

Synopsis of the 2020 VisChem Institute

A Brief Recap of Major Events



This material is based upon work supported by the National Science Foundation under Grant No. DRL-1908121

VisChem Institute – Day 1

Meet and Greet

Experience VisChem as a student

Air, water, solid NaCl, dissolving NaCl, and chemical speciation

Reflect asynchronously on survey data

Analyze sample student storyboards

Read literature on chemistry triplet

Colleague Scavenger Hunt

Do your best to meet a colleague that matches each of these characteristics. Above all, *meet everyone!*

Taught fewer than five years	
Taught/teaches chemistry and another subject	
Lives in a different time zone than you do	
Uses Google (docs, sheets, slides) in their classes	
Is a member of the American Association of Chemistry Teachers (AACT) and/or ACS	
Has been to BCCE, ChemEd, or NSTA conference	
Earned a Bachelor degree in something other than chemistry or chemistry education	
Learned something new teaching remotely this past spring semester	
Learning something new this past spring that they will use in future teaching	
Teaches only chemistry courses	
Has teaching experience at a different level than high school	
Is proud of the condition of their stockroom	
Believes that they may have worked over 1000 stoichiometry problems	
Is the only chemistry teacher at their school	
Needs more model kits for their classroom	
Loves grading lab reports	
Knows another VisChem teacher from before the Institute	
Heard of (or even used) Target Inquiry activities	

VisChem Institute – Day 1

Meet and Greet

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Interactions via chat, video, and breakout groups



Poll Everywhere

Multiple choice and free response

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Read literature on chemistry triplet

Key:

-  Na^+
-  Cl^-
-  H_2O

During reaction:	

After dissolving is complete:	



Parking lot questions and further discussion

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Here are some prompts to stimulate an even more rigorous analysis and reflection on the results. Choose from the ones below (or write some of your own) that enable you to deepen your analysis and respond with findings, insights, and connections to your teaching and even your own learning in VisChem so far.

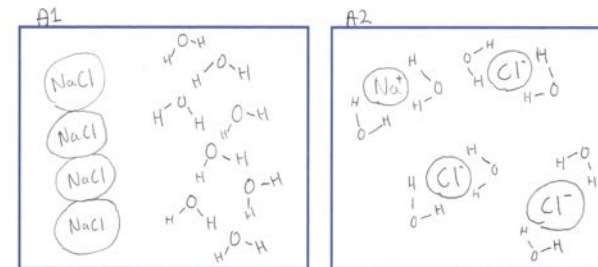
If you have two reports, focus on the report with you and your students. If you only have one report, respond for the aggregate data in the report while reflecting on connections to your own teaching.

How many prompts to do? Don't do all of them!! The goal is to spend a focused hour on analyzing, reflecting, and writing.

- How did students' results compare for visualization and non-viz items?
- What are student content strengths and weaknesses?
- For the items you (or teachers) correctly predicted the most common student answer choice, what are some common features of these items? Why were you (or teachers) able to successfully predict student responses for these items?
- For the items you (or teachers) incorrectly predicted the most student answer, what are some common features of these items? Why were these difficult for you (or teachers) to predict student responses?

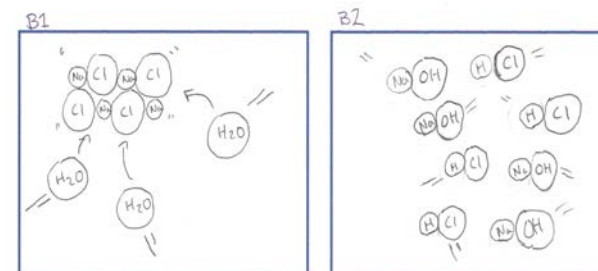
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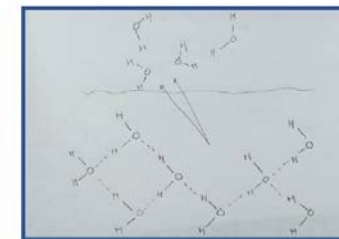
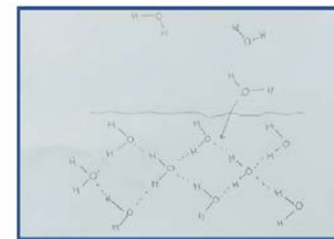
Pre-Evaporation

