Chemistry & The Ways YOU Learn

Johnstone, A.H.; J. Chem. Ed.; 87,1; pp.22-29 (2010)

Let me ask you a question:

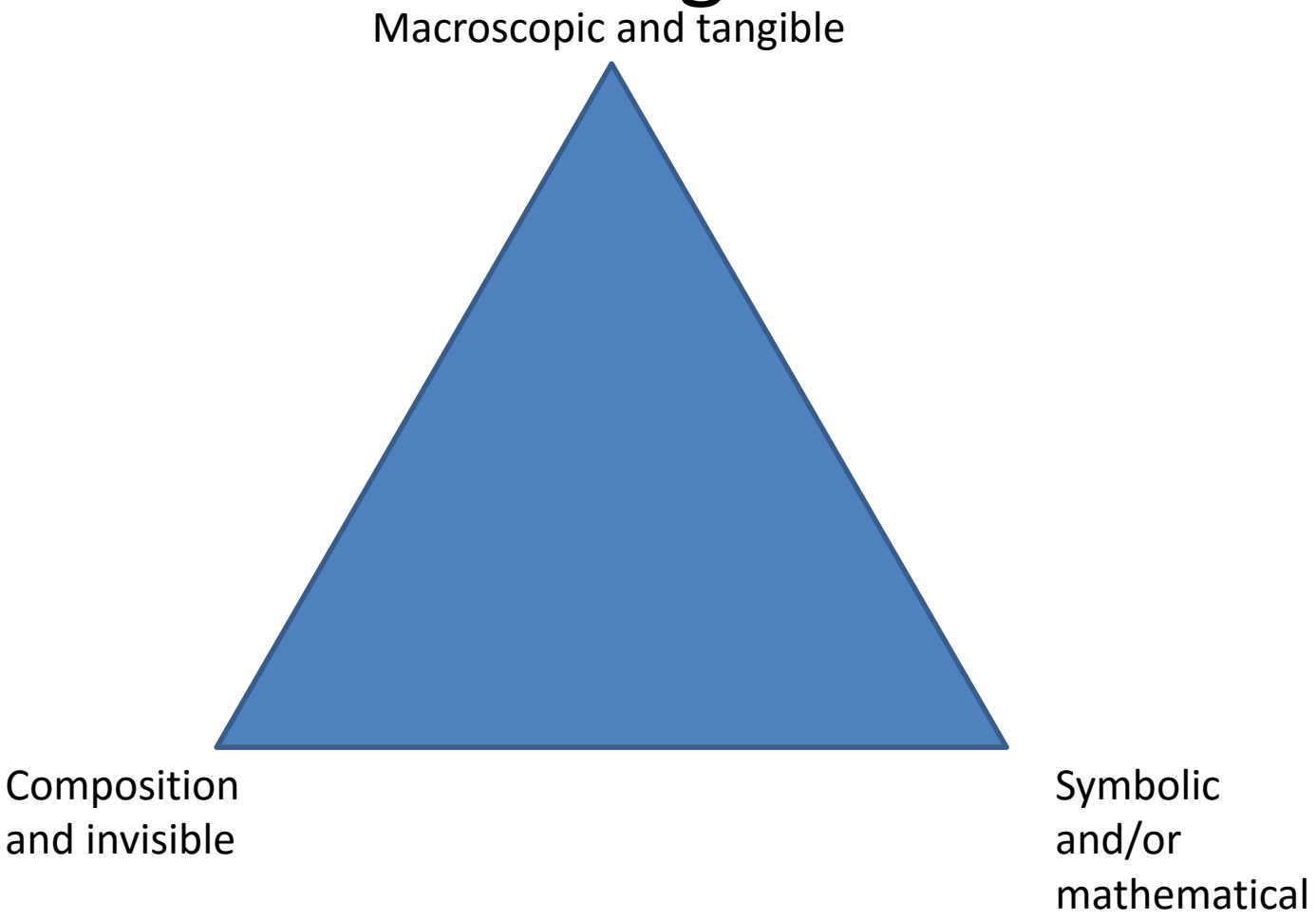
You went shopping. You always buy twice as many shirts as pants. You bought 4 pants. How many shirts did you buy?

