Assignment Chapter 3 Concept Explorations 3.17. Moles and Molar Mass

Part 1:

•a. How many nails would you have if you had 0.15 kg?

there are 500 nails per kg

Nails in.15kg = 500*0.15 = 75 nails

•b. If you had 12 dozen nails, what would be their mass?

mass of 500nails = 1 kg therefore mass of 1 nail = 1/500kg and mass of 12 nails = 12/500kg =0.024 kg

•c. What is the mass of one nail?

mass of 500nails = 1 kg therefore mass of 1 nail = 1/500kg = 0.002kg

•d. What is the mass of 2.3 moles of nails?

Solution

I mole of nail = 6.02*10^23 nails

2.3 mole of nails = 2.3*6.02*10^23 nails

Mass of 2.3 moles of nails = 2.3*6.02*10^23 *1/500 = 2.77 *10^21 kg

Part 2:

•a. If you had 0.15 kg of helium, how many helium atoms would you have?

Molar mass of helium = 4 g

That means 1 mole have 4 g

Or 4g have 1 mole of helium atoms

Or 1 g have ¼ mole of helium atoms

Or 0.15g have ¼(.15) = 0.375*6.02*10^23 =2.25*10^22 helium atoms

•b. If you had 12 dozen helium atoms, what would be their mass?

Mass of 6.02 *10^23 helium atoms = 4 g

Mass of 1 helium atom = $(4/6.02)*10^{-23}$

Mass of 12 helium atom = $(4/6.02)*10^{-23}$ *12 = $8*10^{-23}$ g

•c. What is the mass of one helium atom?

Mass of 6.02 *10^23 helium atoms = 4 g

Mass of 1 helium atom = $(4/6.02)*10^{-23}$

•d. What is the mass of 1.5 moles of helium atoms?

Mass of 1 mole(6.02 *10^23 helium atoms) = 4 g

Mass of 1.5 mole helium atom = $1.5(6.02)*10^{-23} = 9.03*10^{-23}$

Part 3:

Say there is a newly defined “package” called the binkle. One binkle is defined as being exactly 3 × 1012

•a. If you had 1.0 kg of nails and 1.0 kg of helium atoms, would you expect them to have the same number of binkles ? Using complete sentences, explain your answer.

Solution : No 1.0kg of nails and 1.0 kg of helium atoms will never have same number of binkles. A binkle is a fixed number of things different things have different mass so there are different number of binkles for same mass.

•b. If you had 3.5 binkles of nails and 3.5 binkles of helium atoms, which quantity would have more (count) and which would have more mass? Using complete sentences, explain your answers.

Solution : 3.5 binkles of nails and 3.5 binkles of helium atoms are same in numbers. Mass of one nail is greater than I helium atom so the 3.5 binkles of nails have more mass than 3.5 binkles of helium atoms.

•c. Which would contain more atoms, 3.5 g of helium or 3.5 g of lithium? Using complete sentences, explain your answer .

Solution : Mass of one nail is greater than the massof 1 helium atom so the 3.5g of nails have less mass than 3.5 g of helium atoms.

3.18. Moles Within Moles and Molar Mass

Part 1

•a. How many hydrogen and oxygen atoms are present in 5 molecules of H2O?

Molecules of h2o in 5 mole = 5*6.02*10^23 = 30.1 *10^23

No. of atoms of H = 2*30.1 *10^23 = 60.2*10^23

No. of atoms of O = 30.1 *10^23

•b. How many moles of hydrogen and oxygen atoms are present in 5 moles H2O?

In 5 mole of h2o there are 2*5 = 10 mole h atoms and 5 mole oxygen atoms

•c. What are the masses of hydrogen and oxygen in 5.0 mole H2O?

Mass of 10 mole H atoms = 1*10 = 10g and 5 mole oxygen atoms = 16*5 = 80g

•d. What is the mass of 1.0 mole H2O?

1*(2*1+16) = 18g which is molar mass of h2o

Part 2:

Two hypothetical ionic compounds are discovered with the chemical formulas XCl2 and YCl2, where X and Y represent symbols of the imaginary elements. Chemical analysis of the two compounds reveals that 0.25 mol XCl2 has a mass of 100.0 g and 0.50 mol YCl2has a mass of 125.0 g.

•a. What are the molar masses of XCl2 and YCl2?

0.25 mole of $XC1_2$ has a mass 100g

Or 1 mole of $XC1_2$ has a mass 100*4 =400g

0.50 mol YCl_2has a mass of 125.0 g.

Or 1 mole of $YC1_2$ has a mass 125*2 =250g

•b. If you had 1.0-mol samples of XCl2 and YCl2, how would the number of chloride ions compare?

1.0-mol samples of XCl2 and YCl2 will have same no of molecules of XCl2 and YCl2. There are same no. of chloride ions in both XCl2 and YCl2. So 1.0-mol samples of XCl2 and YCl2 will have same no of chloride ions

•c. If you had 1.0-mol samples of XCl2 and YCl2, how would the masses of elements X and Y compare?

1 mole of $XC1_2$ has a mass 100*4 =400g and 1 mole of $YC1_2$ has a mass 125*2 =250g

Mass of cl_2 is same for both samples so the ratio of mass of x/y = 400/250 =1.6

•d. What is the mass of chloride ions present in 1.0 mole XCl2 and 1.0 mole YCl2?

I mole of any of these two sample have 2 mole of cl ion. Molar mass of cl = 35.5g.

so mass of 2 mole of ci ion = 2*35.5 = 70 g for each sample.

•e. What are the molar masses of elements X and Y?

Molar mass of X = Molar mass of XCl2 – 2* molar mass of cl ion =400 – 70 = 330g

Molar mass of Y = Molar mass of YCl2 – 2* molar mass of cl ion =250 – 70 = 80g

•f. How many moles of X ions and chloride ions would be present in a 200.0-g sample of XCl2?

Molar mass of XCl2 = 400g. 200 g of XCl2 have ½ mole of Xcl2 or ½ mole of X and 1 mole of Cl ions.

•g. How many grams of Y ions would be present in a 250.0-g sample of YCl2?

Molar mass of YCl2 = 250g. 250 g of XCl2 have 1 mole of YCl2 or 1 mole of X and 2 mole of Cl ions.

•h. What would be the molar mass of the compound YBr3?

Molar mass of Y = Molar mass of YCl2 – 2* molar mass of cl ion =250 – 70 = 80g
Now molar mass of YBr3 = Molar mass of Y + 3* molar mass of Br = 80 + 3* 79.9 = 319.7
Part 3: A minute sample of AlCl3 is analyzed for chlorine. The analysis reveals that there are 24 chloride ions present in the sample. How many aluminum ions must be present in the sample?
There 1/3 Al ions for each Cl ion so There are 1/3*24 = 8 ions of Al for 24 ions of Cl
•a. What is the total mass of AlCl3 in this sample?
Total mass = 8*atomic mass of Al + 24*atomic mass of Cl = 1066.72 amu

•b. How many moles of AlCl3 are in this sample?
1 Mole of AlCl3 contains 6.02*10^23 molecule
Or 8 molecule of AlCl3 are contained in 1.328 *10^{-23} mole