Using Comic Book Characters and Collaborative Technologies to Design a Chemistry Course

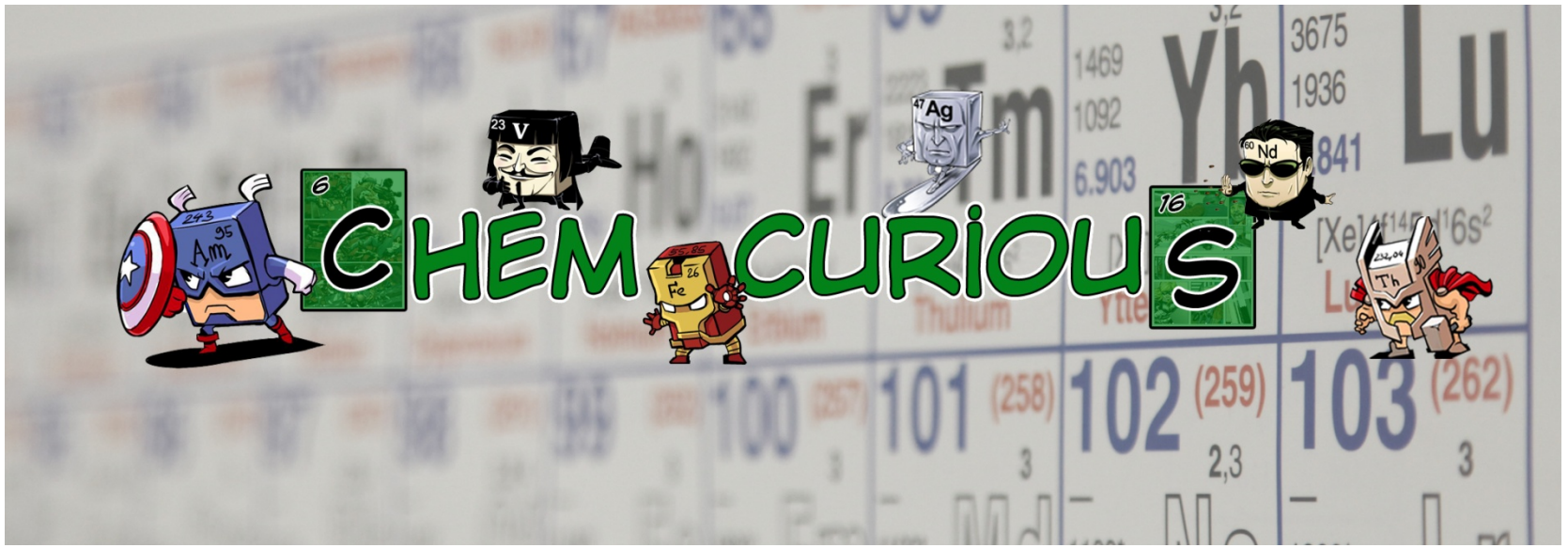
By Yann Brouillette, Ph.D.

#ChemCurious

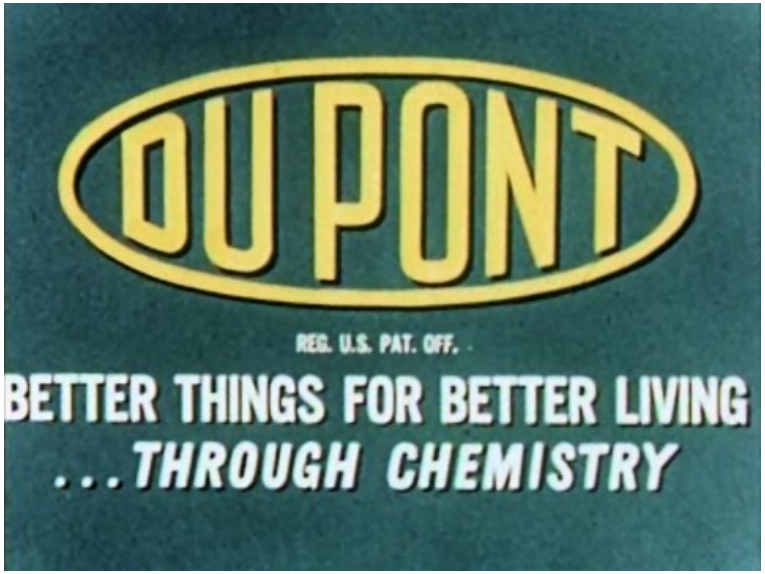
DAWSON COLLEGE

YouTube CHEM CURIOUS

6th Annual SALTISE Conference, June 5th, 2017.


CHEM CURIOUS

Du Pont Advertising Slogan



1935-1982:

"Better Things for Better Living... Through Chemistry."

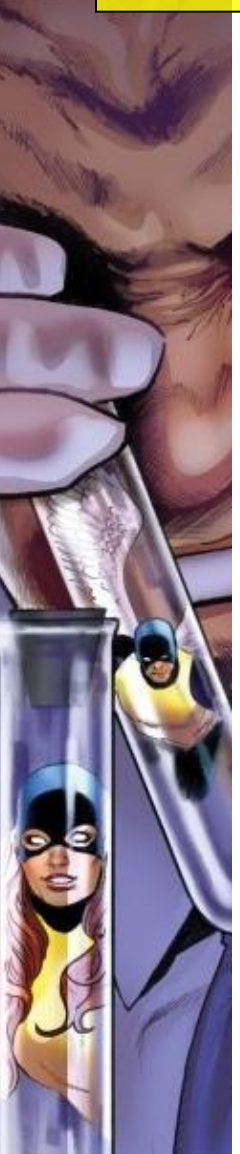
1982-1999:

"Better Things for Better Living."

