**The scientific method, experimental and computational methods**

An understanding of the scientific method and the basic experimental and computational methods it uses are essential to this semester’s lab work. Please read pages 7 to 13 of the lab manual and answer these questions for discussion during next week’s lab (24 Jan 2017).

1. What makes for a good hypothesis?  
   A good hypothesis must be testable; it must suggest experiments that could disprove or support it.
2. Why is it impossible to prove a hypothesis incorrect?  
   We never have access to all of the information the universe may contain. For example, for centuries, Europeans believed that all swans were white. However, when Europeans arrived in Australia, they realized that Australian swans are black.
3. What is the essential difference between data and results?  
   Data are observations made in the lab: numbers read from instruments or observations made by eye. Results are numbers calculated using math. No math is used to obtain data!
4. What is another name of the ‘SI system’ of units? The metric system.
5. How many micrometers (μm) are in one meter? 1E6 or 106 or 1 million
6. What does the term least count mean?  
   Least count is the smallest graduation (or calibration) on an instrument.
7. What is the digit of uncertainty in the number 10.0728?   
   The 8; the last digit is the digit of uncertainty.
8. What two pieces of glassware should not be used to measure volume accurately?  
   Beakers and Erlenmeyer flasks.
9. What is a meniscus and how is it used in measuring liquids?  
   The meniscus is the upward curving surface of the liquids held in a narrow container. The meniscus is created by surface tension. When reading a volumetric instrument read the volume at the bottom of the meniscus.
10. If you are trying to shoot a bulls-eye but all three of your shots it the same spot in an outer ring of the target, have you been precise or accurate?  
    You have been precise but not accurate.
11. Is percent error a measure of precision or accuracy?  
    Percent error is a measure of accuracy.
12. Is percent difference a measure o precision or accuracy?  
    Percent difference is a measure of precision.
13. What does standard deviation say about a set of data?  
    Standard deviation is a measure of how much each value in a set of data differs from the mean of that set. SD is a measure of precision.
14. Which type of zero is never significant? Leading zeros are never significant.
15. What limits the number of significant digits in data and results?  
    The quality of instruments limits the number of sig figs in data and results.