

## Welcome to Jeff's CHEM 4 lecture!

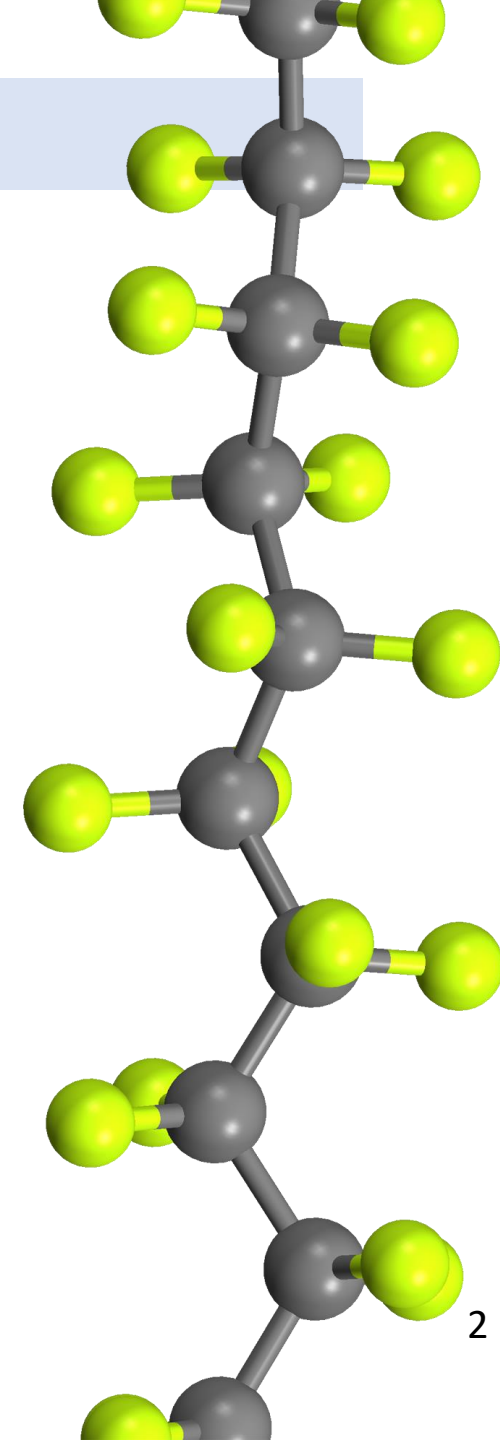
We'll be starting in just a bit...

### While you are waiting:

- 1) Go to [LearningCatalytics.com](https://www.learningcatalytics.com) to prepare for today's clicker questions. Login with your MasteringChemistry login.      **Session ID =**
- 2) Make sure your Zoom User ID is your "first name last name". You can open "participants", then find your name and click on it to change it.
- 3) *In the chat, let us know... What is your favorite Sacramento restaurant that is still doing take-out? I have a bunch of favorites, but Los Jarritos and Anna's Vegan Café are two that I really like.*

## Are up keeping up with CHEM 4?

- ✓ **Exam #1 is Wednesday, Sept 30.**
  - ✓ During normal class period. Go to Canvas to take the exam.
  - ✓ Timed: 50 minutes
  - ✓ 25 multiple choice questions; worth 4 pts each.
  - ✓ Both questions and answers will be randomized for each student.
  - ✓ Can use class handouts, textbook, lecture notes, PowerPoint slides.
  - ✓ Even though it is open book, you will not have enough time to look up every single thing, so you must study and be fully prepared going into the exam.
  - ✓ Get all your materials (such as handouts, calculator and paper/pencil) ready before you start.



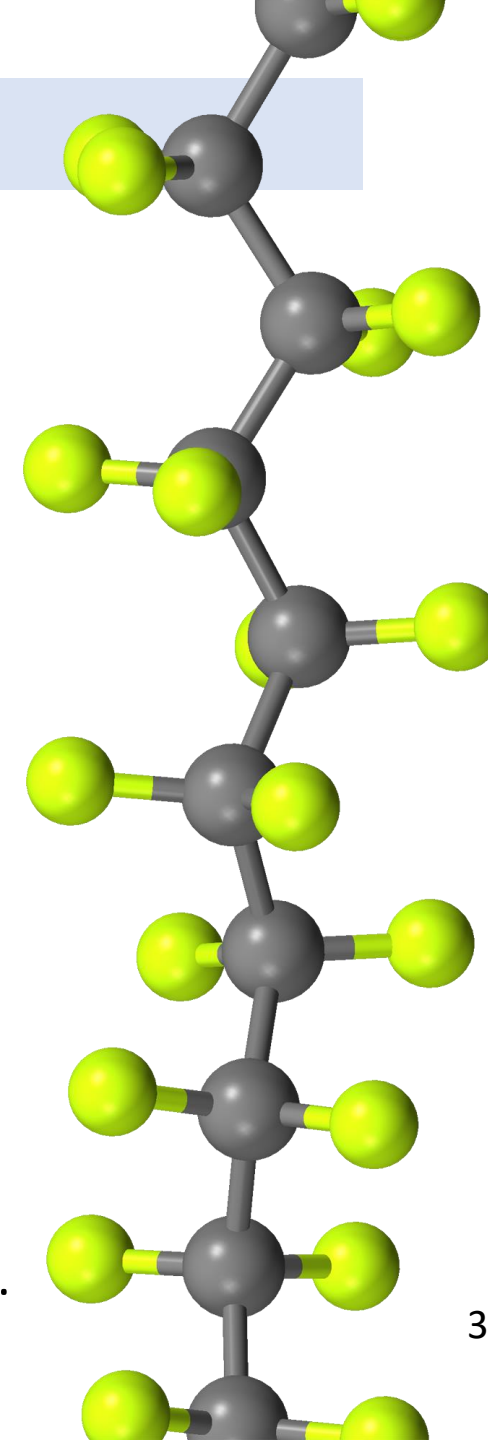
## Are up keeping up with CHEM 4?