1999-present: "The miracles of science".

Chemistry Irony

Chemistry Irony



Chemistry Irony

Chemistry Irony

Different Teaching Styles

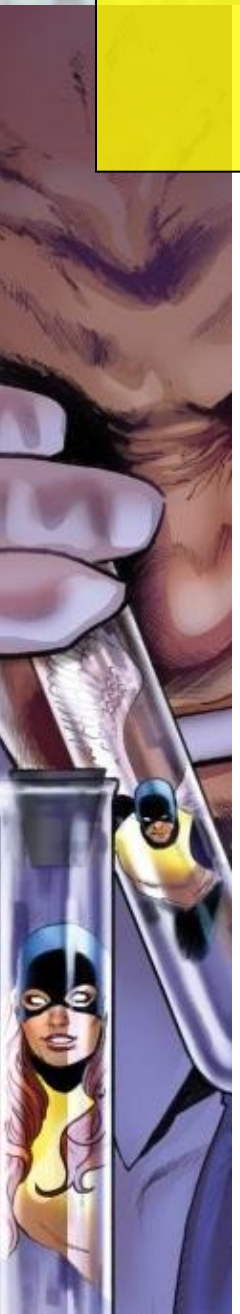
How to read According to Disney...

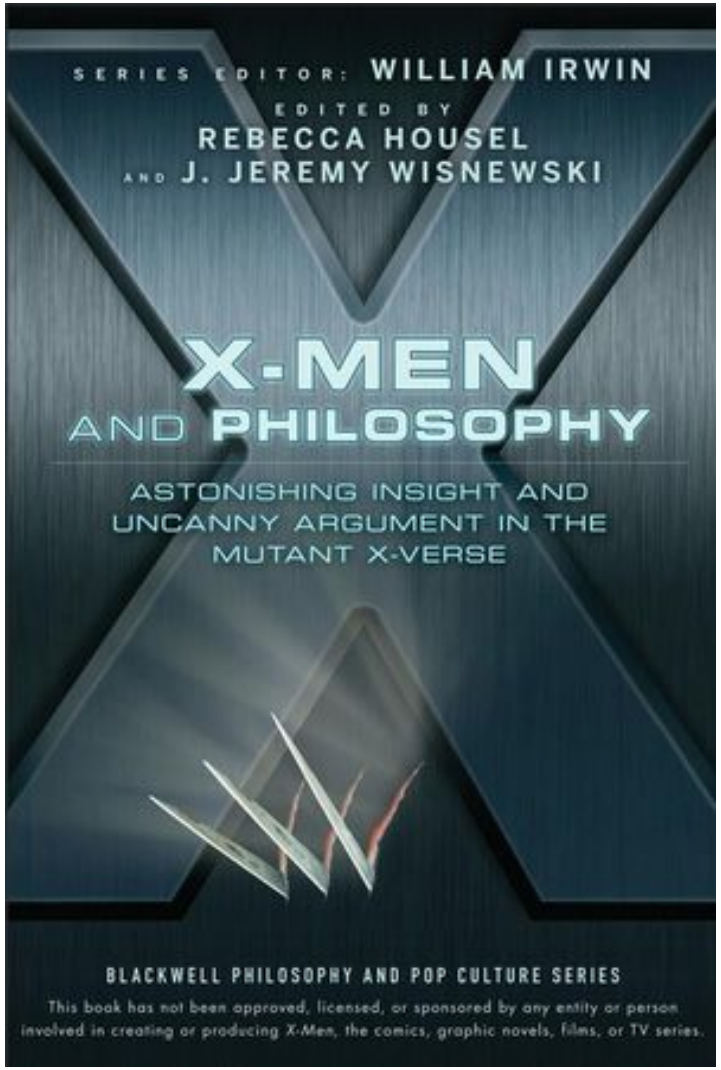
Jane teaches **Tarzan**
-See Jane
-See Jane run

