

تم تحميل هذا الملف من موقع المناهج الإماراتية



شرح وحل الدرس الأول Reduction and Oxidation منهج انسابير

موقع المناهج ← المناهج الإماراتية ← الصف الثاني عشر المتقدم ← كيمياء ← الفصل الثاني ← حلول ← الملف

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المزيد من مادة
كيمياء:

إعداد: Mouad

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة كيمياء في الفصل الثاني

شرح وحل الدرس الرابع Neutralization منهج انسابير

1

شرح وحل الدرس الثالث pH and Ions Hydrogen منهج انسابير

2

شرح وحل الدرس الثاني Bases and acids of Strengths قوة الأحماض والقواعد منهج انسابير

3

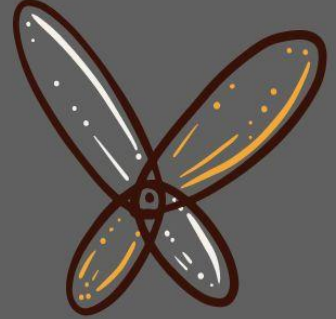
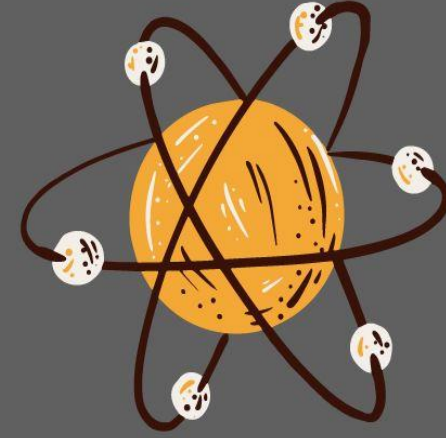
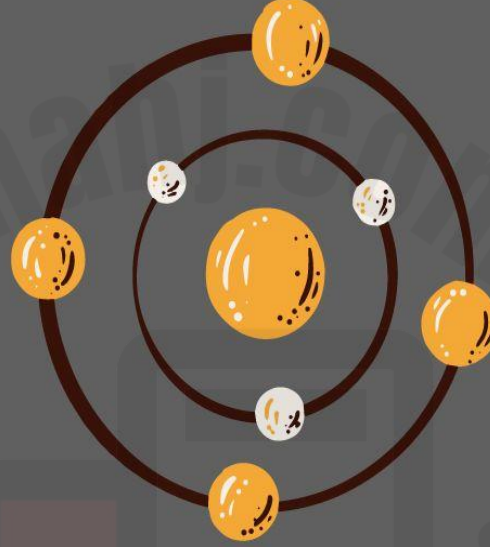
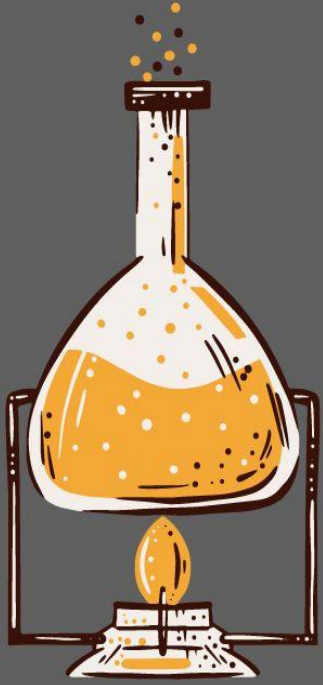
شرح وحل الدرس الأول Bases and Acids to Introduction مقدمة في الأحماض والقواعد منهج انسابير

4

حل مذكرة أسئلة امتحانات سابقة حول وحدة الأحماض والقواعد

5

CHEMISTRY



EasyChemistry4all by Mr. Mouad

مناهج دولة الإمارات

عام، متقدم ونخبة 9،10،11،12

00971557903129

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Inspire Chemistry

Module 18

“Redox Reactions”

Lesson 1: “Oxidation & Reduction”



Learning Outcomes

- ▶ **Describe** the processes of oxidation and reduction.
- ▶ **Identify** oxidizing and reducing agents.
- ▶ **Determine** the oxidation number of an element in a compound.
- ▶ **Interpret** redox reactions in terms of change in oxidation state.



Chemistry



Part 1

Learning objectives:

Define oxidation-reduction reactions.

Explain the use of oxidation number in redox reactions.

Differentiate between oxidizing and reducing agents.



Teacher: Mr. Mouad Azz

Build to the Guiding Questions

- What are oxidation and reduction?
الإختزال الأوكسدة
- How can oxidizing and reducing agents be identified?
عامد عامل أوكسدة
- How is the oxidation number of an element in a compound determined?



