms and one atom (the "central atom") of another element. [note: can also be referred to as oxoanions] . Example $PO_4^{3-}$ ion -> Central atom is Phosphorus and there are four oxygens and a charge of -3.

CLICK: Video Explanation of Naming Variations of Oxyanions.

The embedded questions in the video are NOT assessed and are to enhance your understanding only.

# Summary of Video Naming Rules (and see example on next slide)

Starting with the oxyanions that end in *–ate*, we can name these ions as follows :

1) The ion with one *more* O atom than the *–ate* ion is called the *per…ate* ion. Thus, $ClO_3^-$ is the chlorate ion, so $ClO_4^-$ is the *perchlorate ion*.
2) The ion with one *less* O atom than the *–ate* ion is called the *–ite* ion. Thus, $ClO_2^-$ is the *chlorite ion*.
3) The ion with *two fewer* O atom than the *–ate* ion is called the *hypo…ite* ion. Thus, $ClO^-$ is the *hypochlorite ion*.

Example with the chlorate ion. You need to be able to determine the other oxyanion variations using the "-ate" ions on the periodic table chart (provided during tests)

the **most common of an element's oxyanions** has a name with the form **(root)ate.**

| Relationship | General Name | Example Name | Example formula |
|---|---|---|---|
| One more oxygen atom than (root)ate | per(root)ate | perchlorate | $ClO_4^-$ |
| Most Common | (root)ate | chlorate | $ClO_3^-$ |
| One less oxygen than (root)ate | (root)ite | chlorite | $ClO_2^-$ |
| Two less oxygen than (root)ate | hypo(root)ite | hypochlorite | $ClO^-$ |

# Pneumonic to help remember them!

**Meet the "ATES"**

Nick the Camel ate a Clam Supper in Pheonix with an Ale

Nick - N with 3 consonants and 1 vowel therefore $NO_3^{-1}$

Camel - C with 3 consonants and 2 vowels, therefore $CO_3^{-2}$

Clam - Cl with 3 consonants and 2 vowels, therefore $ClO_3^{-1}$

Supper - S with 4 consonants and 2 vowels, therefore $SO_4^{-2}$

Pheonix - P with 4 consonants and 3 vowels, therefore $PO_4^{-3}$

Ale - Al with 2 consonants and 1 vowel, therefore $AlO_2^{-1}$

At minimum, try to memorize the oxyanions that end in *–ate* so you can apply these guidelines when necessary. There is a posted pneumonic to help you or create/google your own.

# Lets try with Na and $PO_4^{-3}$

On your own, try forming all the variations on the phosphate ion, and naming the compound formed with sodium.

# Side notes on Nomenclature

1. The archaic system:
ferrous (lower ion charge) vs ferric (higher charge) etc -> be able to recognize this but it will not be tested
2. Also, SOME polyatomics use prefixes in the name even though compound is ionic and/or have multiple names. Do NOT add prefixes to indicate number of ions!!

## *More examples of oxyanion groups*

| | |
|---|---|
| perchlorate | $ClO_4^-$ |
| **chlorate** | **$ClO_3^-$** |
| chlorite | $ClO_2^-$ |
| hypochlorite | $ClO^-$ |
| **nitrate** | **$NO_3^-$** |
| nitrite | $NO_2^-$ |
| **phosphate** | **$PO_4^{3-}$** |
| phosphite | $PO_3^{3-}$ |
| **sulfate** | **$SO_4^{2-}$** |
| sulfite | $SO_3^{2-}$ |

See your polyatomic groups lists for other oxyanion groups

Put these slides in PRESENT mode for the following slides.
Attempt the question.

The yellow box will disappear to reveal the solution (possible after a hint).
Compare to yours and ensure you understand any differences. Review the information in the presentation, talk to your peers and post to the FAQ (in that order) as needed.

Write the proper formula and give the proper name for each ionic compound formed between the two listed ions.

$NH_4^+$ and $S^{2-}$

https://chem.libretexts.org/Courses/Los_Angeles_Trade_Technical_College/Foundations_of_Introductory_College_Chemistry/06%3A_Nomenclature/5.3_Naming_Compounds_that_contain_Polyatomic_Ions

Write the proper formula and give the proper name for each ionic compound formed between the two listed ions.

$Al^{3+}$ and $PO_4^{3-}$

# QUIA QUIZ CHECK-UP

Refer to my instructions each semester on how to access this