Significant Figures Enriched Notes

Which digits are <u>significant</u>?

- **Rule #1**: All non-zero digits are significant.
  24 has two sig figs, 24.1 has 3 sig figs

- **Rule #2**: All zeros bounded by non-zero integers are significant.
  2004 has four sig figs 20.04 also has 4 sig figs

- **Rule #3**: Zeros placed before other digits (leading zeros) are not significant.
  0.024 has 2 sig figs

- **Rule #4**: Zeros at the end of a number are significant ONLY if they come after a decimal point. 2.40 has three sig figs 240 only has 2 sig figs

Practice:

409.25	0.050	0.003500
83	300 900	0.916
98.207	4.67×10^{-7}	0.200
0.001	45.030	5 234 000
4.3×10^{2}	35 000	150 000 001
0.003050	0.004400	460 090
4 200	16.8090	50.00300

Rules for Addition and Subtraction

- Answers must be rounded to the **same decimal place** (not sig figs) as the **least** number of decimal places in any of the numbers being added or subtracted.

  Ex. 2.42 + 14.2 + 0.6642 = 17.2842 becomes

- If there is no decimal point in one of the numbers, all decimal points are dropped.

Rules for Multiplication and Division

- The number of sig figs in the answer should be the same as in the number with the least sig figs being multiplied or divided.

Ex. 7.3 x 1264 = 9227.2 becomes

When doing multiple steps in a word problem

- Solve each step using order of operations.
- **Do not round off any number.**
- Once you have your final answer, then you use significant figures according to the last step you do.

Ex: $\frac{125 \times 345.5}{65.3 + 16.6} = \frac{43187.5}{81.9} =$ 527.3199023 becomes

Exceptions and special circumstances

1. **Adding and scientific notation**

$$\frac{(5.8 \times 10^2) + 368}{4.87 \times 10^5}$$

- When adding and using SN, the exponents must be the same.

You have 2 options to solve the problem.
1- Convert 5.8 x10^2 to 580 and get rid of the exponent
580 + 368
2- Convert 368 to the same exponent so it becomes 3.68 x 10^2
5.8 x 10^2 + 3.68 x 10^2
Both are correct, but option 1 is easier

2. **Rounding off and keeping a zero as a significant digit**

$$\frac{8253.0569}{12.7} = 649.847$$

- In this example you must keep 3 sig figs in your answer.

When rounding off 649.847 should become 650.

Problem, 650 only has 2 sig figs
Solution: put a – above the zero, this makes it significant. Becomes

3. **Having many insignificant zero's and addition**

- When adding the following: 136.2 + 2 500 000 + 14.01

We get 2 500 150.21 which should become 2 500 150.

EXCEPT, we have to use sig figs, and the addition rule says that we must round to the least precise decimal place. Therefore, because 2 500 000 is only precise to the hundred thousands place, we need to round the answer to 2 500 000.

- You cannot be more precise than your least most precise number.

This is true for any additions that end in non sig. zero's. ex-
5 500 + 15 = 55 15 but becomes
310 + 6 = 316 but becomes
259 500 + 1670 + 23 = 261 193 but becomes

4. Converting units

- When converting units, sig figs need to be maintained.
  Ex 1- 4.0 cm to m becomes 0.040 m not 0.04 m
  Ex 2- 1250 mL becomes 1.25 L not 1.250 L

5. Constants

- When there is a constant in a formula, the constant does not count as a significant figure.

ex: Coulomb's constant 9.00×10^9 Nm^2/C^2

SIG FIGS PRACTICE

1. How many sig figs are in each of the following numbers?

a) 0.09304
b) 6.58×10^7
c) 0.0200
d) 0.10101
e) 4.508
f) 1204.0
g) 2.9×10^{-3}
h) 2.4×10^7
I) 460
J) 23.230

2. Solve using the correct number of significant figures.

a- 13.5 x 14.2 x 13.080 x 0.01 = 25.07436 =

b- 187 x 0.008 ÷ 14.2887 = 0.104698118 =

c- 911 x 677 x 0.0089 = 5489.0483 =

d- $8.0 \times 10^{5} \div 4.02 \times 10^{9} = 0.000199005$ =

e- $(1.23 \times 10^{5})\ (1.445 \times 10^{7}) \div 0.023 = 7.727608696 \times 10^{13}$ =