### ✓ Resources:

- ✓ CHEM 4 Website: [tinyurl.com/SacStateChem4](https://tinyurl.com/SacStateChem4)
  - ✓ Learning Outcomes
  - ✓ PowerPoint slides
  - ✓ Finish up any late homework for credit
- ✓ Practice exams are posted on Canvas.
  - ✓ Time yourself; take it like a real exam.
  - ✓ Make a list of the type of questions you are getting wrong and focus your study on those topics. For extra practice on those topics, review: PowerPoint slides, e-text, homework problems, PAL worksheet.

### ✓ Need help?

- ✓ Jeff's office hours: MWF 9 – 9:30 am and 11 – 11:30 am; and by appointment.
- ✓ PAL office hours: link is on our CHEM 4 website.
- ✓ PAL study hall: today from 1-2 pm. Zoom Code: 934 4492 5270. Open to all CHEM 4 students.
- ✓ Review session on Monday: Email me questions by Sunday, Sept 27 at 12 noon.
- ✓ *Commit to Study (C2S)* – **Allows you to drop lowest exam.**



## Review clicker question (Covers material from last lecture)

Go to [LearningCatalytics.com](https://www.learningcatalytics.com) and login with your MasteringChemistry. Session ID =

1) Which of the following formula/name pairs is correct? While you are waiting for the answer, write the correct name for all the ones that are wrong.

A)  $\text{K}_2\text{Cr}_2\text{O}_7$  = potassium(I) dichromate

B)  $\text{Fe}(\text{CN})_2$  = iron cyanide

C)  $\text{NiS}_2\text{O}_3$  = nickel(II) thiosulfite

D)  $\text{Cr}(\text{BrO})_3$  = chromium(III) bromite

E)  $(\text{NH}_4)_3\text{PO}_3$  = ammonium phosphite

F)  $\text{ZnO}$  = zinc(II) oxide

G)  $\text{Sn}(\text{SO}_3)_2$  = tin(II) sulfite

### Should be:

[potassium dichromate]

[iron(II) cyanide]

[nickel(II) thiosulfate]

[chromium(III) hypobromite]

correct

[zinc oxide]

[tin(IV) sulfite]

## **CHEM 4 lecture**

Wednesday – September 23, 2020

*Sec 5.9*

Naming acids

## Reading clicker question (Covers material from today's assigned reading)

Go to [LearningCatalytics.com](https://www.learningcatalytics.com) and login with your MasteringChemistry. Session ID =

- 2) Which of the following statements about acids is false?
- A) Acids are molecular compounds that produce  $\text{H}^+$  ions when dissolved in water.
  - B) The "H" usually comes first in the acid's formula.
  - C) Acids are characterized by their sour taste.
  - D) Binary acids contain hydrogen and one other element.
  - E) The names for oxyacids acids start with "hydro".
  - F) Writing "(aq)" after the formula for an acid means it has been dissolved in water.
  - G) Some metals react with acids to produce dissolved metal ions.

