

# **1 AP Chemistry, Labs and Me**

## **2 The Introduction**

For reasons that I find frankly a little confusing, some of you may know that my reputation tends to go before me in general, and in particular in relation to the role of labs and lab assessment in AP Chemistry. In all seriousness, I think I am a little misunderstood. At least some of that misunderstanding is based in cultural differences that exist in relation to high school chemistry education between me and most of the people in this room. In my experience that can be extremely difficult (if not impossible) to overcome (I'll mention this several times during this presentation), BUT ignoring those issues for a moment I wanted to state in a succinct manner, my position in relation to "the lab question". Here's my simple take;

## **3 My Position**

*"My frustration, indeed annoyance, does not have its origins with those that promote labs as a valuable tool in teaching AP chemistry, rather it is with those who believe that labs are essential, BUT then cannot see the folly of the current assessment situation, and those that believe that a lab based portion of the exam is impossible to achieve."*

## **4 The Discussion**

This leads to me to four "essential questions" and what I believe to be one, simple "answer".

## **5 QUESTION 1**

*Should a “wet” lab experience be a fundamental part of an AP chemistry course?*

If the answer is NO; then this discussion is over and I would have a degree of sympathy with you, BUT this presentation is not about that particular debate so I’m saying no more about it at this stage.

**6** If the answer is YES (as it seems to be for the majority of people involved with AP Chemistry and contrary to popular belief, me too! (I performed approx. 20 labs last year in my AP course which perhaps most importantly fulfilled the obligations associated with my audit.)); then I believe that the College Board has a fundamental obligation to FORCE\* teachers to make it part of their course.

\*This is a VERY important word, and as you will hear if you come to my presentation, “Teaching AP Chemistry the English Way” tomorrow, it is potentially one of those insurmountable cultural barriers I mentioned earlier. Without giving too much away about tomorrow’s presentation, I have LITERALLY been called a Communist for suggesting that there should be a central dictate (from the CB) that would somehow interfere with the individual teacher’s right to teach what they choose. These comments actually expose a huge (peculiarly American) misunderstanding about the role of organizations like the College Board, but more of that tomorrow. BTW – I have come to understand that term “Communist” is not a descriptor that is meant as a compliment in the USA! That leads us to Question #2....

## **7 QUESTION 2**

*How can the College Board ensure that a “wet” lab experience IS occurring in AP chemistry courses?*

**8** The answer is DEFINITELY NOT the audit for more than one reason, the main one being that the audit is completely toothless without follow-up monitoring. Nobody knows if, what I have said I will do on my approved audit, is ACTUALLY what I am doing between August and May in the classroom each year. The College Board is relying upon my professional integrity, which, in my case is a very sound decision, but as a general policy is a flawed one.

The answer is really incredibly simple. A significant portion of the AP exam has to be a component that is lab (or lab skills), based. It has to be virtually impossible to get a passing score on the exam without physically performing labs. Currently of course, it is entirely possible to achieve a “5” on the exam and therefore be “extremely well-qualified” by the CB’s own definition and have never picked up a test-tube in one’s life. This leads us to Question #3....

### **9 QUESTION 3**

*Is the current pencil and paper test of lab skills an adequate way to assess students' practical abilities?*

If you believe the answer is yes, then frankly I believe you're wrong! There are two reasons that I say this;

**10** (i) Even IF it were possible to examine lab skills with a pencil and paper test (which I don't believe it is), the number of points devoted to it across the whole exam is currently insufficient to make it relevant anyway. Taking the March 2008 practice exam as an example there are only four multiple-choice items that can be considered "lab based" (49, 50, 61 and 67); in the free response, there is only a total of two points (in question 3(a)), across all six questions! Now, the math here is slightly fuzzy since we do not have a scoring worksheet for this exam, but nevertheless, conservative estimates suggest that this represents in the region of 5% of the total points available on the exam, possibly even less. Even if the pencil and paper test were a great way to assess these skills this would be woefully inadequate if you consider your answer to question #3 to be yes.

(ii) Point (i) is somewhat moot anyway since I do not believe that is possible to adequately test lab skills via a pencil and paper test in the first place. Let's take a simple example, the Beers' Law question from '03, 2003, 5 (**see handout Beer's Law**).