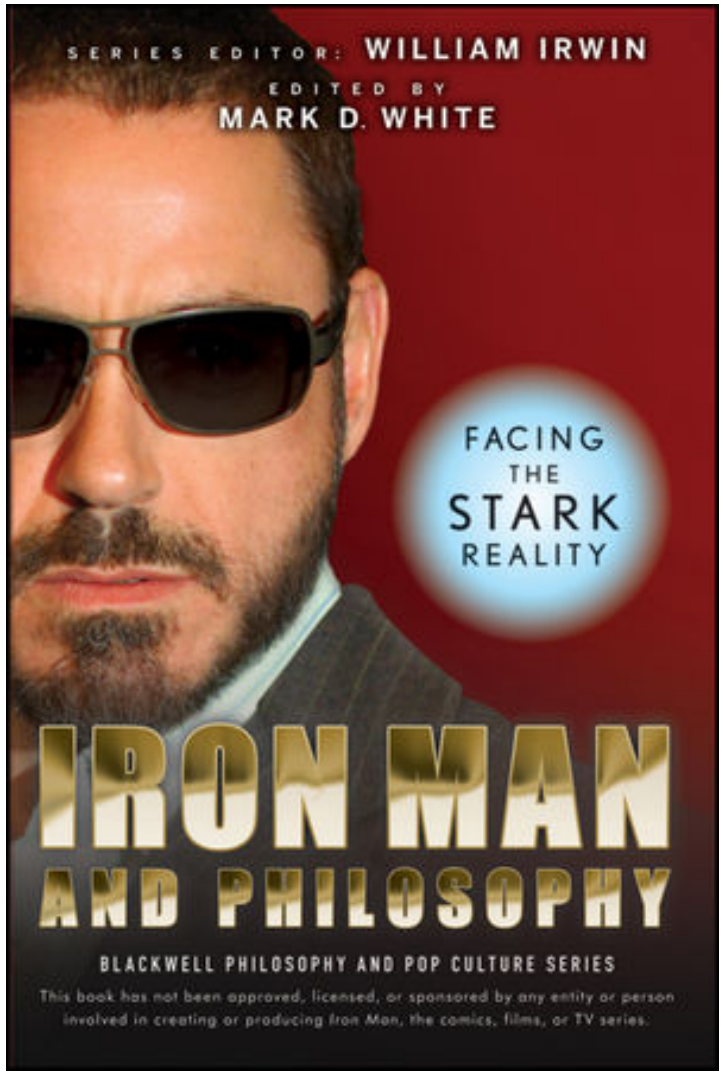
Belle teaches **Beast**
- Shakespeare's Romeo & Juliet

Collaborative Learning

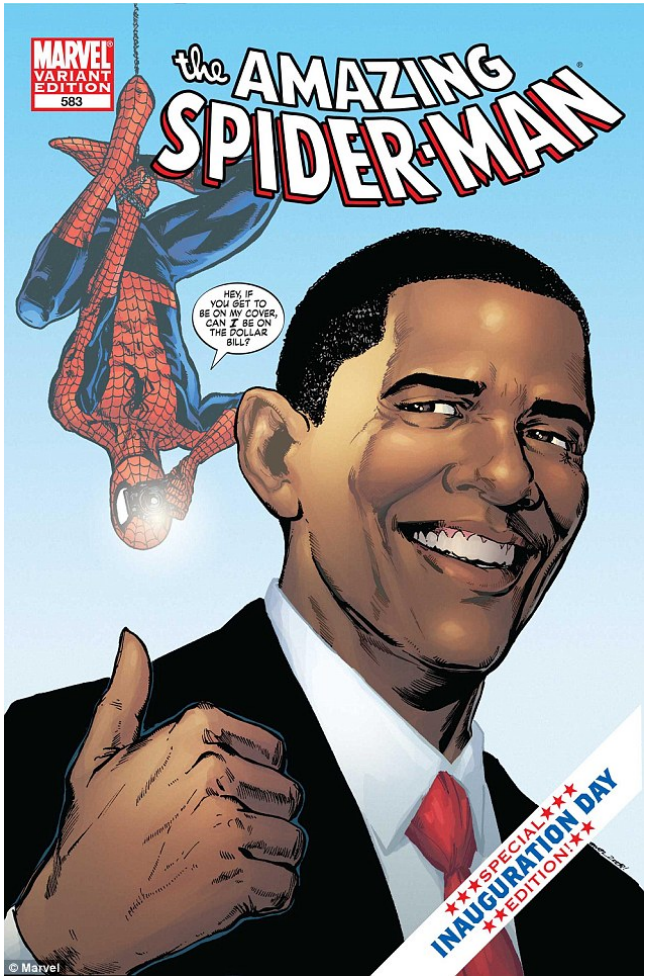
Comics and Philosophy







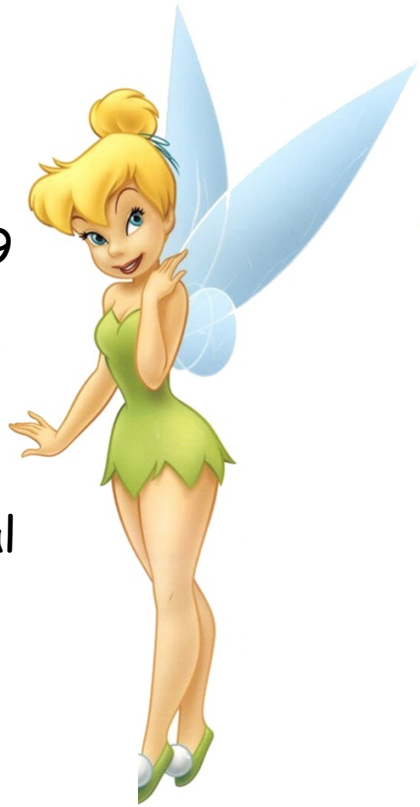
Comics and Politics



Fictional Characters as UN Honorary Ambassadors

Red from Angry Birds for the 2016 International Day of Happiness

Tinker Bell was the 2009 honorary ambassador of green" to promote environmental awareness



Winnie the Pooh was the 1998 ambassador for International Day of Friendship

Wonder Woman announced as UN honorary ambassador for the empowerment of women

On **October 21st 2016**

The campaign launches on the 75th anniversary of Wonder Woman's first appearance.


SALTISE
PHEROMONE SERUM #009
ISHERWOOD

Who am I?

