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Name:_____

Redox Basics – Supplemental Worksheet KEY

1. Reactions that involve transfer of electrons are called redox or oxidation-reduction reactions.
2. A process in which electrons are lost is called oxidation.
3. A process in which electrons are gained is called reduction.
4. Loss of electrons cannot occur without gain of electrons and therefore, a reduction must take place at the same time as an oxidation.
5. When a substance undergoes a reduction, it causes the oxidation of another substance. Therefore, it is called oxidizing agent.
6. Oxidation numbers are used to keep track of electrons transfer. When a substance undergoes an oxidation its oxidation number increases.
7. The oxidation number of any free element such as H_2, Br_2, Na, Xe is zero.
8. The oxidation number of an element in a monatomic ion is the charge of the ion. Therefore, the oxidation number of the sodium ion, Na^+, is +1 while the oxidation number of the chloride ion, Cl^-, is -1.
9. The sum of the oxidation numbers in a compound is always zero.
10. In a polyatomic ion, the sum of the oxidation numbers of the atoms is equal to the charge of the ion.
11. When combined, oxygen is usually assigned an oxidation number of -2.
12. When combined, hydrogen is usually assigned an oxidation number of +1.
13. When combined, Grp IA elements have oxidation number of +1.
14. When combined, Grp IIA elements have oxidation number of +2.
15. When combined, Grp IIIA elements have oxidation number of +3.
16. When combined, fluorine has an oxidation number of -1.
17. In the phosphate ion, the oxidation number of phosphorous is +5.
    The sum of the oxidation numbers in PO_4^{3-}, a polyatomic ion, is -3, the charge of the ion. We assign -2 as the oxidation number of each O and x as the oxidation number of P and write the following equation: x + 4(-2) = -3…. x = +5.
18. In the dichromate ion, the oxidation number of chromium is +6.
    The sum of the oxidation numbers in $Cr_2O_7^{2-}$, a polyatomic ion, is -2, the charge of the ion. We assign -2 as the oxidation number for each oxygen, and x as the oxidation number of each chromium and write the following equation: 2x + 7(-2) = -2… x = +6.
19. In potassium sulfate, K_2SO_4, the oxidation numbers are: potassium +1 sulfur +6 and oxygen -2.
    The sum of the oxidation numbers in K_2SO_4 (a compound) is zero. We assign -2 as the oxidation number for each oxygen and +1 as the oxidation number of each potassium and x as the oxidation number of the sulfur and write: 2(+1) + x +4(-2) = 0…. x = +6
20. The oxidation numbers of nitrogen in N_2 is zero, in NH_4^+ is -3 and in NO_3^- is +5.
    N_2: free element… so the oxidation number is zero. NH_4^+: polyatomic ion. x + 4(-1) = +1… x = -3. NO_3^- : polyatomic ion x + 3(-2) = -1… x = +5.
21. Zinc, Zn, reacts with copper (II) ions, Cu^{2+}, to give Zn^{2+} and copper, Cu. Zn is being oxidized and Cu^{2+} is being reduced. The oxidizing agent is Cu^{2+} and the reducing agent is Zn.
    The oxidation number of Zn changes from 0 to +2. This indicates a loss of electrons (oxidation). The oxidation number of Cu^{2+} changes from +2 to zero. This indicates a

gain of electrons (reduction). The electrons lost by Zn cause the reduction of Cu^{2+}. Therefore, Zn is the reducing agent. Cu^{2+} is on the other hand is the oxidizing agent since it causes zinc to loose electrons or to get oxidized.

22. When $KClO_3$ is heated, it produces KCl as one of the products. In this process, the oxidation number of Cl changes from +5 to -1.
For $KClO_3$, potassium is +1 and O is -2. So, (+1) + x + 3(-2) = 0… x = +5 For KCl (potassium is +1). (+1) + x = 0… x = -1

23. Zinc displaces hydrogen from sulfuric acid, H_2SO_4, and the reaction produces hydrogen gas and zinc sulfate. In this process, hydrogen is being reduced and its oxidation number changes from +1 to zero. The reducing agent is Zn.
$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
The oxidation number of hydrogen changes from +1 to zero. This indicates a gain of electrons (a reduction). The electrons gained by hydrogen come from zinc. So, zinc causes the reduction of hydrogen and is therefore, the reducing agent.