Post-Evaporation

Reflect asynchronously on survey data

Analyze sample student storyboards

Student A



Student B



Read literature on chemistry triplet

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Chemistry Education Research and Practice

RSC Publishing

PERSPECTIVE

[View Article Online](#)
[View Journal](#) | [View Issue](#)

Cite this: *Chem. Educ. Res. Pract.*, 2013,
14, 156

**Revisiting the chemistry triplet: drawing upon the
nature of chemical knowledge and the psychology of
learning to inform chemistry education**

Keith S. Taber*

VisChem Institute – Day 2

Discuss literature in breakout rooms



Experience the Cognitive Learning Model as a student

Discuss pedagogical features of VisChem, read literature, and revise accordingly

Respond to VisChem Institute Mid-Survey

Use VisChem Learning Design to develop precipitation lesson plan

Discussion Questions for Triplet Article

1. What are ways to ensure that all three levels are addressed in learning activities and assessments?
2. In examining Taber's list of important ideas for teaching chemistry (see below, a-e), choose the top two in terms of challenge to carry out as a high school chemistry teacher.
3. Why are the two you selected in #2 the *most* challenging to execute?
4. How can the VisChem Approach address two (yes, pick only two) of these challenges?
 - Limiting the amount of new information being presented at any one time;
 - Helping students relate new teaching to existing learning;
 - Reinforcing new learning over long enough timescales (e.g. weeks and months) to support the natural processes by which learning is consolidated to become better integrated and more robust (so strengthening connections between concepts and supporting economic 'chunking');
 - Modelling the ways in which chemists operate with and between the two domains of conceptual knowledge (macroscopic descriptions and categories; theoretical submicroscopic models) using the symbolic language of the subject as the means to readily represent and communicate these concepts; but
 - Offering sufficient scaffolding to support students in gradually learning to operate within and across the domains in the way experts can.

VisChem Institute – Day 2

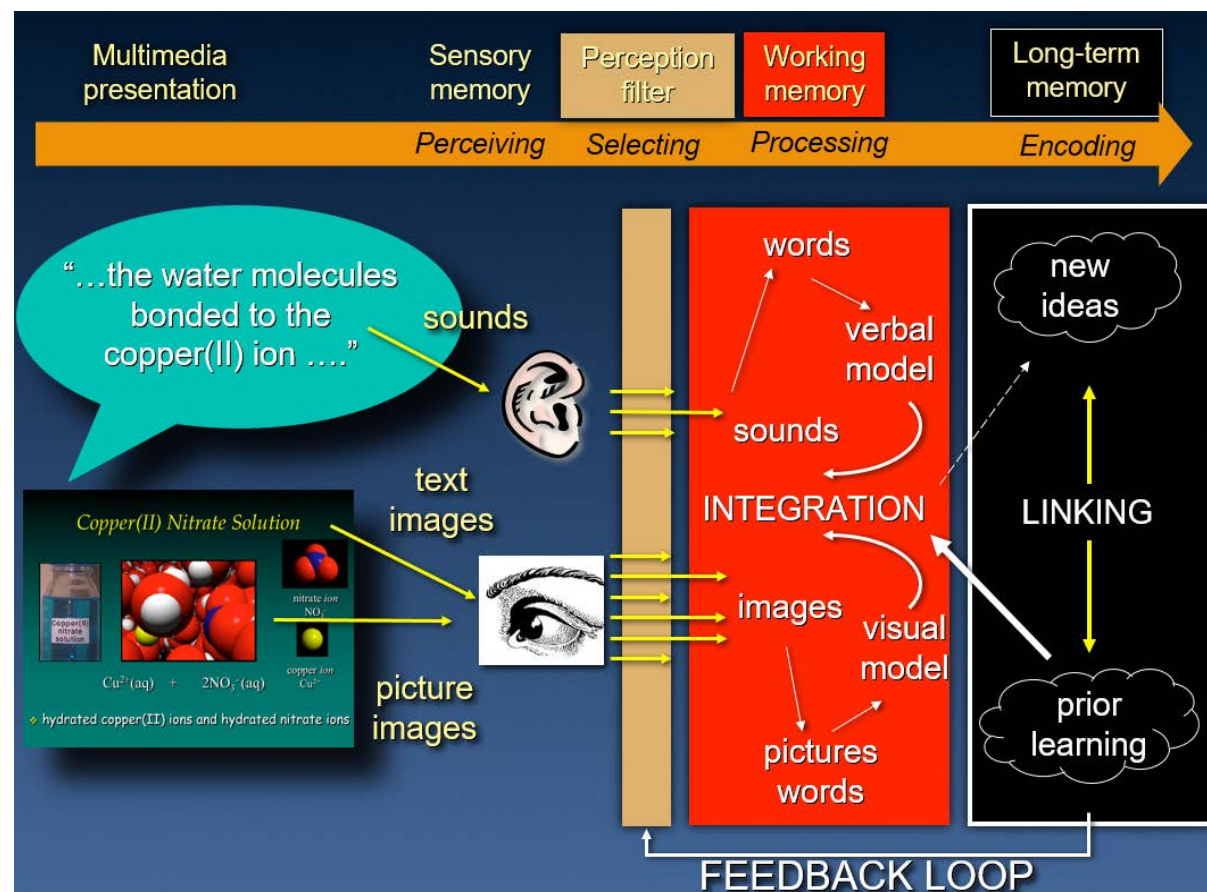
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VisChem Institute – Day 2

