**Thread NSTA physical and chemical change question**

**From:** physics-request@list.nsta.org on behalf of William Robertson  
**Sent:** Thu 7/22/2010 2:13 PM  
**To:** chemistry@list.nsta.org; generalscience@list.nsta.org; physics@list.nsta.org  
**Subject:** physical versus chemical change

What do all of you think about the distinction between physical and chemical change? I know it's taught as part of most curricula, but is it of value? If so, why? If not, why not? I'll withhold my view on it and just gather opinions if that's okay. I'm particularly interested in hearing from a wide variety of educators, from early elementary through college.

Thanks, all.

Bill

William C. Robertson, Ph.D.

Bill Robertson Science, Inc.

*Stop Faking It! Finally Understanding Science So You Can Teach It.*

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On Jul 22, 2010, at 4:06 PM, Kent Schielke wrote:

|  |
| --- |
| Didn't we all have a LONG discussion about this last year?  Kent Schielke Naperville IL |

7/22/2010 3:03 PM

I teach high school chemistry & physics (various levels of both subjects...going into my 3rd year teaching) and a physical vs. chemical change is one of my favorite topics to teach in chemistry. I think it’s necessary because it ties so closely with the rest of the curriculum. I like to focus on the energy/ temperature changes throughout the reaction and move into why and how elements react and how we can represent those reactions through equations. Graphing the temperature for the phase change of water is always shocking for my students and I think it’s great to compare to a general endo/exothermic chemical change.  My students really like the labs in this unit and it’s easy to connect to their everyday lives outside of my classroom.

Sheri Starks

H.L. Richards High School

[Sheri.Starks@CHSD218.ORG](mailto:Sheri.Starks@CHSD218.ORG)

On Jul 22, 2010, at 9:08 PM, Kent Schielke wrote:

|  |
| --- |
| Mr. Robertson,  To answer your specific question, I still teach the distinction to my middle school students but do try to get them to understand that many scientists and teachers think the distinction is fuzzy due to the ways many substances change their behavior and characteristics when they make a "physical" change (e.g., change of state).  But then we do also talk about the changes in electron bonds versus not taking place, and the existence of new molecules versus a change in state.  So I guess I am trying to present it as something of a spectrum, but with some very evident different "regions."  Does that make some sense?  Kent Schielke Naperville IL  --- On **Thu, 7/22/10, William Robertson *<***[***wrobert9@ix.netcom.com***](mailto:wrobert9@ix.netcom.com)***>*** wrote:  From: William Robertson <[wrobert9@ix.netcom.com](mailto:wrobert9@ix.netcom.com)> Subject: Re: physical versus chemical change To: "Jim Rose" <[j.rose.cfs@gmail.com](mailto:j.rose.cfs@gmail.com)> Cc: [chemistry@list.nsta.org](mailto:chemistry@list.nsta.org), [generalscience@list.nsta.org](mailto:generalscience@list.nsta.org), [physics@list.nsta.org](mailto:physics@list.nsta.org) Date: Thursday, July 22, 2010, 5:48 PM  Thanks to everyone who has responded to this. Because this is apparently a repeat discussion, let me summarize what I've learned and people can correct me if I have it wrong. Many who are teaching actual chemical reactions find the classification useful as they present the material, but the concept is not all that useful in and of itself. That's my opinion going in. It's common to cover the topic in elementary and middle school, where we use things like color change and the release of a gas as indicators of a chemical change. That's a problem, though, because there are many exceptions to those indicators. In fact, there's no way to make a proper classification unless you already know the chemistry of what's going on! The reason I asked the question is that I'm in a position to hand out advice to elementary and middle school teachers, and in the past I've said that it's pretty much an artificial distinction to make unless the students understand the underlying chemistry. Just looking for reasons why I should or should not change that advice.  Thanks again, everyone.  Bill  William C. Robertson, Ph.D.  Bill Robertson Science, Inc.  *Stop Faking It! Finally Understanding Science So You Can Teach It.*  [wrobert9@ix.netcom.com](imap://dwsunal@bama.ua.edu:143/mc/compose?to=wrobert9@ix.netcom.com)  1340 Telemark Drive  Woodland Park, CO 80863  719-686-1609  On Jul 22, 2010, at 4:27 PM, Jim Rose wrote:    I think there was such a discussion... there's an unofficial archive (and thanks to whomever's compiling them!) of these posts at: <http://groups.google.com/group/unofficial-nsta-archive>  Jim Rose Carolina Friends School Durham, NC |

