$\qquad$ Date: $\qquad$
Chemistry ~ Ms. Hart
Class: Anions or
Cations

### 11.2 Redox Reactions

SPARK:

1. What is the oxidation state for oxygen? Explain, in terms of electrons, the reason why oxygen has that particular oxidation state.
2. What is the oxidation state of nitrogen in $\mathrm{Ba}\left(\mathrm{NO}_{3}\right)_{2}$ ?

## Oxidation States:

- Positive, negative, or neutral (o) values can be assigned to atoms.
- These numbers are known as $\qquad$ .
- Oxidation states identify how many electrons are either gained or lost by an atom or ion.

Quick Review and Practice

|  | Oxidation State | Atom or ion? | \# of electrons |
| :---: | :---: | :---: | :---: |
| $\mathbf{K}^{+1}$ |  |  |  |
| $\mathbf{K r}$ |  |  |  |
| $\mathrm{O}^{-2}$ |  |  |  |

Up until now, we have figured out the oxidation state by looking at the reference table. However, some elements have multiple oxidation states depending on the compound.

Example: Find the oxidation state of the elements in $\mathrm{K}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$.
*First ask yourself: Is this a compound or a polyatomic ion? WHY?
$\rightarrow$ This is a compound, so the total sum of the oxidation states must equal $o$.

| Element |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- |
| Subscript (how <br> many are there?) |  |  |  | Total |
| Oxidation State |  |  |  |  |
| Sum of oxidation <br> states |  |  |  |  |

What is REDOX?

LEO the lion goes GER

| What does it mean? |  |  |
| :---: | :--- | :--- |
| More positive or <br> more negative? |  |  |
| Example |  |  |

How do you identify a redox reaction?

1. Assign oxidation numbers to each atom
2. If both reduction and oxidation occurs, it is a redox reaction.

What?! Okay, here is an example.
Example 1:
$2 \mathrm{FeCl}_{2}+\mathrm{Cl}_{2} \rightarrow 2 \mathrm{FeCl}_{3}$
Step 1: Determine the oxidation state of each element on the product and reactant side.

| Product Side |  | Reactant Side |  |
| :---: | :---: | :---: | :---: |
| Element | Oxidation State | Element | Oxidation State |
|  |  |  |  |
|  |  |  |  |

Step 2: Ask the following questions-

1. Did any of the oxidation states change from the reactant side to the product side?
2. Which element was reduced? $\qquad$
3. Which element was oxidized? $\qquad$
4. So, is this a REDOX reaction? $\qquad$

## Helpful hints:

- If there is a free element on one side, but it is combined in a compound on another side it IS a redox reaction.

Example: $\quad \mathrm{Zn}+2 \mathrm{HCl} \rightarrow \mathrm{ZnCl}_{2}$

- If it is a double replacement reaction, it is NOT a redox reaction.

Example: $\quad \mathrm{Zn}(\mathrm{OH})_{2}+2 \mathrm{HCl} \rightarrow \mathrm{ZnCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}$

Try this:
Is this a redox reaction? Why or why not?

$$
2 \mathrm{Mg}+\mathrm{O}_{2} \rightarrow 2 \mathrm{MgO}
$$

Step 1: Determine the oxidation state of each element on the product and reactant side.

| Product Side |  | Reactant Side |  |
| :---: | :---: | :---: | :---: |
| Element | Oxidation State | Element | Oxidation State |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Step 2: Ask the following questions-

1. Did any of the oxidation states change from the reactant side to the product side?
2. Which element was reduced? $\qquad$
3. Which element was oxidized? $\qquad$
4. So, is this a REDOX reaction? $\qquad$
Classwork
Directions: determine whether or not the following reactions are REDOX reactions.
5. $\mathrm{Zn}+2 \mathrm{HCl} \rightarrow \mathrm{ZnCl}_{2}$
6. $2 \mathrm{HCl}+\mathrm{FeS} \rightarrow \mathrm{FeCl}_{2}$
7. $\mathrm{Cu}+2 \mathrm{Ag}^{+} \rightarrow \mathrm{Cu}^{2+}+2 \mathrm{Ag}$
8. $\mathrm{Zn}(\mathrm{OH})_{2}+2 \mathrm{HCl} \rightarrow \mathrm{ZnCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}$
9. $4 \mathrm{HCl}+\mathrm{MnO}_{2} \rightarrow \mathrm{MnCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}+\mathrm{Cl}_{2}$
10. $\mathrm{Zn}+\mathrm{Cu}^{2+} \rightarrow \mathrm{Zn}^{2+}+\mathrm{Cu}$
11. $\mathrm{MnO}_{2}+4 \mathrm{H}^{+}+2 \mathrm{Fe}^{2+} \rightarrow \mathrm{Mn}^{2+}+2 \mathrm{Fe}^{3+}+2 \mathrm{H}_{2} \mathrm{O}$
12. All redox reactions involve
(1) the gain of electrons only
(2) the loss of electrons only
(3) both the gain and the loss of electrons
(4) neither the gain nor the loss of electrons
13. A redox reaction is a reaction in which
(1) only reduction occurs
(2) only oxidation occurs
(3) reduction and oxidation occur at the same time
(4) reduction occurs first and then oxidation occurs

## MORE PRACTICE:

## BLAST FROM THE PAST

The table below shows mass and volume data for four samples of substances at 298 K and 1 atmosphere.
Masses and Volumes of Four Samples

| Sample | Mass $(\mathrm{g})$ | Volume $(\mathrm{mL})$ |
| :---: | :---: | :---: |
| A | 30. | 60. |
| B | 40. | 50. |
| C | 45 | 90. |
| D | 90. | 120. |

Which two samples could consist of the same substance?
(1) $A$ and $B$
(3) $B$ and $C$
(2) $A$ and $C$
(4) $C$ and $D$

Which electron configuration could represent a strontium atom in an excited state?
(1) 2-8-18-7-1
(3) 2-8-18-8-1
(2) $2-8-18-7-3$
(4) $2-8-18-8-2$

Which group on the Periodic Table of the Elements contains elements that react with oxygen to form compounds with the general formula $\mathrm{X}_{2} \mathrm{O}$ ?
(1) Group 1
(3) Group 14
(2) Group 2
(4) Group 18

An unsaturated solution is formed when 80. grams of a salt is dissolved in 100. grams of water at $40 .{ }^{\circ} \mathrm{C}$. This salt could be
(1) KCl
(3) NaCl
(2) $\mathrm{KNO}_{3}$
(4) $\mathrm{NaNO}_{3}$

37 Compared to an electron in the first electron shell of an atom, an electron in the third shell of the same atom has
(1) less mass
(3) more mass
(2) less energy
(4) more energy