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Use VisChem Learning Design to develop precipitation lesson plan

In this breakout, **brainstorm** as many VisChem Learning Design features as you can. *

*If you have time, classify the features in two groups -- features th you wish to learn more about, and ones for which you are already comfortable handling in your own class.

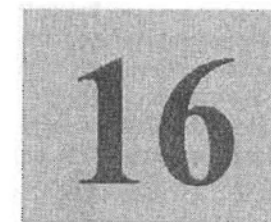
How to proceed and capture your ideas? Keep reading...

Visit the chat to access your Google Doc to take notes. Elect a scribe for the first 15 minutes or so to document the brainstormed ideas.

Switch scribes to share the work and continue. **Do not post your ideas to this discussion board until directed to do so in the large group session.**



Google docs



Using Multimedia to Visualize the Molecular World: Educational Theory Into Practice

Roy Tasker
School of Science, Food, and Horticulture
University of Western Sydney

VisChem Institute – Day 2



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What features of the VisChem Institute are **supporting** your learning?

What features of the VisChem Institute are **hindering** your learning?

How can the VisChem Institute be **improved** to better facilitate your learning?

VisChem Institute – Day 2

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Experience the Cognitive Learning Model as a student

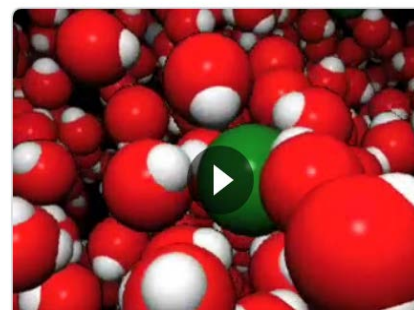
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Respond to VisChem Institute Mid-Survey

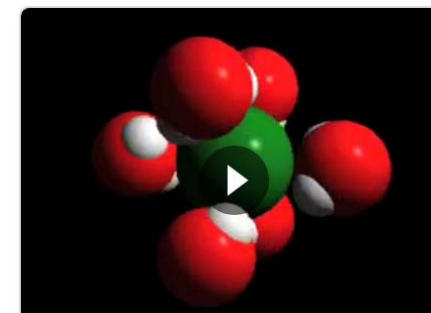
Use VisChem Learning Design to develop precipitation lesson plan



Using the VisChem animations and what you have learned thus far about the VisChem Learning Design, develop a lesson plan to teach precipitation. Be as detailed as possible so that you have a "classroom ready" version of the lesson. Please upload your lesson here. The deadline is Friday July 10th 10:00 am EDT.



D4No06_Aqueous_Sodium_C...



C3No02_Hydrated_Chloride_i...

