

Unit
11

Lesson
1

AIM

- What is redox?

AGENDA

- Intro to redox notes
- U11L1 video

YOYO

- Pull up the U11L1 (unit 11 lesson 1) video on YouTube

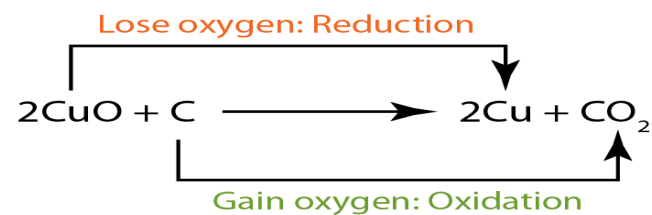
HOMEWORK

- Nothing tonight
- Follow the calendar

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Original Understanding of Redox

- The substance **gaining** oxygen is **oxidized**, while the substance **losing** oxygen is reduced.



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Reduction – Oxidation Reactions (REDOX)

- Reactions that involve the **transfer of electrons; both reduction and oxidation must happen simultaneously!**

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Reduction – Oxidation Reactions (REDOX)

- Reduction = **gain of electrons** by an atom or ion; **oxidation number goes down/reduces**
- Oxidation = **loss of electrons by an atom or ion;** **oxidation number goes up/increases**

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How to Remember Redox (mnemonics)

- LEO the lion says GER
 - Lose Electrons Oxidation
 - Gain Electrons Reduction
- OIL RIG
 - Oxidation Is Loss
 - Reduction is Gain



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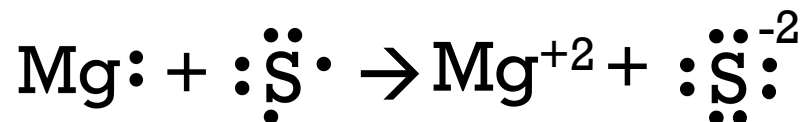
Conservation of Charge

- if one atom **loses** electrons, there must be another atom that will **gain electrons** to conserve charge.

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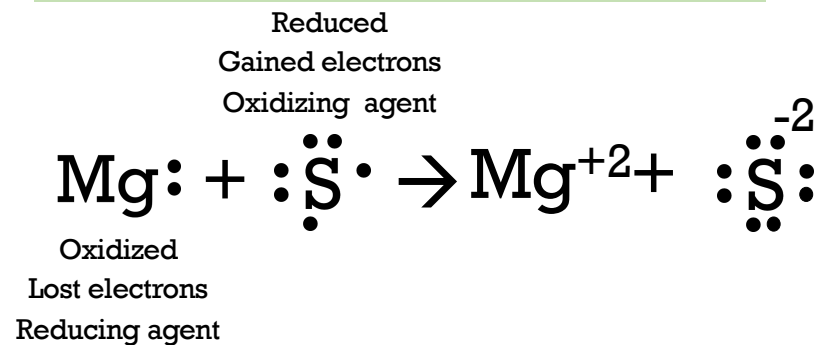
Redox Reactions that Form Ions

- The substance that **loses electrons** is called the **reducing agent**. (Substance that is **oxidized**)
- The substance that **gains electrons** is called the **oxidizing agent**. (Substance that is **reduced**)



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Redox Reactions that Form Ions: Example



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Identifying Oxidation Numbers

- one way that we can begin to **identify a redox reaction** is to identify the **oxidation #** from reactant to product side (for every element involved in the reaction).
- oxidation numbers are used to track the **movement of electrons** (electron transfer) from reactant to product side of reaction

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Oxidation Number (State)

- **positive, negative, or neutral (zero) values** that can be assigned to atoms
- used to identify how many electrons are being lost or gained by an atom/ion when they **form bonds**
- top listed # to the upper right is the most common oxidation number for that element

12.0111	-4
	+2
	+4
C	
6	
2-4	

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Tricks to Identifying Redox Reactions

- Trick 1: **single replacement reactions** are always REDOX!
- Example: **$\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$**

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Tricks to Identifying Redox Reactions

- Trick 2: **double replacement reactions** are NOT REDOX!
- Ex: **$\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$**
- *charges stay the same for all elements in this reaction

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A Reaction is Redox if...

