

تم تحميل هذا الملف من موقع المناهج الإماراتية



## أوراق عمل القسم الأول Reduction and Oxidation الأوكسدة والاختزال

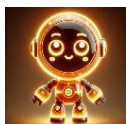
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المزيد من مادة  
كيمياء:

### 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

أوراق عمل الدرس الأول bases and acids to Introduction مقدمة الأحماض والقواعد

1

شرح وحدة الأحماض والقواعد ووحدة الأوكسدة والإختزال

2

أوراق عمل الوحدة الرابعة الأحماض والقواعد

3

أوراق عمل الوحدة الرابعة Bases and Acids الأحماض والقواعد منهج انسباير

4

مذكرة تأسيس بداية الفصل الثاني

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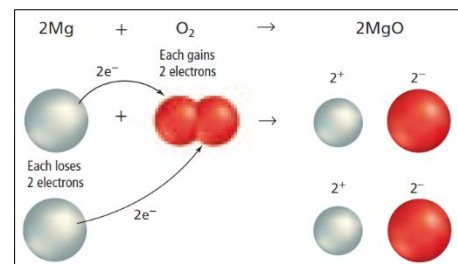
## Section 1: Oxidation and Reduction

### Electron Transfer and Redox Reactions

A reaction in which electrons are transferred from one atom to another is called an **oxidation-reduction reaction**, which is also called a **redox reaction**.

Complete chemical equation:  $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$

Net ionic equation:  $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{Mg}^{2+} + 2\text{O}^{2-}$  (ions in crystal)



The reaction of magnesium and oxygen involves a transfer of electrons from ..... to .....

Classify the reaction between magnesium and oxygen .....

Write the complete chemical equation and the net ionic equation for the single-replacement reaction in which chlorine in an aqueous solution reacts with bromide ions from an aqueous solution of potassium bromide.

Note that chlorine ..... from bromide ions to become chloride ions. When the two bromide ions lose electrons, the two bromine atoms form a covalent bond with each other to produce .....

The formation of the covalent bond by sharing of electrons is also an oxidation-reduction reaction.

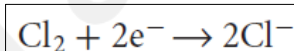
### Oxidation and reduction

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



Sodium is oxidized because .....

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



Oxidation and reduction are complementary processes. Explain.

.....

### Changes in oxidation number

The **oxidation number** of an atom is the number of electrons lost or gained by the atom.

**In oxidation:** oxidation number increases, **In reduction:** oxidation number decreases

Which element is more likely to gain electrons, potassium, or chlorine? Why?

## Oxidizing and Reducing Agents

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

The substance that reduces another substance by losing electrons is called a **reducing agent**.

In this reaction  $2K(s) + Cl_2(g) \rightarrow 2KCl(s)$  what is the oxidizing agent and the reducing agent?

### Uses of redox reactions in everyday life:

- To remove tarnish from metal objects.
- Adding chlorine bleach to your laundry to whiten clothes, you are using an aqueous solution of sodium hypochlorite (NaClO), an oxidizing agent. It oxidizes dyes, stains, and other materials that discolor clothes.

## Redox and Electronegativity

What is electronegativity? .....

In this reaction  $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$  The reactants and products are all molecular compounds.

Hydrogen has an electronegativity of 2.20, and nitrogen's electronegativity is 3.04.

Which element is reduced (partially gained  $e^-$ )? ..... Which element is oxidized (partially lost  $e^-$ )? .....

What is the oxidizing agent? ..... what is the reducing agent? .....

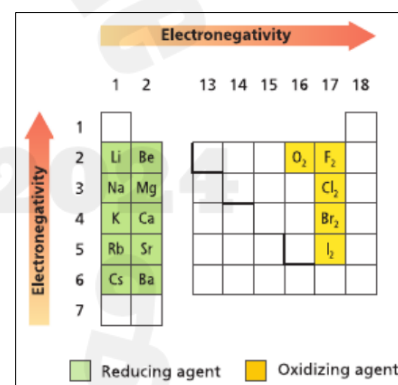
### Describe the trends of electronegativity in the periodic table:

In periods: .....

In groups: .....

which element would be the strongest oxidizing agent. ....

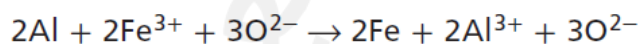
Which is the strongest reducing agent? .....



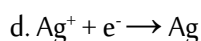
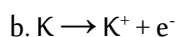
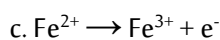
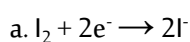
## Identify Oxidation-Reduction Reactions

Identify what is oxidized and what is reduced in this reaction.