DAWSON COLLEGE

Name:

- **Yann Brouillette**

Department:

- **Chemistry**

Work experience:

- **7 years**

Courses:

- **Introduction to College Chemistry**
- **General Chemistry**
- **Chemistry of Solutions**
- **Organic Chemistry**

Classes

Duration:

- 15 weeks

Laboratory:

- 2h00 (or 3h00) / week

Theory:

- 1h30 x 2 / week

Immediate engagement because already Active:

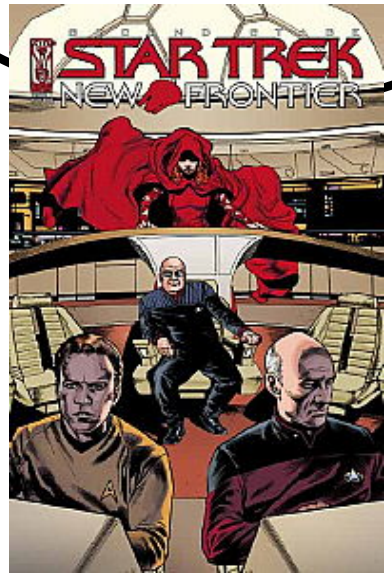
- Practical Experiments
- Teamwork (2)

Needs to be more interactive:

- ...

New Frontiers for Engaging the Learner: Interconnecting design and assessment

New Frontiers… That's **Star Trek**, right?



Chemistry and Science-Fiction

COMPLEMENTARY COURSE

COMIC BOOK CHEMISTRY

202-BWT-03

THIS FUN COURSE IS DESIGNED FOR NON-SCIENCE STUDENTS WHO WANT TO LEARN MORE ABOUT CHEMISTRY USING FACTS DESCRIBED IN SUPERHEROES' UNIVERSE.

THE COMIC BOOK CHEMISTRY COURSE TAKES AN IN-DEPTH LOOK AT HOW CERTAIN SUPER POWERS, MYSTICAL MACHINES AND HEROIC STUNTS CAN ACTUALLY BE POSSIBLE, AND IN WHAT EXTENT THEY CAN BE EXPLAINED BY CHEMISTRY.

Fall Semester

ONLY AT D

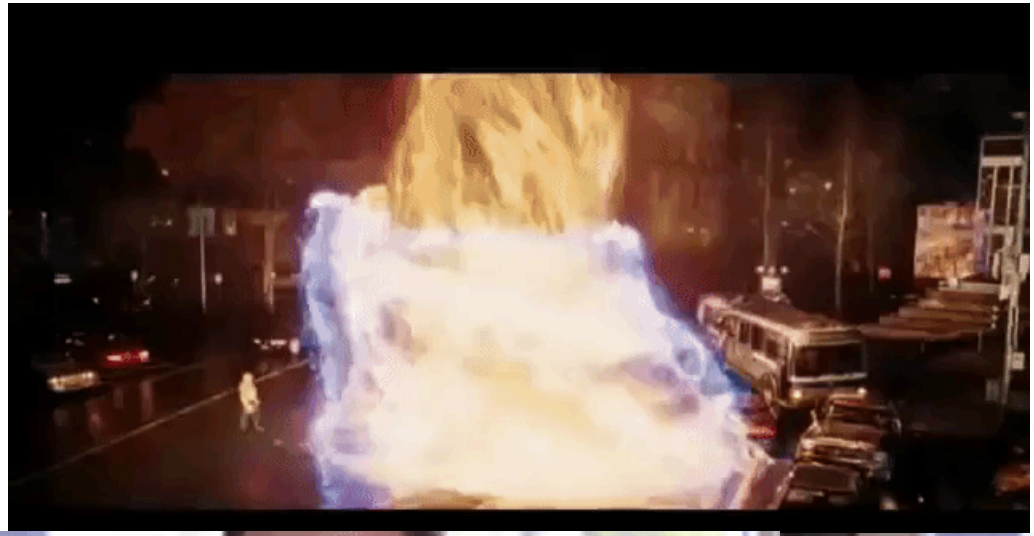
Human Torch Flaming HANDS

https://www.youtube.com/watch?v=ohl7ZTnwrK8

Bubbling methane in soapy water to Flame on!

Fantastic Four Fire Tower

https://www.youtube.com/watch?v=4v2COiSyvBc



Methanol (CH_3OH)
NaCl (for orange flame)
Turn table
Mesh Garbage can

Strontium chloride (for red flame)

