APPENDIX II

Using a Scientific Calculator

A calculator is useful for most calculations in this book. You should obtain a scientific calculator, that is, one that has at least the following function keys on its keyboard.

Addition [+]	Second function [F], [INV], [Shift]
Subtraction [−]	Change sign [+/−]
Multiplication [×]	Exponential number [Exp]
Division [÷]	Logarithm [Log]
Equals [=]	Antilogarithm [10^x]

Not all calculators use the same symbolism for these function keys, nor do all calculators work in the same way. The following discussion may not pertain to your particular calculator. Refer to your instruction manual for variations from the function symbols shown above and for the use of other function keys.

Some keys have two functions, upper and lower. In order to use the upper (second) function, the second function key [F] must be pressed in order to activate the desired upper function after entering the number.

The second function key may have a different designation on your calculator.

The display area of the calculator shows the numbers entered and often shows more digits in the answer than should be used. Therefore, the final answer should be rounded to reflect the proper number of significant figures of the calculations.

Addition and Subtraction

To add numbers using your calculator,

1. Enter the first number to be added followed by the plus key [+].
2. Enter the second number to be added followed by the plus key [+].
3. Repeat Step 2 for each additional number to be added, except the last number.
4. After the last number is entered, press the equal key [=]. You should now have the answer in the display area.
5. When a number is to be subtracted, use the minus key [−] instead of the plus key.

As an example, to add 16.0 + 1.223 + 8.45, enter 16.0 followed by the [+] key; then enter 1.223 followed by the [+] key; then enter 8.45 followed by the [=] key. The display shows 25.673, which is rounded to the answer 25.7.

Examples of Addition and Subtraction

Calculation	Enter in sequence	Display	Rounded answer
a. 12.0 + 16.2 + 122.3	12.0 [+] 16.2 [+] 122.3 [=]	150.5	150.5
b. 132 − 62 + 141	132 [−] 62 [+] 141 [=]	211	211
c. 46.23 + 13.2	46.23 [+] 13.2 [=]	59.43	59.4
d. 129.06 + 49.1 − 18.3	129.06 [+] 49.1 [−] 18.3 [=]	159.86	159.9

Multiplication To multiply numbers using your calculator,

1. Enter the first number to be multiplied followed by the multiplication key [×].
2. Enter the second number to be multiplied followed by the multiplication key [×].
3. Repeat Step 2 for all other numbers to be multiplied except the last number.
4. Enter the last number to be multiplied followed by the equal key [=]. You now have the answer in the display area.

Round off to the proper number of significant figures.

As an example, to calculate (3.25)(4.184)(22.2), enter 3.25 followed by the [×] key; then enter 4.184 followed by the [×] key; then enter 22.2 followed by the [=] key. The display shows 301.8756, which is rounded to the answer 302.

Examples of Multiplication

Calculation	Enter in sequence	Display	Rounded answer
a. 12 × 14 × 18	12 [×] 14 [×] 18 [=]	3024	3.0×10^3
b. 122 × 3.4 × 60.	122 [×] 3.4 [×] 60. [=]	24888	2.5×10^4
c. 0.522 × 49.4 × 6.33	0.522 [×] 49.4 [×] 6.33 [=]	163.23044	163

Division To divide numbers using your calculator,

1. Enter the numerator followed by the division key [÷].
2. Enter the denominator followed by the equal key to give the answer.
3. If there is more than one denominator, enter each denominator followed by the division key except for the last number, which is followed by the equal key.

As an example, to calculate $\frac{126}{12}$, enter 126 followed by the [÷] key; then enter 12 followed by the [=] key. The display shows 10.5, which is rounded to the answer 11.

Examples of Division

Calculation	Enter in sequence	Display	Rounded answer
a. $\frac{142}{25}$	142 [÷] 25 [=]	5.68	5.7
b. $\frac{0.422}{5.00}$	0.422 [÷] 5.00 [=]	0.0844	0.0844
c. $\frac{124}{0.022 \times 3.00}$	124 [÷] 0.022 [÷] 3.00 [=]	1878.7878	1.9×10^3

Exponents In scientific measurements and calculations, we often encounter very large and very small numbers. To express these large and small numbers conveniently, we use exponents, or powers, of 10. A number in exponential form is treated like any other number; that is, it can be added, subtracted, multiplied, or divided.

