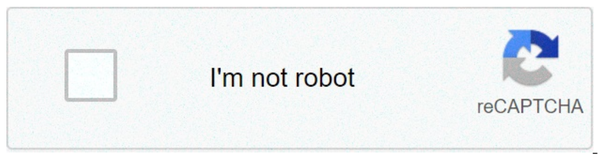

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Classifying balancing chemical reactions answers

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Chemical processes in industry rely heavily on the use of catalysts, which are usually added to a reaction mixture in trace amounts, and most biological reactions do not take place without a biological catalyst or enzymeCatalysts that occur naturally in living organisms and catalyze biological reactions.. Examples of catalyzed reactions in industry are the use of platinum in petroleum cracking and reforming, the reaction of SO2 and O2 in the presence of V2O5 to produce SO3 in the industrial synthesis of sulfuric acid, and the use of sulfuric acid in the synthesis of compounds such as ethyl acetate and procaine. Not only do catalysts greatly increase the rates of reactions, but in some cases such as in petroleum refining, they also control which products are formed. The acceleration of a reaction by a catalyst is called catalysisThe acceleration of a chemical reaction by a catalyst..Catalysts may be classified as either homogeneous or heterogeneous. A homogeneous catalystA catalyst that is uniformly dispersed throughout the reactant mixture to form a solution. is uniformly dispersed throughout the reactant mixture to form a solution. Sulfuric acid, for example, is a homogeneous catalyst used in the synthesis of esters such as procaine (Example 13). An ester has a structure similar to that of a carboxylic acid, in which the hydrogen atom attached to oxygen has been replaced by an R group. They are responsible for the fragrances of many fruits, flowers, and perfumes. Other examples of homogeneous catalysts are the enzymes that allow our bodies to function. In contrast, a heterogeneous catalystA catalyst that is in a different physical state than the reactants. is in a different physical state than the reactants. For economic reasons, most industrial processes use heterogeneous catalysts in the form of solids that are added to solutions of the reactants. Because such catalysts often contain expensive precious metals such as platinum or palladium, it makes sense to formulate them as solids that can be easily separated from the liquid or gaseous reactant-product mixture and recovered. Examples of heterogeneous catalysts are the iron oxides used in the industrial synthesis of ammonia and the catalytic converters found in virtually all modern automobiles, which contain precious metals like palladium and rhodium. Catalysis will be discussed in more detail in Chapter 14 "Chemical Kinetics" when we discuss reaction rates, but you will encounter the term frequently throughout the text. Chemical reactions may be classified as an acid–base reaction, an exchange reaction, a condensation reaction and its reverse, a cleavage reaction, and an oxidation–reduction (or redox) reaction. To keep track of electrons in chemical reactions, oxidation states are assigned to atoms in compounds. The oxidation state is the charge an atom would have if all its bonding electrons were transferred completely to the atom that has the greater attraction for electrons. In an oxidation–reduction reaction, one atom must lose electrons and another must gain electrons. Oxidation is the loss of electrons, and an element whose oxidation state increases is said to be oxidized. Reduction is the gain of electrons, and an element whose oxidation state decreases is said to be reduced. Oxidants are compounds that are capable of accepting electrons from other compounds, so they are reduced during an oxidation–reduction reaction. In contrast, reductants are compounds that are capable of donating electrons to other compounds, so they are oxidized during an oxidation–reduction reaction. A combustion reaction is a redox reaction in which the oxidant is O2(g). An amide bond is formed from the condensation reaction between a carboxylic acid and an amine; it is the essential structural unit of proteins and many polymers. A catalyst is a substance that increases the rate of a chemical reaction without undergoing a net chemical change itself. A biological catalyst is called an enzyme. Catalysis is an acceleration in the rate of a reaction caused by the presence of a substance that does not appear in the chemical equation. A homogeneous catalyst is uniformly dispersed in a solution of the reactants, whereas a heterogeneous catalyst is present as a different phase, usually a solid. What is a combustion reaction? How can it be distinguished from an exchange reaction? What two products are formed in the