Balancing redox reactions practice pdf

Determine the amount of oxidation of the elements in each of the following compounds: a. H2CO3 b. N2 c. (OH)42- d. NO2- e. LiH F. Fe3O4 Tip Identify the species oxidized and decreases in each of the following reactions: a. Cr' Sn4 Cr3 - Sn2 b. 3 Hg2 2 Fe (s) 3 Hg2 2 Fe3 c. 2 As (s) 3 Cl2 (g) 2 AsCl3 Hint Would You Use an Oxidant Agent or Reducing Agent to Make the Next Reactions Occur? a. ClO3- ClO2 b. SO42- C. Mn2 MnO2 d. yn'Cl2 Tip Write balance equations for the following redox reactions: a. NaBr - Cl2 NaCl - Br2 b. Fe2O3 - CO Fe - CO2 in Acid Solution C. CO - I2O5 CO2 - I2 in Basic Tip Tip Write Balanced Equations for the following reactions: Tip A. Cr(OH)3 - Br2 CrO42- Br- in base solution b. O2 - Sb H2O2 - SbO2 - in basic solution Tip c. HCOOH - MnO4- CO2 - Mn2 in sour solution d. ClO2- ClO2 - Cl- in sour solution Tip Write a balanced half of reactions NiO2 - 2 H2O - Fe Ni (OH)2 - Fe (OH)2 in base solution b. CO2 - 2 NH2OH CO and N2 - 3 H2O in base solution c. 2 NK - H2O2 - 2 Fe2 2 Fe3 - 2 H2O in sour solution d. H' - 2 H2O - 2 MnO4- 5 SO2 2 Mn2 - 5 HSO4 - in acid solution Hint Oxidation-Reduction or redox reactions occur when elements of chemical reaction acquire or lose electrons, causing an increase or decrease in the number of oxidation. The Half Equation method is used to balance these reactions. When a redox reaction, one or more elements are oxidized and one or more elements are reduced. Oxidation is the loss of electrons, while a decrease is an increase in electrons. An easy way to remember this is to think about charges: an item's charge decreases if it receives electrons (an acronym to remember the difference of LEO - Loss of electron oxidation reactions of redox usually occur in one of two environments: acidic or core. and one to cut. The equation is balanced by adjusting the coefficients and adding H2O, H and e- in this order: 1) The balance of atoms in the equation, except O and H. 2) To balance the oxygen atoms, add an appropriate amount of water molecules (H2O) to the other side. 3) To balance hydrogen atoms (including those added in step 2), add H. 4 ions) Fold the charges on each side. They should be equal by adding enough electrons (e-) to the more positive side. E- on each side should be equal; If they are not equal, they should multiply by the appropriate integers should be done the same. Semi equations are added together, undoing electrons to form one balanced equation. Cancel as much as possible. (If balanced in a basic solution, a solution, The amount of OH- must be added to turn the remaining H e into water molecules) The equation can now be tested to make sure it is balanced. Further, these steps will be shown in another example: Example I_2 (PageIndex1A): In acidic MnO_4 Aqueous Solution Problem : Oxidation: (I- rightarrow I_2)) This is half of oxidation, because the state of oxidation varies from -1 on the left side to 0 on the right side. This indicates an increase in electrons. Decrease: (MnO_4) is half the reduction, because the acidination varies from 7 euros on the left side to 2 on the right side. This indicates a reduction in electrons. 2) In order to balance this half of the reaction we must start by balancing all atoms except any hydrogen or oxygen atoms. Oxidation: (2I) - rightarrow I_2) In order to balance the oxidation of half the reaction you must first add 2 before I on the left side, so that an equal number of atoms on both sides. Decline: (MnO_4) To reduce half the reaction, you may notice that all atoms except hydrogen and oxygen are already balanced because there is one manganese atom on either side of the half reaction. 3) Balance oxygen atoms by adding H2O to the side of an equation that needs oxygen. After completing this step, add H' to the side of the equation, which lacks the H atoms needed for balance. Oxidation: (2 I - rightarrow I_2) Because in this half of the reaction there are no oxygen or hydrogen atoms, no balancing is required. Shortening: (MnO_4) rightarrow Mn 4 H_2O) The first step in balancing this reaction with step 3 is to add 4 H2O atoms to balance oxygen atoms with 4 on the other side of MnO4 - Decline: (MnO_4- - 8 H' (rightarrow Mn'2) - 4 H_2O) Now that oxygen atoms have been balanced, you can see that there are 8 H atoms on the right side of the equation and none on the left. So you have to add 8 H' atoms to the left side of the equation to make it balanced. 