CH 151 Problem Set #1

Complete problem set on separate pieces of paper showing all work, circling final answers, etc.

Covering: **Chapter One**
Important Tables and/or Constants: 1 cm^3 = 1 mL; k = 10^3; c = 10^{-2}; m = 10^{-3}; μ = 10^{-6}; n = 10^{-9}; **273.15**

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1. With a high grade measuring device, the length of an object is determined to be 13.452 mm. Three students are asked to determine the length of the same object using a lower grade measuring device. How do you evaluate the following work of the three students with regard to accuracy and precision?

Trial	Student A	Student B	Student C
1	13.6 mm	13.4 mm	13.9 mm
2	13.9 mm	13.5 mm	13.9 mm
3	13.3 mm	13.5 mm	13.3 mm
4	13.6 mm	13.4 mm	14.3 mm

2. Determine the number of significant figures in each of the following measured values:
    a. 0.111101
    b. 0.0000007
    c. 0.013013013
    d. 0.130130130
3. Determine the number of significant figures in each of the following measured values:
    a. 4000
    b. 4.000
    c. 67,000,100
    d. 43,200
4. In the following pails of numbers, tell whether both members of the pair contain the same number of significant figures.
    a. 2305 and 2350
    b. 0.6600 and 0.0066
    c. 23,000 and 23,001
    d. 936,000 and 0.000936
5. Round off each of the following numbers to the number of significant figures indicated in parentheses.
    a. 3883 (two)
    b. 0.00003011 (two)
    c. 4.4050 (three)
    d. 2.1000 (three)
6. Without actually solving the problems, indicate the number of significant figures that should be present in the answers to the following multiplications and divisions. Assume that all numbers are measured quantities.
    a. 3.33 x 3.03 x 0.0333
    b. 300,003 x 20,200 x 1.33333
    c. 333,000 / 3.33000
    d. 0.0666 / 1.3457

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7. Carry out the following mathematical operations, expressing your answers to the correct number of significant figures. Assume that all numbers are measured quantities.
    a. (2.322 + 4.00) / (3.200 + 6.73)
    b. 7.403 / (3.220 x 5.000)
    c. (11.2 x 11.2) / (3.3 x 6.5)
    d. (5600 x 300) / (22 x 97.1)
8. Without actually solving the problems, indicate the number of significant figures that should be present in the answers to the following additions and subtractions. Assume that all numbers are measured quantities.
    a. 0.06 + 1.32 + 7.901
    b. 4.72 - 3.908
    c. 23.6 + 33 + 17.21
    d. 46,230 + 325 + 45
9. Carry out the following mathematical operations, expressing your answers to the correct number of significant figures. Assume that all numbers are measured quantities.
    a. 237 + 37 + 7
    b. 3.111 + 3.11 + 3.1
    c. 235.45 + 37 + 36.4
    d. 4.111 - 3.07
10. Express the following numbers in scientific notation.
    a. 787.6
    b. 0.01798
    c. 40.0
    d. 675,000
11. Each of the following numbers is expressed in nonstandard (incorrect) scientific notation. Convert each number to standard (correct) scientific notation.
    a. 47.23×10^{2}
    b. 23.60×10^{-2}
    c. 0.100×10^{5}
    d. 0.023×10^{-3}
12. Perform the following mathematical operations. Be sure your answer contains the correct number of significant figures and that it is in correct scientific form.
    a. $\{(3.00 \times 10^{5}) \times (6.00 \times 10^{3}) \times (5.00 \times 10^{6})\} / 2.00 \times 10^{7}$
    b. $4.1111 \times 10^{-3} / \{(3.003 \times 10^{-6}) \times (9.8760 \times 10^{-5})\}$
    c. $\{(6 \times 10^{5}) \times (6 \times 10^{-5})\} / \{(3 \times 10^{2}) \times (1 \times 10^{-10})\}$
    d. $\{(3.00 \times 10^{6}) \times (2.7 \times 10^{3}) \times (8.50 \times 10^{3})\} / \{(2.22 \times 10^{2}) \times (8.504 \times 10^{6})\}$
13. What should the recorded uncertainty be (±0.1 unit, ±0.01 unit, etc.) for measurements made using the following measuring device scales?
    a. a graduated cylinder scale with markings in 10 mL intervals
    b. a meter stick scale with markings in 1 cm intervals
    c. a buret (a volumetric device) scale with markings in 0.1 mL intervals
    d. a double pan mass balance scale with markings in 100 g intervals

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14. Identify the metric prefixes corresponding to each of the following powers of ten, or vice versa.
    a. 10^{-3}
    b. 10^{-9}
    c. 10^{3}
    d. pico
    e. micro
    f. centi
15. Calculate the volume of each of the following objects, each of which has a regular geometrical shape.
    a. a cube of steel whose edge is 3.5175 mm ($V = s^3$)
    b. a spherical marble with a radius of 1.212 cm ($V = {}^4/_3\pi r^3$)
    c. a bar of iron 6.0 m long, 0.10 m wide and 0.20 m high ($V = l * w * h$)
    d. a cylindrical rod of copper with radius = 3.2 mm and length = 62 mm ($V = {}^4/_3\pi\, r^2\, L$)
16. A certain petroleum refinery operation uses hydrogen gas at the rate of 5 x 10^4 g/min. Express this hydrogen consumption rate in the following units:
    a. dg/min ($d = 10^{-1}$)
    b. g/sec
    c. kg/hr
17. Perform the following metric system conversions, using dimensional analysis.
    a. 3.25 km^2 to m^2
    b. 0.30 pm^3 to m^3
18. A piece of metal weighing 187.6 g is placed in a graduated cylinder containing 225.2 mL of water. The combined volume of solid and liquid is 250.3 mL. What is the density, in grams per milliliter, of the metal?
19. A pediatric dosage of a certain analgesic is 225 mg/kg of body weight per day. How much analgesic, in milligrams per day, should be administered to a child who weighs 12.3 kg?
20. A 2004 US penny (zinc plated with a thin layer of copper) with a mass of 2.552 g contains 2.488 g of zinc. What is the mass percentage in the penny of copper? of zinc?
21. The accepted value for the normal boiling point of benzaldehyde, a substance used as an almond flavoring, is 178 °C. In a laboratory setting, three students are asked to experimentally determine the normal boiling point of benzaldehyde. Their results are:

    Student 1: 175 °C *Student 2:* 190 °C *Student 3*: 181 °C

    Calculate the percent error associated with each student's reported boiling point.
22. Carry out the following temperature scale conversions.
    a. Mercury freezes at 234.3 K. What is this temperature in degrees Celsius?
    b. Normal body temperature for a chickadee is 41.0 °C. What is this temperature in Fahrenheit?
    c. A recommended temperature setting for household hot water heaters is 140 °F. What is this temperature in degrees Celsius?
    d. The metal aluminum mets at 934 K. What is this temperature in degrees Fahrenheit?

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