## Background: Making acids from ions

### Monatomic ion Symbol

bromide ion	Br <sup>-</sup>
chloride ion	Cl <sup>-</sup>
fluoride ion	F <sup>-</sup>
iodide ion	I <sup>-</sup>
<del>nitride ion</del>	<del>N<sup>3-</sup></del>
<del>oxide ion</del>	<del>O<sup>2-</sup></del>
sulfide ion	S <sup>2-</sup>

### Ions made by adding "H" Symbol

hydrogen carbonate ion (bicarbonate)	HCO <sub>3</sub> <sup>-</sup>
hydrogen oxalate ion (bioxalate)	HC <sub>2</sub> O <sub>4</sub> <sup>-</sup>
hydrogen phosphate ion	HPO <sub>4</sub> <sup>2-</sup>
dihydrogen phosphate ion	H <sub>2</sub> PO <sub>4</sub> <sup>-</sup>
hydrogen sulfate ion (bisulfate)	HSO <sub>4</sub> <sup>-</sup>
hydrogen sulfide ion (bisulfide)	HS <sup>-</sup>
hydrogen sulfite ion (bisulfite)	HSO <sub>3</sub> <sup>-</sup>

### Polyatomic ion Symbol

acetate ion	C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>
<del>ammonium ion</del>	<del>NH<sub>4</sub><sup>+</sup></del>
arsenate ion	AsO <sub>4</sub> <sup>3-</sup>
borate ion	BO <sub>3</sub> <sup>3-</sup>
bromate ion	BrO <sub>3</sub> <sup>-</sup>
bromite ion	BrO <sub>2</sub> <sup>-</sup>
carbonate ion	CO <sub>3</sub> <sup>2-</sup>
chlorate ion	ClO <sub>3</sub> <sup>-</sup>
chlorite ion	ClO <sub>2</sub> <sup>-</sup>
chromate ion	CrO <sub>4</sub> <sup>2-</sup>
cyanide ion	CN <sup>-</sup>
dichromate ion	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>
<del>hydroxide ion</del>	<del>OH<sup>-</sup></del>
hypobromite ion	BrO <sup>-</sup>
hypochlorite ion	ClO <sup>-</sup>

### Polyatomic ion Symbol

hypoiodite ion	IO <sup>-</sup>
iodate ion	IO <sub>3</sub> <sup>-</sup>
iodite ion	IO <sub>2</sub> <sup>-</sup>
nitrate ion	NO <sub>3</sub> <sup>-</sup>
nitrite ion	NO <sub>2</sub> <sup>-</sup>
oxalate ion	C <sub>2</sub> O <sub>4</sub> <sup>2-</sup>
perbromate ion	BrO <sub>4</sub> <sup>-</sup>
perchlorate ion	ClO <sub>4</sub> <sup>-</sup>
periodate ion	IO <sub>4</sub> <sup>-</sup>
permanganate ion	MnO <sub>4</sub> <sup>-</sup>
phosphate ion	PO <sub>4</sub> <sup>3-</sup>
phosphite ion	PO <sub>3</sub> <sup>3-</sup>
sulfate ion	SO <sub>4</sub> <sup>2-</sup>
sulfite ion	SO <sub>3</sub> <sup>2-</sup>
thiosulfate ion	S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>

Given any parent ion, be able to write the formula for the corresponding **acid**.

Add one H<sup>+</sup> ion for each negative charge on the parent ion.

### Example:

Parent ion	Corresponding acid
CO <sub>3</sub> <sup>2-</sup>	H <sub>2</sub> CO <sub>3</sub> (aq)
Cl <sup>-</sup>	HCl (aq)
PO <sub>3</sub> <sup>3-</sup>	H <sub>3</sub> PO <sub>3</sub> (aq)

## Background: Naming acids made from ions ending in “-ate” and “-ite”

### Formula → Name

- Change parent ion ending from **-ate** to **-ic acid**.
- Change parent ion ending from **-ite** to **-ous acid**.

**Remember:** “I **ate** something **icky** at the white **ite** **house**.”

*becomes* (from ate to icky)  
*becomes* (from ite to house)

### Example:

Formula	Parent ion	Acid name
$\text{HNO}_3(\text{aq})$	$\text{NO}_3^- = \text{nitrate}$	<b>nitric acid</b>
$\text{HNO}_2(\text{aq})$	$\text{NO}_2^- = \text{nitrite}$	<b>nitrous acid</b>
$\text{H}_2\text{CO}_3(\text{aq})$	$\text{CO}_3^{2-} = \text{carbonate}$	<b>carbonic acid</b>
$\text{HIO}(\text{aq})$	$\text{IO}^- = \text{hypoiodite}$	<b>hypoiodous acid</b>



## Background: Important exceptions

Monatomic ion Symbol

bromide ion	Br <sup>-</sup>
chloride ion	Cl <sup>-</sup>
fluoride ion	F <sup>-</sup>
iodide ion	I <sup>-</sup>
<del>nitride ion</del>	<del>N<sup>3-</sup></del>
<del>oxide ion</del>	<del>O<sup>2-</sup></del>
sulfide ion	S <sup>2-</sup>