GREEN Flames

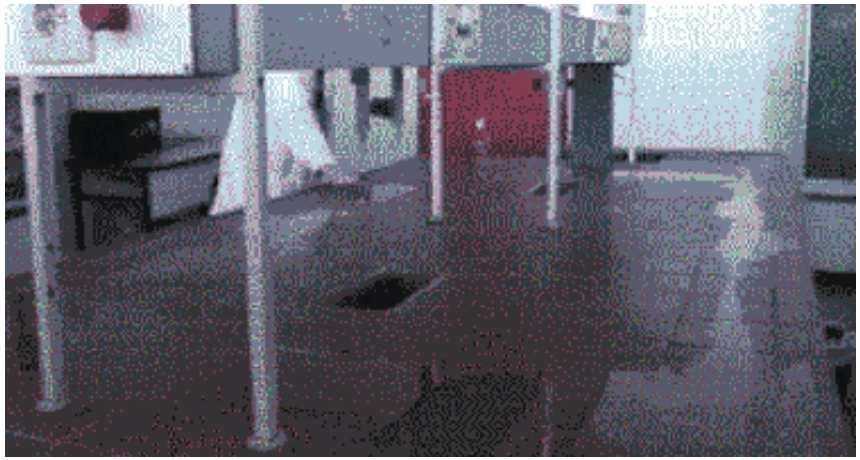
Disney
MALEFICENT

Game Of Thrones WILDFIRE

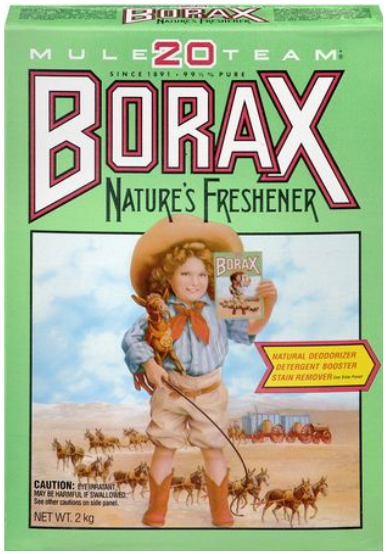
- During the Battle of Blackwater opposing the Lannister and the Baratheon, Tyrion uses **Wildfire** to defeat his enemies (season 9 episode 2).

Flamable Liquid

- Trimethyl borate ($B(OCH_3)_3$) is a colorless flammable liquid notable for its bright green flames when set on fire.



Synthesis from Household Items



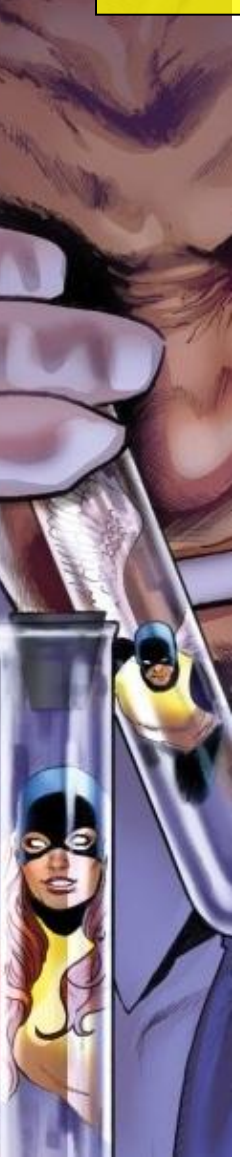
- Borax = Sodium tetraborate
- Dissolving in methanol:

$$Na_2B_4O_7 + 12\ CH_3OH \rightarrow 4\ B(OCH_3)_3 + 2\ NaOH + 5\ H_2O$$

Inconvenient: some orange color due to the burning of sodium

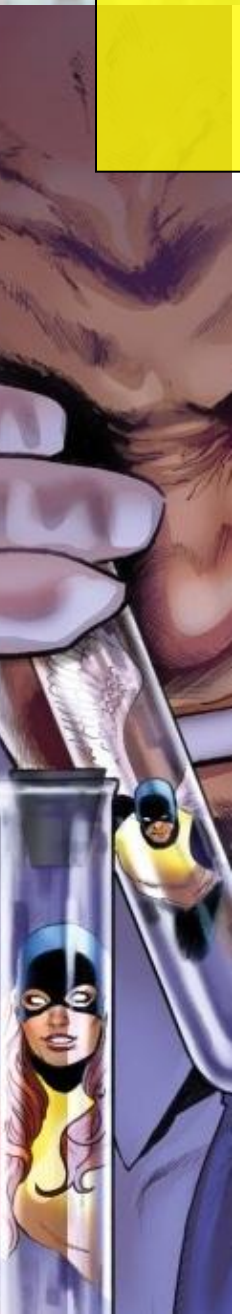
Other Route: $CuSO_4$

https://www.youtube.com/watch?v=s1Nu2PX0Izs



Coming Soon!

Exchange with Students



MYDAWSON LEA
Yann Brouillette

Visual Classrooms

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Visual Classrooms
To Share and Compare

Visual Classrooms | Teacher Dashboard | About | Help | Comic Book Chemistry: Discussi | Prof. Brouillette

Edit Prompt

Dear Students, Welcome to Visual Classroom.

Please watch the trailer below and quickly reply a short answer to "What do you think will be WONDERful in this upcoming movie?"

Navigate

Wonder Woman Trailer Impressions

Arrange

Options

Filter...

Notifications

New Idea

Eric Alex K

Unfortunately, in the last 3 years, DC's movies were only half as WONDERful as their trailers. They weren't, for the most part, terrible, but there was room for improvement. For this movie, I WONDER if they're really going to stick to the story where Wonder Woman was made out of clay, or if there will be a big reveal about how the entire thing was a tale to avoid Hera's wrath.

As for the scientific aspect, although a scientific explanation of the Lasso of Truth is tempting too, I would like to explore her sword. According to *Wonder Woman: The Ultimate Guide to the Amazon Princess* (Scott Beatty, qtd. in Wikipedia), her sword is sharp enough to separate an atom from its electrons. Obviously, it is impossible to just break an atom with the swing of a sharp metal stick, but how much energy would have to flow into an atom to allow its electrons to leave? Could such energy be produced by a device small enough to be placed on a sword?

Eryka L

In my opinion this upcoming movie will be a great change. It will be a fresh look at a super hero who is a women. So many superhero movies are based on men, so for the main focus of this movie to be a women will be interesting. This will be an empowering movie, in my opinion it will get alot of female supporters behind it. I just hope that female strenght is well portrayed in this movie and that she isnt just looked as upon a sexual image like she is portrayed in the comic books. There is more to wonder woman than her big breasts and short shorts, this is what i hope to see in this movie.

