Unit 1 Measurement
TEST PRACTICE

1. The effects of social skills training on a 29-year-old male adult with mental retardation were explored. The subject listened to typical social situations (such as getting a compliment or saying thank you) on audiotape and discussed the situations with a therapist. The subject's positive social verbal interactions were counted before the training, at three times during the training period, and at three times after the training had been completed. All counts were taken by observing the subject at an evening recreation time in the subject's group home. Results show that positive interactions increased during the training period but then rapidly decreased after training had stopped.

    a. Population of interest: adult males with mental retardation

    b. Independent variable: social skills training

    c. Dependent variable: positive social verbal interactions

    d. Control: number of positive social verbal interactions before training

    e. What is the purpose of a control? To provide a basis or standard for comparison

    f. Hypothesis: If training affects social skills, then the number of positive verbal social interactions will increase after training is provided because subjects will continue to exhibit learned behaviors.

    g. Data collected: number of interactions before, during, and after training

    h. Was the collected data qualitative or quantitative? quantitative

    i. Logical conclusion: hypothesis was not supported by experimental results

2. Measurements consist of a number and a unit. All measurements possess a certain degree of uncertainty or error.

3. Significant figures in a measurement consist of all known digits and one estimated digit. Non-zero digits are always significant. There are three types of zeros to consider:

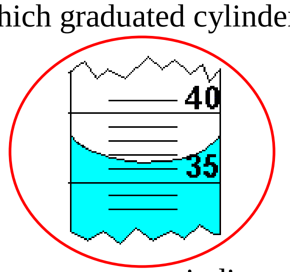
    a. Trapped zeros are <u>always</u> significant.

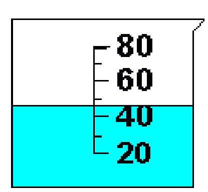
    b. Leading or placeholder zeros are <u>never</u> significant.

    c. Trailing zeros are <u>sometimes</u> significant. Explain when these zeros <u>are</u> significant. Trailing zeros are significant when a decimal point is written.

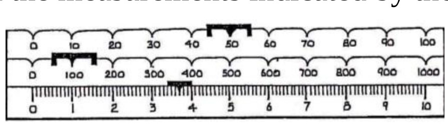
    d. Which measurement – 5.7 cm or 5.70 cm – is more precise?

    e. Which graduated cylinder provides a more precise measurement?

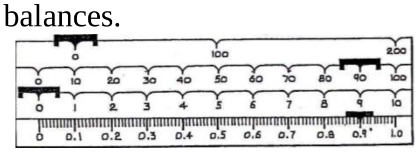




4. Record the measurements indicated by the following balances.



153.70 g



90.900 g

5. Identify the SI base unit for each of the following quantities:
   a. Mass *kilogram* b. Time *second* c. Length *meter* d. Amount of substance *mole* e. Temperature *kelvin*

6. In chemistry, the derived unit typically used for the volume of solids is the *cubic centimeter*. This unit is equivalent to the *milliliter* for which the base unit is the *liter*.

7. List the metric prefixes in order from the largest to the smallest. *k h da base d c m*

   The difference between a prefix and an adjacent prefix is a factor of *10*.

8. The first part of an activity takes 272.25 s to complete. The second part lasts 320.5 s. The total activity lasts *272.25 s + 320.5 s = 592.8 s*. Express this length of time in milliseconds *(592,800 ms)* and in kiloseconds *(0.5928 ks)*. Write these converted results (ms and ks) in scientific notation *(5.928×10^5 ms and 5.928×10^{-1} ks)*. How many significant figures are in each of these converted results? *4 SF*

9. In the Virtual Density Lab, you made two volume measurements using the virtual graduated cylinder to calculate the volume of the mineral sample. The name of this method for calculating the volume of an object is known as *water displacement*.

   a. If the initial volume measurement was 781 mL and the final volume was measured to be 857 mL, the volume of the mineral was *857 mL - 781 mL = 76 mL*.

   b. If the known density for the mineral in #9a is 5.02 g/cm^3, what is the mass of the sample? *m = (76 mL)(5.02 g/cm^3) = 380 g*

10. The method named in Question #8 is used for objects for which the dimensions cannot be measured with a ruler; these objects are described as *irregular*. Objects whose dimensions can be measured with a ruler are known as *regular* objects.

11. The following measurements were made for a rectangular block: length = 2.45 cm; width = 1.72 cm, and height = 3.10 cm. Calculate its volume and write the answer to the correct number of significant figures. *volume = (2.45 cm)(1.72 cm)(3.10 cm) = 13.1 cm^3*

12. In The Density of Water Lab, you used a method called mass displacement to calculate the mass of the water alone. The measurements made included the mass of the empty graduated cylinder and then the mass of the graduated cylinder with varying volumes of water.

   a. If the mass of the empty cylinder was 40.7 g and the measurement of the cylinder and water together was 80.5 g, the mass of the water alone was *80.5 g - 40.7 g = 39.8 g*.

   b. Given that the known density of water is 1 g/mL, the volume of water in #10a would be *V = (39.8 g/1 g/mL) = 39.8 mL*. Note: *The value for the density of water is a known constant.*

13. The degree to which repeated measurements of the same quantity yield the same results is known as *precision*, whereas the closeness of a measurement to the actual or known value is *accuracy*.

14. The object of an exercise is to create a sample with a mass of 2.0000 grams. The experimenter measures the mass of his sample in five repeated measurements with the following results.

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
2.0001 g	2.0003 g	1.9994 g	1.9996 g	2.0004 g

What is the range of the data collected? *0.001 g* Would these results be considered precise? *yes*

Determine the accuracy of the data by first calculating the average mass for the five trials. *1.99996 g = 2.0000 g* Then, using the average as the experimental value, calculate the percent error. *0.0020000%* How would you describe the accuracy of the data? *Highly accurate*

$$\frac{|1.99996\ g - 2.0000\ g| \times 100}{2.0000\ g}$$