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Enter an equation of a chemical reaction and click 'Balance'. The answer will appear below Always use the upper case for the first character in the element name and the lower case for the second character. Examples: Fe, Au, Co, Br, C, O, N, F. Compare: Co - cobalt and CO - carbon monoxide To enter an electron into a chemical equation use {-} or e To enter an ion, specify charge after the compound in curly brackets: {+3} or {3+} or {3}. Example: Fe{3+} + I{-} = Fe{2+} + I2 Substitute immutable groups in chemical compounds to avoid ambiguity. For instance equation C6H5C2H5 + O2 = C6H5OH + CO2 + H2O will not be balanced, but PhC2H5 + O2 = PhOH + CO2 + H2O will Compound states [like (s) (aq) or (g)] are not required. If you do not know what products are, enter reagents only and click 'Balance'. In many cases a complete equation will be suggested. Reaction stoichiometry could be computed for a balanced equation. Enter either the number of moles or weight for one of the compounds to compute the rest. Limiting reagent can be computed for a balanced equation by entering the number of moles or weight for all reagents. The limiting reagent row will be highlighted in pink. A chemical equation represents a chemical reaction. It shows the reactants (substances that start a reaction) and products (substances formed by the reaction). For example, in the reaction of hydrogen (H_2) with oxygen (O_2) to form water (H_2O), the chemical equation is:However, this equation isn't balanced because the number of atoms for each element is not the same on both sides of the equation. A balanced equation obeys the Law of Conservation of Mass, which states that matter is neither created nor destroyed in a chemical reaction.Balancing with inspection or trial and error method This is the most straightforward method. It involves looking at the equation and adjusting the coefficients to get the same number of each type of atom on both sides of the equation. Best for: Simple equations with a small number of atoms. Process: Start with the most complex molecule or the one with the most elements, and adjust the coefficients of the reactants and products until the equation is balanced. Example:H2 + O2 = H2OCount the number of H and O atoms on both sides. There are 2 H atoms on the left and 2 H atom on the right. There are 2 O atoms on the left and 1 O atom on the right.Balance the oxygen atoms by placing a coefficient of 2 in front of H2O: Now, there are 4 H atoms on the right side, so we adjust the left side to match: Check the balance. Now, both sides have 4 H atoms and 2 O atoms. The equation is balanced.Balancing with algebraic method This method uses algebraic equations to find the correct coefficients. Each molecule's coefficient is represented by a variable (like x, y, z), and a series of equations are set up based on the number of each type of atom. Best for: Equations that are more complex and not easily balanced by inspection.Process: Assign variables to each coefficient, write equations for each element, and then solve the system of equations to find the values of the variables.Example: C2H6 + O2 = CO2 + H2OAssign variables to coefficients:a C2H6 + b O2 = c CO2 + d H2OWrite down equations based on atom conservation:2 a = c6 a = 2 d2 b = 2c + dAssign one of the coefficients to 1 and solve the system.a = 1c = 2 a = 2d = 6 a / 2 = 3b = (2 c + d) / 2 = (2 * 2 + 3) / 2 = 3.5Adjust coefficient to make sure all of them are integers. b = 3.5 so we need to multiply all coefficient by 2 to arrive at the balanced equation with integer coefficients: 2 C2H6 + 7 O 2 = 4 CO2 + 6 H2OBalancing with oxidation number method Useful for redox reactions, this method involves balancing the equation based on the change in oxidation numbers. Best For: Redox reactions where electron transfer occurs. Process: identify the oxidation numbers, determine the changes in oxidation state, balance the atoms that change their oxidation state, and then balance the remaining atoms and charges. Example: Ca + P = Ca3P2 Assign oxidation numbers: Calcium (Ca) has an oxidation number of 0 in its elemental form. Phosphorus (P) also has an oxidation number of 0 in its elemental form. In Ca3P2, calcium has an oxidation number of +2, and phosphorus has an oxidation number of -3. Identify the changes in oxidation numbers: Calcium goes from 0 to +2, losing 2 electrons (oxidation). Phosphorus goes from 0 to -3, gaining 3 electrons (reduction). Balance the changes using electrons: Multiply the number of calcium atoms by 3 and the number of phosphorus atoms by 2. Write the balanced Equation:Balancing with ion-electron half-reaction methodThis method separates the reaction into two half-reactions – one for oxidation and one for reduction. Each half-reaction is balanced separately and then combined.Best for: complex redox reactions, especially in acidic or basic solutions.Process: split the reaction into two half-reactions, balance the atoms and charges in each half-reaction, and then combine the half-reactions, ensuring that electrons are balanced. Example: Cu + HNO3 = Cu(NO3)2 + NO2 + H2O Learn to balance chemical equations: Next: balancing chemical equations Practice what you learned: Practice balancing chemical equations Related chemical tools: Molar mass calculator pH solver C2H5OH + 3O2 → 2CO2 + 3H2Oethanol + oxygen → carbon dioxide + waterThis is the equation for complete combustion of ethanol in air. If there is a lack of oxygen, carbon monoxide (CO) may be formed instead of carbon dioxide (CO2). Further deprivation of oxygen will lead to unburned carbon residue (C), or soot. Alcohols react with oxygen in the air when ignited and undergo complete combustion to form carbon dioxide and wateralcohol + oxygen → carbon dioxide + waterComplete combustion of alcohols to produce carbon dioxide and waterLower alcohols burn with an almost invisible flame and make good fuelsEthanol can be produced sustainably as a fuel by the fermentation of sugarsHowever, the energy density (the amount of energy in kJ per kg of fuel) is lower than gasoline so cars that run on ethanol must either have a larger fuel tank or fill up more oftenBlending ethanol with gasoline or diesel increases the energy density and makes it safer in case of fires as it is easier to see the flames compared to pure ethanol burningHowever, the are socio-economic concerns about using large quantities of farm land to produce crops for fermentation, which could be better used for food productionBe careful when balancing equations for the combustion of alcohols, as students often forget to count the oxygen in the alcohol.Did this page help you? To help you plan your year 11 chemistry lesson on: Combustion of alcohols: planning, download all teaching resources for free and adapt to suit your pupils' needs.The starter quiz will activate and check your pupils' prior knowledge, with versions available both with and without answers in PDF format.We use learning cycles to break down learning into key concepts or ideas linked to the learning outcome. Each learning cycle features explanations with checks for understanding and practice tasks with feedback. All of this is found in our slide decks, ready for you to download and edit. The practice tasks are also available as printable worksheets and some lessons have additional materials with extra material you might need for teaching the lesson.The assessment exit quiz will test your pupils' understanding of the key learning points.Our video is a tool for planning, showing how other teachers might teach the lesson, offering helpful tips, modelled explanations and inspiration for your own delivery in the classroom. Plus, you can set it as homework or revision for pupils and keep their learning on track by sharing an online pupil version of this lesson.Explore more key stage 4 chemistry lessons from the Organic chemistry unit, dive into the full secondary chemistry curriculum, or learn more about lesson planning. The short answer for the problem is as follows: (a) The balanced thermochemical equation for the complete combustion of ethanol is: \(C_2H_5OH (l) + 3 O_2 (g) \rightarrow 3 H_2O (g) + 2 CO_2 (g) \quad \Delta H = -1,235 \, \text{kJ/mol}\) (b) The enthalpy diagram for this reaction shows that the reactants have higher energy levels than the products, with an arrow pointing downwards representing the heat released (\(\Delta H = -1,235 \, \text{kJ/mol} \)). The vertical axis is labeled as "Enthalpy (H)", and the diagram is titled "Enthalpy Diagram for the Combustion of Ethanol". 01 To begin, we need to identify the products of the combustion reaction. Combustion reactions involve reacting with oxygen (O2) to produce water (H2O) and carbon dioxide (CO2). The general equation for the complete combustion of ethanol, C2H5OH, can be written as: C2H5OH (l) + O2 (g) → H2O (g) + CO2 (g) Now, we balance the equation. The balanced equation is: C2H5OH (l) + 3 O2 (g) → 3 H2O (g) + 2 CO2 (g) 02 We are given the heat released per mole of ethanol during this reaction as -1,235 kJ/mol. We use the balanced equation from Step 1 and add the heat to write the thermochemical equation: C2H5OH (l) + 3 O2 (g) → 3 H2O (g) + 2 CO2 (g) ΔH = -1,235 kJ/mol 03 An enthalpy diagram is used to represent the change in heat during a reaction. The reactants are on the left, the products are on the right, and the difference in height represents the change in heat. Since heat is being released in this reaction (-1,235 kJ/mol), the products are at a lower energy level compared to the reactants. The enthalpy diagram for this reaction will look as follows: 1. Start by drawing two horizontal lines: one for the reactants and one for the products. Label the reactants line as "C2H5OH (l) + 3 O2 (g)" and the products line as "3 H2O (g) + 2 CO2 (g)". 2. Draw an arrow pointing downwards from the reactants line to the products line to represent the decrease in energy during the reaction. 3. Label the arrow with the heat value: ΔH = -1,235 kJ/mol. 4. Label the vertical axis as "Enthalpy (H)" 5. Label the diagram as "Enthalpy Diagram for the Combustion of Ethanol" The enthalpy diagram represents the exothermic nature of the combustion reaction, as heat is being released and the products have a lower enthalpy than the reactants. Unlock Step-by-Step Solutions & Ace Your Exams! Full Textbook Solutions Get detailed explanations and key concepts Unlimited Al creation Al flashcards, explanations, exams and more... Ads-free access To over 500 millions flashcards Money-back guarantee We refund you if you fail your exam. Over 30 million students worldwide already upgrade their learning with Vaia! These are the key concepts you need to understand to accurately answer the question. In chemistry, a thermochemical equation is a balanced chemical equation that includes the change in enthalpy (ΔH), which is the heat content of a system. It shows not only the quantity of substances involved in the reaction but also the heat exchange with surroundings. For