combustion of an organic compound containing only carbon, hydrogen, and oxygen? Is it possible to form only these two products from a reaction that is not a combustion reaction? Explain your answer. What factors determine whether a reaction can be classified as a redox reaction? Name three characteristics of a balanced redox reaction. Does an oxidant accept electrons or donate them? Does the oxidation state of a reductant become more positive or more negative during a redox reaction? Nitrogen, hydrogen, and ammonia are known to have existed on primordial earth, yet mixtures of nitrogen and hydrogen do not usually react to give ammonia. What natural phenomenon would have enough energy to initiate a reaction between these two primordial gases? Catalysts are not added to reactions in stoichiometric quantities. Why? State whether each of the following uses a homogeneous catalyst or a heterogeneous catalyst. Platinum metal is used in the catalytic converter of an automobile. Nitrogen is biologically converted to ammonia by an enzyme. Carbon monoxide and hydrogen combine to form methane and water with a nickel catalyst. A dissolved rhodium compound is used as a catalyst for the conversion of an alkene to an alkane. State whether each of the following uses a homogeneous catalyst or a heterogeneous catalyst. Pellets of ZSM-5, an aluminum- and silicon-containing mineral, are used to catalyze the conversion of methanol to gasoline. The conversion of glucose to a carboxylic acid occurs with catalysis by the enzyme glucose oxidase. Metallic rhodium is used to the conversion of carbon monoxide and water to carbon dioxide and hydrogen. Complete the following table to describe some key differences between homogeneous and heterogeneous catalysis. To increase the rate of a reaction, a scientist decided to use a catalyst. Unexpectedly, the scientist discovered that the catalyst decreased the yield of the desired product, rather than increasing it. What might have happened? Please be sure you are familiar with the topics discussed in Essential Skills 2 (Section 3.7 "Essential Skills 2") before proceeding to the Numerical Problems. Classify each chemical reaction according to the types listed in Table 3.1 "Basic Types of Chemical Reactions". 12FeCl2(s) + 3O2(g) → 8FeCl3(s) + 2Fe2O3(s) CaCl2(aq) + K2SO4(aq) → CaSO4(s) + 2KCl(aq) HCl(aq) + NaOH(aq) → NaCl(aq) + H2O(l) Br2(l) + C2H4(g) → BrCH2CH2Br(l) Classify each chemical reaction according to the types listed in Table 3.1 "Basic Types of Chemical Reactions". 4FeO(s) + O2(g) → 2Fe2O3(s) Ca3(PO4)2(s) + 3H2SO4(aq) → 3CaSO4(s) + 2H3PO4(aq) HNO3(aq) + KOH(aq) → KNO3(aq) + H2O(l) ethane(g) + oxygen(g) → carbon dioxide(g) + water(g) Assign oxidation states to the atoms in each compound or ion. (NH4)2S the phosphate ion [AlF6]3− CuS HCO3− NH4+ H2SO4 formic acid n-butanol Assign oxidation states to the atoms in each compound or ion. ClO2 HO2− sodium bicarbonate MnO2 PCl5 [Mg(H2O)6]2+ N2O4 butanoic acid methanol Balance this chemical equation: NaHCO3(aq) + H2SO4(aq) → Na2SO4(aq) + CO2(g) + H2O(l) What type of reaction is this? Justify your answer. Assign oxidation states to the atoms in each compound. iron(III) nitrate Al2O3 potassium sulfate Cr2O3 sodium perchlorate Cu2S hydrazine (N2H4) NO2 n-pentanol Assign oxidation states to the atoms in each compound. calcium carbonate NaCl CO2 potassium dichromate KMnO4 ferric oxide Cu(OH)2 Na2SO4 n-hexanol For each redox reaction, determine the identities of the oxidant, the reductant, the species oxidized, and the species reduced. H2(g) + I2(s) → 2HI(g) 2Na(s) + 2H2O(l) → 2NaOH(aq) + H2(g) 2F2(g) + 2NaOH(aq) → OF2(g) + 2NaF(aq) + H2O(l) For each redox reaction, determine the identities of the oxidant, the reductant, the species oxidized, and the species reduced. 2Na(s) + Cl2(g) → 2NaCl(s) SiCl4(l) + 2Mg(s) → 2MgCl2(s) + Si(s) 2H2O2(aq) → 2H2O(l) + O2(g) Balance each chemical equation. Then identify the oxidant, the reductant, the species oxidized, and the species reduced. (Δ indicates that the reaction requires heating.) H2O(g) + CO(g) → CO2(g) + H2(g) the reaction of aluminum oxide, carbon, and chlorine gas at 900ºC to produce aluminum chloride and carbon monoxide HgO(s) → Δ Hg(l) + O 2 (g) Balance each chemical equation. Then identify the oxidant, the reductant, the species oxidized, and the species reduced. (Δ indicates that the reaction requires heating.) the reaction of water and carbon at 800ºC to produce hydrogen and carbon monoxide Mn(s) + S8(s) + CaO(s) → CaS(s) + MnO(s) the reaction of ethylene and oxygen at elevated temperature in the presence of a silver catalyst to