A. 1
B. 2
C. 4
D. 8

Congratulations, you know how to do stoichiometry!!

The problem is, if I ask you the same basic question about magnesium and chlorine, the results are not as good – even though it's the same question!

You could think of most subjects as a triangle



AH Johnstone, J. Chem Ed, 87(1),22. (2010)

4 legs
2 ears
Fur
Mouth
Liver
2 lungs
Etc.

DOG

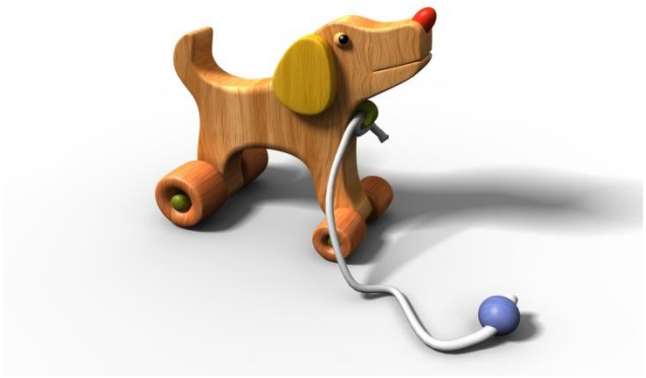
4 legs
2 ears
Fur
Mouth
Liver
2 lungs
Etc.

The dog was missing one leg and one ear.

DOG

For “everyday” objects and activities, we learn to navigate the triangle without any conscious thought. If I simply say or write “dog”, you each conjure up some image and understanding based on your previous experience.

DOG



My PERFECT Dogs

Your “Perception Filter”

Your experience creates a “perception filter” which influences how you interpret information.

