Chapter 3

5 a) 3.71 d) 2.85×10^{-6} g) 242.
b) 10.7 e) 12.6251
c) 40. or 4.0×10^{1} f) 6.0×10^{-4}

6 a) 175.324 g/mol b) 140.0936

7 a) 123 d) 3.04 g) 4.600
b) 75.5 e) 3.04×10^{-10} h) 4.9×10^{-7}
c) 5520. or 5.520×10^{3} f) 11.9

8. See attached graph.

12 a) systematic
b) systematic
c) Random
d) Random

16 a) $9.23 + 4.21 - 3.26 = 10.18$ $\therefore$ 10.18 ± 0.07 (0.7%)

absolute unc. $= \sqrt{(0.03)^2 + (0.02)^2 + (0.06)^2} = 0.07$

%relative unc $= \frac{0.07}{10.18} \cdot 100\% = 0.69\% \approx 0.7\%$

b) $(91.3 \times 40.3)/21.1 = 174.39$

% relative unc $= 100\sqrt{\left(\frac{1}{91.3}\right)^2 + \left(\frac{0.2}{40.3}\right)^2 + \left(\frac{0.2}{21.1}\right)^2} = 1.53\%$

absolute $= \frac{1.53}{100} \cdot 174.39 = 2.67 \Rightarrow 3$

$\therefore$ 174 ± 3 (2%)

16 c) $4.97 - 1.86 = 3.08 \pm ?$

$\sqrt{0.05^2 + 0.01^2} = 0.05_1$

$3.08 / 21.1 = 0.1459_7 \pm ?$

Relative unc $= \sqrt{\left(\frac{0.05_1}{3.08}\right)^2 + \left(\frac{0.2}{21.1}\right)^2} = 0.0188 \Rightarrow 1.88\% = 2\%$

absolute $= 0.0188 \cdot 0.1459_7 = 0.0027 \Rightarrow 0.003$

$\therefore 0.146 \pm 0.003$ (2%)

d) $2.0164 + 1.233 + 4.61 = 7.8594$

absolute unc $= \sqrt{(0.0008)^2 + (0.002)^2 + (0.01)^2} = 0.0102 = 0.01$

relative $= 0.01_0 / 7.8594 = 0.0013 = 0.1\%$

$\therefore 7.86 \pm 0.01$ (0.1%)

e) sum $= 2185.8$

abs: $\sqrt{0.8^2 + 0.2^2 + 0.1^2} = 0.8_3 = 0.8$

% relative $= \frac{0.8}{2185.8} \cdot 100 = 0.038\% = 0.04\%$

$\therefore 2185.8 \pm 0.8$ (0.04%)

f) $3.14^{1/3} = 1.464_3$

Rel: $\frac{1}{3}\left(\frac{0.05}{3.14}\right) \cdot 100\% = 0.53_1\% = 0.5\%$

absolute: $1.464_3 \cdot 0.0053_1 = 0.007_7$

$\therefore 1.464 \pm 0.008$ (0.5%)

g) $\log(3.14) = .4969_3$

absolute $= 0.43429\left(\frac{0.05}{3.14}\right) = 0.0069_2$

relative $= \frac{0.0069_2}{0.4969} \cdot 100\% = 1.4\%$

$\therefore 0.497 \pm 0.007$ (1.4%)

18 a) $58.442770 \pm ?$

$e = \sqrt{(2\times10^{-8})^2 + (2\times10^{-3})^2} = 0.002$ $\therefore$ 58.442 ± 0.002 g/mol

b) $2.634\ g \cdot \frac{1\ mol}{58.442\ g} \cdot \frac{1}{0.1\ L} = 0.450703 \pm ?\ M$

$e = 0.450703\sqrt{\left(\frac{0.002}{2.634}\right)^2 + \left(\frac{0.002}{58.442}\right)^2 + \left(\frac{0.08}{100}\right)^2} = 0.000497$

$\therefore$ $(0.4507 \pm 0.0005)\ M$

21 $0.9674\ g\ Na_2CO_3 \cdot \frac{1\ mol\ Na_2CO_3}{105.9884\ g} \cdot \frac{2\ mol\ HCl}{1\ mol\ Na_2CO_3} \cdot \frac{1}{0.02735\ L} = 0.66745\ M$

$e = 0.66745\sqrt{\left(\frac{0.0009}{0.9674}\right)^2 + \left(\frac{0.0007}{105.9884}\right)^2 + \left(\frac{0.04}{27.35}\right)^2} = 0.001157$

$\therefore$ $0.667 \pm 0.001\ M$

23 $255,18426 \pm ?$

$unc = \sqrt{(9\cdot0.0008)^2 + (9\cdot0.00007)^2 + (6\cdot0.0003)^2 + (3\cdot0.0002)^2}$

$= 0.007472$

$\therefore$ 255.184 ± 0.007 g/mol

Problem 3-8

Volume (mL)	Correction (mL)
0.03	0.00
10.04	0.04
20.03	0.02
29.98	-0.03
40.00	0.00
49.97	0.03