Kent,

Yes, you make perfect sense. As I read your response, I was thinking how the students would react to this situation. They might be wondering if it's a spectrum rather than a dichotomy, then why present it as a dichotomy? Of course if the discussion leads to an understanding of how substances interact, then it's a good discussion. Personally, I've learned a lot by asking various colleagues whether certain interactions are physical or chemical. The final answer doesn't matter all that much, but it gets us discussing the interactions, and I have sometimes found out I didn't understand things as well as I thought I did.

If you're discussing electron bonds, then it sounds like you're doing what many others have talked about, which is to use the chemical/physical distinction as a useful description to help students understand general processes.

Bill

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On Thu, Jul 22, 2010 at 6:06 PM, Kent Schielke <[schielkesspp@yahoo.com](mailto:schielkesspp@yahoo.com)> wrote:

|  |
| --- |
| Didn't we all have a LONG discussion about this last year?  Kent Schielke Naperville IL |

I can tell you that we pretty much have the same discussions, with slight variations, year after year - and many of them are soooooo cyclic you can tell when it's grade time, exam time, consider new books time, break time, etc!

And since I have those emails... I'll see if I can find a "best of" one and send it your way.

kathy g

Apologies if that's the case, Kent. I only recently signed up for the listservs.

Bill

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Thanks again, everyone.

Bill

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Jim Rose  
Carolina Friends School  
Durham, NC  
  
---------------------------------------------------------------------

On Jul 22, 2010, at 9:02 PM, Gary Pinkall wrote:

Dr. Robertson,

You make an excellent point.  It makes perfect sense to me what you are saying.  I appreciate you sharing this.

As far as passing on advice to teachers, I think to have the most impact you need to give your advice to those who write state standards.  That is what drives most of what we teach.  Even if you reach every teacher and they are on board with what you saying, if it is a tested objective, it will be taught.

I do not think you should change your advice but realize it is not always the teachers making those decisions.

Gary Pinkall

Gary,

Believe me, I know what drives all of this. If I gave the impression that teachers make all these decisions, forgive me. I know that's not the case. It all comes down to the scope and sequence at various levels, from national to state to district. We could start a completely different conversation about how state and district standards are developed. Regarding the advice I give to teachers, I always put that advice in context. *If* they have control over even part of what they teach, then that's what they should address. I do understand all the constraints that classroom teachers deal with. I am as humble as I can be in this respect. The average classroom teacher deals with things I couldn't possibly tolerate day to day! I'm weaker than most of you. ;o)

Bill

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-----Original Message-----  
From: physics-request@list.nsta.org on behalf of virginia malone  
Sent: Fri 7/23/2010 9:44 AM  
To: William Robertson  
Cc: chemistry@list.nsta.org; generalscience@list.nsta.org; physics@list.nsta.org  
Subject: Re: physical versus chemical change

Maybe the question is, when do students use the information that that a change is chemical change or physical.  Maybe this is taught because physical and chemical weathering are taught in geology. Maybe because one can refine the definition when studying chemistry. Maybe because it is important in structural engineering. Maybe this is some kind "we have always done it this way" thing , like teaching 4th graders to predict weather patterns in elementary school, when making the prediction is difficult for experts. (my opinion; this is a hold over from our rather agrarian roots).

