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Www hschemsolutions com stoichiometry 3.3 mole to mole problems worksheet

Skills development explains the meaning of the word stochiometry. Determine mole ratios in chemical equations. Calculate the number of moles of any reacticant or product from a balanced equation, taking into account the number of moles of a retant or product. Calculate the mass of any reatan or product from a balanced equation, based on the mass of a reacticant or product. He learned that chemical equations provide information about the type of particles that react to products. Chemical equations also give us the relative number of particles and moles that respond to form products. In this section, you will examine the quantitative relationships between reatans and the quantity of products in a balanced equation. It's called stoichiometry. Stoichiometry is defined as calculating the amount of reacters or products in a chemical reaction using the relationships in the balanced chemical equation. The word stochiometria is actually Greek in two words: \(\sigma \tau \omicron \iota \kappa \eta \iota \omicron u\), which means element, and \(\mu \epsilon \tau \rho \omicron u), which means action. The mole, as you remember, is a quantitative measure that matches the particle count of Avogadro. How does that relate to the chemical equation? Look at the chemical equation below. The co-substances used, as we have learned, tell us the relative amount of each material in the equation. So for every 2 units of copper (II) sulphate (\(\ce{CuSO_4}\)) we need 4 units of potassium iodide (\(\ce{KI}\)). For every two dozen copper (II) sulphates, we need 4 dozen potassium iodide. Since the mole unit is also a counting unit, this equation can also be interpreted in moles: In each case of two copper (II) sulphates, we need 4 moles of potassium iodide. Look at the chemical equation below. This reaction can be interpreted in many ways. \[\ce{N_2O_3} + \ce{H_2O} \rightarrow 2 \ce{HNO_2}\] A nitrous trioxide molecule plus a water molecule produces two hydrogen nitrite molecules. One mole of nitrous trioxide and one moth water produces two moles of hydrogen nitrite. Example 7.6.1 For each of the following equations, enter the number of formula units or molecules and the number of moles present in the balanced equation. a) \(2 \ce{C_2H_6} + 7 \ce{O_2} \rightarrow 4 \ce{CO_2} + 6 \ce{H_2O}\) b) \(\ce{KBrO_3} + 6 \ce{KI} + 6 \ce{HBr} \rightarrow 7 \ce{KBr} + 3 \ce{H_2O}\) Solution: a) Two molecules \(\ce{C_2H_6}\) and seven molecules \(\ce{O_2}\) result in four molecules \(\ce{CO_2}\) and six \(\ce{H_2O}\) molecules. Two moles \(\ce{C_2H_6}\) plus seven moles \(\ce{O_2}\) four moles \(\ce{CO_2}\) and six moles \(\ce{H_2O}\). b) One molecule \(\ce{KBrO_3}\) plus six molecules \(\ce{KI}\) plus six molecules \(\ce{KBr}\) results in seven molecules, three molecules \(\ce{I_2}\) and three \(\ce{H_2O}\) molecules. One mole \(\ce{KBrO_3}\) plus six moles \(\ce{KI}\) plus six moles \(\ce{HBr}\) brings seven moles \(\ce{KBr}\) and three moles \(\ce{I_2}\) and three moles \(\ce{H_2O}\). In chemistry, we talk to each other using chemical equations, just as mathematicians talk to each other using mathematical equations. In chemistry, we also want to talk about quantities. With the help of stochiometry, it is possible to predict the amount of reacters as a product that can be used and produced in a chemical reaction. To do this, you need to work with balanced chemical