Two step equations practice worksheet answers

Continue

In this article, you will learn about how to balance chemical equations easily with simple steps. Feel free to download our free worksheets with answers for your practice. Parts of a Balanced Chemical Equation Before you start balancing chemical equations, it is important that you become firmly acquainted with the various part of one. Every balanced chemical equation consists of two parts: the reactant side and the product side. Both of these sides are separated by the means of an arrow. On the left side of the arrow, you will find the reactant side. This side represents the elements which are used for initiating the experiment. On the right side of the arrow, we have the product side. This side is used to display the elements or compounds which are generated from the chemical process. The Need for Balancing Chemical Equations Ever since you started learning about the field of Chemistry, your teachers might often have stressed upon the importance of balancing chemical equations. But have you ever pondered on the reason behind this? Why do you need to respect the law of the conservation of mass? Quite simply, you need to balance your equations to follow the law of conservation of mass. Law of Conservation of Mass: According to the law of conservation of mass, the mass of products that are derived from a chemical equation should mandatorily equal the mass of the reactants. Minding the law of conservation of mass while balancing equations is quite important. Not only does it help you to prevent errors, but it also assists scientists in knowing the quantities of reactants to create a particular product that they want to make. Moreover, the law also helps chemical manufacturers to increase the efficiencies of their processes. When Should You Start To Balance A Chemical Equation? As soon as you derive a chemical equation stating the reactants and the products, check out if the number of atoms on either side are equal to each other or not. In the event that you detect the numbers to be uncommon, rest assured, you should start balancing the elements and compounds on either side of the chemical equation. How Should You Balance A Chemical Equation? The primary aspect that you need to keep in mind while balancing a chemical equation is this; the entire process is completely based on trial and error. When you start to balance a particular chemical equation, you will need to go through several processes before you stumble upon the right coefficients to balance the number of atoms. Another aspect that you need to remember is that balancing chemical equations requires a lot of practice. Once you perfect the practice of balancing, you can become completely reliant on your intuition to lead you through the complete process. While balancing your equations, you need to follow certain simple stems. Here's what you need to do: Start by counting the number of atoms, present for each element on the side of the reactants as well as the products. When you find out that certain elements are not balanced, place the required coefficient that is needed to balance the elements. Once you are done with this, check out if the number of atoms for the other elements is also equal on both the sides. Repeat the process until you find out that all the elements on both the sides of the chemical equations are balanced. As aforementioned, the process in itself is quite simple. However, it takes significant practice before can start to balance these equations completely with your intuition. An Easy Example To Get You Started With Now that you know the steps, you are wholly capable of balancing chemical equations. Let's solve some of them, shall we? With the help of above-mentioned steps and a practical example, you will be better able to understand how the entire process works. Do not feel anxious if you feel that you are still not ready to solve these problems. With our method, even your toddler sibling will be able to understand how chemical equations are balanced. And if still feel a tad bit confused after solving all these equations, try to solve a few more of such problems. Remember what we advised in a previous section: You will need significant practice before you can confidently start to balance these equations with your intuition. Let's start with this example. This equation represents a reaction between two Iron Oxide (Fe_2O_3) and Carbon (C). The products formed are Iron (Fe) and Carbon Dioxide (CO_2). $Fe_2O_3 + C \rightarrow Fe + CO_2$ Alright, so we have our equation. Let's begin to balance the equation with the help of the steps mentioned above. Step 1: Start by counting the number of atoms present, for each element on the side of the reactants as well as the products. $Fe_2O_3 + C \rightarrow Fe + CO_2$ On the reactants side, we have: 2 atoms of Fe 3 atoms of O 1 atom of C On the product side, we have: 1 atom of Fe 2 atoms of O 1 atom of C By comparing the number of atoms present for each element on each side, you might have determined that the reaction is obviously not balanced. Therefore, let's move on to Step 2. Step 2: When you find out that certain elements are not balanced, place the required coefficient that is needed to balance the elements. Let's start by balancing the oxygen atoms. To do this, make the oxygen atoms as six on either side of the chemical equation. $2Fe_2O_3 + C \rightarrow Fe + 3CO_2$ On towards the next step now. Step 3: Once you are done with this, check out if the number of atoms for the other elements is also equal on both the sides. Now that we have an equal number of oxygen atoms on either side of the equation, let's check out if the other elements of the equation are equal or not. $2Fe_2O_3 + C \rightarrow Fe + 3CO_2$ On the reactant side, we have: 4 atoms of Fe. 6 atoms of O. 1 atom of