New Vocabulary

 oxidation-reduction reaction

 redox reaction

 oxidation

 reduction

 oxidation number

 oxidizing agent

 reducing agent



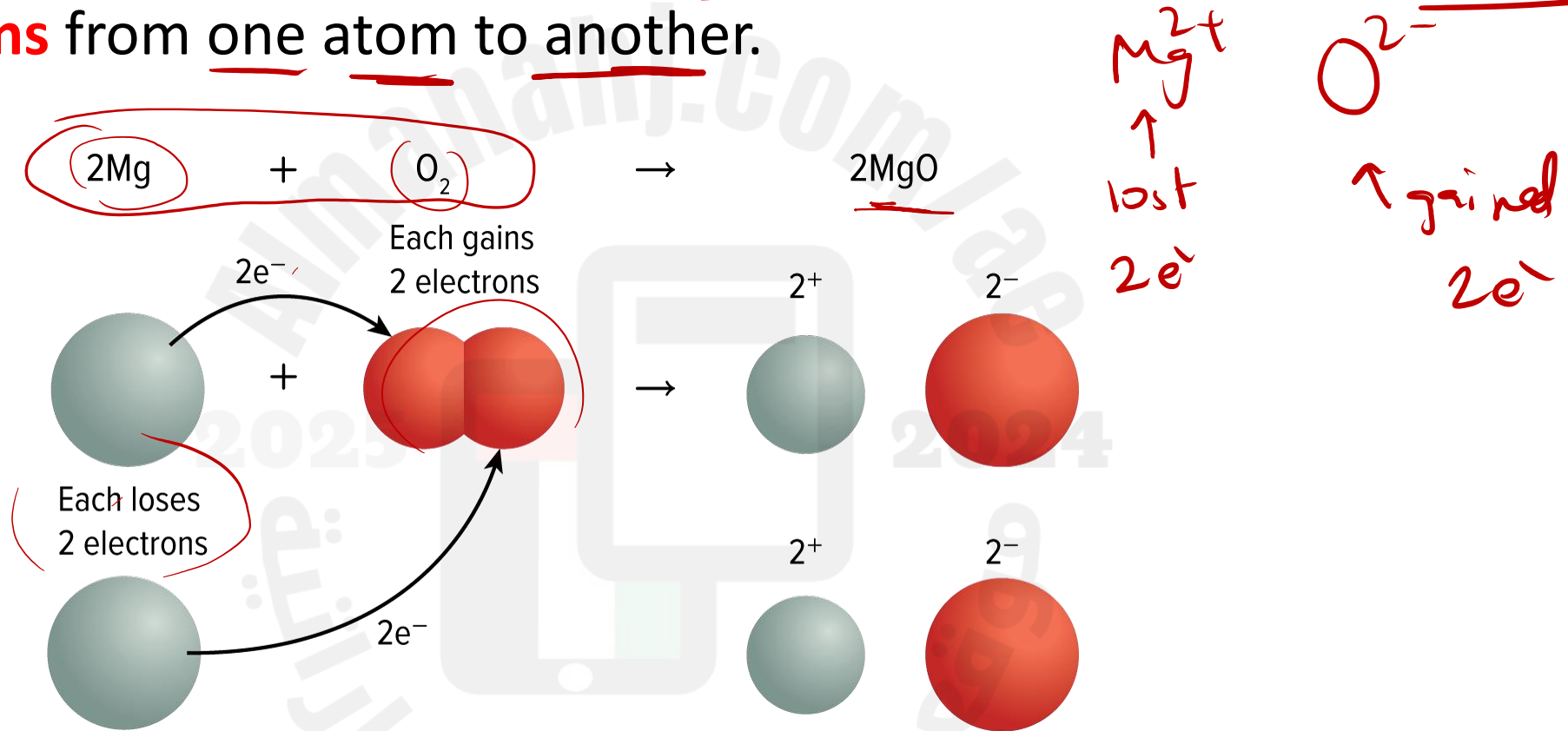
Review Vocabulary

spectator ion: an ion that does not participate in a reaction and is not usually shown in an ionic equation

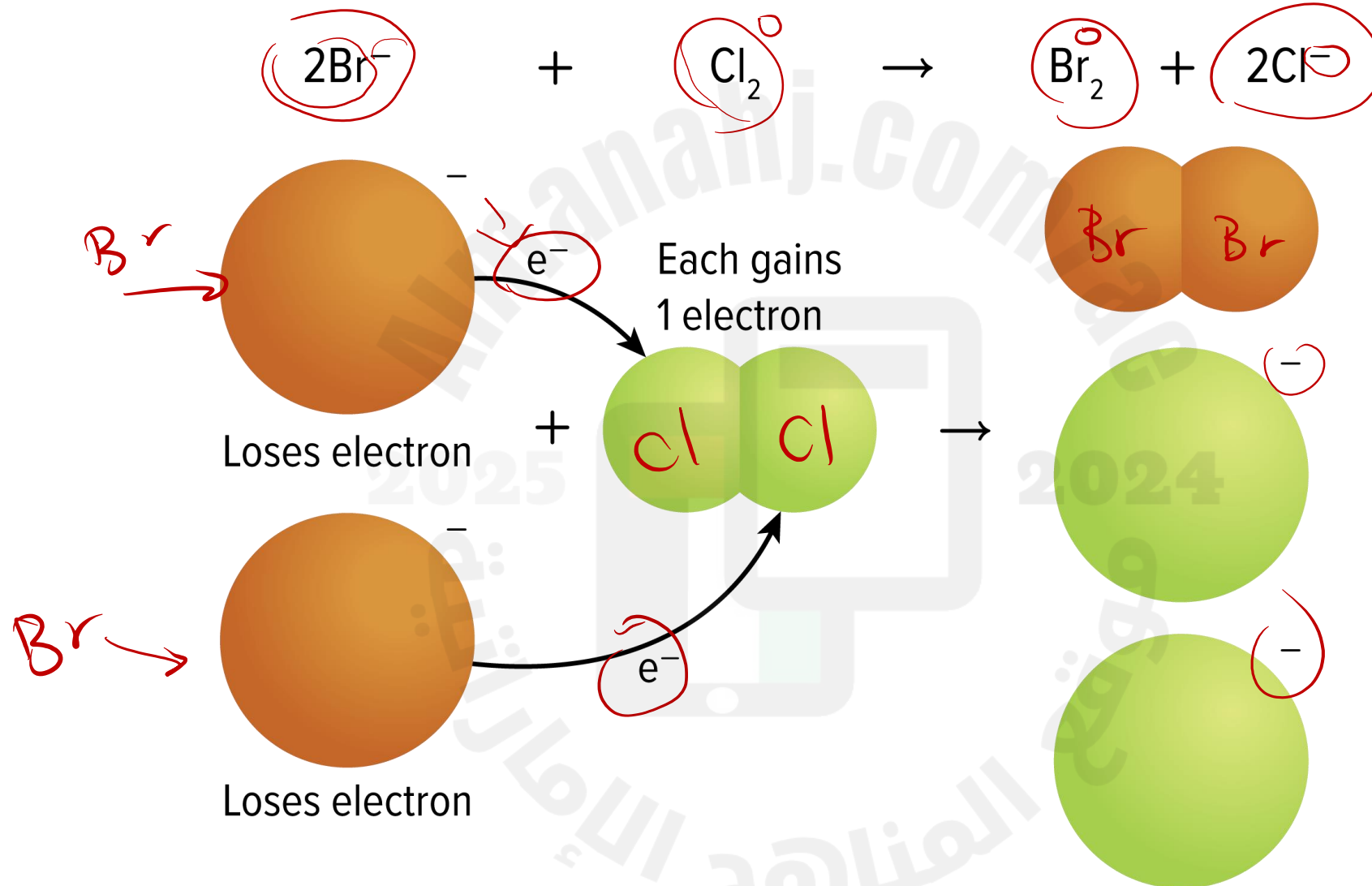


Electron Transfer and Redox Reactions

- An **oxidation-reduction reaction**, or **redox reaction** involves the **transfer of electrons** from one atom to another.