DOG = Unconditional love

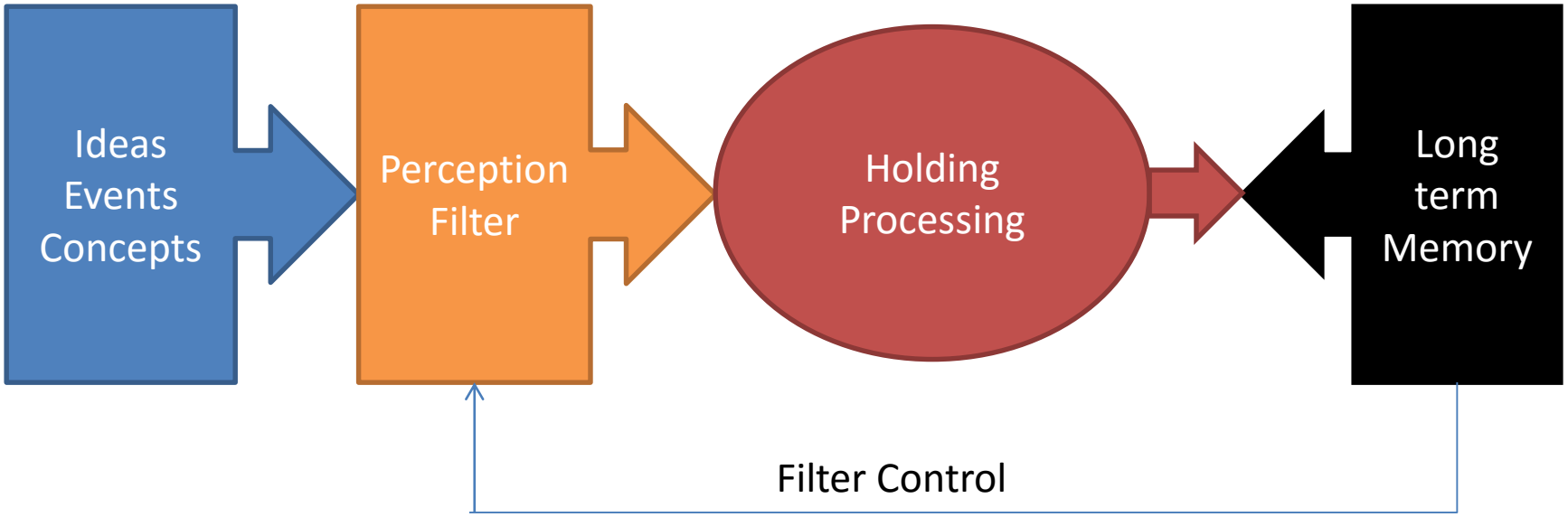
DOG = warm, fuzzy puppy

DOG = KILLER! KILLER! KILLER!

This changes how you view and even solve a problem.

Information Processing

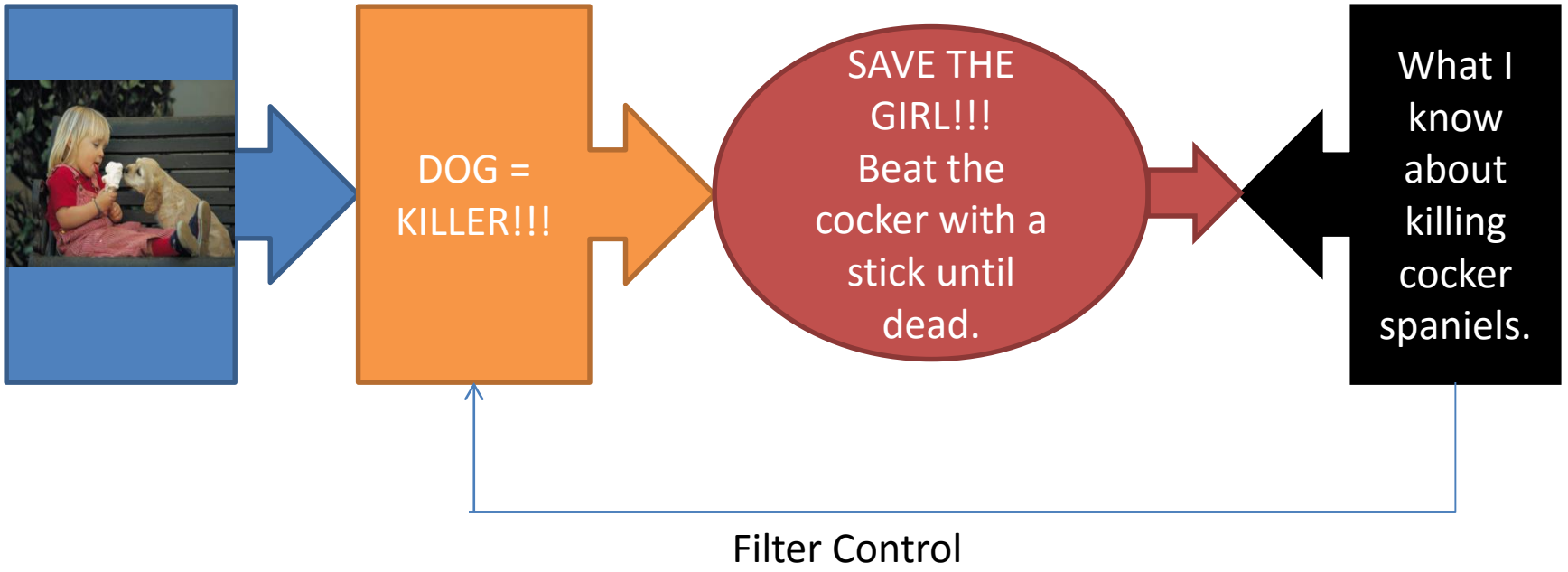
Something new gets filtered by your previous experience. You use what you "know" and use it to "process" the new idea. This creates new "memory" which changes how you filter ideas in the future.



AH Johnstone, J. Chem Ed, 87(1),22. (2010)
R. Case, "Intellectual development: Birth to Adulthood", Academic Press: New York, 1985.

