

Complete each of the following problems. For numerical problems, you must show your work in order to possibly earn full credit.

1. Identify the following as either *chemical* or *physical* changes or properties. (2 pts. ea.)

<u>chemical</u>	a. Vinegar and baking soda produce a gas when mixed.
<u>physical</u>	b. Water boils at 100°C.
<u>physical</u>	c. Chocolate melts if you leave it in the sun.
<u>chemical</u>	d. Cars rust after driving on salted roads.

2. Convert the following metric quantities. (4 pts. ea.)

a. 242 mm = ? km

$$242 \text{ mm} \times \frac{10^{-3} \text{ m}}{1 \text{ mm}} \times \frac{1 \text{ km}}{10^3 \text{ m}} = 242 \times 10^{-6} \text{ km} = 2.42 \times 10^{-4} \text{ km}$$

b. 0.00468 mg = ? µg

$$0.00468 \text{ mg} \times \frac{10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ µg}}{10^{-6} \text{ g}} = 0.00468 \times 10^3 \text{ µg} = 4.68 \text{ µg}$$

3. You conduct an experiment where 31 grams of phosphorous is reacted with oxygen until all of the phosphorous has been converted to a phosphorous oxide compound. In the experiment, 71 g of the compound is produced. From this information, what mass of oxygen is required to produce 13 grams of this product? (8 pts.)

The law of conservation of mass allows us to calculate the mass of oxygen that must have combined to form the product. If 71 g of product is produced by consuming 31 g of phosphorous and some mass of oxygen (O), then $(71 - 31 = 40)$ g of O must have been used. The law of definite proportions lets us assume that this ratio of 40 g O per 71 g compound must be constant. With this knowledge, we can calculate the mass of oxygen required:

$$13 \text{ g compound} \times \frac{40 \text{ g oxygen}}{71 \text{ g compound}} = 7.3 \text{ g oxygen}$$

So, 7.3 grams of oxygen will be required to produce 13 grams of product.

Bonus: List one example of each of the following. There are many acceptable answers to each part. (2 points each)

a. a homogeneous mixture: _____

b. a heterogeneous mixture: _____