Science Skills in General Chemistry Labs

SCIENCE SKILLS

Although there are many practices central to science and engineering, including:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Chem 1M and 1N are introductory general chemistry lab courses that serve a very diverse, dynamic, and dedicated set of students. These classes provide opportunities to learn and develop many skills central to STEM, some of which are listed below:

- Conduct an investigation individually and collaboratively following proper lab technique (e.g., correctly handling chemicals, using equipment, disposing of waste, etc.); assess safety considerations and obey safety rules.
- Assess the type, quantity, and accuracy of data needed to produce reliable measurements.
- Collect data, generate and evaluate results, analyze limitations and sources of error, and communicate outcomes.
- Apply mathematical techniques to calculate results based on data, including unit conversions in complex measurement problems with quantities having derived or compound units (e.g., mg/mL, kg/m^3, etc.).
- Consider limitations on the precision of the data (e.g., number of trials, risk, time, equipment).
- Use statistical treatments, such as error propagation, to correctly represent the precision associated with derived results.
- Compare and contrast various procedures and data sets to examine consistency, precision, and accuracy of measurements and observations.
- Apply concepts of statistics and probability (such as linear fits using slope and intercept values) to find relationships between dependent and independent variables, using digital tools when feasible.

- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data, when reporting results, and when discussing experimental assumptions and claims.
- Based on results, suggest changes to the procedure or its components in order to optimize precision and accuracy, keeping in mind what can be investigated within the scope of the laboratory with available resources.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of observations and results, taking into account possible unanticipated effects and sources of experimental error.
- Communicate information, results, claims, and analysis (e.g., about the procedure in relation to the data and results) in multiple formats (e.g., orally, graphically, textually, mathematically).