Electron Transfer and Redox Reactions



Quiz

1. Which involves the transfer of electrons from one atom to another?

A redox reaction

C nuclear reaction

B evaporation

D melting



What is the definition of:

Oxidation

Reduction



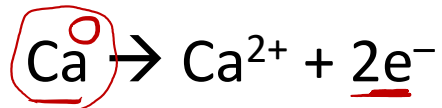
e^- : electron

Electron Transfer and Redox Reactions

فقدان

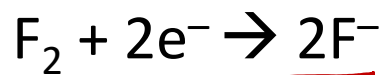
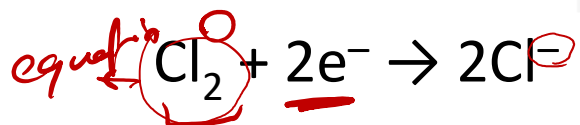
- Oxidation** is defined as the loss of electrons from atoms of a substance.

Equation



اكتساب الالكترونات

- Reduction** is defined as the gain of electrons by the atoms of a substance.



Oxidation and reduction are complementary processes: oxidation cannot occur unless reduction also occurs. It is important to recognize and distinguish between oxidation and reduction. A memory aid might help you remember the distinction. The phrase Loss of Electrons is Oxidation, and Gain of Electrons is Reduction is shortened to **LEO GER**.

LEO the lion says **GER** or, for short, **LEO GER**.



Quiz

2. Which is defined as the loss of electrons from atoms of a substance?

A reduction

B ionization

C oxidation

D polarization



Quiz

3. Which is defined as the gain of electrons by the atoms of a substance?

A ionization

B oxidation

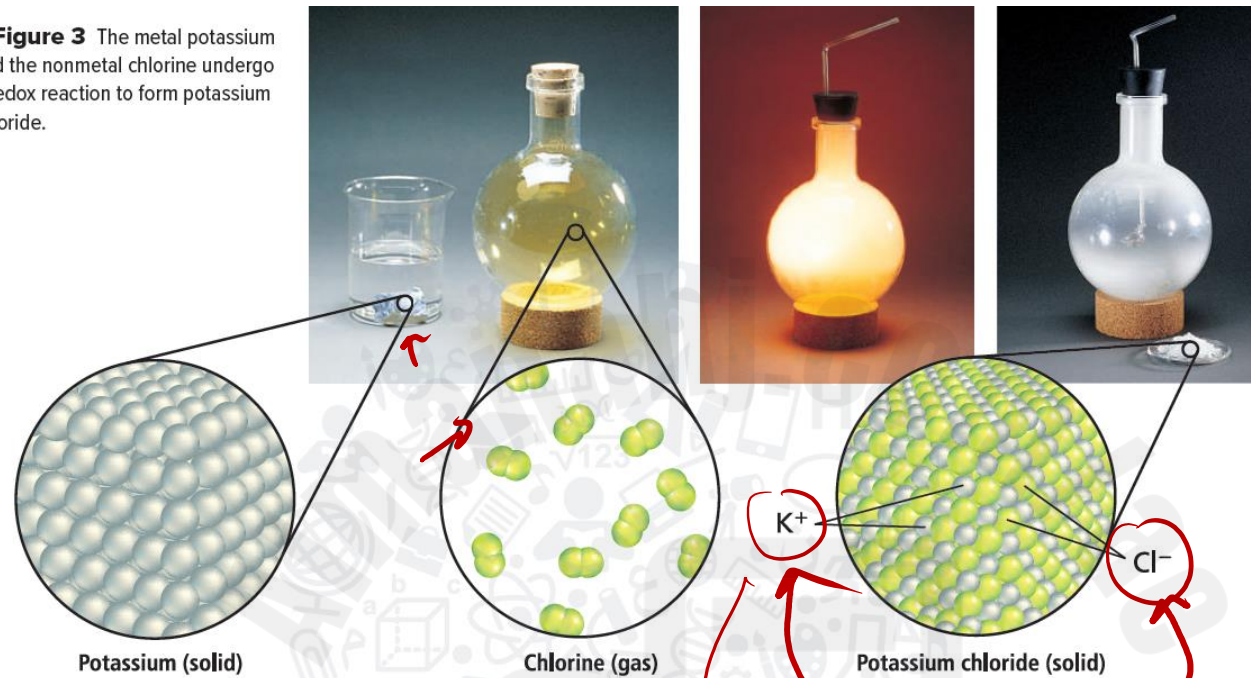
C reduction

D polarization

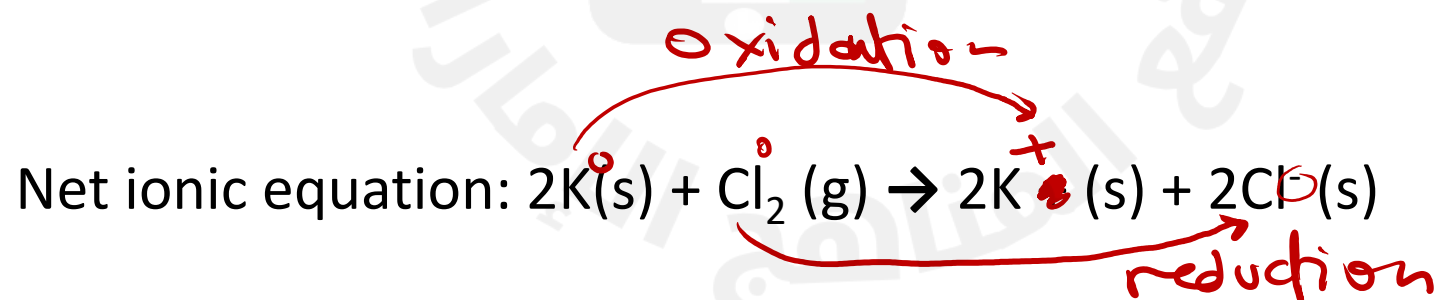
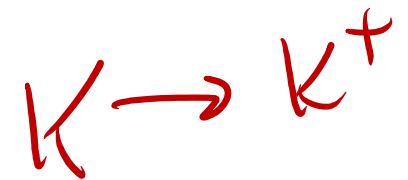


Electron Transfer and Redox Reactions

■ **Figure 3** The metal potassium and the nonmetal chlorine undergo a redox reaction to form potassium chloride.

