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Redox reaction example problems with answers

Learning goals learn to balance simple redox responses by testing. Learn to balance complex redox responses by half-response method. Use a dissolver, or parts of it, as a responder or product in a redox response balance. Balancing simple redox responses can be a simple matter of going back and forth between products and responders. For example, in the redox response of Na and Cl_2: $Na + Cl_2 \rightarrow$ nacl that should be immediately clear that Cl atoms are not balanced. We can fix this by putting a 2 coefficient against the product: $Na + Cl_2 \rightarrow 2\ NaCl$ however, now sodium is unbalanced. This can be fixed by including coefficient 2 against na responder: $2\ Na + Cl_2 \rightarrow 2\ NaCl$ This response is now balanced. It was quite simple; We say we're able to balance the response by testing. Many simple redox responses can be balanced by testing. Balance this redox response by testing. $So_2 + O_2 \rightarrow SO_3$ solution has one S atom on both sides of the equation, so the sulfur is balanced. However, the responsive side has four O atoms while the product side has three. Obviously we need more O atoms on the product side, So let's start by including coefficient 2 on SO_3: $SO_2 + O_2 \rightarrow 2\ SO_3$ it now gives us six O atoms on the product side, and it also doesn't balance the S atoms. We can balance the two elements by adding a 2 coefficient on the so_2 side reacting: $2\ SO_2 + O_2 \rightarrow 2\ SO_3$ it gives us two S atoms on both sides and a complete of six O atoms on both sides of the chemical equation. This Redux reaction is now balanced. Test yourself balancing this redox response by testing. $Al + O_2 \rightarrow Al_2O_3$ Answer $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$ The first thing you need to do when encountering a balanced redox response is try to balance it out by testing. Some redox responses are not easily balanced by testing. Consider the redox response: $Al + Ag^+ \rightarrow Al^{3+} + Ag$ At first glance, this equation looks balanced: there is one Ag atom on both sides and an atom to either side. However, if you look at the total charge on each side, there is a payment imbalance: on the responsive side there is a total charge of 1+, while on the product side there is a total charge of 3+. There's something wrong with this chemical equation; Despite the equal number of atoms on each side, it is unbalanced. A fundamental point about previously unsailed redox responses is that the total number of lost electrons must equal the total number of electrons a backed up to the redox response to be balanced. This is not the case for the aluminum and silver reaction: Al's atom loses three electrons to become Al^{3+} ion, while the Ag^+ ion gains only one electron to become a thorough silver. To balance this out, we will write down each oxidation and reduction response individually, and explicitly list the number of electrons in each. Individually, oxidation and reduction responses are called half reactions. Then we'll take multiples of each response up to the number Electrons on each side completely cancel and combine the half responses into an overall response, which must then be balanced. This method of balancing redox responses is called the half-response method. (There are other ways to balance redox responses, but this is the only one that will be used in this text. Half the oxidation response involves aluminum, which is being oxidized: $Al \rightarrow Al^{3+}$ This half response is not entirely balanced because the total charges on each side are not equal. When sealed to oxidized to Al^{3+}, it loses three electrons. We can write these electrons explicitly as products: $Al \rightarrow Al^{3+} + 3e^-$ now half this response is balanced - in terms of atoms and payloads. Half the reduction response involves money: Ag+ → Ag total charge is not balanced on both sides. But we can fix this by adding one electron to the reacting side because Ag+ Ion must get one electron to make a neutral Ag atom: Ag++e-→ Ag This half response is now also balanced. When combining the two semi-similar reactions into a balanced chemical equation, the key is that the total number of electrons must be turned off, so that the number of electrons lost by atoms equals the number of electrons accumulated by other atoms. This may require you to multiply the half of one or both responses by an inte inteber to make the number of electrons on each side equal. With three electrons as products and one as a reacter, the least common death of these two numbers is three: we can use one aluminum reaction but must take three times the silver reaction: Al → Al3+ + 3e- 3 × [Ag+ + e- → Ag] 3 on the second response is distributed to all species in response: Al → Al3+ + 3e- 3Ag+ + 3e- → 3Ag now two half responses can be combined just as two algebraic equations with the arrow serves as an equal sign. , the same species can be aborted on both sides of the arrow: Al + 3Ag++ 3e-→Al3++ 3Ag + 3e- A net balanced redox response is as follows: Al + 3Ag+ → Al3+ + 3Ag still has only one atom on each side of the chemical equation, but now there are three Ag atoms, and the total payment on each side of the equation is the same (3+ for both sides). This Redux reaction is balanced. It takes more effort to use the half-response method than by testing, but the correct redox balanced response has been achieved. Balances this redox response using the half-response method. Fe2+ Cr → Fe + Cr3+ solution We start by writing both