

Chemistry Education Cumulative Exam

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The chemistry education cume is to be completed as an essay no longer than 5 pages. Students may access all readings from the reading list while completing the cume.

1. Select **one** of the empirical reports below. Summarize the article: (1) detail the methods employed in the study, (2) enumerate the misconceptions about fundamental chemistry concepts that were documented, and (3) report (or extrapolate) the prevalence of the documented misconceptions among undergraduate students in the U.S.
2. For the selected report, provide an explanatory model that (1) identifies the genesis of the misconceptions documented, and (2) accounts for why these misconceptions are resistant to instruction. Your explanatory model should appeal to contemporary learning theory.
3. Propose a design for a short intervention that can best help students to overcome one of the misconceptions reported in the empirical report you selected. The learning environment you propose should include design elements that emerge from the same theory of learning your referenced in #2.
4. Propose a research design that would allow you to test the effectiveness of your learning environment. Detail the methods you would employ as you did in #1.

Empirical Reports (choose one):

1. Azizoglu, N., Alkan, M., & Geban, O. (2006). Undergraduate pre-service teachers' understandings and misconceptions of phase equilibrium. *Journal of Chemical Education*, 83(6), 947-953.
2. Luxford, C. J., & Bretz, S.L. (2013). Moving beyond definitions: What student generated models reveal about their understanding of covalent bonding and ionic bonding. *Chemistry Education Research and Practice*, 14, 214-222.
3. McClary, L., & Talanquer, V. (2011). College chemistry students' mental models of acids and acid strength. *Journal of Research in Science Teaching*, 48(4), 396-413.

Supplemental Reading on Learning Theory and Research Design:

1. Bransford, J. D., Brown, A. L., Cocking, A. L. (2000). *How People Learn: Brain, Mind, and Experience*. National Academy Press: Washington, D.C.
2. Creswell., J. W. (2014) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). SAGE: Washington, D.C.