Significant Figures & Scientific Notation Notes Complete

Recap:

Accuracy refers to how close a measurement is to the true or accepted value.
Precision refers to how close measurements of the same item are to each other. Precision is independent of accuracy.

For an **analog** scale, the uncertainty is ± half of the smallest scale division.
For a **digital** scale, the uncertainty is ± 1 in the least significant digit.

1. Significant figures apply to measured values. They are significant to the measurement NOT the number.
2. The number of significant figures is determined by the resolution of the instrument used to make the measurement. The last digit in a measured number is always the "estimated" digit.

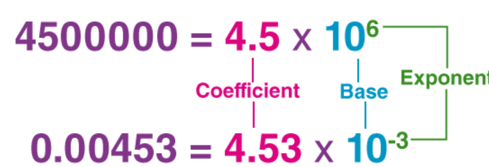
RULE: If a number contains no zeros, all of the digits are significant.	RULE: All 'Captured' zeros (ones between two non zero digits) are significant.
How many significant digits are in each of the following examples? a) 438 b) 26.42 c) 1.7 d) .653	How many significant digits are in each of the following examples? a) 506 b) 10,052 c) 900.431
RULE: Zeros to the right of a non zero digit	
a) If they are to the right of a nonzero number but not 'Captured' between nonzero and decimal point, they are not significant.	b) If these zeros are 'captured' between a nonzero number and a decimal point, they are significant
How many significant digits are in each of the following examples? a) 4830 b) 60 c) 4,000	How many significant digits are in each of the following examples? a) 4830. b) 60. c) 4,000.
RULE: Leading Zeros are never significant. They are simply place holders.	RULE: All zeros to the right of a decimal point and to the right of a non-zero digit are significant. They indicate the degree of accuracy in the measurement.
How many significant digits are in each of the following examples? a) 0.06 b) 0.0047 c) 0.005	How many significant digits are in each of the following examples? a) .870 b) 8.0 c) 16.40 d) 35.000 e) 1.60

Practice Problems: How many significant digits are in each of the following examples?

1) 47.1	2) 9700.	6) 701.905	7) 50.00
3) 0.005965000	4) 560	8) 50.012	9) 0.000009
5) 0.0509		10) 0.0000104	

Determining Significant Digits When Rounding	
1) 689.683 grams (4 significant digits) 2) 0.007219 (2 significant digits) 3) 4009 (1 significant digit) 4) 3.921 x 10-1 (1 significant digit)	5) 8792 (2 significant digits) 6) 309.00275 (5 significant digits) 7) .1046888 (3 significant digits)
Rule for Addition and Subtraction	Rule for Multiplication and Division
Round the sum or difference so that it has the same number of decimal places as the measurement having the fewest decimal places (you can only be as accurate as the LEAST accurate measurement) Example: Add 369.3389 + 17.24 First simply add the two numbers. Answer = 386.5789 17.24 had the fewest number of decimal places with 2 places past the decimal. The above answer will have to be rounded to two places past the decimal. Rounded Answer = 386.58	Express a product or a quotient to the same number of significant figures as the multiplied or divided measurement having the fewer significant figures. Example: Multiply 6.99 x .25 First simply multiply the two numbers. Answer = 1.7475 .25 had the fewest number of significant digits with 2. The above answer will have to be rounded to two significant digits. Rounded Answer = 1.7
Find the sum or difference of the following and round them to the correct number of digits. a) 39.61 – 17.3 b) 1.97 + 2.700 c) 100.8 – 45 d) 296.0 + 3.9876	Multiply or divide the following and give your answer in the correct number of significant digits. a) 4.7929 ÷ 4.9 b) 5 x 3.999 c) 84 ÷ .09 d) .815 x 215.7

<u>**Scientific Notation**</u>



a way to express very small or very large numbers that is often used in "scientific" calculations where the analysis must be very precise.

To Change from Standard Form to Scientific Notation:

1) Place decimal point such that there is one non-zero digit to the left of the decimal point.
2) Count number of decimal places the decimal has "moved" from the original number. This will be the exponent of the 10.
3) If the original number was less than 1, the exponent is negative; if the original number was greater than 1, the exponent is positive.

Example: The number: 4,750,000	Example: The number: 0.000789
Add the decimal point: 4,750,000. Move the decimal so there is only ONE number (greater than 0) before the decimal: 4.75 (moved 6 decimal places) Answer: 4.75 X 10^{6} The original number was greater than 1 so the exponent is positive	Move the decimal so there is only ONE number (greater than 0) before the decimal: 7.89 (moved 4 decimal places RIGHT) Answer: 7.89 X 10^{-4} The original number was less than 1 so the exponent is negative.

10^{9}	=	1,000,000,000	Giga (G)
10^{8}	=	100,000,000	
10^{7}	=	10,000,000	
10^{6}	=	1,000,000	Mega (M)
10^{5}	=	100,000	
10^{4}	=	10,000	
10^{3}	=	1,000	Kilo (K)
10^{2}	=	100	
10^{1}	=	10	
10^{0}	=	1	
10^{-1}	=		0.1
10^{-2}	=	centi (c)	0.01
10^{-3}	=	milli (m)	0.001
10^{-4}	=		0.0001
10^{-5}	=		0.00001
10^{-6}	=	micro (μ)	0.000001
10^{-7}	=		0.0000001
10^{-8}	=		0.00000001
10^{-9}	=	nano (n)	0.000000001

To Change from Scientific Notation to Standard Form:

(1) Move decimal point to RIGHT for POSITIVE exponent of 10.

(2) Move decimal point to LEFT for NEGATIVE exponent of 10.

Example with positive exponent:	Example with negative exponent:
Convert 5.023 x 10^{5} Move the decimal and write standard notation: Answer: 502300	Convert 5.023 x 10^{-5} Move the decimal and write standard notation: Answer: 0.00005023