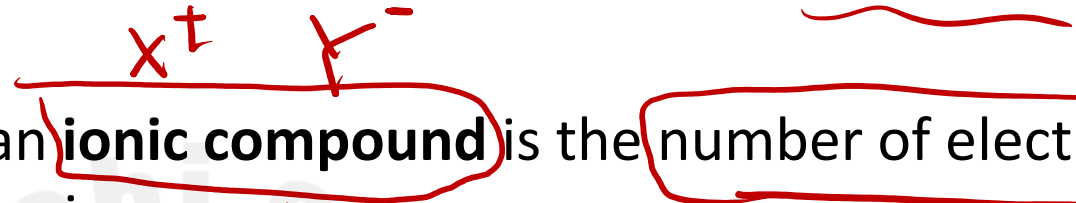


Look at this reaction. Which atom was oxidized? **K** or Cl?



Electron Transfer and Redox Reactions

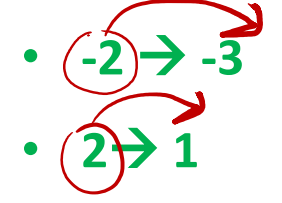
- Oxidation numbers are tools that scientists use to keep track of the movement of electrons in a redox reaction.
- The **oxidation number** of an atom in an **ionic compound** is the number of electrons lost or gained by the atom when it forms an ion.



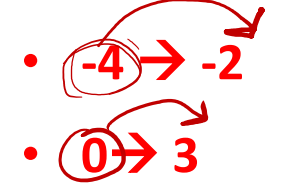
Oxidation number: $+3$ Ionic charge: $3+$

In ionic compounds:
Oxidation number $+3$ = **Lost 3 electrons**
Oxidation number -2 : **gained 2 electrons**

- When an atom or ion is **reduced**, the numerical value of its oxidation number **decreases**.



- When an atom or ion is **oxidized**, its oxidation number **increases**.



Quiz

4. In an atom in **an ionic compound**, which is the number of electrons lost or gained by the atom when it forms an ion?

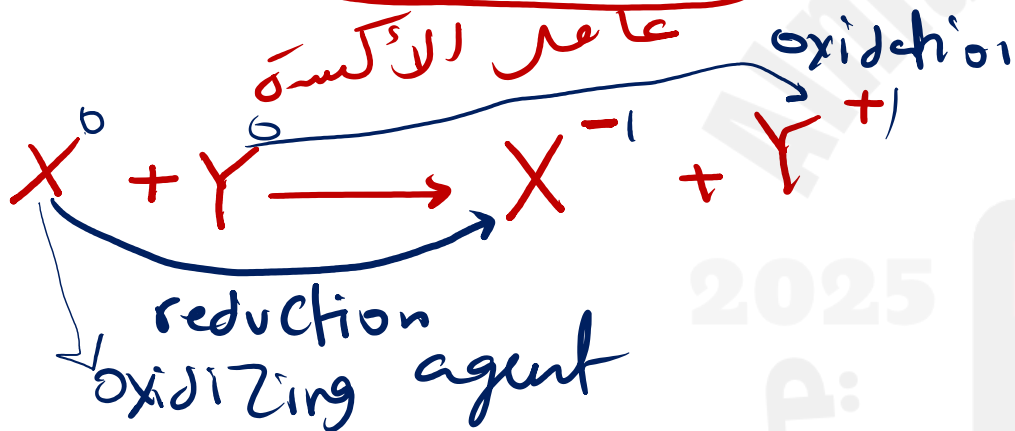
- A mass number
- B reduction number
- C atomic number
- D oxidation number



Oxidizing and Reducing Agents



- The substance that oxidizes another substance by accepting its electrons is called an **oxidizing agent**.



- The **oxidizing agent** is the substance that is reduced in a redox reaction.

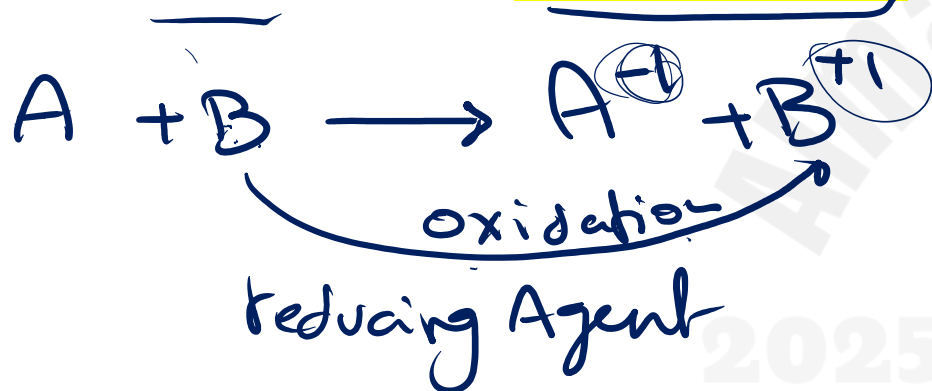
Summary of Redox Reactions

Process	$X \xrightarrow{\text{transfer of } e^-} Y$
Oxidation <ul style="list-style-type: none"> A reactant loses an electron. Reducing agent is oxidized. Oxidation number increases. 	<ul style="list-style-type: none"> X loses an electron. X is the reducing agent and becomes oxidized. The oxidation number of X increases.
Reduction <ul style="list-style-type: none"> Other reactant gains an electron. Oxidizing agent is reduced. Oxidation number decreases. 	<ul style="list-style-type: none"> Y gains an electron. Y is the oxidizing agent and becomes reduced. The oxidation number of Y decreases.



Oxidizing and Reducing Agents

- The substance that reduces another substance by losing its electrons is the **reducing agent**.



- The reducing agent is the substance that is oxidized in a redox reaction.