I have asked teachers a more general question for the last 40 years. What do you expect your kids to be doing with all of this knowledge 10 years after they graduate?  The following is a summary of the answers I received.  You can skip down to a summary table showing the four reasons people teach. You have to sign-up, but the site is free and sends no emails.

<http://wetheteachers.com/viewfiles.php?fid=643>

VA

[allie2500@gmail.com](mailto:allie2500@gmail.com)

I have taught this concept in Middle School science with the basic proviso that a chemical change requires a new substance to be formed.  I use a 40 photo powerpoint and we as a class look at each situation and try to come to an agreement on what is happening.  Some are straight forward but the ones that bring the most discussion/disagreement are sometimes also the most valuable as students enter higher learning as they try to justify their choices - ex. whipping cream - there is a lot of discussion online about this and many different "experts" on different sides of the scientific fence.  
  
All this discussion brings out wonderful methods of science discussion about agreement and proof.  
  
Even if all this brings about that sometimes it is hard to decide or classify as one or the other and it is more complicated than black or white I think that is valuable in itself.  
  
I am moving into HS Chemistry and Physics this year and plan to use some of my existing resources and look forward to hopefully beginning even more complicated discussions.  
  
Michelle Hankey  
Palmetto Ridge HS, FL

I come to this as a new (this year) chemistry teacher and a rather new (6-year) teacher in general.  I expect my answer will not be satisfactory to many students or teachers, but I think:  
  
Because it's cool!  The difference between physical and chemical change is fundamental to how matter interacts.  Changes of state are fundamentally different from chemical interactions based on charges among particles.  Learning this concept informs students about the kind of universe they inhabit, and how it works.  Is it important for students to understand the universe and the laws thereof?  I think so.  Is it "practical"?  Will they be able to "use it"?  Some will, some won't, but that's true of most of what we teach, I'm afraid.  
  
Michael Harris, Boston Public Schools

True of all students, including teachers!  
Bill   
  
  
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On Jul 24, 2010, at 12:43 PM, Deena Gould wrote:

Inductive vs deductive . . . .   
  
8th grade students are reluctant to talk until you tickle their curiosity.

Deena,

That's a great story line. Because you use it as a means to understanding actual chemical processes, I think it fits into the category of an organizer that you are not teaching just for the sake of teaching it. As for what I'll be telling teachers, as someone else mentioned, it is most likely out of the hands of most teachers because it's in the standards they have to follow. I still don't like the idea of teaching physical/chemical changes as a concept unto itself, using things like color change and gas production as indicators of a chemical change. As I said before, unless you know the underlying chemistry, you can't really make an accurate classification. And if you aren't delving into the underlying chemistry with the students, it's not a great use of class time. Where it becomes bad is testing the students on whether or not a change is physical or chemical, because in the end you want them to understand chemical processes, not this particular distinction. It's a lot like living and non-living. You get to a point where it's really difficult to decide. Now, both distinctions can generate great discussions (as we have here!), so if used for that then great. I like how Joe presented things. You encourage the students to explore the classification, but they're really learning basic chemistry, so when they get to the point that they realize the dichotomy isn't really a true dichotomy, then it's not a big deal. And of course I think the way you're using it is great. I've learned a lot from the responses to this question.

Bill

I really like that idea, Joe.   
  
Bill   
  
  
**On Jul 24, 2010, at 11:27 AM, Joseph Bellina wrote:**

How about turning the question around and making it a guided inquiry activity.   
  
so, suppose we wanted to separate changes that we observe into things we call physical and thinks we call chemical.  Which would be which and what evidence would we use to make that decision.  Are there some that are obvious, and there some that are not, and what is the evidence.   
  
Seems to me this could be done at any grade level, and would get to the standard without getting into the false dichotomy that if must be one or the other.   
  
joe   
  
Joseph J. Bellina, Jr. Ph.D.   
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574-276-8294   
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