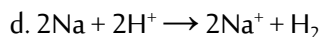
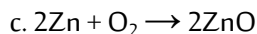
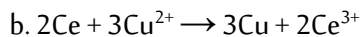
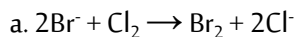
Identify the oxidizing agent and the reducing agent.



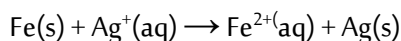
Identify each of the following changes as either oxidation or reduction. Recall that  $e^-$  is the symbol for an electron.



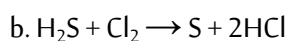
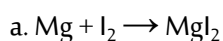
Identify what is oxidized and what is reduced in the following processes.



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



Challenge Identify the oxidizing agent and the reducing agent in each reaction.



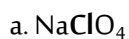
### Determining Oxidation Numbers ( $n_{\text{element}}$ )

Find the oxidation number of sulfur in each compound.

$\text{Na}_2\text{SO}_4$ :	$\text{H}_2\text{S}$ :	S:	$\text{S}_2\text{Cl}_2$ :	$\text{SO}_2$ :	$\text{K}_2\text{S}_2\text{O}_3$ :
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Find the oxidation number of each element in potassium chlorate ( $\text{KClO}_3$ ) and in a sulfite ion ( $\text{SO}_3^{2-}$ ).

Determine the oxidation number of the **boldface** element in the following formulas for compounds and ions.

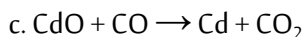
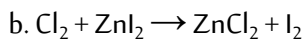
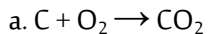


Determine the oxidation number of **nitrogen** in each of these.



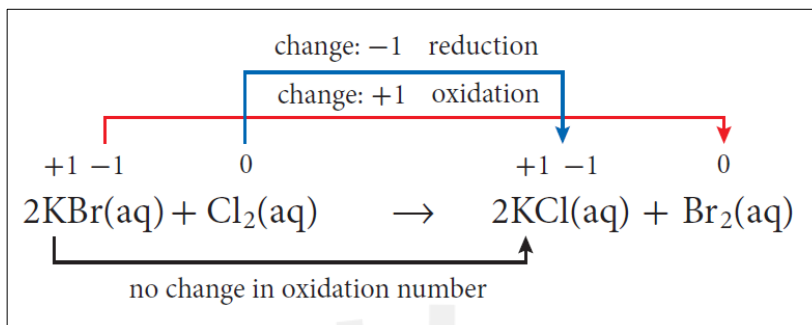
Table 2 Rules for Determining Oxidation Numbers		
Rule	Example	$n_{\text{element}}$
1. The oxidation number of an atom of an uncombined element is zero.	Na, O <sub>2</sub> , Cl <sub>2</sub> , H <sub>2</sub>	0
2. The oxidation number of a monatomic ion is equal to the charge of the ion.	Ca <sup>2+</sup>	+2
	Br <sup>-</sup>	-1
3. The oxidation number of the more-electronegative atom in a molecule or a complex ion is the same as the charge it would have if it were an ion.	N in NH <sub>3</sub>	-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
5. The oxidation number of oxygen in compounds is always -2 except in peroxides, such as hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> ), where it is -1. When it is bonded to fluorine, the only element more electronegative than oxygen, the oxidation number of oxygen is positive.	O in NO <sub>2</sub>	-2
	O in H <sub>2</sub> O <sub>2</sub>	-1
6. The oxidation number of hydrogen in most of its compounds is +1, except in metal hydrides; then, the oxidation number is -1.	H in NaH	-1
7. The oxidation numbers of group 1 and 2 metals and aluminum are positive and equal to their number of valence electrons.	K	+1
	Ca	+2
	Al	+3
8. The sum of the oxidation numbers in a neutral compound is zero.	CaBr <sub>2</sub>	(+2) + 2(-1) = 0
9. The sum of the oxidation numbers of the atoms in a polyatomic ion is equal to the charge of the ion.	SO <sub>3</sub> <sup>2-</sup>	(+4) + 3(-2) = -2

**Challenge** Determine the net change of oxidation number of each of the elements in these redox equations.



### Oxidation Numbers in Redox Reactions

When an atom is oxidized, its oxidation number increases. When an atom is reduced, its oxidation number decreases.



The oxidation number of bromine changed from ..... to ..... so it is .....

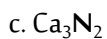
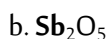
The oxidation number of chlorine changed from ..... to ..... so it is .....

The potassium ion is a spectator ion. Why?

