5.1.6 MATHEMATICS IN SCIENCE

1. Rounding

When rounding a number, the key digit is the number next to the desired digit.

Rule:

1. If the key digit is less than 5, round down. This means leave the desired digit alone.

   Examples: Round to whole numbers: 4.3 =

   13.4 =

   Round to the tenths place: 134.631 = 134.6

   89. 4438 = 89.4

2. If the key digit is greater than 5, or equal to 5 ,round up. This means increase the desired digit by one.

   Example: Round to whole numbers: 4.8 =

   13.512 =

   Round to tenths place: 134.661 =

   89. 458 =

   Examples: Round to whole numbers: 4.5 =

   13.5 =

   Round to tenths place: 134.65 =

   89. 9500 =

Scientific Notation:

Defn. : Scientific Notation is used to represent very large and very small numbers. By multiplying or dividing by powers of 10, number are expressed as one whole number. For scientific notation, one digit (other than 0) is placed before the decimal point. The other significant digits are placed after the decimal point. (Also read textbook pg. 576).

Very large numbers :

2345 =
5000000000000 =

Very small numbers:

0. 00146598 =

0.0000000000000098766 =

Significant Digits

Defn. Significant Digits are meaningful digits. They are like "placeholders".

Rules:

1. All non-zero digits are significant (i.e. 123456 has six significant digits)
2. Leading zeros are never significant (i.e. 0.0000000000123 has three sig. figs.)
3. Captured zeros are always significant (i.e. 101120407 has nine significant digits.)
4. Trailing zeros are only significant if a decimal point is seen. (12.00 = 4 sig. figs.)

Examples: How many significant digits are in each of the following numbers?

18 = 0.023 =

788.925 = 0.00562500 =

5. Answers to mathematical problems in science may only have the same number of significant digits as the lowest number (of sig. digs) in the problem.

Examples:

$57.23 \div 10 = 5.723 = 5.7$

$876 \times 10 = 8760 = 8.760 \times 10^3 = 8.8 \times 10^3$

6. There are only 2 types of numbers in science considered to be exact. This means that they have an infinite number of significant digits. These are:

a. **Counts**:

There are 23 students in this class, not 24, not 23.987, but 23. If the 10 in the previous example was a count, then there would be 4 sig. digs in the answer. The number 10 would have an infinite number of sig. digs, so the answer would be limited by the 4 sig. digs in the number 57.23

b. **Numbers by Definition**:

12 objects = 1 dozen or 1000 m = 1km
These numbers also have an infinite number of sig. digs, so they do not limit the sig. digs in a multiplication or division problem.

14. 583 km X 1000 m = 14583 m

Exact Values Examples

Counted values	Defined values
4 dogs	1000 m/km
135 students	10 mm/cm
3 blue jays	1 h/60 min

Precision Rule for Adding and Subtracting

When adding and /or subtracting measured values of known precision, the answer has the same number of decimal places as the measurement with the fewest decimal places.

Certainty Rule

When multiplying and /or dividing, the answer has the **same number of significant digits** as the measurement with the fewest number of significant digits.

Now it's your turn!   Name ___________________________

PRACTICE WITH SIGNIFICANT DIGITS

1. How many significant digits are in the following measurements?

a. 146.20 g

b. 14.6 cm

c. 0.04 g

d. 15 desks

e. 54.706 mL

f. 276598.8900 t

g. 2.36×10^{-3}

h. 6.217

2. Change the following to scientific notation and round to 3 significant digits:

a. 2345 =

b. 5000000000000 =

c. 0. 00146598 =

d. 0.0000000000000098766 =

e. 76.43 g=

f. 4508 mL =

g. 0.000056 s =

g. 0.472 kg =

3. Calculate the following (Use the Certainty rule for correct number of Sig. Dig.'s in final answer):

a. 1.678 g x 15 jellybeans =

b. (2.76×10^{-3}) N x (7.4×10^{5}) m =

c. 4.7 L = ____________ mL

d. 40.5 km/h x 3.3 h =

e. $87.34 ÷ 5 people =

f. $A = 3.14 \times (2.3)^2$