

Chem 462—Instrumental Analysis

Appendix 1 Solution Set

A1.6. $\bar{x} = .500$

$s = 1.84 \times 10^{-3}$

$s_m = \frac{s}{\sqrt{N}}$ (p. A-9)

$1.00 \times 10^{-4} \times .500 = 1.00 \times 10^{-4}$

$1.00 \times 10^{-4} = \frac{1.84 \times 10^{-3}}{\sqrt{N}} \Rightarrow N = \left(\frac{1.84 \times 10^{-3}}{1.00 \times 10^{-4}} \right)^2 = 334$ measurements

A1.18. $d = 2.15 \text{ cm}$ $s = 0.02 \text{ cm}$

$V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \left(\frac{d}{2} \right)^3$ $V = \frac{4}{3} \pi \left(\frac{2.15 \text{ cm}}{2} \right)^3 = 5.20 \text{ cm}^3$

$\frac{s_x}{x} = y \frac{s_p}{P}$ (p. A-17)

$\frac{s_v}{5.20 \text{ cm}^3} = 2 \frac{(0.02 \text{ cm})}{2.15 \text{ cm}} \Rightarrow s_v = 0.097 \text{ cm}^3$

$V = 5.20 \text{ cm}^3$ $s_v = 0.097 \text{ cm}^3$

A1.20. $m = 5.0000 \text{ g}$ $s_m = 0.0002 \text{ g}$

$V = 100.00 \text{ mL}$ $s_v = .15 \text{ mL}$

$\{X\} = \frac{5.0000 \text{ g}}{100.00 \text{ mL}} = .050000 \frac{\text{g}}{\text{mL}}$

$\frac{s_c}{c} = \left[\left(\frac{0.0002}{5.0000} \right)^2 + \left(\frac{.15}{100.00} \right)^2 \right]^{1/2} = 1.506 \times 10^{-3}$

$s_c = 7.50 \times 10^{-5} \frac{\text{g}}{\text{mL}}$

A1.22. $b_0 = .162$

$N = 5$

$b_1 = .232$

$\sum x_i = 50$

$\sum x_i^2 = 9874$

$\sum y_i = 750$

$\Delta = N \sum x_i^2 - (\sum x_i)^2$

$\sigma_y^2 = \frac{1}{N-2} [\sum (y_i - b_0 - b_1 x_i)^2]$

x_i	y_i	y_{fit}	Δy^2
0.0	.06	.162	.0104
5.0	1.48	1.322	.0250
10.0	2.28	2.482	.0196
15.0	3.98	3.642	.1142
20.0	4.61	4.802	.0369

$\sigma_y^2 = \frac{1}{3} (.2061) = .0687$

$\Delta = 5(750) - (50)^2 = 1250$

d.

$\sigma_{b_0}^2 = \frac{\sigma_y^2}{\Delta} \sum x_i^2 = \frac{.0687}{1250} (750) = .0412$

$\sigma_{b_1}^2 = \frac{N \sigma_y^2}{\Delta} = \frac{5(.0687)}{1250} = 2.75 \times 10^{-4}$

e. $y = .162 + .232x$

$x = \frac{y - .162}{.232} = \frac{3.67 - .162}{.232} = 15.12$