.....

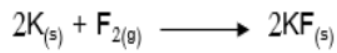
### Assessment

Determine the oxidation number of the **boldface** element in these compounds and ions.



Which of the following is correct in relation to the reaction below?

أي مما يأتي صحيح فيما يتعلق بالتفاعل أدناه؟



The potassium atom **K** gained an electron and it is reduced

اكتسبت ذرة البوتاسيوم **K** إلكترونًا وحدث لها اختزال

Fluorine **F<sub>2</sub>** gained electrons and was oxidized

اكتسب الفلور **F<sub>2</sub>** إلكترونات وحدث له أكسدة

Fluorine **F<sub>2</sub>** lost electrons and was oxidized

فقد الفلور **F<sub>2</sub>** إلكترونات وحدث له أكسدة

The potassium atom **K** lost an electron and was oxidized

فقدت ذرة البوتاسيوم **K** إلكترونًا وحدث لها أكسدة

What is the **reducing** agent in the following reaction?

ما العامل المختزل في التفاعل التالي؟



**Cl<sub>2</sub>**

**S**

**H<sub>2</sub>S**

**HCl**

What is the correct ascending order of the following formulas according to the oxidation number of **chlorine** in each of them?

ما الترتيب التصاعدي الصحيح للصيغ التالية حسب عدد تأكسد الكلور في كل منها؟

Cl<sub>2</sub> - NaCl - KClO<sub>4</sub> - KClO

NaCl → Cl<sub>2</sub> → KClO → KClO<sub>4</sub>

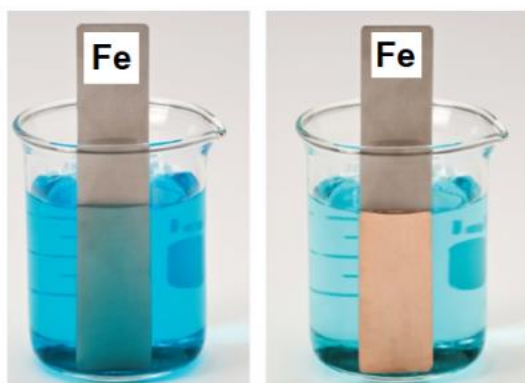
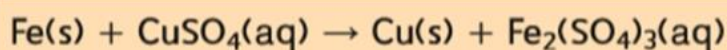
Cl<sub>2</sub> → NaCl → KClO<sub>4</sub> → KClO

KClO<sub>4</sub> → NaCl → Cl<sub>2</sub> → KClO

KClO<sub>4</sub> → KClO → Cl<sub>2</sub> → NaCl

An iron plate was placed in a solution of copper(II) sulfate as shown in the figure below. Why did the color of the iron plate change?

تم وضع صفيحة من الحديد في محلول كبريتات النحاس (II) كما هو موضح في الشكل أدناه. لماذا تغير لون صفيحة الحديد؟



Oxidation of copper atoms to copper(II) ions

أكسدة ذرات النحاس إلى أيونات النحاس (II)

Reduction of iron (III) ions by gaining electrons

اختزال أيونات الحديد (III) باكتسابها إلكترونات

Oxidation of iron (III) ions by losing electrons

أكسدة أيونات الحديد (III) بفقدانها إلكترونات

Reduction of copper (II) ions and deposition of copper on the iron plate

اختزال أيونات النحاس (II) وترسب النحاس على صفيحة الحديد

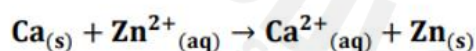
Which of the following has the highest oxidation number of Manganese (Mn)?

- A-  $\text{MnO}_2$
- B-  $\text{K}_2\text{MnO}_4$
- C-  $\text{MnO}$
- D-  $\text{KMnO}_4$

أي مما يلي لديه أعلى عدد تأكسد للمنجيز (Mn) ؟

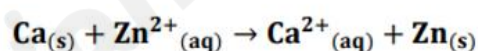
- $\text{MnO}_2$ -A
- $\text{K}_2\text{MnO}_4$ -B
- $\text{MnO}$ -C
- $\text{KMnO}_4$ -D

Which of the following is the reducing agent in the following reaction?



- A-  $\text{Ca}_{(s)}$
- B-  $\text{Zn}^{2+}_{(aq)}$
- C-  $\text{Ca}^{2+}_{(aq)}$
- D-  $\text{Zn}_{(s)}$

أي مما يلي هو العامل المختزل في التفاعل التالي ؟



- $\text{Ca}_{(s)}$ -A
- $\text{Zn}^{2+}_{(aq)}$ -B
- $\text{Ca}^{2+}_{(aq)}$ -C
- $\text{Zn}_{(s)}$ -D



In the reaction represented by the equation below.  
Which of the following is **correct**?