VisChem Institute – Day 3

Share mid-institute feedback and updates

Discuss, revise, and upload learning design tasks

Explore acid-bases and quantitative topics through VisChem

Read misconception papers asynchronously

Meet in expert groups to discuss papers

Helping Learning

- Going through the experience as a student
- Modeling the VisChem Design for the teacher work in the Institute
- Colleagues!
- Breakouts and learning from fellow participants
- Support from team/facilitators
- Storyboards
- Organization of activities overall
- Time to make connections to my teaching
- Deep dives into chemistry
- Focus on educational/cognitive psychology
- Asynchronous activities
- Application of activities
- Feedback
- Readings
- Discussions
- Lectures
- Building own lesson plan
- Instructors keeping things on task and having a good time
- Jokes, animals

Hindering Learning

- Concentration of work/intensity/amount of info
- Zoom fatigue
- Not being F2F/COVID-19/being at home
- Technology problems
- Too much time discussing
- Not enough time for discussion
- Not giving the resources/readings up front

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Precipitation Learning Design Breakout Instructions

1. Designate the order of the presentations.
 2. Elect a time keeper for each presenter. This role requires precision and the willingness to enforce the time restrictions. :-)
 3. Presenter can share screen and has 8 minutes (max) to describe the components of their precipitation learning design.
 4. Listeners have 5 minutes (max) to learn more by asking questions.
 5. Repeat 3 & 4 for rest of the group.
 6. Take a break. Option: Take a 5 minute break between sessions.
- You have 60 minutes.

VisChem Institute – Day 3

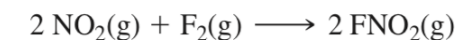
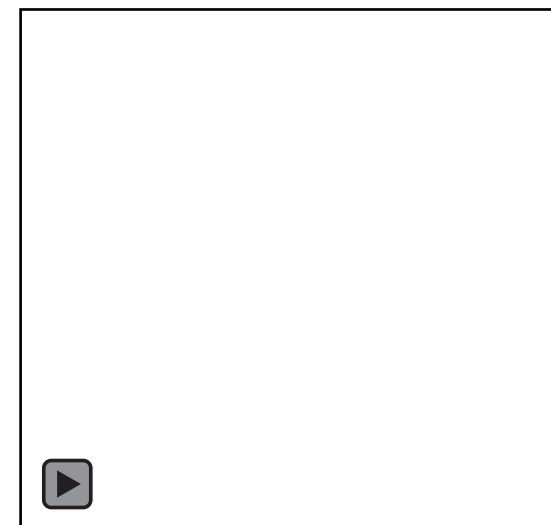
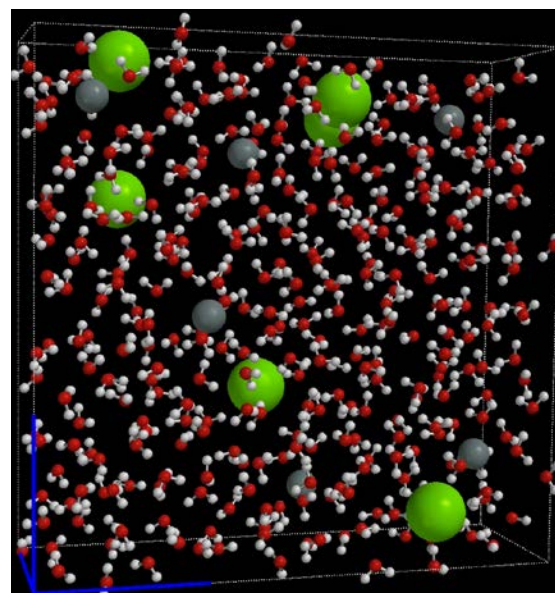
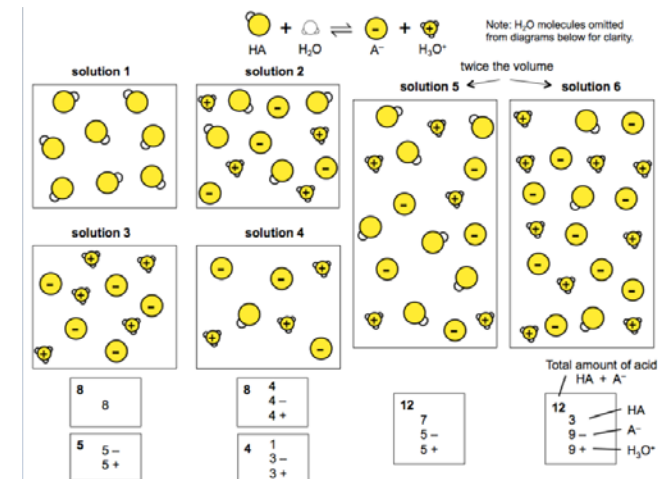
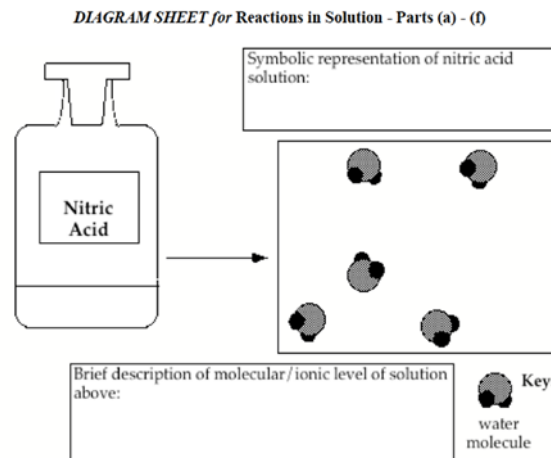
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Discussion of Misconceptions Papers