09/05/2016

1

Prof. Brouillette

I totally agree that "there is more to Wonder Woman than her big breasts and short shorts" and despite many adaptations of the character, comics books for mature

Félix P

The thing with the new wave of DC movies is that, at least for me, I look forward to seeing them because of how much potential they have and then get disappointed when I see them. When "Man of Steel" was announced, I saw a bunch of possibilities that the studio could have used and didn't. From then on, I saw all "Batman V Superman" and "Suicide Squad" and was pretty sad they didn't really pay honor to their Comic Book counterparts. However, I might just be falling in that same pattern again but, I believe DC can pull themselves back up from these three not so successful movies with Wonder Woman. Just as a character, she is such a powerful and interesting character. This trailer shows that the studio has grasped some of the mistakes it has done with his past films. Personally, if this movie doesn't succeed, I think it might

Visual Classrooms

Eric Alex K

The table salt box contains more than just NaCl (shockers!). Its ingredients include: "salt, calcium silicate, sodium thiosulphate, [and] potassium iodide." The easiest substance that I can convert into the scientific formula form is **potassium iodide,** a molecule formed by an ionic bond between elements 19 and 53. It is written as **KI** (that's an "I", as in "Identity," not as in "laugh")

The cocoa powder mix contains "cocoa [and] potassium carbonate." The latter is an ionic bond of element K with the polyatomic cation CO3 (the "3" should be small). Since an ion carbonate has a charge of 2- and one atom of potassium has a charge of 1+, **potassium carbonate** is written as **K2CO3** (all numbers in subscript).

10/03/2016

1

Prof. Brouillette

Good! Yes, table salt is more than just NaCl, that is why there are lots of different companies offering different products. It is usually the amount of iodide that differs greatly from one company to another. That is why they don't have exactly the same taste, although VERY similar.

10/03/2016

tony F

Eryka L

little fact about me: Ive gotten operated 8 times for knee problems that i have. I am missing cartilage. So when there is lots of humidity my knees start to hurt. One thing that helps for a few hours is deep relief (gel for joint pain). This inflammation reducer contains Titanium Dioxide(TiO2), this nomenclature can also be found in sunscreen, gum,paint, toothpaste... (https://fr.wikipedia.org/wiki/Dioxyde_de_titane), it also contains Iron Oxide(Fe2O3) in its ingredients.

My next ingredient is magic pouder. I love baking cakes. Baking powder is used for your cake to rise (So you dont get a pancake). This magic powder has lots of magical nomencalture inside. It contains 3 simple ingredients: corn starch, monocalcium phosphate (CaH4P2O8) (also used in fertilizers -https://en.wikipedia.org /wiki/Monocalcium_phosphate) and sodium bicarbonate(NaHCO3).Sodium bicarbonate can be used for many other things such as pest control (getting rid of bigs in your house), a fire extinguisher (stops small fires in home) and medical uses (when mixed with water it can help heart burn) (https://en.wikipedia.org /wiki/Sodium_bicarbonate). Surprisingly these 3 ingredients make miracles while baking also.

For me these are two household products i use all the time and it was intereseting to see what was in them and what these elements are also used for. (this also gave me the opportunity to explore places in the pantry i didnt even know existed :P)

10/04/2016

Marilena P

Comet is often used in a house to clean. Comet contains ***Bleach (Sodium Hypochlorite) NaOCl*** and another ingredient is ***Sodium Carbonate Na2CO3*** (the 2 and 3 should be subscript, I didn't know how to do that here.)

Another item I have in my house is vitamins. My mom takes one everyday and she got me to take some too just to make sure we've got all our vitamins everyday. There are lots of things I could have put for this one but the ones I chose are: ***Magnesium Oxide, MgO*** and ***Potassium Chloride, KCl.***

https://www.google.ca/search?sourceid=chrome-psyapi2&ion=1&espv=2&ie=UTF-8&q=comet%20cleaner%20ingredients&oq=comet%20&aqs=chrome.0.69i59j69i57j0l4.1505j0j7

https://www.google.ca /search?q=one+a+day+vitamins+ingredients+list&newwindow=1&espv=2&biw=1366&bih=662&source=lnms&sa=X&ved=0ahUKEwi_1uKU0sLPAhUI0oMKHS_PAKEQ_AUIBygA&dpr=1

10/04/2016

2

Prof. Brouillette

Great!

In terms of nomenclature, if we didn't have to put the metal first, then Magnesium oxide formula would read OMG!

Correct Ambiguity

https://www.youtube.com/watch?v=zh05k99kkms&t=71s

1. Students need to find what is wrong.
2. Another student (or group) needs to explain "Why it is wrong".
3. Get other students to comment on the provided explanations.

Visual Classrooms
Elemental Hero Project

manda B

11/30/2015

rof. Brouillette

om: **Copper**

Bronze armor because of presence of Cu in Bronze. *OOD*

Injuries (cuts, bruises, blood) are green/blue because color of Cu ions. *GOOD*

Sword with green/blue flame because of flame color of . *GOOD*.

eat illustration!

11/30/2015

ctoria A

y something that could be interesting for your essay is the fact t copper is a catalytic compound. Which means it's speeds up tain reactions. Just a thought.