Summary of Redox Reactions

Process	transfer of e ⁻ X $\xrightarrow{\hspace{2cm}}$ Y
Oxidation <ul style="list-style-type: none"> A reactant <u>loses an electron</u>. Reducing agent is <u>oxidized</u>. <u>Oxidation number increases</u>. 	<ul style="list-style-type: none"> X loses an electron. X is the reducing agent and becomes oxidized. The oxidation number of X increases.
Reduction <ul style="list-style-type: none"> <u>Other reactant gains an electron</u>. <u>Oxidizing agent is reduced</u>. <u>Oxidation number decreases</u>. 	<ul style="list-style-type: none"> Y gains an electron. Y is the oxidizing agent and becomes reduced. The oxidation number of Y decreases.



Quiz

5. Which is the substance that oxidizes another substance by accepting its electrons ?

A polarizing agent

C ionizing agent

B oxidizing agent

D reducing agent



Summary

- Oxidation-reduction reactions involve the transfer of electrons from one atom to another.
- When an atom or ion is reduced, its oxidation number decreases. When an atom or ion is oxidized, its oxidation number increases.
- **Oxidation number** refers to the number of electrons lost or gained by an atom.
- **In ionic compounds**, the **oxidation number** is the same as the **charge of the ion**.





Part 2

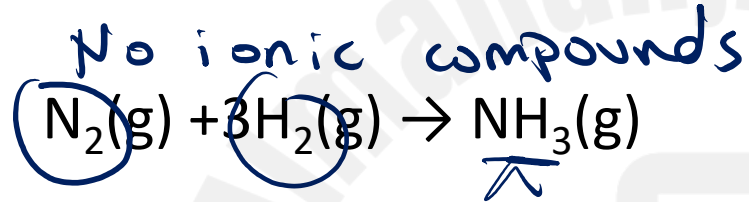
Learning objectives:

Identify oxidized and reduced atoms in a redox reaction

Determine the oxidation numbers of atoms in a redox reaction using the **listed** rules.

Redox and Electronegativity → g 10 adv

- Redox reactions are not limited to atoms of an element changing to ions.
- Some redox reactions involve changes in molecular substances (Covalent compounds) or polyatomic ions (with covalent bonds).



- N is **reduced** and H is **oxidized**.

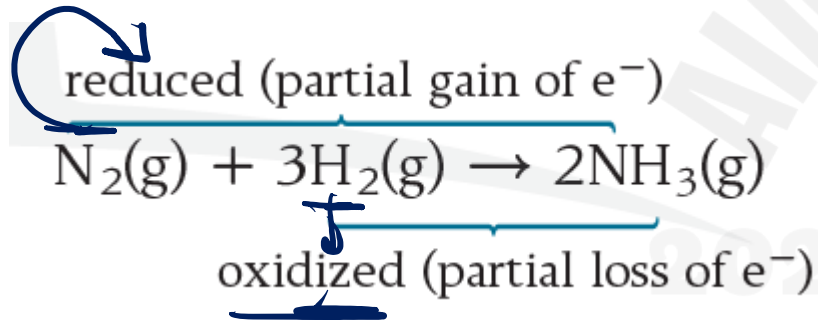
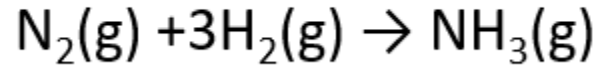
- To determine which was oxidized and which was reduced, **you must know which atom is more electronegative.**
- Elements with **high electronegativity** are **strong oxidizing agents.**
 - It means they are **reduced**

reduced



Redox and Electronegativity

reduced
↑



Higher electronegativity = Reduced

Electronegativity

	1	2	13	14	15	16	17	18
1	H							
2	Li	Be				O ₂	F ₂	
3	Na	Mg					Cl ₂	
4	K	Ca					Br ₂	
5	Rb	Sr					I ₂	
6	Cs	Ba						
7								

Reducing agent
oxidized

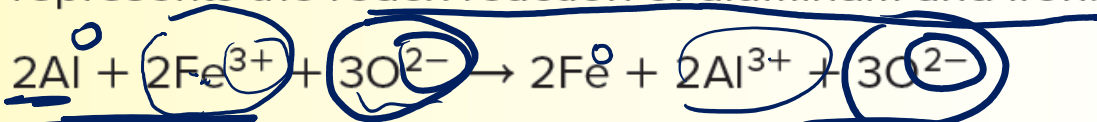
Oxidizing agent
reduced



EXAMPLE 1



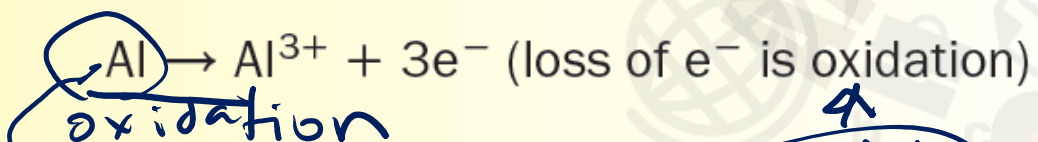
Identify Oxidation-Reduction Reactions The following equation represents the redox reaction of aluminum and iron.



Identify what is oxidized and what is reduced in this reaction. Identify the oxidizing agent and the reducing agent.

2 SOLVE FOR THE UNKNOWN

Identify the oxidation process and the reduction process.



The aluminum atom loses three electrons and becomes an aluminum ion.



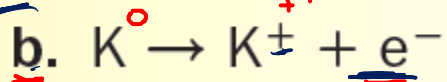
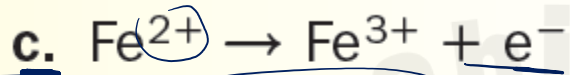
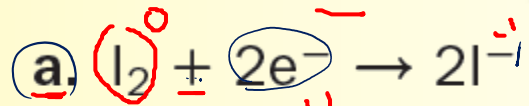
The iron ion accepts the three electrons lost from aluminum and becomes an iron atom.

Al is oxidized and is therefore the reducing agent. Fe³⁺ is reduced and is therefore the oxidizing agent.



APPLICATIONS

1. Identify each of the following changes as either oxidation or reduction
Recall that e^- is the symbol for an electron.



a. Red.

b. Ox.