In your **expert groups** (when you're all discussing the same paper), consider these questions to get things rolling:

1. What are the common misconceptions?
2. How can we surface students' misconceptions?
3. How can VisChem help students confront and remediate misconceptions?
4. How similar/dissimilar are misconceptions in the paper compared to your students' ideas?

 Papageorgiou&Zarkadis2016.pdf 

 Luxford&Bretz2013.pdf 

 Galley2004.pdf 

 DeVos&Pilot2001.pdf 

 Cooper&Klymkowsky2013.pdf 

 Benson1993.pdf 

Efficiency Guides

 [Galley 2004 and Cooper & Klymkowsky 2013](#) 

 [Luxford & Bretz 2013](#) 

 [De Vos & Pilot 2001](#) 

 [Benson 1993](#) 

 [Papageorgiou & Zarkadis 2016](#) 

VisChem Institute – Day 4

Meet in mixed breakout groups

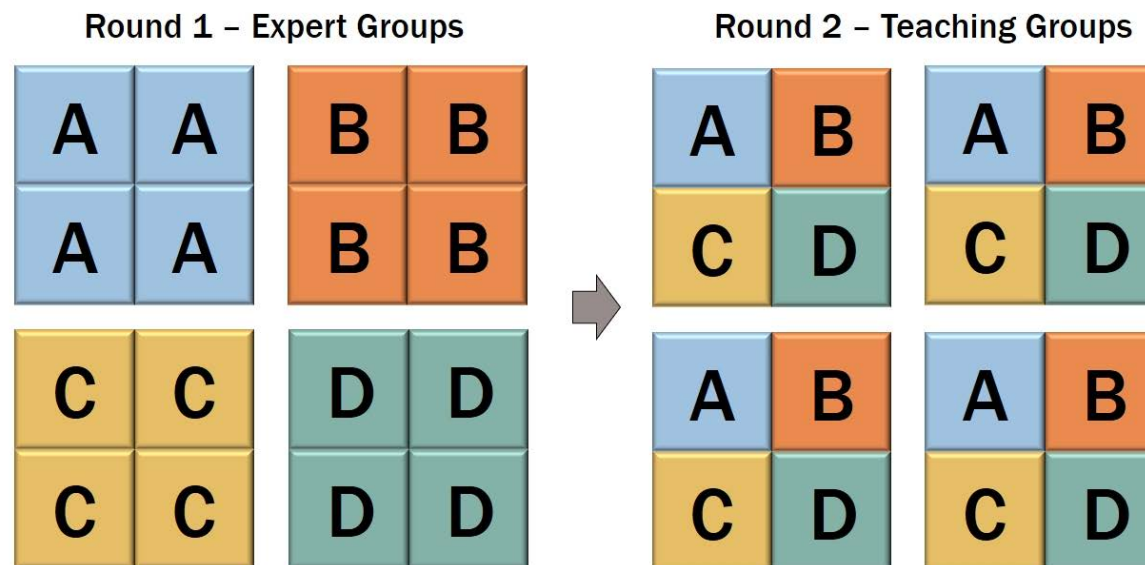
Explore asynchronous redox activity as a student

