

Physics Department Assessment Liaison, Allan Wilson

Department Buy-In and Outcome Definition: Physics classes: There is already an assessment program in place, implemented by all professors in the discipline, and being used to ensure a base-line level of consistency as well as provide data for making decisions about possible changes to the program. As this program is now well-ingrained in the culture of the department, it required no further oversight from me, other than to use as a model for best practices for the other disciplines.

Astronomy: The number of astronomy classes has risen substantially in the past few semesters in an effort to accommodate rising student demand. Both the two full-time faculty who teach this class were in agreement that an assessment was desirable to encourage a minimum degree of consistency among the various sections of this class (many of them taught by new adjuncts who do not claim astronomy as their main area of expertise).

Chemistry 201: The department is currently using and collecting data on a nationally standardized exam from the American Chemical Society which is given at the end of the semester. However, to date there have been no efforts to collect the data and analyze the departmental results in the aggregate. There are also some questions about whether or not this test is the best possible tool for assessing learning gains, as there are many professors who teach this class and some sections might cover substantially different material than what is tested by this exam. Thus, in addition to continuing the use of the current ACS exam, it was decided to conduct a survey of the chemistry faculty to determine what is currently being taught.

Phy Sci 107: This class is only routinely taught by one person in a face-to-face format at HWC. However, there are several sections of this class that are being taught online. I have begun a conversation with the other professors who teach this class. The ultimate goal will be to determine what areas of overlap consistently exist in the various sections of this course, and what possible assessment tools are feasible. These conversations, however, are ongoing, and it is not expected that any firm conclusions will be reached this semester. I hope to meet with these professors in person over faculty development week (the current conversations have all been by email) and perhaps make more progress.

Assessment Research and Design: Astronomy: The two full-time professors who teach this class chose the assessment tool (a nationally standardized astronomy exam), and they indicate that they are reasonably satisfied with it. They have now found another test that they think might work even better, but since the old test has already been used as a pretest at the beginning of the semester, they will stick with it for now.

Chemistry 201: All of the full-time chemistry faculty, as well as several adjuncts who either have taught Chem 201 for several semesters or who teach later courses in the sequence, were surveyed to determine what questions they had about the material that is covered in Chem 201. I then went through the textbook chapter by chapter and created questions

about those subjects that are more peripheral to the core content. (It was assumed, for instance, that everyone teaches stoichiometry, but does everyone teach percent yield?) These questions, in addition to those requested by the faculty, were compiled into a survey.

Pilot Assessment Tools and Processes: Astronomy: This is the first semester for conducting an astronomy assessment, and thus it can technically be considered the “pilot”. The exam was given as a pretest in every section of Astronomy 201, and every section will likewise be giving it again at the end of the semester. Once this has happened, I will collect the data and analyze it, but that will probably be done next semester.

Administer Specific Assessment: Chemistry 201: The survey was given to all 5 fulltime faculty who teach 201, and also to one adjunct who has taught it for numerous years. I would like to thank my colleagues for promptly responding, and there was a 100% response rate. As mentioned above, while these investigations are underway, we are continuing to use the ACS exam – most of the Chem 201 sections will give the exam at the end of the semester, and I will analyze the results in the fall.

Data Analysis: Chemistry 201: The results from the survey were compiled; the survey with the total responses is attached.

Supporting Evidence-Based Change (Use of Findings): Chemistry 201: The overall conclusion seems to be that while we teach everything that is on the exam, there are also things we teach that are *not* on the exam. Thus the ACS exam is certainly adequate, but there is possible room for improvement. Next semester, I will see if the department wants to revisit the selection of an assessment tool for this course. The results were also distributed to the chemistry faculty, and they found the results to be very interesting; specifically, the faculty seemed to appreciate comparing what they teach versus what others in the department cover.

Success Factors: I believe that one of the most important successes of the semester, while not strictly a learning gain, concerns the advancement of an “assessment culture” within the department. There has for numerous years been a 100% participation in the physics assessment program, and now, in its inaugural year, the astronomy assessment program has the same participation. The chemistry assessment has been given by most of the faculty, but there has never been any attempt to compile the results before now. The most notable achievement – the survey of chemistry faculty – also does not directly test student learning gains, but it is nonetheless expected to have broad applicability:

- it will help in the evaluation of possible assessment tools for the department,
- it will be useful in informing new adjuncts what information is expected to be taught and what material is optional,
- it will aid professors of later classes in the sequence to know what material they can confidently expect their students to have seen,
- it has already prompted faculty to reflect critically on the decisions that the department and they as individual teachers make concerning what to teach.

Recommendations: Astronomy: The data from the assessment should be collected and analyzed, and the results communicated to the faculty as early as possible so that they can act on the results. Also, the alternative assessment tool mentioned by one of the faculty needs to be evaluated to see if it is preferable.

Chemistry 201: The data from the assessment should be collected and analyzed, and the results communicated to the faculty as early as possible so that they can act on the results. Also, the faculty should be consulted to see if there is a desire to find a different test, or if the current ACS exam is sufficient for our needs.

Phy Sci 107: The other faculty who teach this class should be contacted for a face-to-face meeting, ideally during faculty development week. The purpose of this meeting would be to determine to what extent are the current sections of the course aligned, and if a more consistent course design is possible and/or desirable.

Physical Science Appendices

Attached: the Chemistry 201 faculty survey with aggregate results.