Ox

Red

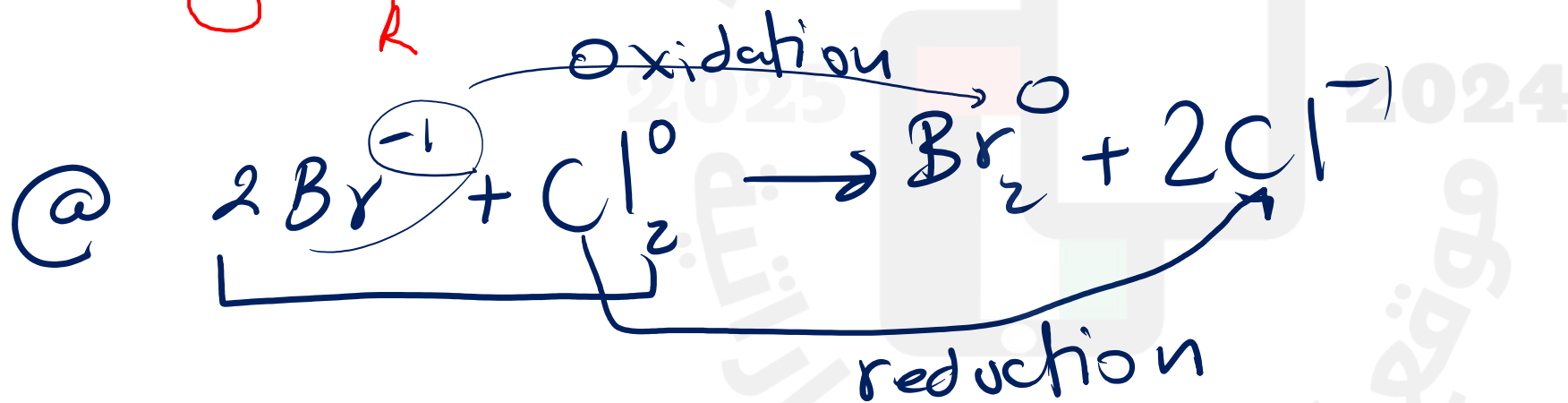
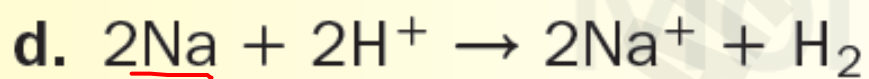
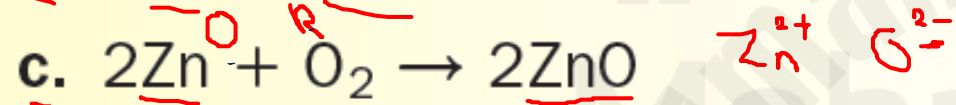
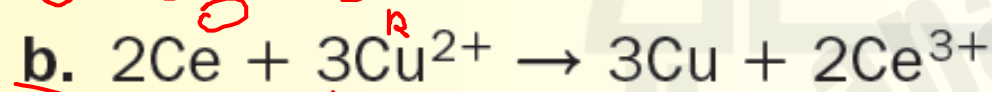
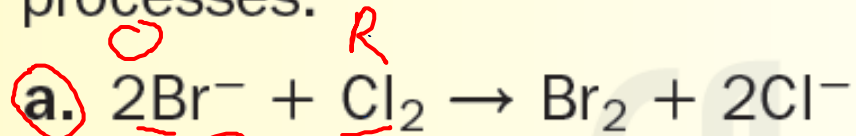
2025

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APPLICATIONS

2. Identify what is oxidized and what is reduced in the following processes.



APPLICATIONS

3. Identify the oxidizing agent and the reducing agent in the following equation. Explain your answer.



Fe is oxidized (Reducing agent)

Ag⁺ is reduced (oxidizing agent)



More Resources

Oxidation State

< 1 / 10 >

In this lesson you will learn:

- to describe what oxidation–reduction reactions involve.
- to calculate oxidation states.
- to recognise redox equations.



↓

<https://edushare.moe.gov.ae/Uploads/Resources/0056f102-72d3-4a45-b7a1-c82c3c57331c/6102729768304640/index.html>

Pages: 2, 3 and 4



(-3)
G115
[N]

(-2)
G116
O

Table 2 Rules for Determining Oxidation Numbers

Rule	Example	oxidation number n_{element}
1. The oxidation number of an atom of an <u>uncombined element</u> is <u>zero</u> .	Na, O ₂ , Cl ₂ , H ₂	0
2. The oxidation number of a <u>monatomic ion</u> is <u>equal to the charge of the ion</u> .	Ca ²⁺	+2
	Br ⁻	-1
3. The oxidation number of the <u>more-electronegative atom in a molecule or a complex ion</u> is the same as the charge it would have if it were an ion.	N in NH ₃	-3
	O in NO	-2
4. The oxidation number of the most-electronegative element, fluorine, is always -1 when it is bonded to another element.	F in LiF	-1

oxidation number

NaF
F → N = 0
F⁻

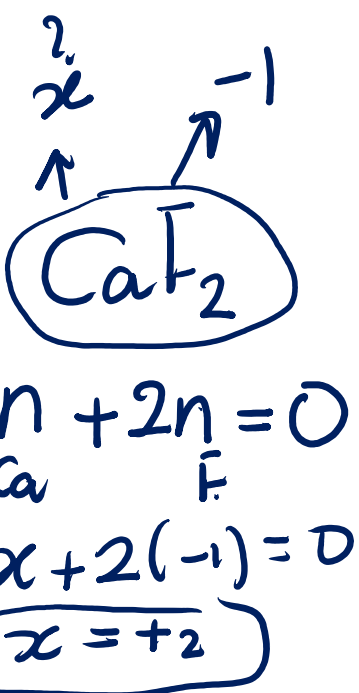


Table 2 Rules for Determining Oxidation Numbers

Rule	Example	n_{element}
5. The oxidation number of oxygen in compounds is always <u>-2</u> except in peroxides, such as hydrogen peroxide (<u>H₂O₂</u>), where it is -1. When it is bonded to fluorine, the only element more electro-negative than oxygen, the oxidation number of oxygen is <u>positive</u> .	O in NO ₂	-2
	O in H ₂ O ₂	-1
6. The oxidation number of hydrogen in <u>most</u> of its compounds is <u>+1</u> , except in metal hydrides; then, the oxidation number is -1.	H in NaH K ₂ CS ₂ Li	-1
7. The oxidation numbers of group 1 and 2 metals and aluminum are positive and equal to their number of valence electrons.	K Gr 1 Ca Gr 2 Al Gr 13	+1 +2 +3
8. The <u>sum of the oxidation numbers in a neutral compound is zero</u> .	CaBr ₂	(+2) + 2(-1) = 0
9. The <u>sum of the oxidation numbers of the atoms in a polyatomic ion is equal to the charge of the ion</u> .	SO ₃ ²⁻	(+4) + 3(-2) = -2



