Chemistry 255
Spring 2011
Problem Set #1
Answer Key

1. a. 6.188 + 1.953 + 0.72 + 18.123 = **26.98**
   b. 62.52 – 4.8 = **57.7**
   c. 27.56 x 8.7 = **240 or 2.4 x 10^2**
   d. 87.6 ÷ 32.4 = **2.70**
   e. log 37.428 = **1.57320**

2. **a.** $\frac{(10.52+11.02+10.12+9.74+10.52+10.22+9.87)}{7} = \frac{72.01}{7} = \mathbf{10.29}$

b. $s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{1.1513}{7-1}} = \mathbf{0.44}$

3. mean = 502.82 mg
   standard dev. = 9.35 mg

$z = \frac{x - \bar{x}}{s}$

* First find z values for 497.21 and 515.91

$497.21: \; z = \left|\frac{497.21 - 502.82}{9.35}\right| = 0.6$ Corresponding area = 0.2258

$515.91: \; z = \left|\frac{515.91 - 502.82}{9.35}\right| = 1.4$ Corresponding area = 0.4192

Area between 497.21 and 515.91 = 0.2258 + 0.4192 = 0.6450 = 64.50% of the tablets

4. You are determining whether two sets of measurements are significantly different

$$t_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{s_{pooled}} \sqrt{\frac{n_1 n_2}{n_1 + n_2}} \qquad s_{pooled} = \sqrt{\frac{\sum_{set\,1} (x_i - \bar{x}_1)^2 + \sum_{set\,2} (x_j - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$\bar{x}_1 = \frac{(98.23 + 101.37 + 99.08)}{3} = 99.56$$

$(x_i - \bar{x}_1)^2$

$(98.23 - 99.56)^2 = 1.769$

$(101.37 - 99.56)^2 = 3.376$

$(99.08 - 99.56)^2 = 0.230$

$1.769 + 3.376 + 0.230 = 5.275$

$$\bar{x}_2 = \frac{(100.57 + 101.429 + 99.12 + 98.24 + 99.58)}{5} = 99.788$$

$(x_j - \bar{x}_2)^2$

$(100.57 - 99.788)^2 = 0.6115$

$(101.429 - 99.788)^2 = 2.6929$

$(99.12 - 99.788)^2 = 0.4462$

$(98.24 - 99.788)^2 = 2.3963$

$(99.58 - 99.788)^2 = 0.0433$

$0.6115 + 2.6929 + 0.4462 + 2.3963 + 0.0433 = 6.1902$

$$s_{pooled} = \sqrt{\frac{5.2754 + 6.1902}{8 - 2}} = 1.382 \approx 1.38$$

$$t_{calc} = \frac{99.788 - 99.56}{1.38} \sqrt{\frac{5 \cdot 3}{5 + 3}} = 0.2262 \approx 0.23$$

t_{table} for 6 degrees of freedom = 3.143

$t_{calc} < t_{table}$

They are the same, the old bottle is still good. They are not significantly different.

5. The high value : 54.34

average = 50.96

st.dev. = 1.70

$G_{calc} = \dfrac{54.34 - 50.96}{1.70} = 1.988 \approx 1.99$ $\qquad$ G_{table} for 6 observations = 1.822

$G_{calc} > G_{table}$ He can reject the high data point.

6. *Equation of line:* $y = (1.308)x + (144.6)$

If $y = 836$ *(Instrument reading) then*

$836 = 1.308x + 144.6$ *solve for x*

$x = 538.59 \approx 529$ *or* $5.29\text{x}10^2$

Error in answer:

$s_y = 13.794$

$$s_x = \frac{13.794}{1.308}\sqrt{\frac{1}{1} + \frac{1}{5} + \frac{(528.593 - 798.6)^2}{(1.308)^2\left(1.0x10^5\right)}} = 13.448$$

Final answer x = 5.3 x 10^2 ± 13

7. a) 2.1 ± 0.2 or 2.1 ± 11%

b) 0.151 ± 0.009 or 0.151 ± 6%

c) 0.22 ± 0.02 or 0.22 ± 11%

d) 0.097 ± 0.002 or 0.097 ± 2%