Information Processing

I know, a silly example, but…



Information Processing

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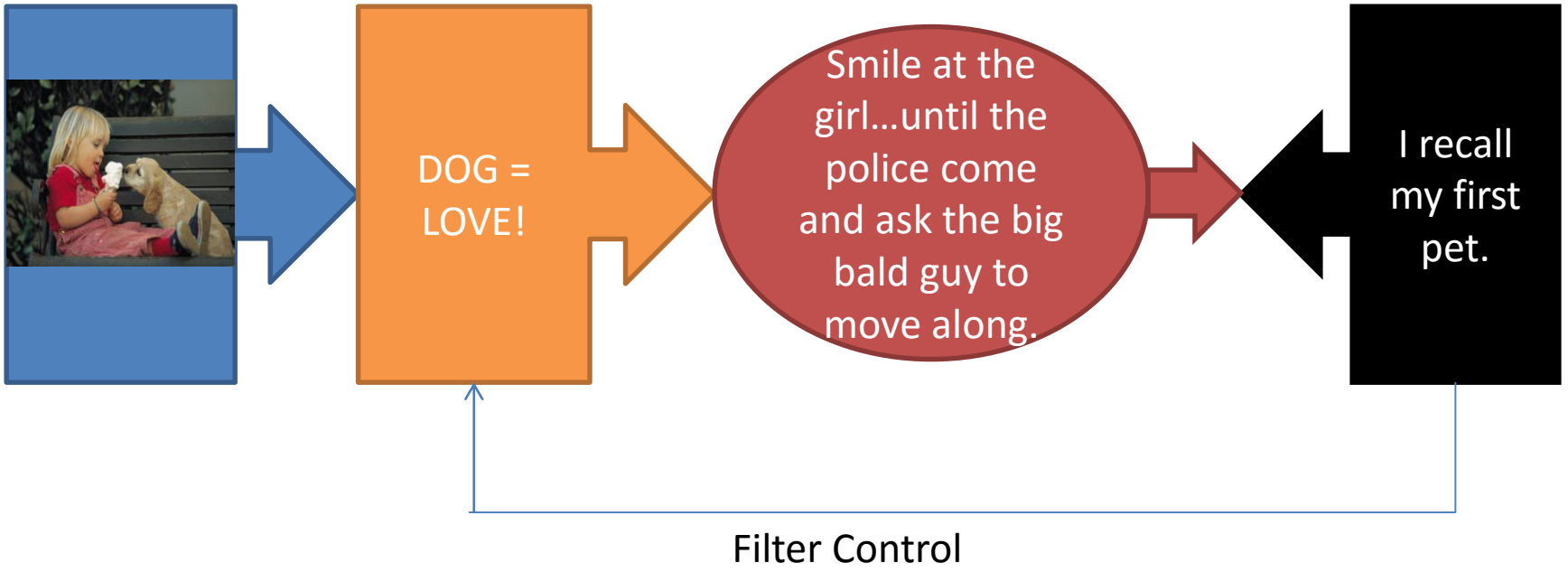
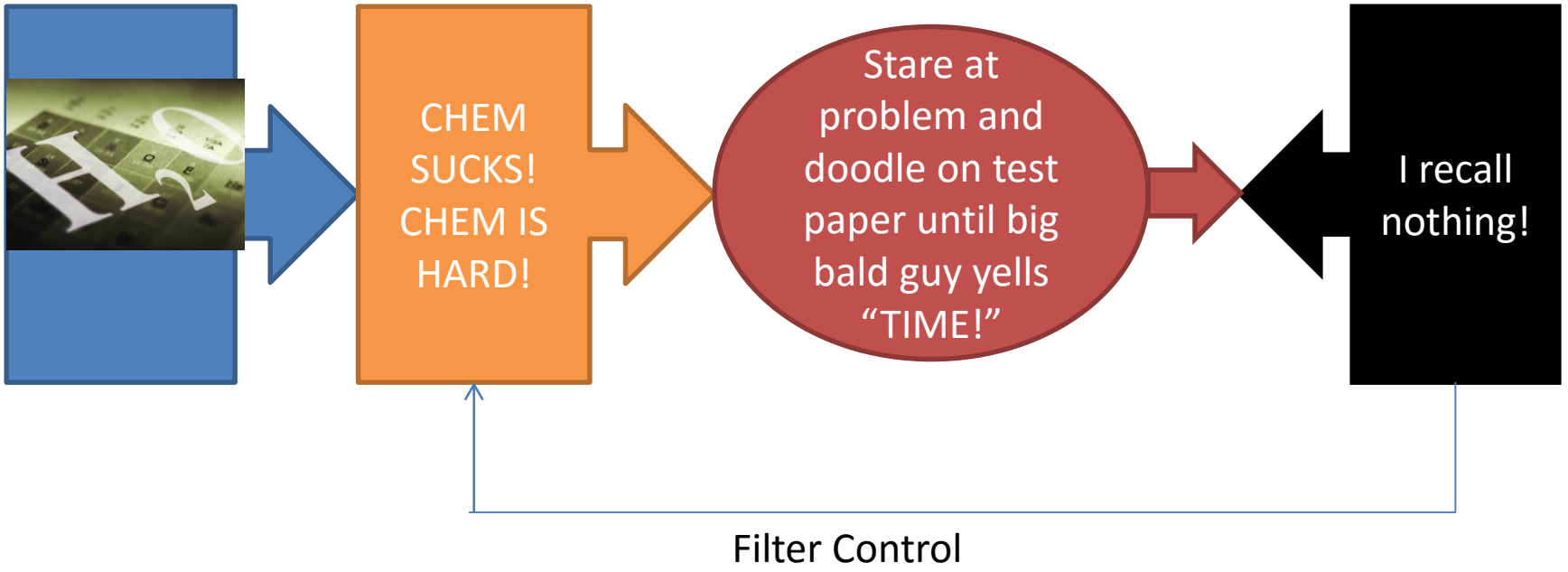