equations. In an earlier section, we looked at mole relationships in balanced chemical equations. In this section, the mole is used as a conversion factor to calculate the moles of the product from a specific number of reaktans or from a specific number of moles. This is called mole mole calculation. Weight calculations are also carried out which allow you to determine the mass of the reactáns that you need to produce a given quantity of product or to calculate the weight of the product from a given reaktan mass. The mole ratio is the number of moles of substances in the reaction. For example, in the following reaction, coding is read as molecules (or formula units) and moles: \[2 \ce{H_2} \left(g \right) + \ce{O_2} \left(g \right) \rightarrow 2 \ce {H_2O} \left(l \right)\] 2 moles \(\ce{H_2}\) responds with a mole of 1 \(\ce{ce{O_2}\), to create 2 moles \(\ce{H_2O}\). Or an alternative method to represent this information about mole ratios. The following mole ratios can be obtained from this reaction: \[\frac{2 \: \text{mol} \: \ce{H_2}}{1 \: \text{mol} \: \ce{O_2 H_2} <3> <2>}} \: \text{or} \: \frac{1 \: \{mol} \: \ce{O_2}}{2 \: \text{mol}} \: \text{mol }} \: \ce{H_2}} \: \text{or} \: \frac{2 \: \text{mol} \: \ce{H_2O}}{2 \: \text{H_2O}}{\\ \text{H_2}} \: \text{or} \: \frac{2 \: \text{mol} \: \ce{H_2O}}{\1 : \text{mol} \: \ce{O_2}} \: \text{or} \: \frac{2 \: \text{mol} \: \ce{H_2}}{2 \: \text{mol} \: \ce{H_2O}} \: \text{or} \: \frac{1 \: \text{mol} \: \ce{O_2}}{2 \: \text{mol} \: \ce{H_2O}}\] Using the coding of a balanced reaction, you can compare any two substances in the reaction, regardless of whether whether they are reaktans or products. The correct mole ratio of reactans and products is determined by a balanced equation in a chemical equation. Therefore, the chemical equation must always be balanced before mole ratios are used for calculations. We have already learned the process through which chemists solve many mathematical problems, the factor-label method. The mole-mole ratio obtained from a balanced reaction in proportion to this process Example 7.6.2: only \(0.050 \: \text{mol}\) magnesium magnesium \(\ce{Mg(OH__2}\) is present, how many moles phosphoric acid, \(\ce{H_3PO_4}\), would the reaction be required? \[2 \ce{H_3PO_4} + 3 \ce{Mg(OH)_2} \rightarrow \Mg_3{PO_4_PO_4_2} + 6 \ce{H_2O}\] Solution: This issue should be configured using the same steps in size analysis. Given: \(0.050 \: \text{mol} \: \ce{Mg(OH)_2}\) Search: \(\text{mol} \: \ce{H_3PO_4}\) We need to compare the required ratio \(\text{mol} \: \ce{Mg(OH)_2}\) and \(\text{mol} \: \ce{H_3PO_4}\). This is the ratio obtained during a balanced reaction. Remember that there are other reacters and products in this reaction, but you do not need to use them to solve this problem. \[0.050 \: \cancel{\text{mol} \: \ce{Mg(OH)_2}} \cdot \frac{2 \: \text{mol} \: \ce{H_3PO_4}}{3 \: \cancel{\text{mol \: \ce{Mg(OH)_2}}} = 0.033 \: \text{mol} \: \ce{H_3PO_4}\] Notice if the equation is not balanced, \(\ce{H_3PO_4}\) would have been different. The reaction shall be balanced in each calculation in such a way that the reaction can be used. As you can see, mole ratios are useful for conversions between one substance and the number of moles of the other. The possibility of carrying out mass calculations makes it possible to determine the mass of the reactant (how many grams) it needs to produce a given quantity of product or to calculate the weight of the product, which it can obtain from a given reactant