

# DEMO

## Unit 4: Oxidation Numbers

This demo will give you a glimpse of how Viziscience helps you take a visual, step-by-step approach to learning oxidation numbers, you will learn:

- **How to assign oxidation numbers accurately**
- **How to recognize redox reactions easily**
- **How to confidently balance redox reactions using half-reactions**



**VIZ!SCIENCE**

<https://viziscience.com>

# Unit 4:

## Activity 4.9(a) Oxidation Numbers

Page 1

This page provides an easy-to-understand introduction to oxidation numbers, a key concept for understanding redox reactions (where electrons are gained or lost).

**Students will learn what oxidation numbers are, how to determine them using the periodic table, and the correct convention for writing them (sign first, eg. +1 or -2).**

To start, a warm-up activity helps students practice finding and writing oxidation numbers using the periodic table.

Quiz with immediate answers

**Oxidation numbers**

**How to find oxidation number of an element**

When two species exchange electrons in a redox reaction, atoms undergo changes in electronic configuration. How do we keep track of the electrons in the atoms? We use a system of counting called **oxidation numbers** or **oxidation states**.

**Na** (+1 oxidation state) and **Cl** (-1 oxidation state) are shown. An arrow labeled "electron transfer" points from Na to Cl. The resulting ions are **Na+** (+1 oxidation state) and **Cl-** (-1 oxidation state).

An **oxidation number** is a number that is assigned to an element **in a compound**. This number represents the number of electrons that an atom can **potentially** gain, lose, or share in a chemical reaction with another element.

Oxidation numbers are also known as **oxidation states**, the terms are used interchangeably.

**Oxidation numbers are usually written with the sign first, then the magnitude.**

eg. +1, +2, -1, -2

sign magnitude  
+1

**Periodic table - Oxidation Numbers**

+1		+2												+3		+4		-3		-2	
1, -1																					
H																					
1	2												3	4-4,2	3,3,5	-2					
Li	Be												3	4	5,3,3	6,2,2	1				
1	2																				
Na	Mg																				
1	2	3	4,3	5,4,3	3,2,6	2,3,4	2,3	2,3	2,3	2,1	2	3	4	3,3,5	4,2,6	1					
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se						
1	2	3	4	5,3	6,5,4	7	3,6,6	3,2,4	2,4	1	2	3	4,2	3,3,5	4,-2,6	1					
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te						

**Concept check**

Use the periodic table above to locate the oxidation numbers for the elements in the table below. These elements have only one oxidation number in their compounds. Eg. Strontium (Sr) is in column 2 has an oxidation number of +2.

(Make sure to put the sign "+" or "-" in front of the number.)

Elements	Oxidation number
Mg	<input type="text"/>
Ca	<input type="text"/>
Na	<input type="text"/>
Zn	<input type="text"/>
O	<input type="text"/>

Check

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# Unit 4:

## Activity 4.9(a) Oxidation Numbers

Page 2

Time and time again, the question comes up about **the difference between oxidation numbers and charges**—this is a common area of confusion for students.

On this page, we take the time to explain this clearly so students can understand the distinction and avoid any lingering doubts.

3 minutes concise concept video

The screenshot shows a web page from VIZ!SCIENCE. The main heading is "Oxidation number vs charge". Below this is a video player with the title "Oxidation Number" and the VIZ!SCIENCE logo. A red arrow points from a yellow callout box to the video player. Below the video player are sections for "Charge" and "Oxidation number". The "Charge" section explains that an atom can acquire a positive or negative charge when it exchanges electrons in a compound. The "Oxidation number" section explains that oxidation numbers are arbitrary numbers assigned to atoms to describe how many electrons an atom would gain or lose in a compound. Below these sections is a table titled "The general convention for writing oxidation number and charge:".