C. On the product side, we have: 1 atom of Fe. 6 atoms of O. 3 atoms of C. As you can see, the elements of iron and carbon are still not balanced. Therefore, it is time that we move on to the 4th step. Step 4: Repeat the process until you find out that all the elements on both the sides of the chemical equations are balanced. Alright, let's start balancing the equation again and this time, let's balance the number of iron atoms first. On the reactant side, we have 4 atoms of Fe while the product side has 1 atom of Fe. To balance them, we need to place 4 atoms of Fe on the product side. $2Fe_2O_3 + C \rightarrow 4Fe + 3CO_2$ Now, on the reactant side we have: 4 atoms of Fe. 6 atoms of O. 1 atom of C. And, on the product side, we have: 4 atoms of Fe. 6 atoms of O. 3 atoms of C. The only element that remains to be balanced now is carbon. This can be easily done considering the fact that carbon exists only in a singular form on the reactant side. In order to correct this, we need to place 3 atoms of carbon on the reactant side. The chemical reaction, hence, will turn out to be: $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ On the reactant side, we have: 4 atoms of Fe. 6 atoms of O. 3 atoms of C. And, on the product side, we have: 4 atoms of Fe. 6 atoms of O. 3 atoms of C. And there you go. Perfectly balanced as all things should be (Yes. We are Marvel fanboys as well). Essential Tips for Beginners As you become further acquainted with balancing chemical equations, it becomes quite easy for you to solve them. However, it still maintains a certain level of difficulty at the beginner level. As a result of this, you might find yourself shying away from the equations and procrastinating to the level where you get totally and utterly repulsed by them. However, there are certain tips that help you during such a stage. When you are beginner, you will be solving quite easy problems compared to those you might see in your Chemistry books. During such times, you will need to keep two essential tips in your mind. These tips will help you to easily balance the equations with ease. These tips are: Start Balancing With Single Elements – Attempt at balancing those elements first which occur in the form of a single molecule first. Owing to their single nature, they are easily flexible and their coefficient can be easily changed as and when needed in further steps. Balance the Hydrogen and Oxygen Molecules at the End – At the beginning, you will come across a lot of equations involving hydrogen and oxygen molecules. Whenever you encounter these, you should interact with these at the end. This is because hydrogen and oxygen molecules often occur together in both the reactant and product side. Once you are done with balancing other elements, focus on these. Format for Writing a Balanced Equation Now that you have balanced the assigned chemical reaction, you might be wondering if there is a format for writing these balanced chemical equations. In actuality, there is not said format that you need to mind for arranging the balanced equation. However, it has also been noticed that people in the field of chemistry often prefer to write solid elements and other compounds first, followed by the gaseous elements and single elements. This often acts as an unwritten rule which is followed by a lot of people around the world. The Coefficients in a Balanced Chemical Equation Up until this point of balancing your chemical equations, you might have known about the various facets surrounding the chemical equation. But there is still one significant aspect of balancing which we haven't discussed: The role of coefficients while balancing equations. At some point or another, you might have certainly wondered how are these coefficients be used while balancing the equation. After all, we cannot magically create or destroy elements during a chemical reaction. The Law of Conservation of Mass prevents this. In actuality, these coefficients define the ratios. For the reactant side, the coefficients define the ratio in which the substances are being used. And for the product side, the coefficients define the ratio in which the substances are being produced. What a Balanced Chemical Equation Does Not Tell Us Balanced chemical equations are highly informative in nature. They divulge a lot of information which is implemented for deriving the desired results from the reactions. However, there are certain aspects which balanced chemical equations don't make you aware of just by solving the equations. The most prominent aspects amongst these are the subscripts used. Take, for example, the last chemical equation which we balanced. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ Now, if you notice, the element Fe has the subscript 2 beside itself, signifying the number of atoms. But if you notice on the product side, element lacks any subscript. This is quite similar to the oxygen element as well. On one hand, it has the subscript 3 while it has the subscript 2 on the other hand. In spite of all this, the total mass of the individual atoms present on both sides of the equation is equal to each other. This is due to the Law of Conservation of Mass which ensures that matter isn't created nor destroyed during a chemical reaction. This is also the reason why the total number of individual atoms are equal on both the reactant and product side. Rules for Balancing Chemical Equations By this point, you might have become nicely acquainted with balancing chemical equations on your own. Resulting, the rules associated with balancing chemical equations must also have become imprinted within your mind. It is with the help of such rules that you can easily balance the assigned chemical equations. However, it is equally important that you put these rules on paper and revise them once thoroughly. Here are a