1ve Gr 1
2ve Gr 2
3ve Gr 13
+1 +2 +3



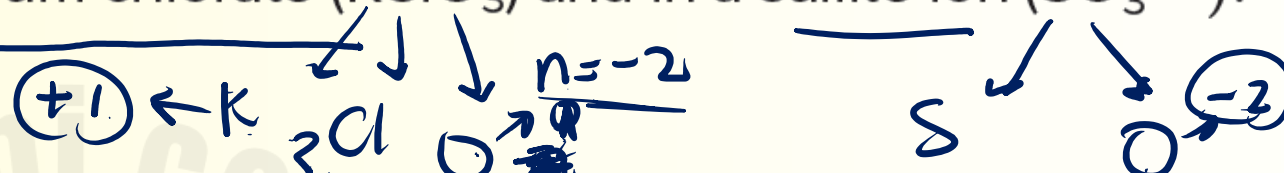
EXAMPLE 2



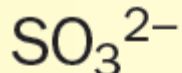
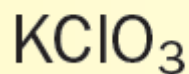
Determine Oxidation Numbers Use the rules for determining oxidation numbers to find the oxidation number of each element in potassium chlorate (KClO_3) and in a sulfite ion (SO_3^{2-}).

1 ANALYZE THE PROBLEM

In the rules for determining oxidation numbers, you are given the oxidation numbers of oxygen and potassium. You are also given the overall charge of the compound or ion. Using this information and applying the rules, determine the oxidation numbers of chlorine and sulfur. (Let n_{element} equal the oxidation number of the element in question.)



Known



$$n_{\text{O}} = -2$$

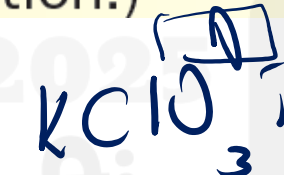
$$n_{\text{K}} = +1$$

Unknown

$$n_{\text{Cl}} = ?$$

$$n_{\text{S}} = ?$$

Rule 8



$$n_{\text{K}} + n_{\text{Cl}} + 3n_{\text{O}} = 0$$

$$+1 + n_{\text{Cl}} - 6 = 0$$

$$n_{\text{Cl}} = +5$$

Rule 9



$$n_{\text{S}} + 3n_{\text{O}} = -2$$

$$n_{\text{S}} - 6 = -2$$

$$n_{\text{S}} = +4$$



2 SOLVE FOR THE UNKNOWN

Assign the known oxidation numbers to their elements, set the sum of all oxidation numbers to zero or to the ion charge, and solve for the unknown oxidation number.

$$(n_K) + (n_{Cl}) + 3(n_O) = 0$$

$$(+1) + (n_{Cl}) + 3(-2) = 0$$

$$1 + n_{Cl} + (-6) = 0$$

$$n_{Cl} = +5$$

The sum of the oxidation numbers in a neutral compound is zero.
For group 1 metals, $n_{\text{element}} = +1$. Substitute $n_K = +1$, $n_O = -2$.

Solve for n_{Cl} .

$$(n_S) + 3(n_O) = -2$$

$$(n_S) + 3(-2) = -2$$

$$n_S + (-6) = -2$$

$$n_S = +4$$

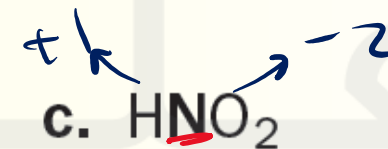
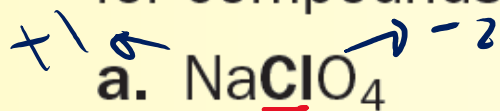
The sum of the oxidation numbers in a polyatomic ion equals the charge on the ion. Substitute $n_O = -2$.

Solve for n_S .

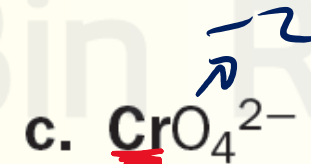
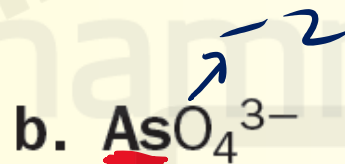
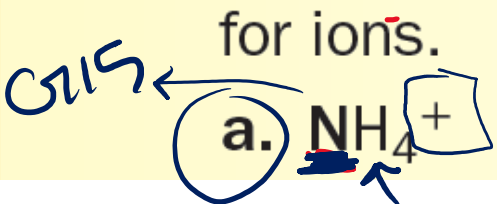


APPLICATIONS

5. Determine the oxidation number of the boldface element in the following formulas for compounds.



6. Determine the oxidation number of the boldface element in the following formulas for ions.



a. $n_{\text{H}} = +1$
 $n_{\text{N}} = ?$

$n_{\text{N}} + 4n_{\text{H}} = +1$

$n_{\text{N}} + 4(+1) = +1$

$n_{\text{N}} = -3$

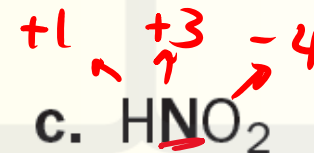
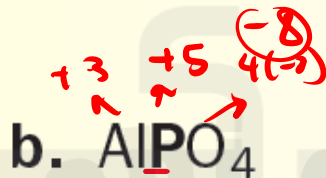
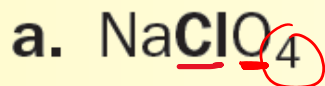
The answer of 6.a