Information Processing

Your attitude, as part of your perception filter, can really affect your ability to solve a problem and learn something new.



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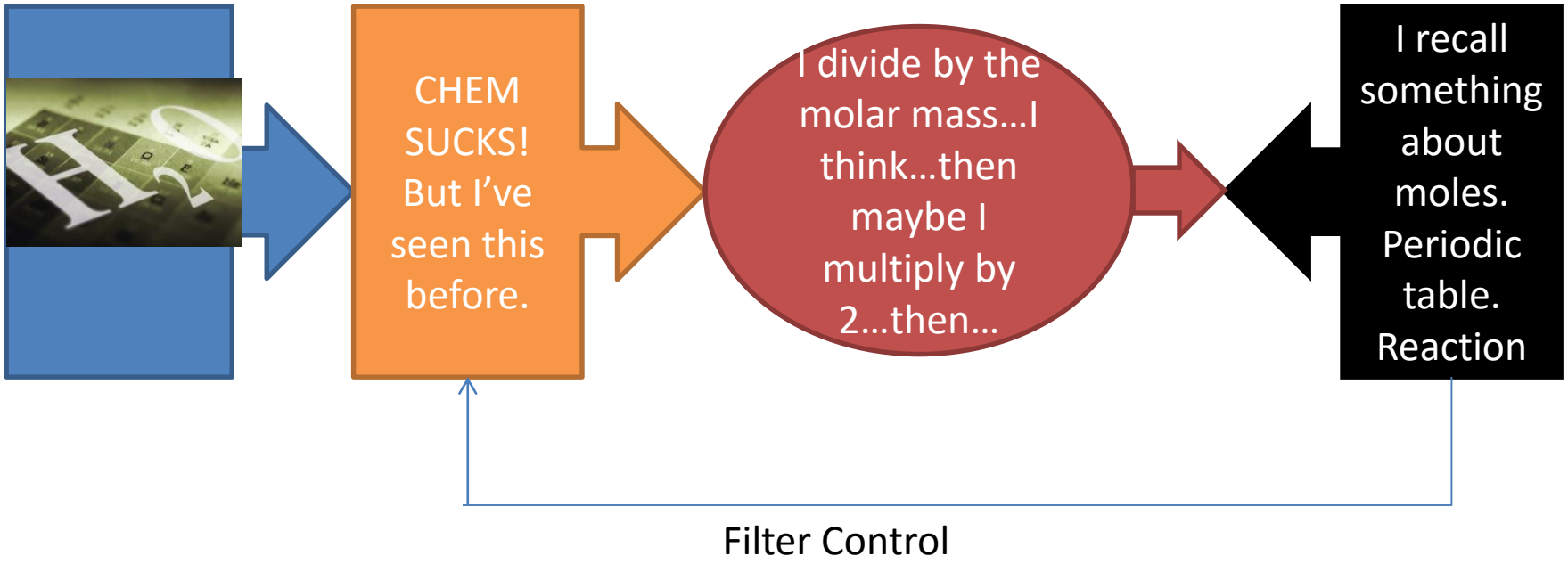
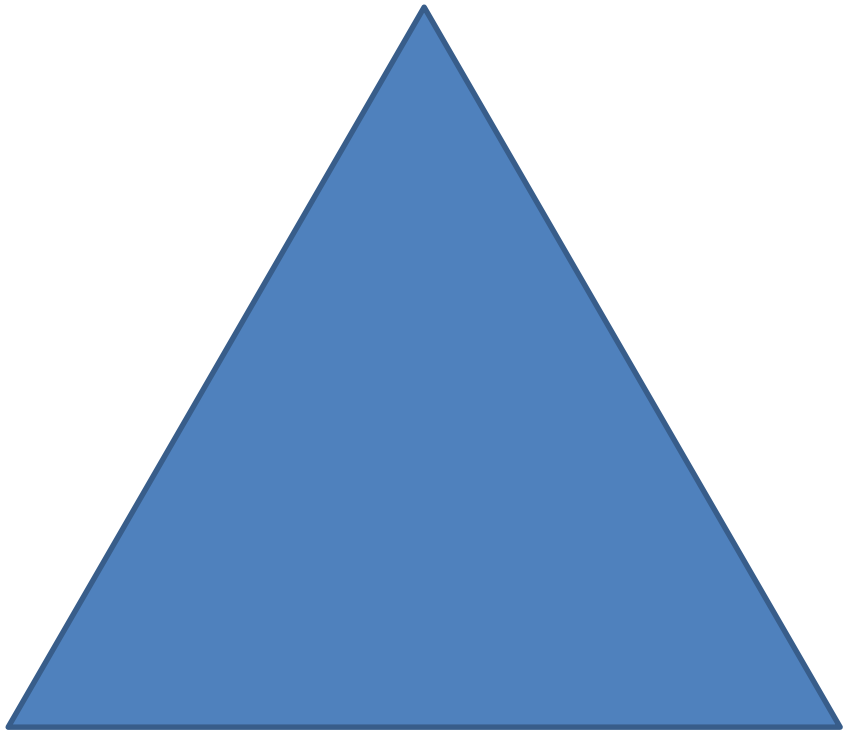


Good attitude or bad attitude.

You still have to learn to “speak” Chemistry.