- oxidation numbers change for 2 elements within a reaction
- reduction (ger) = **gain of electrons** by an atom or ion; **oxidation number** goes **down/reduces**
- oxidation (leo) = **loss of electrons** by an atom or ion; **oxidation number** goes **up/ increases**

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Rules for Assigning Oxidation Numbers Rule #1

- Elements that are free or uncombined will be assigned an oxidation charge of 0, this includes diatomic atoms
 - Ex. Cu: Oxidation number of Cu is 0
 - Ex. H₂: Oxidation number of H is the 0

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Rules for Assigning Oxidation Numbers Rule #2

- The oxidation number of a monoatomic ion = the charge of the monoatomic ion
 - Ex. S²⁻: Oxidation number is -2
 - Ex. Al³⁺: Oxidation number is +3

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Rules for Assigning Oxidation Numbers Rule #3

- Group 1 metals *in compounds* are always assigned an oxidation state of +1

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Rules for Assigning Oxidation Numbers Rule #4

- Group 2 metals *in compounds* are always assigned an oxidation state of +2

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Rules for Assigning Oxidation Numbers Rule #5

- Hydrogen (H) has two possible oxidation numbers
 - +1 when bonded to a nonmetal
 - -1 when bonded to a metal

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Rules for Assigning Oxidation Numbers Rule #6

- Oxygen in compounds are assigned an oxidation state of -2 except when it is a peroxide formula X_2O_2 (then its -1 which is rare)

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Rules for Assigning Oxidation Numbers Rule #7

- Fluorine in a compounds always has an oxidation state of -1

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Rules for Assigning Oxidation Numbers Rule #8

- The sum of the oxidation numbers of all atoms in a polyatomic ion = the charge on the polyatomic ion

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Rules for Assigning Oxidation Numbers Rule #9

- The sum of the oxidation numbers if all atoms (or ions) in a neutral compound is 0

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Assigning Oxidation Number Practice Part 1: Single Elements

- | | |
|---------------------------|---------------------------|
| 1. Al: _____ | 4. <u>Ar</u> : _____ |
| 2. Cu: _____ | 5. O ₂ : _____ |
| 3. H ₂ : _____ | 6. Zn: _____ |

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Assigning Oxidation Number Practice Part 1: Single Elements

- | | |
|-----------------------------|------------------------------|
| 7. Zn ⁺² : _____ | 10. Li ⁺¹ : _____ |
| 8. Cl ⁻¹ : _____ | 11. Te ⁻² : _____ |
| 9. Ca ⁺² : _____ | 12. Ag ⁺¹ : _____ |

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

1. Carbon dioxide (CO₂)

CO ₂	C	O	
Sub	1	1	
Ox #	+4	-2	
Total	+4	-4	

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

2. Calcium hydroxide (Ca(OH)₂)

Ca(OH) ₂	Ca	O	H	
Sub				
Ox #				
Total				

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

3. Water (H₂O)

H ₂ O	H	O	
Sub			
Ox #			
Total			

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

4. Magnesium phosphate (Mg₃(PO₄)₂)

Mg ₃ (PO ₄) ₂	Mg	P	O	
Sub				
Ox #				
Total				

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

5. Ammonium chloride (NH_4Cl)

NH_4Cl	N	H	Cl	
Sub				
Ox #				
Total				

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Assigning Oxidation Number Practice Part 2: Elements in Compounds

6. Carbonate ion (CO_3^{2-})

CO_3^{2-}	C	O	
Sub			
Ox #			
Total			

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Assigning Oxidation Number Practice Part 3: Regents Questions

1. What are the two oxidation states of nitrogen in NH_4NO_2 ?
- +3 and +5
 - +3 and -5
 - 3 and +3
 - 3 and -3

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Assigning Oxidation Number Practice Part 3: Regents Questions

2. What is the oxidation number of manganese in KMnO_4 ?
- +7
 - +2
 - +3
 - +4

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Assigning Oxidation Number Practice Part 3: Regents Questions

3. What is the oxidation state of nitrogen in the compound NH_4Br ?

- a. -1
- b. +2
- c. -3
- d. +4

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Assigning Oxidation Number Practice Part 3: Regents Questions

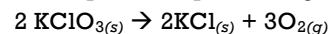
4. What is the oxidation number of sulfur in $\text{Na}_2\text{S}_2\text{O}_3$?

- a. -1
- b. +2
- c. +6
- d. +4

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Assigning Oxidation Number Practice Part 3: Regents Questions

5. Given the balanced equation representing a reaction:



The oxidation state of chlorine in this reaction changes from

- a. -1 to +1
- b. -1 to +5
- c. +1 to -1
- d. +5 to -1

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Assigning Oxidation Number Practice Part 3: Regents Questions

6. What is the oxidation number of chromium in the chromate ion, CrO_4^{2-} ?

- a. +6
- b. +2
- c. +3
- d. +8

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