$n_{\text{N}} = -3$ NOT -4. I made an error while speaking



APPLICATIONS

5. Determine the oxidation number of the boldface element in the following formulas for compounds.



6. Determine the oxidation number of the boldface element in the following formulas for ions.



$$\textcircled{a} \quad n_{\text{Na}} + \textcircled{n_{\text{Cl}}} + 4n_{\text{O}} = 0$$

$$+1 + n_{\text{Cl}} + 4(-2) = 0$$

$$+1 + n_{\text{Cl}} - 8 = 0$$

$$-7 + n_{\text{Cl}} = 0 \rightarrow n_{\text{Cl}} = +7$$

$$n_{\text{As}} + 4(n_{\text{O}}) = -3$$

$$n_{\text{As}} = -3 - (4 \times -2)$$

$$n_{\text{As}} = +5$$

$$n_{\text{Cr}} + 4n_{\text{O}} = -2$$

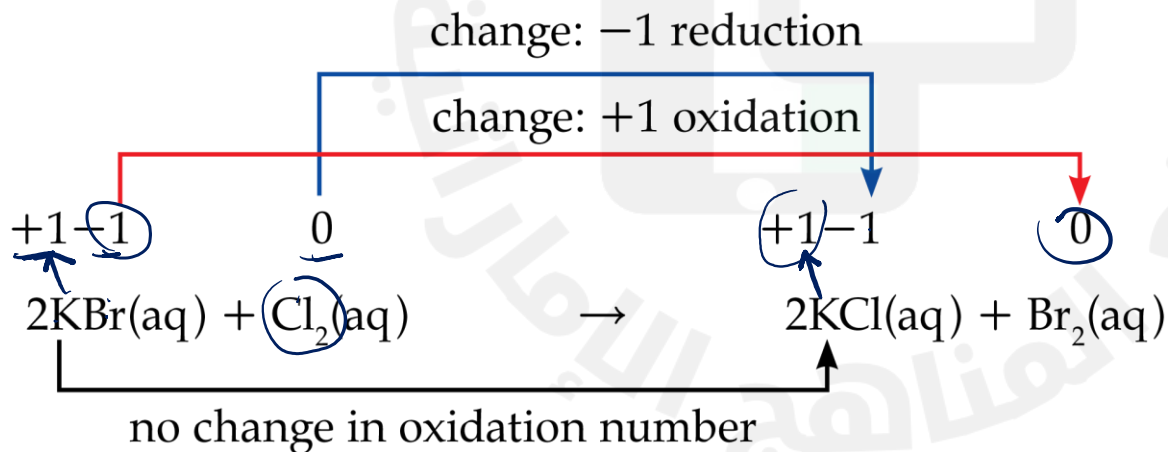
$$n_{\text{Cr}} - 8 = -2$$

$$n_{\text{Cr}} = +6$$



Oxidation Numbers in Redox Reactions

- Oxidation-reduction reactions feature changes in oxidation number.
- Atoms that are reduced have their oxidation number decreased.
- Atoms that are oxidized have their oxidation number increased.



$$+1 - 1 = 0$$



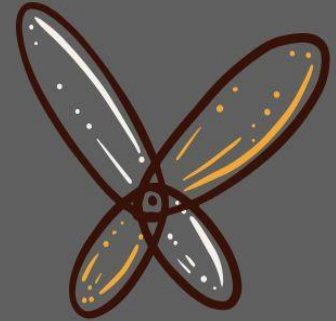
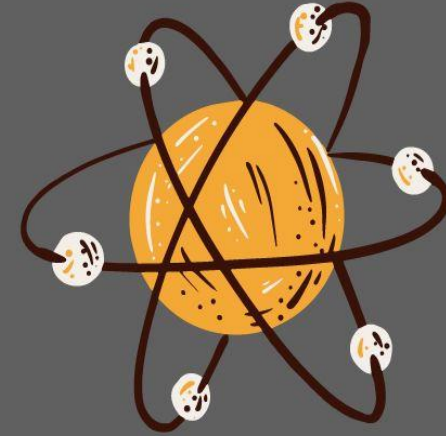
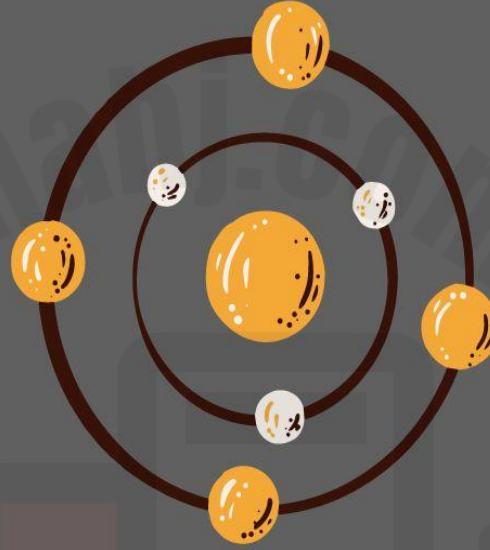
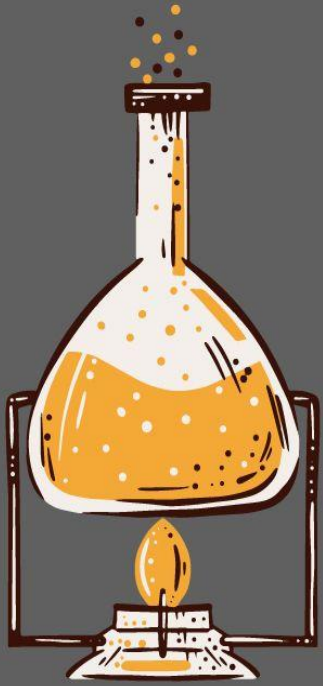
“The End” Self-Reading

Section Summary

- ▶ Oxidation-reduction reactions involve the transfer of electrons from one atom to another.
- ▶ When an atom or ion is reduced, its oxidation number is lowered. When an atom or ion is oxidized, its oxidation number is raised.
- ▶ In oxidation-reduction reactions involving molecular compounds (and polyatomic ions with covalent bonds), the more-electronegative atoms are treated as if they are reduced. The less-electronegative atoms are treated as if they are oxidized.



CHEMISTRY



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