mass or from the mass of the reactant needed to react with a given quantity of other reactant. Just like when working on mole ratios, it's important to make sure that you have a balanced chemical equation before you start. These types of problems can be done with size analysis, also known as the factor-tag method. This is simply a method that uses conversion factors to convert from one unit to another. In this method, you can follow the deletion of units until the correct response. For example, chlorine gas \(15.0\: \text{g}\) is bubbled over liquid sulfur to produce disulfur dichloride. According to the balanced equation, how much sulpin is required in grams: \[\ce{Cl_2} \left(g \right) + 2 \ce{S} \left(l \right) \rightarrow \ce{S_2Cl_2}\] 1. Identify \(15.0 \: \text{g} \: \ce{Cl_2}\) 2. Identify him in the following school year:\(\text{g} \: \ce{S}\) 3. Then use the appropriate ratios, which allow you to break the unwanted units and get to the unit that you are calculating. \[15.0 \: \cancel{\text{g} \: \ce{Cl_2}} \times \frac{1 \: \cancel{\text{mol} \: \ce{Cl_2}{71.0 \: \cancel{\text{g} \: \ce{Cl_2}}} \times \frac{2 \: \{\text{mol} \: \ce{S}}{{{\: \cancel{\text{mol} \: \ce{Cl_2}}} \times \frac{32.1 \: \text{g} \: \ce{S}}{1 \: \cancel{\text{mol} \: \ce{S}}} = 13.6 \: \text{g} \: \ce{S}\] If you combine the proportion of moles with the previously known when we first learned that the mole, there are some we can use it to solve a wide variety of problems. The mole map is a tool that we can use to help us to know what proportions ratios problems. You use this map as if it were a timeline. First you need to know where you are on the map (for specific units) and where you want to go (to find units). The map then lets you know which roads (proportions) to get there. Let's see how this works with a couple of example problems. Example 7.6.3 Thermite reaction is a very exothermal reaction, which is liquid iron with the following balanced equation: \[\ce{Fe_2O_3] \left(s \right) + 2 \ce{Al} \left(s \right) \rightarrow 2 \ce{Fe} \left(l \right) + \ce{Al_2O_3} \left(s \right)\] If \(5.00 \: \text{g}\) iron is generated, how much iron (III) oxide was in the original tank? Solution: 1) Identify the specified: \(5.00 \: \text{g}\) iron. (Even though it's a product, this is still the measurement given to us the problem.) 2) Identify the search units: \(\text{g} \: \ce{Fe_2O_3}\) (Remember, weight is measured in grams.) 3) Proportions: Here comes the map. First, we are at \(5.00 \: \text{g} \: \ce{Fe}\). For this problem, A is \(\ce{Fe}\) on the map. We'll start at the gram. We want to know \(\text{g} \: \ce{Fe_2O_3}\). If this problem occurs, B is \(\ce{Fe_2O_3}\). We're headed for B grams. Our map says that this problem takes 3 ratios (3 paths \(\text{g}\) from A to \(\text{g}\) B): Molar mass A, mole-mole ratio from balanced reaction, and molar mass B. To solve our problem, the work will look like this: \[5.00 \: \cancel{\text{g} \: \ce{Fe}} \cdot \frac{1 \: \cancel{\text{mol} \: \ce{Fe}}}{55.85 \: \cancel{\text{g} \: \ce{Fe}}} \cdot \frac{1 \: \ce{Fe} even \: \ce{Fe_2O_3}{2 \: \cancel{\text{mol} \: \ce{Fe}}} \cdot \frac{159.7 \: \text{g} \: \ce{Fe_2O_3}}{1 \: \{\text{mol} \: \{Fe_2O_3}}} = 7.17 \ : \text{g} \: \ce{Fe_2O_3}\] The example of Ibuprofen 7.6.4 is a common painkiller used by many people around the world. The following formula (\\ce{C_{13}H_{18}O_2}\) is formula i. If Ibuprofen \(200.0 \: \text{g}\) is enough, how much carbon dioxide is produced? Balanced