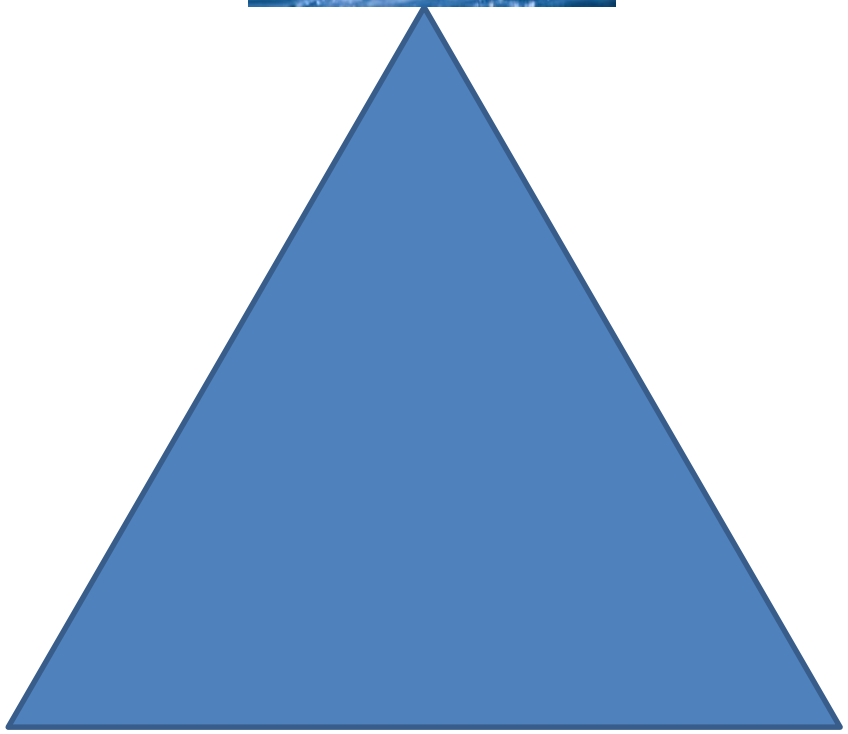
For chemistry

Macroscopic and tangible



Molecular
and invisible

Symbolic and
mathematical



Untreated Water Cluster

Get friendly with the molecules

The challenge to novices in Chemistry is to learn to move around the triangle.

We use symbols to represent actual molecules. The molecules and their interactions create the chemical principles.

But we're only used to seeing the macroscopic object: water, sugar, salt, soda.

We need to learn to associate the symbols with the actual molecules and the macroscopic objects. Then Chemistry starts to make common sense.

Students learn to cope…

…that's not the same as learning.

Developing real understanding requires more effort, and deeper integration of concepts in your mind.

It's quicker and easier to just learn to cope: "I divide by 2". But it is better to know WHY you divide by 2 so you aren't confused when you are actually supposed to divide by 3 or multiply by 2.

It is all on YOU…

No one has ever truly “taught” anything.

“Teach” is not an activity.