Chem 201 Faculty Survey

For each question, please indicate if this topic is taught in your class. One of the main purposes of this survey is to inform those who teach later classes the chemistry sequence (Chem 203, 205, 207, 212) what they can *confidently expect* their students to have seen in this prerequisite class. Therefore, please consider the following response guidelines:

If you simply “cover” the material without expecting students to be able to demonstrate mastery of the material later (test, homework, quiz, lab, etc.), then please choose “no”.

Similarly choose “no” if it is a topic that often gets dropped (for instance if the class is behind schedule).

Lastly, if the question asks if you have students *memorize* a particular fact, and you usually give them the fact (for instance, on a formula sheet or in the text of a problem), then please choose “no”.

Please feel free to include any comments which you feel are pertinent.

Chapter 1:

Unit conversions involving units in the denominator (for instance, converting m/s to m/min)?

Yes__6__ No____

Unit conversions involving units raised to a power (for instance, m² to cm²)?

Yes__6__ No____

Do your students memorize SI prefixes *other than* kilo, centi, milli, and micro?

Yes__3__ No__3__

Chapter 2:

Relating atomic weights to isotope abundances?

Yes__6__ No____

Nomenclature of transition metals using “-ous” and “-ic” suffixes?

Yes__5__ No__1__

Do your students memorize the names, formulas, and charges for common polyatomic ions?

Yes__5__ No__1__

Chapter 3:

Do your students memorize the value for Avogadro’s number?

Yes__3__ No__3__

Calculating empirical and molecular formulas?

Yes__6__ No____

If yes to the above, do your students learn to solve combustion analysis problems?

Yes__4__ No__2__

Limiting reactants?

Yes__6__ No____

If yes to the above, do your students learn to calculate the amount of excess reactant left over?

Yes__6__ No____

Percent yield?

Yes__5__ No__1__

Chapter 4:

Do your students memorize solubility rules?

Yes__2__ No__4__

Net ionic equations?

Yes__6__ No____

Do your students memorize strong/weak acids and bases?

Yes__4__ No__2__

Calculating oxidation numbers?

Yes__5__ No__1__

Do your students memorize any part of the activity series?

Yes__1__ No__5__

Calculating the molarity of electrolytes (for instance, the sodium of sodium sulfate)?

Yes__6__ No____

Do your students work with the dilution formula?

Yes__6__ No____

If yes to the above, do they memorize the dilution formula?

Yes__5__ No__1__

Chapter 5

Relating internal energy, heat, and work?

Yes__6__ No____

State functions?

Yes__5__ No__1__

The distinction/relationship between internal energy and enthalpy?

Yes__5__ No__1__

Bomb calorimetry calculations?

Yes__3__ No__3__

Hess's Law?

Yes__3__ No__3__

Chapter 6

Photoelectric effect?

Yes__5__ No__1__

Bohr model of the hydrogen atom?

Yes__6__ No____

If yes to the above, do your students calculate energy changes?

Yes__4__ No__2__

Calculating De Broglie wavelength of particles?

Yes__5__ No__1__

Calculating uncertainties using the Heisenberg Uncertainty Principle?

Yes__1__ No__5__

Hund's rule?

Yes__6__ No____

Anomalous electron configurations (chromium, copper, etc.)?

Yes__5__ No__1__

Chapter 7

Appearance and reactivity of metals vs. nonmetals vs. metalloids?

Yes__4__ No__2__

Group trends, such as alkali metals, alkaline earths, hydrogen, oxygen, halogens?

Yes__4__ No__2__

Chapter 8

Lattice energy?

Yes__3__ No__3__

Resonance structures?

Yes__6__ No____

Exceptions to the octet rule (BF_3 , PF_5 , etc.)?

Yes__6__ No____

Enthalpy and strengths of covalent bonds?

Yes__5__ No__1__

Chapter 9

Any work with molecular models?

Yes__3__ No__3__

Shapes of hypervalent molecules?

Yes__6__ No____

Hybridization?

Yes__6__ No____

Pi bonds?

Yes__4__ No__2__

Molecular orbital theory?

Yes__1__ No__5__

Chapter 10

Do your students memorize the ideal gas law?

Yes__4__ No__2__

If yes to the above, do your students memorize relationships such as Charles's Law, etc?

Yes__2__ No__4__

Stoichiometry involving the ideal gas law?

Yes__6__ No____

Dalton's law of partial pressures?

Yes__6__ No____

Assumptions of kinetic molecular theory?

Yes__6__ No____

Root-mean-square speed?

Yes__4__ No__2__

Graham's law?

Yes__6__ No____

Real gases and the van der Waals equation?

Yes__4__ No__2__

Chapter 11

Viscosity and surface tension of liquids?

Yes__4__ No__2__

Heats of phase changes?

Yes__6__ No____

Crystal structure (unit cells, cubic close packing, etc.)?

Yes__2__ No__4__

Bonding in solids (molecular solids vs. covalent network solids, etc.)

Yes__3__ No__3__

Chapter 12

This chapter in Brown-LeMay is Modern Materials (polymers, superconductors, etc.). Do you do anything in this chapter? If so, what?

Yes____ No__6__

Chapter 13

Energy changes and solution formation?

Yes__4__ No__2__

Factors affecting solubility (intermolecular forces, pressure, temperature)?

Yes__5__ No__1__

Colligative properties (Raoult's law, osmotic pressure, etc.)?

Yes__5__ No__1__

If yes to the above, do you include the van't Hoff factor?

Yes__2__ No__4__

Colloids?

Yes__1__ No__5__

Thank you very much for taking the time to complete this survey!