A few more math with significant figures examples:

$$\underset{5}{15047} \times \underset{2}{11} \times \underset{4}{0.9876} = 163464.5892 \quad \boxed{160000}$$

~~16~~

1.6×10^5

Placeholder zeroes (or scientific notation) required here since we need to know where the decimal goes!

Addition:

147.3	± 0.1
2432	± 1
0.97	± 0.01
+ 111.6	± 0.1
2691.87	

$\boxed{2692}$

DENSITY CALCULATION

$$\frac{\overset{6}{14.7068} \text{ g}}{\underset{2}{2.7} \text{ mL}} = 5.44696296 \text{ g/mL}$$

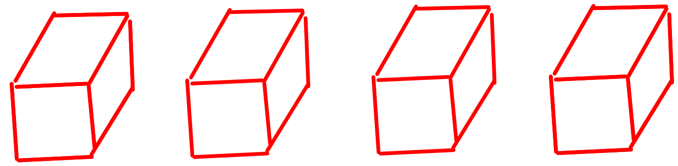
$\boxed{5.4 \text{ g/mL}}$

The only way to improve this density measurement is to improve the volume measurement. (We could actually get away with using a LESS precise balance to measure mass, since the quality of the answer wouldn't change as long as we had two or more significant figures for mass!)

Exact Numbers

- Some numbers do not have any uncertainty. In other words, they weren't measured!

1) Numbers that were determined by COUNTING!



How many blocks are to the left?

exactly 4

2) Numbers that arise from DEFINITIONS, often involving relationships between units

12 in = 1 ft

Km = 10^3 m

* All metric prefixes are exact!

- Treat exact numbers as if they have INFINITE significant figures or decimal places!

Example

You'll need to round the answer to the right number of significant figures!
Convert 4.45 m to in, assuming that 2.54 cm = 1 in

EXACT!

2.54 cm = in $cm = 10^{-2} m$

$$4.45\,\cancel{m} \times \frac{\cancel{cm}}{10^{-2}\,\cancel{m}} \times \frac{in}{2.54\,\cancel{cm}} = 175.1968504\,in$$

3   ∞   ∞

$$= \boxed{175\,in}$$

Usually, in unit conversions the answer will have the same number of significant figures as the original measurement did.

EXCEPTION: Temperature conversions, since these often involve ADDTION (different rule!)

A note on rounding: If possible, try to round only at the END of a multiple-step calculations. Avoid rounding intermediate numbers if possible, since extra rounding introduces ERROR into your calculations.

DALTON'S ATOMIC THEORY

- 1808: Publication of Dalton's "A New System of Chemical Philosophy", which contained the atomic theory

- Dalton's theory attempted to explain two things:

1 CONSERVATION OF MASS

- The total amount of mass remains constant in any process, chemical or physical!

2 LAW OF DEFINITE PROPORTIONS (also called the LAW OF CONSTANT COMPOSITION): All pure samples of a given compound contain the same proportion of elements by mass

The parts of Dalton's theory

1 Matter is composed of small, chemically indivisible ATOMS

2 ELEMENTS are kinds of matter that contain only a single kind of atom. All the atoms of an element have identical chemical properties.

3 COMPOUNDS are kinds of matter that are composed of atoms of two or more ELEMENTS which are combined in simple, whole number ratios.

Most importantly,

4 CHEMICAL REACTIONS are REARRANGEMENTS of atoms to form new compounds.

- Atoms are not gained or lost during a chemical reaction.

- Atoms do not change their identity during a chemical reaction.

- All the atoms that go into a chemical reaction must go out again!

Another look at chemical reactions

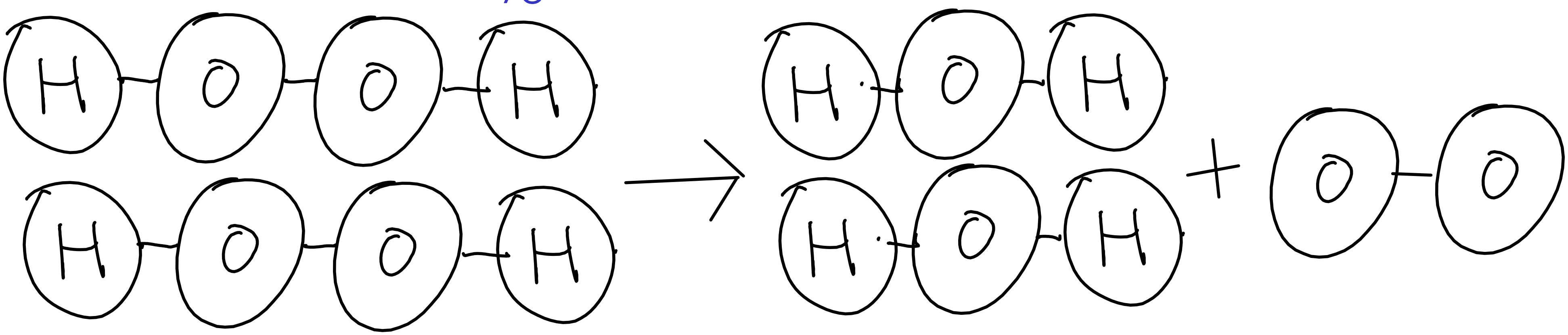
The decomposition of hydrogen peroxide over time (or when poured over a cut) works like this:

HYDROGEN PEROXIDE $\longrightarrow$ WATER + OXYGEN GAS

implying:... $H_2O_2 \longrightarrow H_2O + O_2$

... but wouldn't this mean that somehow an extra oxygen atom would form?

Not according to Dalton's theory. Dalton's theory would predict a different RATIO of water and oxygen would form:



$$\boxed{2H_2O_2 \longrightarrow 2H_2O + O_2}$$

- Dalton's theory sets LIMITS on what can be done with chemistry. For example:

1. Chemistry can't convert lead (an element) into gold (another element). Sorry, alchemists!

2. You can't have a compound form in a chemical reaction that contains an element that was not in your starting materials.

3. You can only make a certain amount of desired product from a fixed amount of starting material.