11/30/2015

toria J

Alexa S

Green Flame

11/30/2015

5

Alexa S

I forgot to write the physical properties but the element is Barium and she has silver hair because that the color of barium. She can produce a green flame, and she can resist heat up to 730 degrees Celcius

11/30/2015

Prof. Brouillette

Atom: **Barium**

1- Silver colored hair because of pure barium color. *GOOD*

2- Produces a green flame from her hand because pure barium burns with a green flame. *GOOD*

3- She can resist heat up to 730 degrees Celsius. *That is not a physical trait.* Please find another one :)

Great illustration!

11/30/2015

Alex S

Barium is also a good electrical conductor, she could some how use that to go with the fire aspect of her. Like a green lightning bolt.

Ann S

This is Copperfield, she represents the element of copper.

11/30/2015

4

Prof. Brouillette

Atom: **Copper**

Perfect.

Great illustration!

11/30/2015

Megha P

Annnn! Your drawing is amazing!!

11/30/2015

Jason L

Alright this is gonna be a little out there bear with me... but what if her veins were copper wires and she could extend them out of her wrists (because of copper's ductility) and use them as a whip or a lasso

Also that's a gorgeous drawing

11/30/2015

Karina G

One of the best illustrations in the class for sure, maybe if you colour it you could add copper accents :)

Vanessa B

Chemical Element: Oxygen

1- Light blue/ pale blue costum a liquid.

2. Skin and eyes are white/clea gas

3. O3 an allot-rope of oxygen. and highly reactive, but has a because of ultraviolet radiation protecting the earth.

- I found his costume kind of b Ox, also known as bullock, wh :):)

- he also carries an oxygen tar would not have been visible, w side :)

2

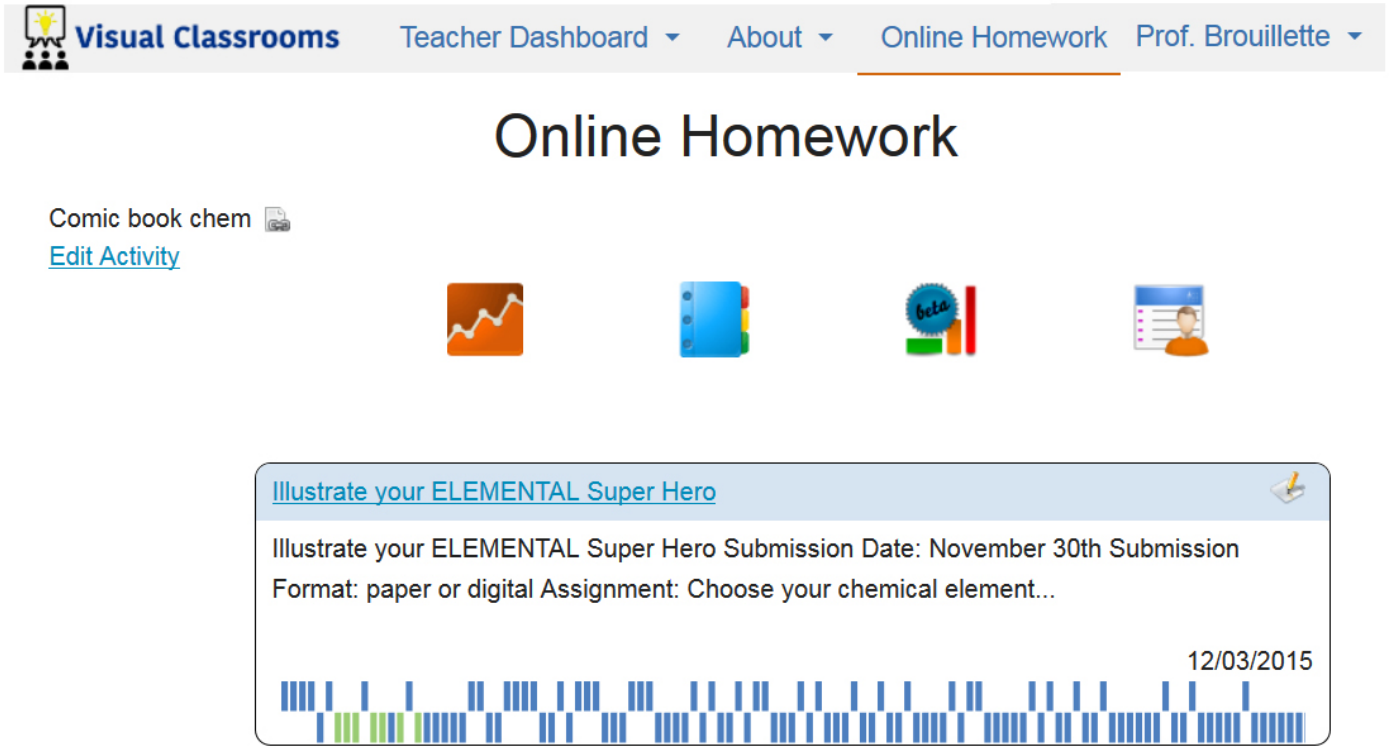
Prof. Brouillette

All GOOD :)

lilia A

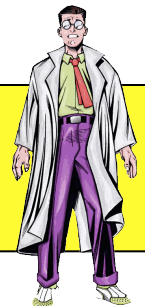
Since he is the ozone protecting

Teachers gets feedback



Conclusion

- **Comics books** are **fun** and everywhere.
- **Plenty of Chemistry** in Comic Books.
- So **Chemistry** is **fun**.