reaction: \[2 \ce{C_{13}H_{18}O_2} + 33 \: \ce{O_2} \rightarrow 26 \ce{CO_2} + 18 \ce{H_2O}\] Solution: Adva: \(200.200.200)\ \: \text{g} \: \ce{C_{13}H_{18}O_2}\) (\(\text{g}\) On the map) Search: \(\text{g} \: \ce{CO_2}\) (\(\text{g}\) B on the map: The map says, that the molar mass of \(\ce{C_{13}H_{18}O_2}\) should be used , then the co-orditary co-ordity of the balanced reaction, and then the molar mass of \(\ce{CO_2}\). \[200.0\: \cancel{\text{g} \: \ce{C_{13}H_{18}O_2}} \ce{C_{13}H_{18}O_2}} \cdot \frac{1 \: \cancel{\text{mol} \: \ce{C_{13}H_{18}O_2}}}{206.3 \: \cancel{\text{g \ \: \ce{C{13}H_{18}O_2}} \cdot \frac{26 \: \cancel{\text{mol} \: \ce{CO_2}}}{{2 \: \cancel{\text{mol} \: \ce{C_{13}H_{18}O_2}}} \cdot \frac{44.01 \ : \text{g} \: \ce{CO_2}}{1 \ : \cancel{\text{mol} \: \ce{CO_2}}} = 555 \: \text{g} \: \ce{CO_2}\] 7.6.5 Ha sulphuric acid sulphuric acid sodium cyanide, the deadly gas is produced hydrogen cyanide. How many sulphuric acids would have been placed in the tank to produce hydrogen cyanide\(12.5 \: \text{g}\)? Balanced reaction: \[2 \ce{NaCN} + \ce{H_2SO_4} \rightarrow \ce{Na_2SO_4} + 2 \ce{HCN}\] Solution: \(12.5 \: \text{g} \: \ce{HCN}\) (\\\ text{g }\) On the map) Search: \(\text{mol} \: \ce{H_2SO_4}\) (\(\text{mol}\) B on the map) Proportions: According to the mole map, we need the molar mass of \(\ce{HCN}\) and the co-ordnables of balanced reaction. \[12.5 \: \cancel{\text{g} \: \ce{HCN}} \ce{HCN}} \cdot \frac{1 \: \cancel{\text{mol} \\ce{HCN}{27.0\: H_2SO_4 \cancel{\text{g} \: \ce{HCN}}} \cdot \frac{1 \: \text{{\\ 2 \: \: \cancel{\text{mol} \: \ce{HCN}}} = 0.231 \: \text{mol} \: \ce{H_2SO_4}\] Example 7 6.6 How many carbonates would be released from the total dehydration of \(18.0 \: \text{g}\) sugar (\(\ce{C_5H_{12}O_6}\)) with sulphuric acid? Balanced reaction: \[\ce{C_6H_{12}O_6} + \ce{H_2SO_4} \rightarrow 6 \ce{C} + 7 \ce{H_2O} + \ce{SO_3}\] Solution: Adva \ (18 \: \text{g} \: \ce{C_6H_{12}O_6}\) Find: atoms \(\ce{C}\) Proportions: The mole map says that we need the molar mass of sugar, a balanced reaction, and finally Avogadro's number. \[18.0 \: \cancel{\text{g} \: \ce{C_6H_{12}O_6}} \c/C_6H_{12}O_6}} \cdot \frac{1 \: \cancel{\text{mol} \: \ce{C_6H_{12}O_6}}}{180 \: \cancel{\\180 \: \cancel{\text{g} \: \ce{C_6H_{12}O_6}}} \cdot \frac{6 \: \cancel{\text{mol} \: \ce{C}}}{1 \: \cancel{\text{mol} \: \ce{C_6H_{12}O_6}}} \cdot \frac{6.02 \times 10^{23} \: \text{atoms\: \ce{C}}{1 \: \cancel{\text{mol} \: \ce{C}}} = 3.6 \10^{23} \: \text{atoms} \: \ce{C}\] Lesson summary stochiometry is the calculation of the quantity of reactant or products in a chemical reaction using the relationships in the balanced chemical equation. Co-elements in a balanced chemical equation are the reaction ratios of the substances in the reaction. The coding of the balanced equation can be used to determine the ratio of moles of all substances in the reaction. Vocabulary Stichiometry: The calculation of quantitative relationships between reacters and products is a balanced chemical equation. Formula unit: An empirical formula for the ionic compound. Molon ratio: The ratio of moles of one reactan or product to the mole of another reaktane or product according to the co-ordnables of a balanced chemical equation. Additional reading/additional links to Stoichiometry: Contributors CK-12 Foundation Sharon Bewick, Richard Parsons, Therese Forsythe, Shonna Robinson, and Jean Dupon. Dupon, I don't know what to say.

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