4) Now that the two halves of the reactions have been balanced correctly you need to balance the charges in each half of the reaction, so that both the reduction and oxidation of the half of the reaction consume the same number of electrons. Oxidation: (2 I' - rightarrow I_2 2e) Due to the fact that there are two I on the left side of the equation that charge -1 we can say that the left side has a total charge of -2. I on the left side of the equation has a total charge of 0. Therefore, to balance the charges of this reaction, we need to add 2 electrons to the right side of the equation so that both sides of the equation have equal charges of -2. Reduction: 5 equaliser - 8 MnO_4 - rightarrow Mn 4 H_2O) Looking at the left side of the equation, you may notice that there are 8 hydrogen atoms with a charge of 1. There is also an MnO4-ion that has a charge of -1. When we add these two charges up, we can calculate that the left side of the equation has a total charge of 7 pounds. The right side has an Mn atom with a charge of No. 2, followed by 4 water molecules that have charges of 0. Thus, the total charge on the right side is 2 euros. We have to add 5 electrons to the left side of the equation to make sure that both sides of the equation have equal charges of 2 euros. 5) Multiply both sides of both reactions into the least common multiples, allowing the semi-reaction to have the same number of electrons and undo each other. Oxidation: (10I- rightarrow 5I_2 10e-) We multiply this half of the reaction by 5 to come up with the next result above. Decline: (10e- - 16H) - 2MnO_4 - (rightarrow 2Mn) 8H_2O) We multiply the reduction of half of the reaction by 2 and come to the answer higher. Multiplying oxidation by half by 5, and cutting by half by 2 we can notice that both semi-etections have 10 electrons and are therefore able to undo each other. 6) Add two half reactions to get a common equation by undoing the electrons and any H2O and H ions that exist on both sides of the equation. In general: (10 I- - 16 XH 2 MnO_4 I_2) H_2O In this problem there is nothing that exists on both halves of the equation that can be abolished except electrons. Finally, double check your work to make sure the mass and charge are balanced. To double-check this equation, you may notice that everything is balanced because both sides of the equation have a total charge of 4 euros. Example: In the basic aqueous solution, the balancing procedure in the base solution is slightly different because OH ions should be used instead of H ions when balancing hydrogen atoms. To give an early response under basic conditions, 16 OH- ions can be added to both sides. On the left, OH- and H' ions will respond to forming water, which will be reversed with some of the H2O on the right. 10I- (aq) - 2MnO4- (aq) - 16H (aq) - 16OH- (aq) which will cancel with some of the H2O on the right: 10I- (aq) 2MnO4- (aq) 16H2O (l) Leaving eight on the reaction side: 10I- (aq) - 2MnO4- (aq) - 8H2O (l) ('rightarrow) 5I2 (s) - 2Mn2 (aq) - 16OH- (aq) This is a balanced reaction in the base solution. Example (PageIndex{2}) To balance the redox response, first take the equation and separate the two halves of the reaction equation specifically oxidize and contraction, and balance them. Balance the next one in a sour solution. (aq) (rightarrow SO4)2-2- (aq) (aq) (rightarrow SO4) (aq)) (right-hand) SO42- (aq) - oxidation, because the state of sulphur oxidation increases from 4 to 6 euros Decline: MnO4 (aq) ((rightarrow) Mn2 (aq) - Decrease, because the state of Mn oxidation decreases from 7 to 2 : Balance of each of the half equations in this order: Atoms other than H and O O O O atoms, adding H2Os with the correct H factor of atoms by adding H' with the correct ratio of sulphur atoms and Mn atoms are already balanced, Balancing The Oxidation of Atoms O: SO32- (aq) - H2O (l) (right- roar) SO4- (aq) Reduction: MnO4- (aq) (right-hand) Mn2 (aq) - 4H2O (l) Then balance H atoms on each side of oxidation : SO32- (aq) - 4H2O (l) (right) SO42- (aq) - 2H (aq) Decline: MnO4- (aq) SO32- (aq) - H2O (l) (right) SO4- (aq) - 2H (aq) - 2e- Reduction : MnO4- (aq) , but multiply the entire equation by the number of electrons in oxidation with the reduction of the equation, and the number of electrons in the contraction with the oxidation equation. Oxidation: SO32- (aq) - H2O (l) (right) SO4- (aq)) Mn2 (aq) - 4H2O (l) - x 2 