SIGNIFICANT FIGURES

Name _____

Measurement can only be as accurate and precise as the instrument that produced it. A scientist must be able to express the accuracy of a number, not just its numerical value. We can determine the accuracy of a number by the number of significant figures it contains.

1) All digits 1-9 inclusive are significant.
   Example: 129 has 3 significant figures.
2) Zeros between significant digits are always significant.
   Example: 5,007 has 4 significant figures.
3) Trailing zeros in a number are significant only if the number contains a decimal point.
   Example: 100.0 has 4 significant figures.
   100 has 1 significant figure.
4) Zeros in the beginning of a number whose only function is to place the decimal point are not significant.
   Example: 0.0025 has 2 significant figures.
5) Zeros following a decimal significant figure are significant.
   Example: 0.000470 has 3 significant figures.
   0.47000 has 5 significant figures.

Determine the number of significant figures in the following numbers.

1. 0.02 1
2. 0.020 2
3. 501 3
4. 501.0 4
5. 5,000 1
6. 5,000. 4
7. 6,051.00 6
8. 0.0005 1
9. 0.1020 4
10. 10,001 5

Determine the location of the last significant place value by placing a bar over the digit. (Example: 1,700̄)

1. 8040 _____
2. 0.0300 _____
3. 699.5 _____
4. 2.000×10^2 _____
5. 0.90100 _____
6. 90,100 _____
7. 4.7×10^{-8} _____
8. 10,800,000. _____
9. 3.01×10^{21} _____
10. 0.000410 _____

CALCULATIONS USING SIGNIFICANT FIGURES

Name _____

When multiplying and dividing, limit and round to the least number of significant figures in any of the factors.

Example 1: 23.0 cm x 432 cm x 19 cm = 188,784 cm^3
The answer is expressed as 190,000 cm^3 since 19 cm has only two significant figures.

When adding and subtracting, limit and round your answer to the least number of decimal places in any of the numbers that make up your answer.

Example 2: 123.25 mL + 46.0 mL + 86.257 mL = 255.507 mL
The answer is expressed as 255.5 mL since 46.0 mL has only one decimal place.

Perform the following operations expressing the answer in the correct number of significant figures.

1. 1.35 m x 2.467 m = 3.33
2. 1,035 m^2 + 42 m = 1077
3. 12.01 mL + 35.2 mL + 6 mL = 53
4. 55.46 g – 28.9 g = 26.6
5. .021 cm x 3.2 cm x 100.1 cm = 6.7
6. 0.15 cm + 1.15 cm + 2.051 cm = 3.35
7. 150 L^3 + 4 L = 154
8. 505 kg – 450.25 kg = 55
9. 1.252 mm x 0.115 mm x 0.012 mm = .0017 or 1.7×10^{-3}
10. 1.278 x 10^3 m^2 + 1.4267 x 10^2 m = _____
    (1000) (100)

1278 + 142.67 = 1420.1421

Multiplication and Division with Significant Digits

Name_____ Section_____

RULE: When multiplying or dividing, your answer may only show as many significant digits as the multiplied or divided measurement showing the least number of significant digits.

Perform the following calculations and round according to the rule above.

1) 13.7 x 2.5 = 34	2) 200 x 3.58 = 700	3) 0.00003 x 727 = .02
4) 5003 / 3.781 = 1323	5) 89 / 9.0 = 9.9	6) 5000 / 55 = 90

Answers 1) 2) 3) 4) 5) 6)

1) 50.0 x 2.00 = 1.00×10^2	2) 2.3 x 3.45 x 7.42 = 59	3) 1.0007 x 0.009 = 0.009 or 9×10^{-3}
4) 51 / 7 = 7	5) 208 / 9.0 = 23	6) 0.003 / 5 = 0.0006 or 6×10^{-4}

Answers 1) 2) 3)

Rule for Multiplication - When you multiply numbers with scientific notation, multiply the coefficients gether and add the exponents. The base will remain 10.

Rule for Division - When dividing with scientific notation, divide the coefficients and subtract the exponents. The base will remain 10.

1) $(6.8 \times 10^{3}) \times (4.54 \times 10^{6})$ 3.1×10^{10}	2) $(2.0 \times 10^{-1}) \times (8.5 \times 10^{5})$ 1.7×10^{5}
3) $(4.42 \times 10^{-3}) \times (4 \times 10^{-2})$ 2×10^{-4}	4) $(3 \times 10^{6}) \times (7 \times 10^{-7})$ 2.1×10^{0}
5) divide (9.2×10^{-3}) by (6.3×10^{6}) 1.5×10^{-9}	6) divide (2.4×10^{6}) by (5.49×10^{-9}) 4.4×10^{14}
Answers 2	5)

Report the answer to the following problems, paying particular attention to the correct number of sig. figs.

a) 986.72 / 5.12 = 193

b) 497.7 / 3.0 = 1.7×10^2

c) 920.7 / 4.32 = 213

d) 400.20 x 3.010 = 1205

e) 98 x 0.006 = .59

f) .009430 x 4310.9 = 40.65

g) 45.20 x 0.0071 = .32

h) 9.0 / 3.0 = 3.0

i) 10. x 300. = 3.0×10^3

j) 10. / 3 = 3.

NOTE: IN ADDITION AND SUBTRACTION, DECIMAL POINTS MUST BE LINED UP.

Solve the following:

a) 0.00000313
+17
17

b) 4.9670
- 3.1
1.9

c) 0.000343
+0.17
.17

d) 78
- .99
77

e) 336,000 – 33,000.03 = 302999

f) 0.99 - .1 = 0.9

Additional practice problems:

How many sig. figs in the following number?

a) 87 2 b) 190. 3 c) 0.000190 3 d) 606.0 4 e) 1.008 4

Round off the following to 2 S.F.

a) 86730 8.7×10^4 b) 120.99 1.2×10^2 c) .0003450 3.5×10^{-4} d) 0.0555 5.6×10^{-2} e) 9898989 9.9×10^6

How many S.F. should be in the following answers: (Don't work out the problems!)

a) 0.2 x 43.98 = 1

b) 43,000,000 x 0.00546 = 2

c) 43.0 – 17.2 = 1

d) 0.00235 – 3.0 = 1

e) 143.000 – 3.45 = 2

f) 3.40 x 0.04 = 1

g) $\frac{0.300 \times .802}{30.44}$ = 3

h) $\frac{39.04 \times 1.009}{3}$ = 1

i) $\frac{0.00390 \times 2.0098}{2.02}$ = 3

Solve the following problems:

22252.32

a) 0.004598
+4
4

b) $\frac{43.2 \times 30.3 \times 17.0}{43.30 \times 0.0045 \times 99}$ = 11535.59
1.929015

c) 338855.0
+10000000.003
10338855.0

d) 73
-14.98
58

e) 8.0
-1.99
6.0

f) 17.0 + 1.4 – 8.9 = 9.5

How many S.F. are in the following numbers?

a) 3.0×10^9 2

b) 0.0090 2

c) 4.20×10^{-4} 3

d) 900,000 1

e) 900,000. 6

f) 9.4450×10^7 5