produce ethylene oxide ZnS(s) + H2SO4(aq) + O2(g) → ZnSO4(aq) + S8(s) + H2O(l) Silver is tarnished by hydrogen sulfide, an atmospheric contaminant, to form a thin layer of dark silver sulfide (Ag2S) along with hydrogen gas. Write a balanced chemical equation for this reaction. Which species has been oxidized and which has been reduced? Assuming 2.2 g of Ag has been converted to silver sulfide, construct a table showing the reaction in terms of the number of atoms in the reactants and products, the moles of reactants and products, the grams of reactants and products, and the molecules of reactants and products. The following reaction is used in the paper and pulp industry: Na2SO4(aq) + C(s) + NaOH(aq) → Na2CO3(aq) + Na2S(aq) + H2O(l) Balance the chemical equation. Identify the oxidant and the reductant. How much carbon is needed to convert 2.8 kg of sodium sulfate to sodium sulfide? If the yield of the reaction were only 78%, how many kilograms of sodium carbonate would be produced from 2.80 kg of sodium sulfate? If 240 g of carbon and 2.80 kg of sodium sulfate were used in the reaction, what would be the limiting reactant (assuming an excess of sodium hydroxide)? The reaction of A2 (blue) with B2 (yellow) is shown below. The initial reaction mixture is shown on the left and the mixture after the reaction has gone to completion is shown on the right. Write a balanced chemical equation for the reaction. Which is the limiting reactant in the initial reaction mixture? How many moles of the product AB4 could you obtain from a mixture of 0.020 mol A2 and 0.060 mol B2? The reaction of X4 (orange) with Y2 (black) is shown below. The initial reaction mixture is shown on the left and the mixture after the reaction has gone to completion is shown on the right. Write a balanced chemical equation for the reaction. Which is the limiting reactant in the initial reaction mixture? How many moles of the product XY3 could you obtain from a mixture of 0.100 mol X4 and 0.300 mol Y2? Methyl butyrate, an artificial apple flavor used in the food industry, is produced by the reaction of butanoic acid with methanol in the presence of an acid catalyst (H+): CH 3 CH 2 CH 2 COOH(l) + CH 3 OH(l) → H + CH 3 CH 2 CH 2 CO 2 CH 3 (l) + H 2 O(l) Given 7.8 g of butanoic acid, how many grams of methyl butyrate would be synthesized, assuming 100% yield? The reaction produced 5.5 g of methyl butyrate. What was the percent yield? Is the catalyst used in this reaction heterogeneous or homogeneous? In the presence of a platinum catalyst, hydrogen and bromine react at elevated temperatures (300°C) to form hydrogen bromide (heat is indicated by Δ): H 2 (g) + Br 2 (l) → Δ Pt 2HBr(g) Given the following, calculate the mass of hydrogen bromide produced: 8.23 × 1022 molecules of H2 6.1 × 103 mol of H2 1.3 × 105 g of H2 Is the catalyst used in this reaction heterogeneous or homogeneous? redox reaction exchange acid–base condensation S, −2; N, −3; H, +1 P, +5; O, −2 F, −1; Al, +3 S, −2; Cu, +2 H, +1; O, −2; C, +4 H, +1; N, −3 H, +1; O, −2; S, +6 H, +1, O, −2; C, +2 butanol: O,−2; H, +1 From left to right: C, −3–2–2–1 2NaHCO3(aq) + H2SO4(aq) → Na2SO4(aq) + 2CO2(g) + 2H2O(l) acid–base reaction Ca, +2; O, −2; C, +4 Na, +1; Cl, −1 O, −2; C, +4 K, +1; O, −2; Cr, +6 K, +1; O, −2; Mn, +7 O, −2; Fe, +3 O, −2; H, +1; Cu, +2 O, −2; S, +6 Hexanol O,−2; H, +1 From left to right: C: −3, −2, −2, −2, −1 Na is the reductant and is oxidized. Cl2 is the oxidant and is reduced. Mg is the reductant and is oxidized. Si is the oxidant and is reduced. H2O2 is both the oxidant and reductant. One molecule is oxidized, and one molecule is reduced. H2O(g) + C(s) →Δ H2(g) + CO(g) C is the reductant and is oxidized. H2O is the oxidant and is reduced. 8Mn(s) + S8(s) + 8CaO(s) → 8CaS(s) + 8MnO(s) Mn is the reductant and is oxidized. The S8 is the oxidant and is reduced. 2C2H4(g) + O2(g) →Δ 2C2H4O(g) Ethylene is the reductant and is oxidized. O2 is the oxidant and is reduced. 8ZnS(s) + 8H2SO4(aq) + 4O2(g) → 8ZnSO4(aq) + S8(s) + 8H2O(l) Sulfide in ZnS is the reductant and is oxidized. O2 is the oxidant and is reduced. Na2SO4 + 2C + 4NaOH → 2Na2CO3 + Na2S + 2H2O The sulfate ion is the oxidant, and the reductant is carbon. 470 g 3300 g carbon 22.1 g 9.9 × 105 g 1.0 × 107 g heterogeneous classifying and balancing chemical reactions worksheet answers. balancing chemical equations worksheet #2 classifying chemical reactions answers. writing balancing and classifying chemical reactions worksheet answers. classifying reactions and balancing chemical equations worksheet answers

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