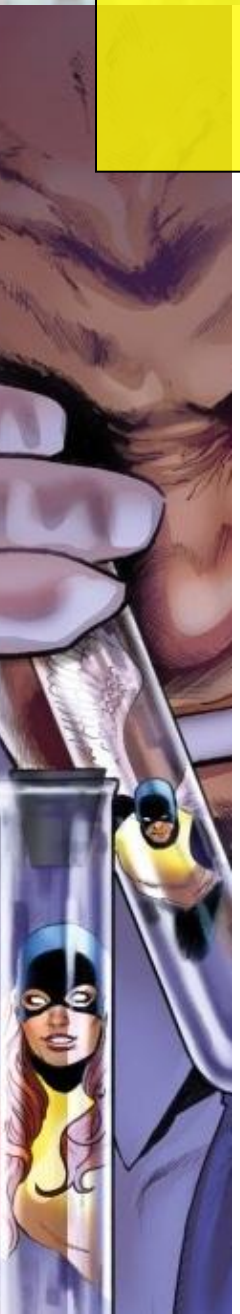
To be continued

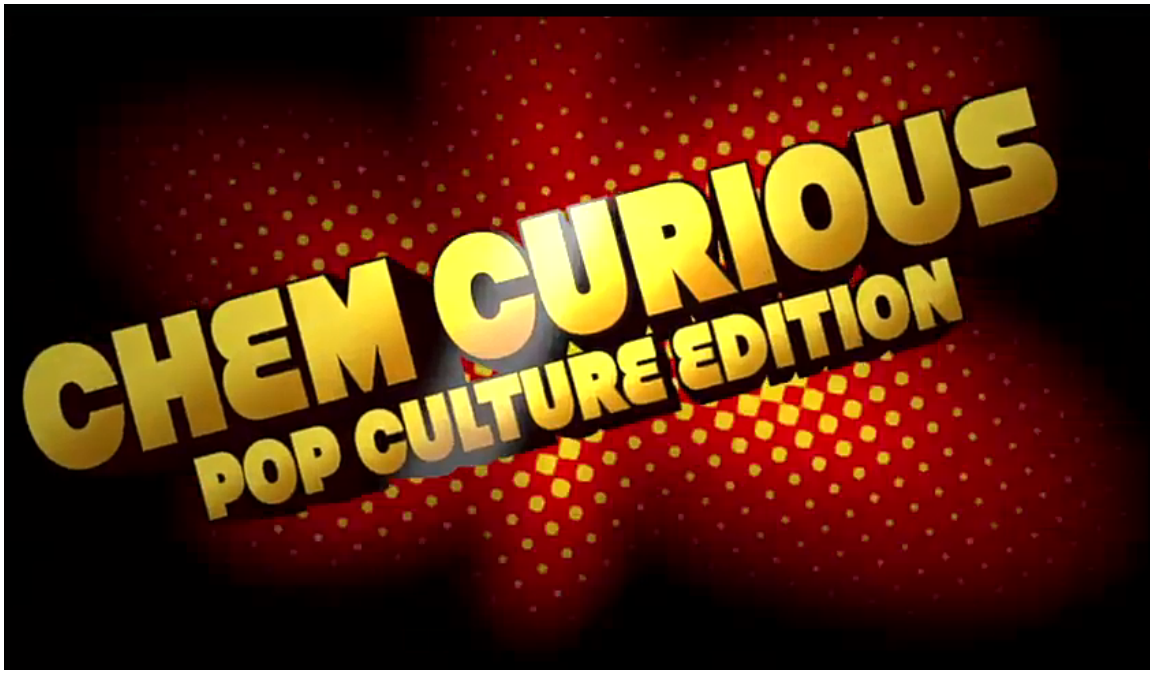
Acknowledgements

- Organizers
- Dawson College
- Wife & Kids
- Comic book Writers and Illustrators
- … and You!

Questions: ybrouillette@dawsoncollege.qc.ca

CHEM CURIOUS Channel

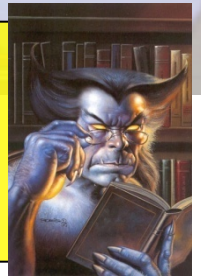




Comic Book Chemistry Videos

https://www.youtube.com/user/ChemCurious?feature=watch

Suggested Readings



- *Inventing Iron Man* by E. Paul Zehr, Johns Hopkins University Press, Baltimore, 2011.
- *ReAction! Chemistry in the Movies* by Mark Griep & Marjorie Mikasen, Oxford University Press, New York, 2009.
- *Becoming Batman* by E. Paul Zehr, Johns Hopkins University Press, Baltimore, 2008.
- *The Physics of Superheroes* by James Kakalios, Gotham Books, New York, 2005.
- *The Science of Supervillains* by Lois Gresh and Robert Weinberg, John Wiley & Sons, Inc., New Jersey, 2005.
- *The Science of Superheroes* by Lois Gresh and Robert Weinberg, John Wiley & Sons, Inc., New Jersey, 2002.
- *The Science of Superman* by Mark Wolverton, BP Books, New York, 2002.
- *The Science of the X-Men* by Link Yaco and Karen Haber, BP Books, New York, 2000.
- *The Science of Star Wars* by Jeanne Cavelos, St. Martin's Press, 1998.

FREE CANADIAN COMICS

Heroes of the North

www.heroesofthenorth.com/COMICS/