في التفاعل الذي تمثله المعادلة أدناه.  
أي مما يأتي **صحيح**؟



The fluoride ions receive electrons from the iodine  
and it is reduced

تستقبل أيونات الفلوريد إلكترونات من اليود ويحدث لها اختزال

The fluoride ions receive electrons from the iodine  
and it is oxidized

تستقبل أيونات الفلوريد إلكترونات من اليود وتحدث لها أكسدة

The iodine receives electrons from the fluoride  
ions and it is reduced

يستقبل اليود إلكترونات من أيونات الفلوريد ويحدث له اختزال

The iodine receives electrons from the fluoride  
ions and it is oxidized

يستقبل اليود إلكترونات من أيونات الفلوريد وتحدث له أكسدة

In the general equation below, if you know that  
the reactant **X** is a reducing agent.

في المعادلة العامة أدناه، إذا علمت أن المتفاعل **X** هو عامل مختزل.

أي مما يأتي يصفه بشكل **صحيح**؟

Which of the following describe it **correctly**?



يكتسب إلكترونات - يزيد عدد تأكسده - تحدث له أكسدة Gains electrons - its oxidation number increases - it is the oxidized	1
يفقد إلكترونات - يزيد عدد تأكسده - تحدث له أكسدة loses electrons - its oxidation number increases - it is the oxidized	2
يكتسب إلكترونات - يقل عدد تأكسده - يحدث له اختزال Gains electrons - its oxidation number decreases - it is the reduced	3
يفقد إلكترونات - يقل عدد تأكسده - يحدث له اختزال loses electrons - its oxidation number decreases - it is the reduced	4

In which of the following formulas does the oxidation  
number of oxygen differ than in the other formulas?

في أي الصيغ التالية يكون عدد تأكسد الأكسجين مختلفاً

عنه في بقية الصيغ؟





In which of the following formulas does the oxidation

في أي الصيغ التالية يكون عدد تأكسد النيتروجين ذو قيمة سالبة؟

number of nitrogen **negative** value?

NO

–

NH<sub>3</sub>

–

KNO<sub>3</sub>

–

HNO<sub>2</sub>

HNO<sub>2</sub>

NO

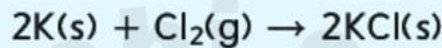
KNO<sub>3</sub>

NH<sub>3</sub>

In the reaction equation below, if you know that the reactant Cl<sub>2</sub> is an oxidizing agent. Which of the following describe it **correctly**?

في معادلة التفاعل أدناه، إذا علمت أن المتفاعل Cl<sub>2</sub> هو عامل مؤكسد.

أي مما يأتي يصفه بشكل صحيح؟



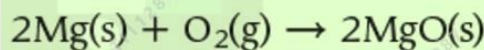
يكتسب إلكترونات - يزيد عدد تأكسده - تحدث له أكسدة Gains electrons - its oxidation number increases - it is the oxidized	1
يفقد إلكترونات - يزيد عدد تأكسده - تحدث له أكسدة loses electrons - its oxidation number increases - it is the oxidized	2
يكتسب إلكترونات - يقل عدد تأكسده - يحدث له اختزال Gains electrons - its oxidation number decreases - it is the reduced	3
يفقد إلكترونات - يقل عدد تأكسده - يحدث له اختزال loses electrons - its oxidation number decreases - it is the reduced	4

In the combustion reaction of magnesium in air represented by the equation below.

في تفاعل احتراق المغنيسيوم في الهواء الذي تمثله المعادلة أدناه.

أي مما يأتي صحيح؟

Which of the following is **correct**?



Atomic number of magnesium - 12	العدد الذري للمغنيسيوم = 12
Atomic number of oxygen = 8	العدد الذري للأكسجين = 8

Magnesium atom becomes negative ion	تصبح ذرة المغنيسيوم أيونًا سالبًا	<input type="radio"/>
Oxygen atom becomes positive ion	تصبح ذرة الأكسجين أيونًا موجبًا	<input type="radio"/>
Each oxygen atom transfers two electrons to each magnesium atom	كل ذرة أكسجين تمنح إلكترونين لكل ذرة مغنيسيوم	<input type="radio"/>
Each magnesium atom transfers two electrons to each oxygen atom	كل ذرة مغنيسيوم تمنح إلكترونين لكل ذرة أكسجين	<input type="radio"/>