M

Math Application

Significant Figures

All measurements are uncertain. Imagine you are baking a cake. You carefully follow the recipe, measuring out 3 cups of flour, 1.5 cups sugar, and so on. You arrive at the place in the recipe where it calls for salt. Thinking it couldn't possibly matter; you simply decide to guess how much salt is needed. You mix the rest of the ingredients, place it in a pan, and bake it a delicious golden brown. The aroma fills the house. When the cake cools, you apply icing, and serve it as dessert to your friends. The first person to eat a bite makes a face—IT TASTES AWFUL! You can easily see how important it is to be exacting in your measurements. At this point it doesn't matter if the flour and sugar were measured correctly, because the least precise measurement affected the whole cake. Because one often encounters measurements that are more and less certain in chemistry, scientists have devised a system of deciding how precise a given value is; or how digits are significant in a given number.

Rules for Counting Significant Figures

1. Nonzero integers always count.
2. Leading zeros (i.e.: 0.0025) never count.
3. Captive zeros (i.e.: 1.008) always count.
4. Trailing zeros are significant only if the number contains a decimal point. (i.e.: 1.000=YES, 100N0)
5. Exact numbers are not included in figuring significant figures (i.e.: 12 in = 1 ft neither the 1 nor the 12 count)

Addition and Subtraction: The result has the same number of *decimal places* as the least precise measurement used in calculation.

Multiplication and Division: The result has the same number *of significant figures* as the least precise measurement used in calculation.

REMEMBER: CALCULATIONS NEVER MAKE MEASUREMENTS MORE PRECISE!!!

Here are a few examples. Determine the number of significant figures in each and then check your answers below.

a.	0.0053	b.	5300	c.	1000.	d.	132.50
e.	100000	f.	0.500	g.	1.03×10^{21}	h.	0.0003

(a--2, b--2, c--4, d--5, e--1, f--3, g--3, h--1)

How many significant figures should the answer to each of these calculations have?

A. (6.2 mi) x (5280 ft/mi) =

B. (30 m/s) x (3600 s/h) x (1 km/1000 m) =

C. (6.023×10^{23} atoms/mole) x (0.42 moles) =

(A--2, B--1, C--2)