Debrief redox activity

Analyze sample student storyboards

Reflect on VCI

Discuss VisChem research in 2020-21 school year



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The screenshot shows a Google Slides presentation titled "REDOX Activity". The interface includes the Google Slides logo and navigation tools at the top. A sidebar on the left lists 8 slides. The main slide area displays slide 1, which features the VisChem logo, the text "Improving Conceptual Understanding in High School Chemistry Moving Students from Description to Explanation by Visualizing the Molecular Level", and the Miami University logo. The title "REDOX Activity" is prominently displayed in the center of the slide.

1 REDOX Activity

2 In order for videos to play properly, you must 'present' the slides (located in the top right-hand corner)

3 Building copper metal reacting with aqueous silver nitrate

4 Did you notice the following changes?
A solid forms on the copper surface. Reaction #1
The solution turns blue.

5 Reflection #1
On the same sheet of paper, write down your responses to the question:
A. What observations do you think your student would make?
Then, find the location of a solid and the solution turning blue on the right-hand side of the activity which corresponds with students.

6 A magnified cross-section of the copper surface
With this, consider the layer of copper metal that has formed on the surface of the copper metal.
Magnified images can better see chemical reactions and help students observe.

7 Storyboard Activity #1
Imagine that you could zoom down to the molecular level.
What would you see? **Reacting** at the copper surface as the reaction begins?
Use the following storyboard template and practice your skills to explain what you think is happening at the molecular level. The storyboard should be the size of a full page (8.5 x 11 in).
In your storyboard, point to the molecules at the beginning, what occurs between the molecules during the reaction, and the product at the end.

8

VisChem Institute – Day 4

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When poll is active, respond at Pollev.com/kmagnone779
Text **KMAGNONE779** to **37607** once to join

Which represents a silver ion in aqueous solution?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollev.com/app

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- | | |
|----------|--|
| 13:25:47 | From Brielle: I expected to see the water molecules always touching each other, but that would be too busy. |
| 13:26:15 | From Candice: Simplifies complex systems to look at specific interactions |
| 13:26:52 | From Sienna: So we are supposed to rewrite the ones that we've already said? If so, it looks like the water is "carrying" the silver chloride to the lattice |
| 13:26:53 | From Erin: electron clouds are absent |
| 13:27:17 | From Ed: Doesn't show the electron transfer, aside from "redistribution of electron cloud" |
| 13:27:18 | From Alex: No way to visualize the forces that are holding atoms/ions together |

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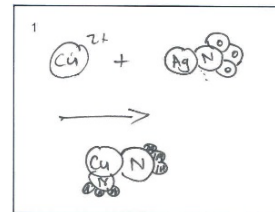
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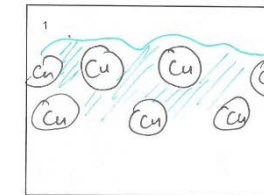
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@ = Oxygen

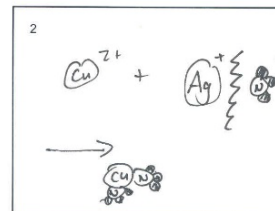
When Silver Nitrate solution is added to copper, + solution will undergo a reaction with which changes the chemical formula for the copper



— sea of electrons.

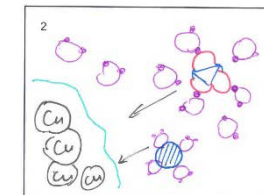
The shape of the copper atoms consists of electrons surrounding the copper. As copper is bunched together, the electrons then forms a array of electrons, often known as a "Sea of electrons"

○ = Cu @ = Cu²⁺



the silver nitrate will break up and become ions. Ions are charged.