few of the most prominent rules, include: Keep The Placement of Reactants and Products in Mind – In every chemical equation, there are two parts to an equation. These parts are separated by an arrow. While writing down the chemical equation, take care to list all the reactants on the left-hand side of the arrow. Similarly, you should take care to list all the products on the right side of the arrow. Ensure That The Right Arrow Is Placed – In most cases, the reactants and the products are separated by a single-sided arrow. This signifies a reaction which is irreversible or is unchangeable after a certain stage. However, in certain situations, the reactions occur at equilibrium. This means that reaction at any forward rate results in a reverse reaction. In such situations, the arrow used is two-sided, i.e. facing towards the reactants and the products. Emphasize on The Law of Conservation of Mass – While balancing the equations, it is of a predominant nature that you keep applying the Law of Conservation of Mass. This is because matter can neither be produced nor destroyed. Keeping this law in mind greatly helps you while balancing equations. Whenever you find an element which has more or less number of molecules, you can easily place a coefficient to balance it. Start With Independent Elements – When you start to balance the equation, start by balancing the independent elements. These are the elements which appear in individually in the equation. If there is no such element or if these elements are already balanced, proceed with the elements that exist in conjunction with other elements. Once this particular element is balanced, you should proceed on to balance other elements until all the elements are balanced. Balanced Only With Coefficients – While balancing the chemical equations, balance them only by placing coefficients in front of them. By no means should you add subscripts because this will completely change the formula of the particular reactant or compound, causing a change in the entire meaning that the equation wants to render. Balancing Chemical Equations with Matrices Up until this point, you have been balancing chemical equations by the means of trial and error. The process was simple, you had to place a coefficient, check if the other elements were balanced or not, and repeat all the steps until you had all the elements balanced. However, it won't be long before you face even tougher balancing problems. And you will face innumerous problems while using the trial and error method for such tough equations. Therefore, on such occasions, you will need a more versatile method for solving the problems. Fortunately, there is one such methodology for solving chemical equations. This method involves a matrix which you can use to easily solve even the toughest of equations. Here are the steps that you should follow while solving chemical equations: Start by placing an alphabet which acts as a variable coefficient for your elements. Arrange all the elements in a column matrix format, as per the subscript values. Solve each of these matrices and generate the various equations. Individually equate all these equations and place the values generated into the other equations that you generated in Step 4. Assume a particular number for each of the values, such that, neither of the values that you derive appear in the form of a fraction and use this number to find out the values of the other coefficients. Finally, place these values into the initial chemical reaction to derive your balance equation. Let's use a simple example to understand this process. Take this chemical equation for instance: $NO + O_2 \rightarrow NO_2$ Now, this is quite a simple equation. In fact, you might have even figured out how to balance this equation. In spite of this, we will use a simple methodology to help you understand how the entire process works. Step 1: Start by placing an alphabet which acts as a variable coefficient for your elements You can use any alphabet as a variable coefficient. For our purpose, we will be using alphabets X, Y, and Z. We will be placing them in this order: $X NO + Y O_2 \rightarrow Z NO_2$ Step 2: Arrange all the elements in a column matrix format, as per the subscript values. You should always follow a format for arranging the elements in a column matrix format. First, start by counting the number of atoms present for every individual occurrence of each element. From our first equation, we can derive that: No. of N atoms = 1 + No. of N atoms = 0 → No. of N atoms = 1 No. of O atoms = 1 + No. of O atoms = 2 → No. of O atoms = 2 According to this format, we will separate the values of each of the elements according to the number of atoms present. Each of these positions will display a value depending on the number of those elements at that particular location. Hence, this is how we will display the values of the elements that are separated into the form of matrices: $X + Y \rightarrow Z$ Notice that value signifying the elements show that each of the elements acquires a particular row. In essence, the nitrogen element acquires the first row while oxygen acquires the second row. Step 3: Solve each of these matrices and generate the various equations Once you have the matrices, you need to solve them and generate the required equations for them. The equations that you generate, generally, depending on the number of elements present within the equation. In this case, we have two elements. Therefore, the equations that formed are: $X + Y0 = Z$ or $X = Z$ (Equation i) $X + 2Y = 2Z$ (Equation ii) Step 4: Individually equate all these equations and place the values generated into the other equations that you generated in Step 4. We have already generated the value of the coefficient X in Equation i. The value of X that we have generated is Z. Therefore, it