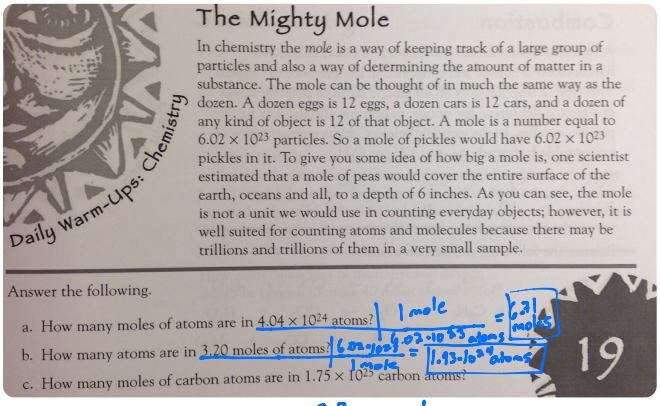
Warm-Up:



Daily Warm-Ups: Chemistry

The Mighty Mole

In chemistry the *mole* is a way of keeping track of a large group of particles and also a way of determining the amount of matter in a substance. The mole can be thought of in much the same way as the dozen. A dozen eggs is 12 eggs, a dozen cars is 12 cars, and a dozen of any kind of object is 12 of that object. A mole is a number equal to 6.02×10^{23} particles. So a mole of pickles would have 6.02×10^{23} pickles in it. To give you some idea of how big a mole is, one scientist estimated that a mole of peas would cover the entire surface of the earth, oceans and all, to a depth of 6 inches. As you can see, the mole is not a unit we would use in counting everyday objects; however, it is well suited for counting atoms and molecules because there may be trillions and trillions of them in a very small sample.

Answer the following.

a. How many moles of atoms are in 4.04×10^{24} atoms? $\frac{4.04 \cdot 10^{24}\ \text{atoms}}{6.02 \cdot 10^{23}\ \text{atoms}} \times \frac{1\ \text{mole}}{1} = 6.71\ \text{moles}$

b. How many atoms are in 3.20 moles of atoms? $\frac{3.20\ \text{moles}}{1} \times \frac{6.02 \cdot 10^{23}\ \text{atoms}}{1\ \text{mole}} = 1.93 \cdot 10^{24}\ \text{atoms}$

c. How many moles of carbon atoms are in 1.75×10^{25} carbon atoms?

19

$$\frac{1.75 \cdot 10^{25}\ \text{atoms}}{6.02 \cdot 10^{23}} \times \frac{1\ \text{mole}}{1} = 29.1\ \text{moles}$$

1) What is the mass in grams of 75.5L of CO_2 at STP?

Volume → Moles → Mass → $C = 12$, $O = 2 \times 16$ → 44.0 g/mol

$$75.5\text{L} \times \frac{1\ \text{mole}}{22.4\text{L}} \times \frac{44\ \text{g}}{1\ \text{mole}} = 148.3\ \text{g}\ CO_2$$

2) How many molecules of CH_4 are there in 24.7g?

$C = 12.01$, $H = 1.01 \times 4$, 16.05

Mass → moles → molecules

$$24.7\text{g} \times \frac{1\ \text{mol}}{16.05\text{g}} \times \frac{6.02 \cdot 10^{23}}{1\ \text{mol}} = 9.26 \cdot 10^{23}\ \text{molecules}$$

3) How many atoms of iodine are in 12.75g of Calcium Iodide?

Ca^{2+} I^- CaI_2 → 3 atoms/molecule

40.08 $127 \times 2 = 294$ g/mol

Mass → Moles → molecules → atoms

$$12.75\text{g} \times \frac{1\ \text{mol}}{294\ \text{g}} \times \frac{6.02 \cdot 10^{23}}{1\ \text{mol}} \times \frac{3\ \text{atoms}}{1\ \text{molecule}} = 5.22 \cdot 10^{23}\ \text{atoms}$$