The American Chemical Society (ACS) Division of Chemical Education (Chem Ed) Examinations Institute (found at <http://chemexams.chem.iastate.edu/>) has several standardized examinations in various disciplines of chemistry. These exams can be found by following the “Exams” link on the webpage aforementioned.

For General Chemistry (our CHEM 1411 & 1412 lecture course sequence), there are specialized exams for each semester as well as exams that cover the full year course (found by clicking “General Chemistry” on <http://chemexams.chem.iastate.edu/materials/exams.cfm>). We chose an exam that covered the full year course material, but was only an hour long (55 minutes)—GC06B. Since the students taking this exam are doing so voluntarily in exchange for the hopes of scholarship money (more on that below), the collected faculty members of the Department of Chemistry decided that a one-hour exam would have more takers than a two-hour exam.

The exam (Stock Code GC06B, Title: General Chemistry 2006 (brief) – a short test for the full year course) is a 50 question, multiple choice timed examination. The exam is confidential, so I cannot provide a copy. There are 5 questions on “Atomic Structure”, 5 questions on “Molecular Structure”, 5 questions on “Stoichiometry”, 6 questions on “Energetics” (thermodynamics), 4 questions on “Dynamics” (kinetics), 5 questions on “States of Matter/Solutions”, 6 questions on “Equilibrium”, 4 questions on “Electrochemistry and Redox”, 5 questions on “Descriptive Chemistry/Periodicity” and 5 questions on “Experimental”.

The ACS Chem Ed Examinations Institute collects data on all examinations given and reports statistical data for every examination. The mean for the 50-question test is 27.45, standard deviation () 8.08, the median is 26.0, KR21 is 0.83 and Std error/meas 3.36. Thus, one  below the mean is 19.37 (and a score of 19 is the 16th percentile) and one  above the mean is 35.53 (and a score of 36 is the 83rd percentile).

One last issue to address is the scholarship money. For the past several years, we offered $250 to the person making the highest score on the exam in any semester. We also offered $200 to anyone scoring in the 85th percentile (or higher), $150 to anyone scoring in the 75th to 84th percentile, and $100 to anyone scoring in the 50th to 74th percentile. We did the same thing this year.

We sent out a single email (on 12/3/13) to all of the chemistry and forensic chemistry majors taking CHEM 1412 in the fall semester, and 6 of 23 eligible students took the exam on 12/5/13. They scored 38, 31, 20, 20, 13 and 8 (4 were forensic chemistry majors and 2 were chemistry majors). For the 23 eligible students, 17 were forensic chemistry majors and 6 were chemistry majors (4/17 = 24% forensic chemistry participation; 2/6 = 33% chemistry participation; 6/23 = 26% overall participation). Four of the 6 students scored one standard deviation below the mean or higher—4/6 = 67% (one forensic chemistry major and one chemistry major scored lower); the top score was in the 88th percentile and one score was in the 65th percentile (both forensic chemistry majors). The remaining two scores were below the mean (20th percentile).

We also sent out a single email (on 4/22/2014) to all of the chemistry and forensic chemistry majors taking CHEM 1412 in the spring semester, inviting them to take the exam on one of two dates (4/30/2014 and 5/1/2014). Of the 51 eligible students, 20 students took the exam. The scores were 38, 36, 35, 33, 33, 33, 32, 24, 24, 23, 21, 20, 20, 19, 17, 17, 17, 16, 14 and 13 (14 were forensic chemistry majors and 6 were chemistry majors). For the 51 eligible students, 37 were forensic chemistry majors and 14 were chemistry majors (14/37 = 38% forensic chemistry participation; 6/14 = 43% chemistry participation, 20/51 = 39% overall). Thirteen of the 20 students scored one standard deviation below the mean or higher—13/20 = 65% (4 forensic chemistry majors and 2 chemistry majors scored lower). Seven of the students scored above the mean.

Overall, the participation rate was 8/20 = 40% for chemistry majors, 18/54 = 33% for forensic chemistry majors and 26/74 = 35% overall.