is time that we focused on Equation ii. $X + 2Y = 2Z$ According to Equation i, $X = Z$. Therefore, Hence, $2Y = 2Z – Z$ $2Y = Z$ $Y = ½Z$ (Equation iii) Step 5: Assume a particular number for each of the values, such that, neither of the values that you derive appears in the form of a fraction and use this number to find out the values of the other coefficients. Once we have generated the final equations, it is time that we used them to generate the final values for our coefficients. In order to do this, we need to assume a particular value for each of the variable coefficients, such that the result does not turn out to be a fractional value. Let's start by assuming that the value of $Z = 1$. If $Z = 1$, then $Y = 1/2$ (according to the Equation iii). However, we don't want a fractional value as our result. Therefore, let's assume that $Z = 2$. Now that $Z = 2$, therefore $Y = 1$. Resultingly, the value of $X = 2$, since $X = Z$ (as per equation i). Step 6: Finally, place these values into the initial chemical reaction to derive your balance equation. The equation which we had at the beginning, was: $X NO + Y O_2 \rightarrow Z NO_2$ According to the results generated by, the value of the variable coefficients stand as per the following: $X = 2$ $Y = 1$ $Z = 2$ Let's place these values into the equation. Upon doing so, we get: $2NO + O_2 \rightarrow 2NO_2$ Therefore, on the reactant side, we have: 2 atoms of N 4 atoms of O And on the product side, we have: 2 atoms of N. 4 atoms of O. As there you have it again. A perfectly balanced chemical equation solved with the help of matrices. Balancing Chemical Equations with Odd Number of Atoms on Elements Another area wherein balancing becomes a tricky affair is during the presence of odd subscripts or atoms of an element. Let us take into consideration, this particular equation: $NH_3 + O_2 \rightarrow NO + H_2O$ The first thing that you will want to do in such cases is to balance those elements which are present in odd numbers on one side but are present in even numbers on the other side of the chemical equation. In this case, we have hydrogen following such a suit. Let us balance this out first. $2NH_3 + O_2 \rightarrow NO + 3H_2O$ Now, we need to balance nitrogen to equate the reaction. $2NH_3 + O_2 \rightarrow 2NO + 3H_2O$ At this point, all the elements present in our chemical equations are balanced… except for oxygen. Hence, you will need to find out a coefficient which can effectively help you to balance the oxygen molecule present on the left-hand side of the reaction. On the reactant side, we have 2 oxygen molecules while on the product side, we have 5 oxygen molecules. Therefore, we will need to find a number which, when multiplied by 2, gives us 5 as the answer. Let this number be x. Therefore, let us place this value into the equation. $2NH_3 + 5/2O_2 \rightarrow 2NO + 3H_2O$ Finally, we need to eliminate the fractional part of the equation. Let's do so by multiplying the entire chemical equation with 2. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ And there you have it. The equation becomes perfectly balanced. A Few Examples worth Mentioning Now that you have covered everything that is to be learned about the basics of balancing chemical equations, you should get yourself acquainted with certain worthwhile chemical equations. Chemical Reaction for Photosynthesis $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ Chemical Reaction for Cellular Respiration $C_6H_{12}O_6 + 6O_2 \rightarrow CO_2 + H_2O + ATP$ Chemical Reaction for Ammonium Nitrate and Water $NH_4NO_3 + Water \rightarrow NH_4 + NO_3$ Chemical Reaction for Magnesium and Hydrochloric Acid $Mg + HCl \rightarrow MgCl_2 + H_2$ Chemical Reaction for Lithium and Water $2 Li + 2H_2O \rightarrow 2 LiOH + H_2$ Chemical Reaction for Calcium Carbonate and Hydrochloric Acid $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O$ Using Games and Apps to Learn About Balancing Chemical Equations It has not escaped our sights that a technologically-savvy world such as ours often uses technological means to better understand any newer concepts that they come across. Keeping this factor in mind, we have brought for you two of the greatest means by which you can enhance your skills at balancing chemical equations while simultaneously enjoying it via your smartphones of computers. Here are the means: Balancing Chemical Equations – We often encounter situations in which, whatever we do, we fail to solve the equation that has presented itself to us. And let's be honest, all of us have been there at some point in our lives. It is in such situations that you might find the need for additional help. And this is exactly what Balancing Chemical Equations aims to do. With the help of this application, you will be easily able to balance the toughest of chemical equations. All that you need to do is to enter the unbalanced reactants and products and by clicking a button, the app displays the balanced chemical equation. You can find the Balancing Chemical Equations application on Google Play for free. Here's a link for the same. 2. The Balancing Equations Game from PHET – Now, an application can only go so far as to keep you engaged. But this is completely contrary to what games can do at keeping you engaged. One of the most engaging games comes from PHET. At their website, you will find the Balancing Equations Game. Upon choosing the option, you are redirected towards a screen for choosing the difficulty of the game. This game is quite interesting. Having tried it out ourselves, we can assure you that not only is it engaging and entertaining, but it is quite informative as well. Therefore, it is one game that you should play if you want to get better at balancing chemical equations and get entertained for a while. Here's a link to their website.