To enter an exponential number into your calculator, first enter the nonexponential part of the number and then press the exponent key [Exp], followed by the exponent. For example, to enter 4.9×10^3, enter 4.94, then press [Exp], and then press 3. When the exponent of 10 is a negative number, press the Change of Sign key [+/−] after entering the exponent. For example, to enter 4.94×10^{-3}, enter in sequence 4.94 [Exp] 3 [+/−]. In most calculators, the exponent will appear in the display a couple of spaces after the nonexponent part of the number—for example, 4.94 03 or 4.94 −03.

Examples Using Exponential Numbers

Calculation	Enter in sequence	Display	Rounded answer
a. $(4.94 \times 10^3)(21.4)$	4.94 [Exp] 3 [×] 21.4 [=]	105716	1.06×10^5
b. $(1.42 \times 10^4)(2.88 \times 10^{-5})$	1.42 [Exp] 4 [×] 2.88 [Exp] 5 [+/−] [=]	0.40896	0.409
c. $\frac{8.22 \times 10^{-5}}{5.00 \times 10^7}$	8.22 [Exp] 5 [+/−] [÷] 5.00 [Exp] 7 [=]	1.644 −12	1.64×10^{-12}

Logarithms The logarithm of a number is the power (exponent) to which some base number must be raised to give the original number. The most commonly used base number is 10. The base number that we use is 10. For example, the log of 100 is 2.0 ($\log 100 = 10^{2.0}$). The log of 200 is 2.3 ($\log 200 = 10^{2.3}$). Logarithms are used in chemistry to calculate the pH of an aqueous acidic solution. The answer (log) should contain the same number of significant figures to the right of the decimal as is in the original number. Thus, log 100 = 2.0, but log 100. is 2.000.

The log key on most calculators is a function key. To determine the log using your calculator, enter the number and then press the log function key. For example, to determine the log of 125, enter 125 and then the [Log] key. The answer is 2.097.

Examples Using Logarithms
Determine the log of the following:

	Enter in sequence	Display	Rounded answer
a. 42	42 [Log]	1.6232492	1.62
b. 1.62×10^5	1.62 [Exp] 5 [Log]	5.209515	5.210
c. 6.4×10^{-6}	6.4 [Exp] 6 [+/−] [Log]	−5.19382	−5.19

Antilogarithms (Inverse Logarithms) An antilogarithm is the number from which the logarithm has been calculated. It is calculated using the [10^x] key on your calculator. For example, to determine the antilogarithm of 2.891, enter 2.891 into your calculator and then press the second function key followed by the [10^x] key: 2.891 [F] [10^x].

The display shows 778.03655, which rounds to the answer 778.

Examples Using Antilogarithms
Determine the antilogarithm of the following:

	Enter in sequence	Display	Rounded answer
a. 1.628	1.628 [F] [10^x]	42.461956	42.5
b. 7.086	7.086 [F] [10^x]	12189896	1.22×10^7
c. −6.33	6.33 [+/−] [F] [10^x]	4.6773514 −07	4.7×10^{-7}

Additional Practice Problems*

Problem	Display	Rounded answer
1. $143.5 + 14.02 + 1.202$	158.722	158.7
2. $72.06 - 26.92 - 49.66$	−4.52	−4.52
3. $2.168 + 4.288 - 1.62$	4.836	4.84
4. $(12.3)(22.8)(1.235)$	346.3434	346
5. $(2.42 \times 10^{6})(6.08 \times 10^{-4})(0.623)$	916.65728	917
6. $\dfrac{(46.0)(82.3)}{19.2}$	197.17708	197
7. $\dfrac{0.0298}{243}$	1.2263374 −04	1.23×10^{-4}
8. $\dfrac{(5.4)(298)(760)}{(273)(1042)}$	4.2992554	4.3
9. $(6.22 \times 10^{6})(1.45 \times 10^{3})(9.00)$	8.1171 10	8.12×10^{10}
10. $\dfrac{(1.49 \times 10^{6})(1.88 \times 10^{6})}{6.02 \times 10^{23}}$	4.6531561 −12	4.65×10^{-12}
11. $\log 245$	2.389166	2.389
12. $\log 6.5 \times 10^{-6}$	−5.1870866	−5.19
13. $\log 24 \times \log 34$	2.1137644	2.11
14. antilog 6.34	2187761.6	2.2×10^{6}
15. antilog −6.34	4.5708818 −07	4.6×10^{-7}

*Only the problem, the display, and the rounded answer are given.