the combustion of ethanol, the thermochemical equation is expressed as:C_2H_5OH (l) + 3 O_2 (g) → 3 H_2O (g) + 2 CO_2 (g) ΔH = -1235 kJ/molThis equation indicates that when 1 mole of ethanol completely combusts in excess oxygen, 1235 kJ of heat are released. The negative sign shows that this is an exothermic reaction, where energy is given out to the surrounding environment. Understanding thermochemical equations is crucial for students as it lays the foundation for exploring energy changes in chemical reactions. An enthalpy diagram visually represents the energy change during a chemical reaction. Energy is plotted on the vertical axis, while the reaction progress is along the horizontal axis. For the combustion of ethanol, the diagram highlights the energy levels of the reactants and products. Because the reaction is exothermic, the products rest at a lower energy level compared to the reactants.Here's a simplified guide to interpreting such a diagram:At the start, reactants have a higher stored energy.An arrow pointing downwards shows the release of energy.The length of the arrow correlates to the magnitude of energy change, here labeled as ΔH = -1235 kJ/mol.The finished diagram helps visualize the energy flow from reactants to products, reinforcing the concept that heat is being released.Utilizing enthalpy diagrams enhances a student's comprehension by providing a clear and concrete representation of abstract energy concepts in chemical processes. An exothermic reaction is a chemical reaction that releases energy through light or heat. The combustion of ethanol is a classic example, as it gives off heat when chemical bonds are formed in the products (water and carbon dioxide) that are more stable than the bonds in the reactants (ethanol and oxygen). This process can be remembered by the simple mantra: 'Exo' means 'exit,' thus energy exits the system.Recognizing an exothermic reaction in a thermochemical equation or an enthalpy diagram can be straightforward:Thermochemical equations will have a negative ΔH value.Enthalpy diagrams show a downward arrow as heat is emitted.For students, understanding exothermic reactions is fundamental as it relates to topics in thermodynamics and has practical applications in everyday life such as heating and combustion engines. A balanced chemical equation is pivotal in stoichiometry as it ensures that the Law of Conservation of Mass is satisfied, meaning that atoms are neither created nor destroyed in a chemical reaction. To balance the equation for the combustion of ethanol, consider all atoms involved:Count all the atoms of each element in the reactants and products.Adjust coefficients before each formula to achieve the same number of atoms on both sides.Verify that the total mass of the reactants equals the total mass of the products.After balancing, the resulting equation for the ethanol combustion is:C_2H_5OH (l) + 3 O_2 (g) → 3 H_2O (g) + 2 CO_2 (g)Here we have the perfect stoichiometric ratio indicating that for every one mole of ethanol, three moles of diatomic oxygen are required to form three moles of water and two moles of carbon dioxide. This balanced equation serves as a blueprint, offering insights into the quantities of reactants needed and products formed – a critical skill for students aiming to predict the outcome of chemical reactions. In a particular experiment, excess ethanol was combusted in limited oxygen to produce soot (solid carbon), carbon monoxide gas and water vapour. Write a balanced chemical equation to represent the incomplete combustion of ethanol in this experiment. Write the word equation for the incomplete combustion of methane: general equation: reactants → products general word equation: alcohol + oxygen gas → solid carbon + carbon monoxide + water vapour word equation for this reaction: ethanol + oxygen gas → solid carbon + carbon monoxide + water vapour Write the formula for each reactant and product in the word equation: Reactants Products ethanol : oxygen gas : C2H5OH(l)O2(g) solid carbon : carbon monoxide gas:water vapour : C(s)CO(g)H2O(g) Write the unbalanced chemical equation by substituting the formula for the name of each reactant and product in the word equation: word equation: ethanol + oxygen gas → solid carbon + carbon monoxide + water vapour unbalanced chemical equation: C2H5OH(l) + O2(g) → C(s) + CO(g) + H2O(g) Balance the chemical equation: unbalanced chemical equation : C2H5OH(l) + O2(g) → C(s) + CO(g) + H2O(g) No. C atoms : 2 = 1 + 1 =2 C atoms balanced Check to see if hydrogen atoms are balanced. C2H5OH(l) + O2(g) → C(s) + CO(g) + H2O(g) No. H atoms : 5+1 =6 ≠ 2 H atoms NOT balanced Need to multiply the number of water molecules by 3 to balance the hydrogen atoms. C2H5OH(l) + O2(g) → C(s) + CO(g) + 3H2O(g) No. H atoms : 5+1 =6 = 3x2 =6 H atoms balanced Check to see if oxygen atoms are balanced. C2H5OH(l) + O2(g) → C(s) + CO(g) + 3H2O(g) No. O atoms : 1 + 2 = 3 ≠ 1 + 3x1 =4 O atoms NOT balanced Need 1 more O atom on the left hand side of the equation. 1 atom of O is half an oxygen molecule (½O2) Add ½ to the number of O2 molecules on the left hand side, that is, 1 + ½ = 1½ or 3/2 C2H5OH(l) + 1½O2(g) → C(s) + CO(g) + 3H2O(g) No. O atoms : 1 + (1½x2=3) = 1 + 3x1 O atoms balanced The balanced chemical equation for the incomplete combustion of methane gas in this experiment is (1): C2H5OH(l) + 3/2O2(g) → C(s) + CO(g) + 3H2O(g) Do you understand this? Join AUS-e-TUTE! Take the test now!

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