semi-responses. Chromium is being oxidized and iron is being reduced: Cr → Cr3 + Oxidation Fe2 + → Fe Reduction so we include the appropriate number of electrons on the right side to balance the charges for each response: Cr → Cr3+ + 3e- Fe2+ + 2e- → Fe The first reaction involves three electrons, while the second reaction involves two electrons. The most common of these two numbers is six. To get six electrons per response we need to multiply the first response and triple the second response: 2 × [Cr → Cr3+ 3e]] = 2 Cr → 2 Cr3+ + 6e- 3 × [Fe2+ + 2e- → Fe] = 3 Fe2+ + 6e- → 3 We can combine the final two fe responses, Note that the electrons disable: 2 Cr + 3 Fe2++ 6e-→2 Cr3++ 3 Fe + 6e- which includes a balanced redox response is 2 Cr + 3 Fe2+ → 2 Cr3+ + 3 Fe Test Yourself Balance This response redox using Half response method., O2- + F2 → O2 + F- Answer 2 O2- + 2 F2 → O2 + 4 F- Many redox reactions occur in an impressive solution - in water. Because of this, in many cases H2O or a fraction of the H2O molecule (H+ or OH-, in particular) can participate in a redox response. As such, we need to learn how to incorporate the melt into a balanced redox equation. Consider the next oxidation reaction half in a crippling solution, which has one Cr atom on each side: Cr3 + → CrO4- Here, the Cr Atom goes from +3 to oxidation mode +7. To do this, Atom Cr must lose four electrons. Let's start by listing the four electrons as products: Cr3+ → CrO4, + 4e, but where do O atoms come from? They come from water molecules or a common fragment of a water molecule containing atom O: OH-ion. When we balance this half-response, we must feel free to include each of these species in response to the balance of fundamentals. Let us use H2O to balance the O atoms; We need to include four water molecules to balance the four O atoms in products: 4 H2O + Cr3+ → CrO4- + 4e- it balances the O atoms, but now presents hydrogen for response. We can balance the H atoms by adding H+ ion, which is another fragment of the water molecule. We need to add eight H+ ions alongside the product: 4 H2O + Cr3+ → CrO4- + 4e- + 8 H+ balanced Cr atoms, balanced O atoms, and balanced H atoms; If we check the total charge on both sides of the chemical equation, they are the same (3+, in this case). Half of this reaction is now balanced, using water molecules and parts of water molecules as reacters and products. Reduction responses can be similarly leveled. When oxidizing and reducing half of individually balanced responses, they can be combined in the same way as before: by taking multiples of each half response as needed to disable all electrons. Other species, such as H+, OH and H2O, may also be eliminated in the final balanced response. Unless otherwise noted, it doesn't matter if you add H2O or OH - as a source of O atoms, although a reaction may indicate an acidic solution or basic solution as a clue of which species to use or which species to avoid. Ions are not very common in acidic solutions, so they should be avoided under these circumstances. Balance the Redux response. Assume a basic solution. MnO2 + CrO3- → Mn + CrO4- Solution We start by separating oxidation and reduction processes so that we can balance each half response separately. The outer reaction is as follows: CrO3- → The Cr Atom switches from +5 to oxidation mode +7 and loses two electrons in the process. We add these two electrons alongside the product: CrO3- → CrO4- → + 2e- Now we must balance the O atoms. We can balance them by adding H+ as products: OH- + CrO3- → CrO4- + 2e- + H+ If we check the atoms and overall billing on both sides, we see that this response is balanced. However, if the response occurs in a basic solution, it is unlikely that H+ ions will be present in quantity. The way to address this is to add an additional OH ion to each side of the equation: OH- + CrO3- + OH- → CrO4- + 2e- + H+ OH- The two oh ions on the left can be grouped as -2OH. On the right, the H+ and OH yons can be grouped into the H2O molecule: 2 OH- + CrO3- → CrO4- + 2e- + H2O This is a more suitable form for a basic solution. Now we balance the reduction response: MnO2 → Mn Atom Mn goes from +4 to 0 in oxidation number, Which requires a space of four electrons: 4e- + MnO2 → Mn so we balance the O atoms and then the Atoms H: 4e- + MnO2 → Mn + 2 OH- 2 H + 4e- + MnO2 → Mn + 2 OH- we add two OH- ions per side to eliminate H+ ion in response; The reactive species combine to form two water molecules, and the number of OH ions in the product increases to four: 2 H2O + 4e- + MnO2 → Mn + 4 OH - this response is balanced into a basic solution. Now we combine the two half-balanced responses. The carbon reaction has two electrons, while the reduction response has four. The least common multiplier of these two numbers is four, so we multiply the pickle response by 2 so that the electrons are balanced: 2 × [2 OH- + CrO3- → CrO4- + 2e+ H2O] 2 H2O + 4e- + MnO2 → Mn + 4 OH- Combining these two equations result in the following equation: 4 OH- + 2 CrO3- + 2 H2O + 4e- + MnO2 → 2 CrO4- + 4e- + 2 H2O + Mn + 4 OH- The four electrons undone. So did the two H2O molecules and the four yins. What's left is 2 CrO3- + MnO2 → 2 CrO4- + Mn which is our final redox balanced response. Test yourself balancing this redox response. Assume a basic solution. CL- + MnO4- → MnO2 + ClO3- Answer H2O + Cl- + 2 MnO4→ 2 MnO2 + ClO3- + 2 OH- Redox Responses Takeaway Key can be balanced by testing or by half response method. Solvent may participate in redox responses; In psy similar solutions, H2O, H+, and OH may be responsive or products. Products.