This was an interesting question for a number of reasons, but the reason that I pick on it is, at the time, not only did I not conduct a lab of this nature with my students; I didn't even discuss the theory! That meant that my kids (who were sophomores with zero prior chemistry classes) were confronted with that question having no knowledge of what was before them. Of course, it didn't matter! Close inspection of the problem tells us that 4 out of the 8 points were fairly easy to score with basically no knowledge of the lab at ALL! (BTW, I think the College Board made a mistake in 2003 since the Beer's Law equation was not on the data packet at the time, but did appear in 2004). I recall asking my kids when they came out of the exam about the question, and several didn't even realize that they knew nothing about the experiment. My point? That the assessment of "lab" questions via pencil and paper under the current system, are very negotiable with zero theory or lab experience, and totally negotiable with only theory. This leads us to Question #4....

#### **11 QUESTION 4**

*Is it logistically impossible to administer a system of assessment at AP that includes an ACTUAL lab test?*

**12** Again, those of you that think the answer is “yes” are simply wrong in my opinion.

How do I know? Well it’s been going on in the UK for decades with great success. Over that period there have been a few different models, and they have to be taken in the context of the system as a whole (which can at first glance seem quite complicated and I will talk more about tomorrow), but in “The Answer” we’ll see one of the basic outlines for the academic year 2009-2010 and beyond. OK, here’s the Answer....

### 13 THE ANSWER

*“A significant portion of the assessment that requires that students’ actually perform laboratory experiments”*

**14** How can this be achieved? Let’s look at one assessment model that is being used by AQA, one of the organizations similar to the CB in the UK, in its’ A level specification 2420. **15** There are 6 units of assessment within 2420;

- Unit 1 (75 minutes) and Unit 2 (105 minutes) are written exams
- Unit 4 (105 minutes) and Unit 5 (105 minutes) are written exams
- Unit 3 and Unit 6 are the “Lab component”

**16** To achieve the A Level qualification, students sit all six units over a course of two years. The Lab component contributes 20% (a meaningful amount) of the overall final grade. **17** To help to illustrate what we are talking about, let’s concentrate on Unit 6, where there are two routes to assessment of Units 6;

**18** Route T – Internally assessed meaning that the teacher does the grading

**19** Component 1 (PSA)

Assessed internally by the teacher throughout the course. They choose two from each of three sections to be tested on (**see handout PSA/PSV**)

**20** Component 2 (ISA)

Stage 1. Students collect data using an AQA provided task sheet (i.e. the students “do” a lab provided by the external body) under controlled conditions and present the data and make observations. This is INTERNALLY assessed by the teacher, but according to AQA scoring guidelines.

Stage 2. A written test based upon the activity in stage 1. This is INTERNALLY assessed by the teacher, but according to AQA scoring guidelines (**see handout ISA**)

All of Route T is moderated externally

**21** Route X – Externally assessed meaning that the Examination Board does the grading

**22** Component 1 (PSV)

As PSA above but a check box method (**see handout PSA/PSV**)

**23** Component 2 (EMPA)

As ISA above but externally assessed and is slightly longer to account for the absence of SPECIFIC internal assessment by the teacher (**see handout EMPA**)

## **24 The Problems**

Now, I'm not going to suggest that there would not be challenges and teething troubles along the way, not least of all ones related to the cultural differences between the UK and the USA in relation to public exams, and to the Communists, but to suggest that this CANNOT be done is just plain wrong – and anyway, this is America where I am led to believe that giving up is not an option and I am reliably informed that “one can do ANYTHING here”!

## **25 The Summary**

I believe that the Status Quo is unacceptable and whatever changes are in place for the re-vamping of the AP chemistry course description that we could be hearing about shortly, should ultimately include some kind of lab based assessment. Of course, I actually have no dog in this fight, since I can achieve great results without changing a single thing about my AP course; the kind of change I am proposing would mean more work for me. However, I believe that for the AP chemistry course to maintain a level of credibility with colleges and other interested parties, a lab portion in the assessment has to be implemented. I have a sneaking suspicion that the audit, in large part was an attempt by the CB to impose a lab element on to AP course without going through the real effort of actually implementing it properly. If it was, it fails.

In short, implementation of this type is entirely possible and absolutely necessary.

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