However, Cu has a charge of 2+ which means NO₃ is needed to make a stable molecule.

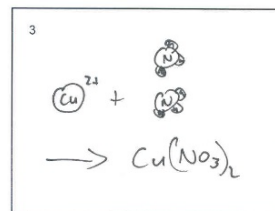


○ = Nitrate ion

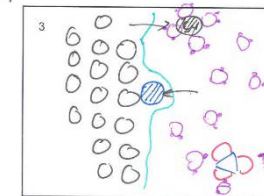
○ = water molecule

○ = Silver ion

As Silver nitrate solution is added, the ions will collide to the copper surface.



Two sets of nitrate will bond to the copper to make copper nitrate.



As the water molecules transport the silver ion to the surface of the copper, the silver copper will share it's electrons turning the silver ion to a silver atom.

While this is occurring, the copper has taken out of the metal.

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Putting It All Together

1. Think about all you have learned in the past 4 days about VisChem.
2. Take 10-15 minutes on your own to review slides 1-3 in “🔗 [Integrating VisChem Ideas](#) 📄.”
3. Generate and write down (in your own notes) at least one *NEW* insight about VisChem and place it in the Chat.

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In this assignment, **reflect** on how have you grown throughout the VCI in reaching. Provide specific examples of what you have developed a better understanding of and/or what needs to be further addressed. Refer back to your initial reflection of the VisChem Institute Learning Outcomes to document any additional changes. You may type in the text entry box, attach a word document, or provide a Google Doc link.

Part A: Describe how you've have grown in the VisChem Institute with respect to each of these learning outcomes.

Part B: Describe how you see the VisChem Approach (and Institute) relating to each of these NGSS components.

1. [🔗 Science and engineering practices: *Developing and Using Models* and *Constructing Explanations*](#). ⬇

2. Disciplinary core ideas: *Structure and Properties of Matter* and *Chemical Reactions*.

Part C: Describe any ADDITIONAL learning outcomes you've gained from the VisChem Institute.

Part D: Describe anything else you'd like to do and/or learn as a member of the VisChem Community of Practice.

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Start Date	Teacher Student Interaction	If Online: Conferencing system used	Learning Management system
8/17/2020	Fully in person	WebEx	Canvas
8/5/2020	Fully in person, as of now	Google meet	Google Classroom
8/24/2020	In person OR Online (synchronous&asynchronous) - students must choose one, as of now; hybrid is not allowed	Zoom	Has been Google, changing to Scho
9/4/2020	Will be finalized in early August. As of now, mix of remote and in person. Will update ASAP		Google Classroom
8/25/2020	Unsure yet; hybrid mix of in-person and online as of now, will update	google meet, schoology conference	Schoology
8/12/2020	I don't know yet (I will update on: July 31st)	Google meet and maybe zoom	canvas
	Mix of in person teaching and asynchronous online days (called 3/2 model, splitting the student population in half by alphabetic last name, only half the students in school at one time. First half M/T, last half R/F, alternating Wednesdays. Days at home will still require teacher made lessons, but asynchronously from my in-class teaching.		
8/11/2020		Microsoft Teams (built for business, but works okay for ed	Teams & Infinite Campus for attenda
8/17/2020	Unsure yet; hybrid mix of in-person and online as of now (I will update	WebEx	Schoology
8/20/2020	Fully Online with mix of synchronous and asynchronous lessons	Google Meet	Google Classroom
8/5/2020	Not sure yet, will update by July 17th	Zoom & Google Meet	Google Classroom
	Currently teachers will have to teach fully in person and students online at the same time. In theory they are saying we wont have to do both but its most likely that it will be both. Parents have been given the option to either send their students fully virtual for the first semester or fully in person. AB block on Mon-Thur with 7 skinny periods on Friday		
8/12/2020		Zoom & Google Meet	eCLASS which is Desire2Learn
8/12/2020	Unsure yet; maybe hybrid or total online	Google Meet	Google Classroom
8/11/2020	advising fully in person	Google Meet	Google Classroom
8/24/2020	Unsure, we have all 3 options (in-person, hybrid, all online)	Unsure	
8/17/2020	First quarter online at this time.	TEAMS	TEAMS