General Reaction: Oxidation: 5 SO32- (aq) - 5H2O (l) - Decline: 2 MnO4- (aq)O4- (aq) - 16H (aq) 10e- (right) 5SO42- (aq) : Simplify and cancel similar conditions on both sides as 10e- and water. (aq) (aq) - 2 MnO4 (aq) Example{3}: Balance this reaction in both acidic and basic axal solutions (ce-MnO4 zgt;) - (aq) they are divided into semi-ducks: CeMnO4--(aq) - MnO2 (s) is a reduction in semi-decection, because the oxygen IS LOST) and ceSO3'2- (aq) - SO4, because oxygen GAINED) Now, to balance the oxygen atoms, we have to add two water molecules to the right side of the first equation and one water molecule on the left side of the second equation: (aq) - MnO2 (s) - 2H2O as well as those that are added in the last step), we have to add four ions of NZ to the left side of the first equation, and two Ionov H e to the right side of the second equation. (s) - MnO2 (s) - 2H2O (l) 2O (l) 2O (l) - SO3'2- (aq) - SO4'2- (aq) In the first equation the charge is 3 euros on the left and 0 on the right, so we have to add three electrons to the left side to make the charges the same. In the second equation, the charge is -2 on the left and 0 on the right, so we have to add two electrons to the right. Se3e- y 4H - (MnO4)-(aq) - MnO2 (s) (aq) --'gt; SO4'2''-'(aq) - 2H' - 2e'-onumber - Now we have to make electrons equal to each other, so we multiply each equation by an appropriate number to get a total of several (in this case, by 2 for the first equation and by 3 for the second). (s) -2 (3e-- 4H) - MnO4 (aq) - MnO2 (s) - 2H2O (l)) (H2O (l) - SO3'2- (aq) -'gt; SO4'2- (aq) 6e--- 8H '-2MnO4' - (aq) -'gt; 2MnO2 (s) l) 3SO3'2'-' (aq) -'gt; 3SO4'2-' (aq) We can cancel 6e- because they're on both sides. We can get rid of 6H 'on both sides as well by turning 8H' into the first equation to ... The same method gets rid of the se3H2O (l) at the bottom, leaving us with only one (s)H2O (l) on top. After all, the general reaction should not have electrons remaining. Now we can write one balanced equation: Ce2MnO4--(aq) To balance in the base environment, add in each way to neutralize water molecules in water molecules: (aq) - 2H2O - 3SO3-2-' (aq) -'gt; H2O (l) - 2MnO2 (s) (aq) - 2OH---onumber, and then cancel water molecules (ce)2MnO4 (aq) (aq) - 2MnO2 (s) - 3SO4'2-' (aq) - 2OH-onumber Equation is now balanced in the base environment. Example : (PageIndex{4})) Balance this reaction in a sour solution (FE(OH)3 (OCl'-' (rightarrow FeO4)2-2th Cl'-onumber (Decision Step 3 Reduction: OCl- (Right) Cl- Oxidation: Fe (OH)3 B) FeO42- Step 2/3: Decline: 2H' - OCl- 2e- (right) Cl- No H 2O Oxidation: Fe (OH)3 2e- (right) Cl- - H2O - x 3 - Fe (OH)3 (H2O) FeO42-2Fe (OH)3 2 H2O (right) 2FeO42- 6e- 10H' 6H' 3OCl- 2e- 2Fe (OH)3 (2 H2O) 3Cl- 3Cl- 3 H2O 6e- + 10H+ Step 5: Simplify: \[\ce{3OCl^{-} + 2Fe(OH)3 \rightarrow 3Cl^{-} + H2O + 2FeO4^{2-} + 4H^{+}}\] Example \(\PageIndex{5}\) Example 2: VO43- + Fe2+ \(\rightarrow\) VO2+ + Fe3+ in acidic solution Step 1: Oxidation: Fe2+ \(\rightarrow\) Fe3+ Reduction: VO43- \(\rightarrow\) VO2+ Step 2/3: Oxidation: Fe2+ \(\rightarrow\) Fe3+ + e- Reduction: 6H+ + VO43- + e- \(\rightarrow\) VO2+ + 3H2O Step 4: Overall Reaction: Fe2+ \(\rightarrow\) Fe3+ + e- + 6H+ + VO43- + e-\(\rightarrow\) VO2+ + 3H2O ______________________________ \[\ce{Fe^{2+} + 6H^{+} + VO4^{3-}} + \cancel{e^{-}} \ce{ \rightarrow Fe^{3+}} + \cancel{e^{-}} \ce{ + VO^{2+} + 3H2O}\] Step 5: Simplify: \[\ce{Fe^{2+} + 6H^{+} + VO4^{3-} \rightarrow Fe^{3+} + VO^{2+} + 3H2O}\] Balance the following equations in both acidic and basic environments: 1) Cr2O72-(aq) + C2H5OH(l) --> Cn3+(aq) + CO2(g) 2) Fe2+(aq) + MnO4-(aq) --> Fe3+(aq) + Mn2+(aq) Solutions : 1. (Кислотный ответ: 2Cr2O7-(aq) - 16H(aq) - C2H5OH (l) --> 4Cr3 (aq) (Основной ответ: 2Cr2O7-(aq) - 5H2O (l) - C2H5OH (l) --> 4Cr3 (aq) - 2CO2 (g) - 16OH-(aq)) 2. (Кислотный ответ: MnO4-(aq >) (Основной ответ: MnO4-(aq) - 5Fe2 (aq) - 4H2O (l) --> Mn2(aq) В реакции redox, также известной как реакция окисления-уменьшения, необходимо для окисления и уменьшения произойти одновременно. В окислительной половине реакции элемент приобретает электроны. Вид теряет электроны в сокращении половины реакции. Эти реакции могут происходить как в кислых, так и в базовых решениях. Ссылки Петруччи, Ральф, Уильям Харвуд, Джеффри Херринг, и Джеффри Мадура. Общая химия: Принципы и современные приложения. 9-е издание. 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