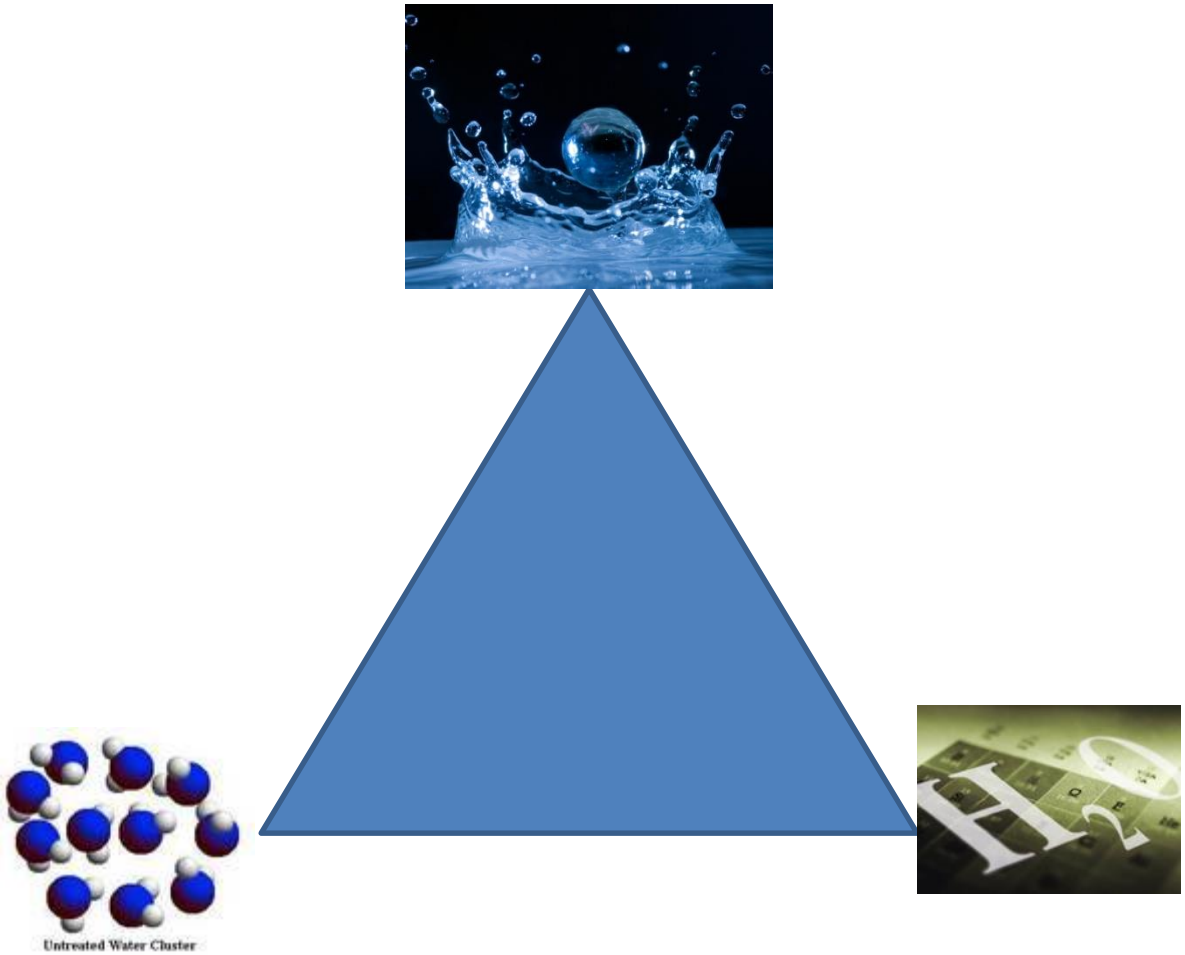
I can dance up here all day, show you pretty pictures, solve 1000 problems and at the end of the day…you’ve watched 125 YouTube videos.

Learning is ACTIVE…

Teaching is irrelevant.

Teachers are resources. No different than your text book or the internet. The only advantage I have over your textbook is that I can actually talk with you. (Some of you will consider that a disadvantage.)

Learning is what we do. Learning is all on you.



So I've shown you the triangle. I've shown you a model for learning. But YOU have to learn to navigate the triangle.

If I write H_2O – I know what it means to me! It has to mean something to you. Our success or failure will ultimately depend on how well we communicate.

Dog – what do you “see”?

I can say “water”. I can say “H-two-O”. I can write “H_2O”. I could say “dihydrogen monoxide”.
If you don’t already, you’ll learn to think “water” for all of those things.
But what do you picture?

Water

Water

H-two-Oh

Dihydrogen monoxide

H_2O

All symbols.

Water

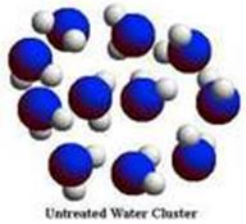
Water

H-two-Oh

Physical object. You've drunk it, washed in it, swam in it, boiled it, froze it, mixed it with other materials…

Dihydrogen monoxide

H_2O



There's the tiny invisible molecules that make up water. It is ultimately their collective action that you observe.

MOLECULES MOVE!

http://www.youtube.com/watch?v=cThvGD-o_90&feature=related

So even beyond picturing the water molecules, we want to develop a sense of the interaction of molecules with each other and their environment. They aren't simply a static picture.

http://www.youtube.com/watch?v=ll0BqGHknSg

“Football team”

Of course most of the world thinks…

But along with that you have a lot of knowledge. You know how people move. You know what happens when two people bump into each other…

Chemistry is easy…

…if you develop the same sense of the molecular rules as you have for everyday events.

A lot of the rules are very similar…

When molecules collide…

http://www.youtube.com/watch?v=Uuz_jdMajf8