Bell Work, Nov 18 - 21, 2013

Molar Mass, Moles, Stoichiometry

Bell Work, Monday, Nov 18, 2013

1. Define atomic number.

The number of protons in an atom. This is always a whole number and is always smaller than the molar mass.

2. Define molar mass.

The molar mass is the mass in grams of 1 mole of a substance. This number is always larger than the atomic number & includes decimals.

3. Define a mole

A mole is a weighable amount of an element or compound.

One mole of any substance always contains the same numbers of molecules or atoms.

Thus the mole is used "to count by weighing."

4. How many particles (atoms, molecules, ions) are equal to a mole? **6.022×10^{23} atoms, molecules, ions or anything**

Bell Work, Monday, Nov 18, 2013

5. **How much does a mole of elements weigh?**

   The weight of a mole of elements are equal to the molar mass of that element.

6. **Summarize what we know about a mole of elements.**

   A. **The mass of a mole of elements equals its molar mass**

   B. **A mole elements contains 6.022×10^{23} atoms of that element**

7. **Compare and contrast a dozen and a mole.**

   A dozen and a mole are both counting units.

   A dozen = 12 of anything

   A mole = 6.022×10^{23} of anything.

   Thus the molar mass in grams = 6.022×10^{23} of atoms or molecule which = 1 mole

Bell Work, Tuesday, Nov 19, 2013

1. The number carbon and oxygen atoms represented by the formula $Pb(C_2O_4)_2$ is ____ carbons and ____ oxygen atoms.

$(C_2O_4)_2 = 2(C_2O_4)$

$2(C_2O_4) = 2 \cdot C_2$ and $2 \cdot O_4$

$2 \cdot C_2 = 4$ atoms of carbon, $2 \cdot O_4 = 8$ atoms of oxygen

2. The molar mass of Na_2CO_3 is: 105.99 g

Molar mass of Na = 22.99 g

Molar mass of C = 12.01 g

Molar mass of O = 16.00 g

Molar mass of two Na's is 2 x 22.99 = 45.98 g

Molar mass of one C is 1 x 12.01 = 12.01 g

Molar mass of three O's is 3 x 16.0 = 48.00 g

105.99 g

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3. Which of the following is not true about one mole?

a. one mole contains 6.02×10^{23} particles

b. 12 g of carbon equals one mole of carbon atoms

c. the mass of 1 mole of carbon atoms = the mass of 1 mole of boron atoms

d. the number of atoms in 1 mole of carbon = the number of atoms in 1 mole of boron

4. Determine how many seconds it would take a computer to count a mole of things if the computer can 1.2×10^{13} calculations per second. Convert this figure into years.

$$6.0 \times 10^{23} \text{ things} \times \frac{1\ sec}{1.2 \times 10^{13} \text{ things}} = 5.0 \times 10^{10} \text{ sec}$$

$$5.0 \times 10^{10} \text{ sec} \times \frac{1\ hr}{3600\ sec} \times \frac{1\ day}{24\ hr} \times \frac{1\ yr}{365\ days} = 1600 \text{ yr}$$

Bell Work, Tuesday, Nov 19, 2013

5. State Avogadro's number of atoms or molecules.

6.022×10^{23} atoms or molecules

Note 6.022×10^{23} is known as Avogadro's number.

Bell Work, Wednesday, Nov 20, 2013

1. Use Avogadro's number to find how many atoms are there in 0.00150 moles Zn?

Avogadro's number = 6.022×10^{23}

1 mole of Zn = 6.022×10^{23} atoms of Zn

_____ x _____ = _____

(given) times factor = (answer)

$$1.50 \times 10^{-3} \text{ mol Zn} \times \frac{6.02 \times 10^{23} \text{ atoms Zn}}{1 \text{ mol Zn}} = 9.03 \times 10^{20} \text{ atoms}$$

Bell Work, Wednesday, Nov 20, 2013

2. What is the mass of 100 million atoms of gold? Could you mass this on a balance? **To little to weigh out.**

#of atoms → moles → Grams

Avogadro's number = 6.022×10^{23}

1 mole of Au = 6.022×10^{23} atoms of Au

1 mole of Au = 196.97 g

_____ **x** ——— **=** _____

(given) times factor = (answer)

_____ **x** ——— **=** _____

$$1.00 \times 10^{8} \text{ atoms Au} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \times \frac{197.0 \text{ g}}{1 \text{ mol}} = 3.27 \times 10^{-14} \text{ g Au}$$

Bell Work, Wednesday, Nov 20, 2013

3. **A 4.07 g sample of NaI contains how many atoms of Na?**

Grams → moles → # of atoms

Molar mass of Na = 22.99 grams, Molar mass of I = 126.9

Molar mass of NaI = 149.9, 1 mole of NaI = 149.9 g NaI

1 mole of NaI = 6.022×10^{23} atoms of NaI

1 mole of NaI = 1 mole Na (6.022×10^{23} molecules of NaI contains 6.022×10^{23} atoms Na)

$$4.07\ \text{g NaI} \times \frac{1\ \text{mol}}{149.9\ \text{g}} \times \frac{6.02 \times 10^{23}\ \text{form. units}}{1\ \text{mol}} \times \frac{1\ \text{atom Na}}{1\ \text{form. unit NaI}} = 1.63 \times 10^{22}\ \text{atoms Na}$$

Bell Work, Thursday, Nov 21, 2013

1. **The relative mass of an atom can be found by comparing the mass of the atom to the mass of**

a. one atom of carbon-12.
b. one atom of hydrogen-1.
c. a proton.
d. uranium-235.

2. A mole is the number equal to the number of carbon atoms **in exactly 12 g of pure carbon-12.**

3. The carbon-12 atom is assigned a relative mass of exactly

a. 1 g.
b. 6 g.
c. 12 g.
d. 100 g.