Ions made by adding "H<sup>+</sup>" Symbol

hydrogen carbonate ion (bicarbonate)	HCO <sub>3</sub> <sup>-</sup>
hydrogen oxalate ion (bioxalate)	HC <sub>2</sub> O <sub>4</sub> <sup>-</sup>
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Polyatomic ion Symbol

acetate ion	C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>
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bromate ion	BrO <sub>3</sub> <sup>-</sup>
bromite ion	BrO <sub>2</sub> <sup>-</sup>
carbonate ion	CO <sub>3</sub> <sup>2-</sup>
chlorate ion	ClO <sub>3</sub> <sup>-</sup>
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hypochlorite ion	ClO <sup>-</sup>

Polyatomic ion Symbol

hypoiodite ion	IO <sup>-</sup>
iodate ion	IO <sub>3</sub> <sup>-</sup>
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perbromate ion	BrO <sub>4</sub> <sup>-</sup>
perchlorate ion	ClO <sub>4</sub> <sup>-</sup>
periodate ion	IO <sub>4</sub> <sup>-</sup>
permanganate ion	MnO <sub>4</sub> <sup>-</sup>
phosphate ion	PO <sub>4</sub> <sup>3-</sup>
phosphite ion	PO <sub>3</sub> <sup>3-</sup>
sulfate ion	SO <sub>4</sub> <sup>2-</sup>
sulfite ion	SO <sub>3</sub> <sup>2-</sup>
thiosulfate ion	S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>

For parent ions that include **sulfur** and **phosphorous** start with the roots "sulfur" and "phosphor" before adding the "-ic acid" and "-ous acid" endings.

### Example:

Formula	Name
H <sub>3</sub> PO <sub>3</sub>	phosphorous acid
H <sub>3</sub> PO <sub>4</sub>	phosphoric acid
H <sub>2</sub> SO <sub>3</sub>	sulfurous acid
H <sub>2</sub> SO <sub>4</sub>	sulfuric acid

## Background: Naming acids made from ions ending in “-ate” and “-ite”

### Name → Formula

- Replace **-ic acid** with **-ate** to find the parent ion, then add enough H<sup>+</sup> ions to make an acid.
- Replace **-ous acid** with **-ite** to find the parent ion, then add enough H<sup>+</sup> ions to make an acid.

### Example:

Acid name	Parent ion	Acid formula
perbromic acid	perbromate = $\text{BrO}_4^-$	$\text{HBrO}_4 (\text{aq})$
bromic acid	bromate = $\text{BrO}_3^-$	$\text{HBrO}_3 (\text{aq})$
bromous acid	bromite = $\text{BrO}_2^-$	$\text{HBrO}_2 (\text{aq})$
hypobromous acid	hypobromite = $\text{BrO}^-$	$\text{HBrO} (\text{aq})$

## Background: Naming acids made from ions ending in “-ide”

### Formula → Name

- Add the prefix **hydro-** and change the ending of the parent ion from **-ide** to **-ic acid**.

Formula	Parent ion	Acid name
HBr(aq)	Br <sup>-</sup> = bromide	hydrobromic acid
H <sub>2</sub> S(aq)	S <sup>2-</sup> = sulfide	hydro <u>sulfur</u> ic acid

### Name → Formula

- Look for **hydro- -ic acid** and change it to **-ide** to find the parent ion. Then add enough H<sup>+</sup> ions to make an acid.

Acid name	Parent ion	Formula
hydroiodic acid	iodide = I <sup>-</sup>	HI(aq)

## Progress clicker question (covers material we are learning now)

Go to [LearningCatalytics.com](https://www.learningcatalytics.com) and login with your MasteringChemistry. Session ID =

3) What is the name of  $\text{H}_2\text{C}_2\text{O}_4$  (aq)?

A) carbonic acid

B) oxalic acid

C) dihydrogen dicarbonate

D) oxalous acid

E) acetic acid

F) carbonous acid

parent ion =  $\text{C}_2\text{O}_4^{2-}$  = oxalate

Handwritten red arrows originate from the parent ion equation. One arrow points from the oxalate ion to the 'oxalic acid' option (B). Another arrow points from the oxalate ion to the 'oxalous acid' option (D). A third arrow points from the oxalate ion to the 'carbonous acid' option (F).

## Progress clicker question (covers material we are learning now)

Go to [LearningCatalytics.com](https://www.learningcatalytics.com) and login with your MasteringChemistry. Session ID =

4) Which of the following formula/name pairs is correct? While you are waiting for the answer, write the correct name for all the ones that are wrong.

A)  $\text{MgSO}_3$  = magnesium sulfate

B)  $\text{HClO}_2$  (aq) = chloric acid

C)  $\text{FeCrO}_4$  = iron(II) chromate

D)  $\text{HIO}$  (aq) = hydroiodous acid

E)  $\text{AgNO}_3$  = silver(I) nitrate

F)  $\text{Sn}(\text{CO}_3)_2$  = tin(II) carbonate

### Should be:

[magnesium sulfite]

[chlorous acid]

correct

[hypoiodous acid]

[silver nitrate]

[tin(IV) carbonate]