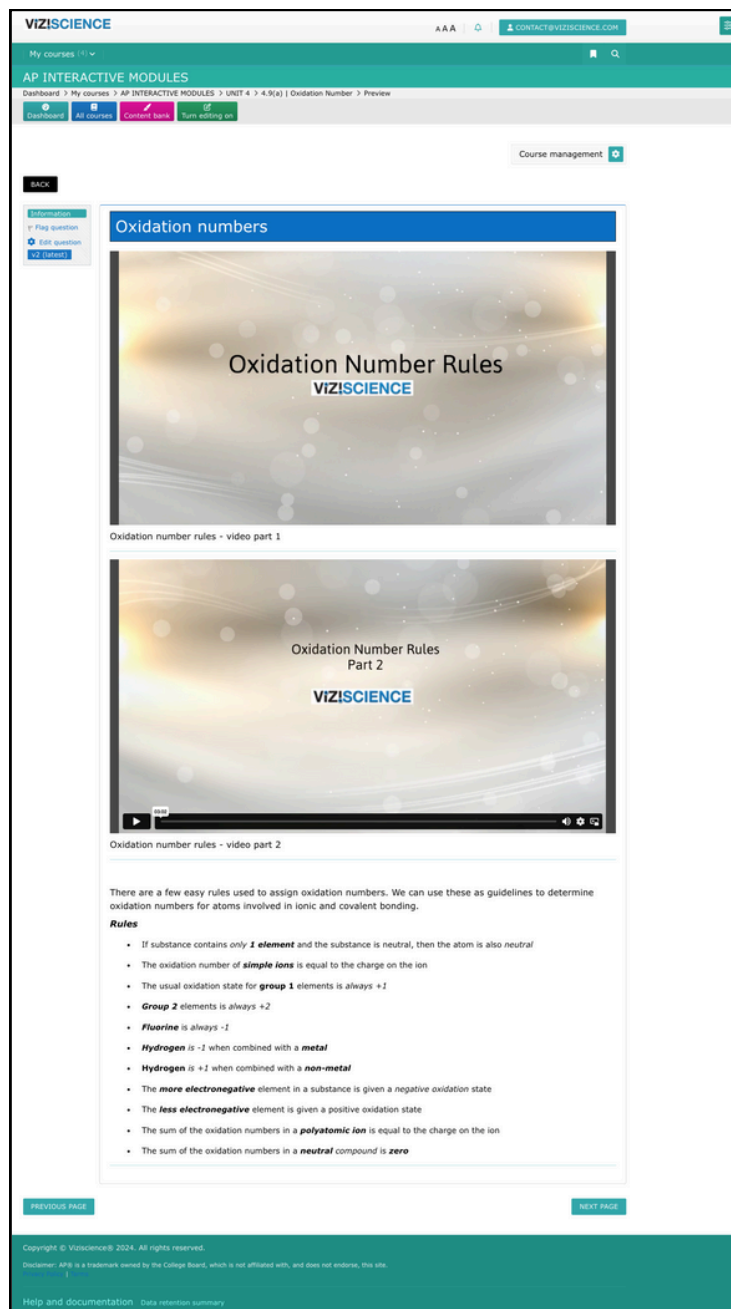
Oxidation number	Charge
+1	1+
-1	1-

# Unit 4:

## Activity 4.9(a) Oxidation Numbers

Page 3

Students are introduced to a few general rules as a guide to understanding oxidation numbers.



The screenshot shows the VIZISCIENCE website interface. At the top, there is a navigation bar with 'VIZISCIENCE' on the left, 'AAA' in the center, and 'CONTACT@VIZISCIENCE.COM' on the right. Below this is a search bar and a 'My courses' dropdown menu. The main content area is titled 'AP INTERACTIVE MODULES' and shows a breadcrumb trail: 'Dashboard > My courses > AP INTERACTIVE MODULES > UNIT 4 > 4.9(a) | Oxidation Number > Preview'. There are buttons for 'Dashboard', 'All courses', 'Customize', and 'Turn editing on'. A 'Course management' button is also visible. The page content is titled 'Oxidation numbers' and features two video players. The first video is titled 'Oxidation Number Rules VIZISCIENCE' and the second is 'Oxidation Number Rules Part 2 VIZISCIENCE'. Below the videos, there is a text block: 'There are a few easy rules used to assign oxidation numbers. We can use these as guidelines to determine oxidation numbers for atoms involved in ionic and covalent bonding.' This is followed by a section titled 'Rules' with a bulleted list of guidelines. At the bottom of the page, there are 'PREVIOUS PAGE' and 'NEXT PAGE' buttons, and a footer with copyright information and a disclaimer.

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# Unit 4:

## Activity 4.9(a) Oxidation Numbers

Page 4

The screenshot shows the VIZ!SCIENCE website interface. At the top, there is a navigation bar with 'VIZ!SCIENCE' on the left, 'AAA' in the center, and 'CONTACT@VIZ!SCIENCE.COM' on the right. Below this is a 'My courses' dropdown menu. The main content area is titled 'AP INTERACTIVE MODULES' and shows a breadcrumb trail: 'Dashboard > My courses > AP INTERACTIVE MODULES > UNIT 4 > 4.9(a) | Oxidation Number > Preview'. There are several navigation buttons: 'Dashboard', 'All courses', 'Content bank', and 'Turn editing on'. A 'Course management' button is also visible. The main content area features a 'BACK' button, a 'Question 2' sidebar with 'Times remaining: 2', 'Flag question', 'Edit question', and 'V2 (latest)'. The main question area is titled 'Rule 1' and contains the text: 'If substance contains **only 1 element** and the substance is neutral, then the atom is also **neutral**. Eg. Cl<sub>2</sub> .... oxidation number of Cl is 0.' Below this, it asks to 'Select all the atoms that have oxidation numbers of 0 from the list below.' and provides a list of atoms with checkboxes: S, Fe, H<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub>, P<sub>4</sub>, HCl, and S<sub>8</sub>. A 'CHECK' button is at the bottom of the list. Navigation buttons for 'PREVIOUS PAGE' and 'NEXT PAGE' are also present. The footer contains copyright information: 'Copyright © Viz!Science® 2024. All rights reserved.' and a disclaimer: 'Disclaimer: AP® is a trademark owned by the College Board, which is not affiliated with, and does not endorse, this site.' There are also links for 'Help and documentation' and 'Data retention summary'.

This page helps students understand **Rule 1**, the most basic rule of oxidation numbers: when a substance is made up of only one element in its neutral state, the oxidation number of each atom is 0.

This foundational concept provides a starting point for mastering oxidation number assignments.

# Unit 4:

## Activity 4.9(a) Oxidation Numbers

This page provides examples to guide students in finding oxidation numbers for **monoatomic ions**.

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The screenshot shows the VIZ!SCIENCE website interface. At the top, there is a navigation bar with the VIZ!SCIENCE logo, user information (AAA), and a contact email (CONTACT@VIZ!SCIENCE.COM). Below this is a breadcrumb trail: Dashboard > My courses > AP INTERACTIVE MODULES > UNIT 4 > 4.9(a) | Oxidation Number > Preview. A sidebar on the left contains 'My courses' and 'Show sidebar'. The main content area is titled 'AP INTERACTIVE MODULES' and includes a 'Course management' button. The central focus is 'Rule 2: Simple ions', which states: 'The oxidation number of simple ions is equal to the charge on the ion. Write the oxidation numbers for the ions. (Remember to write the "+" or "-" sign first then the magnitude)'. Below this text is a table with columns for ions (K<sup>+</sup>, Na<sup>+</sup>, Cl<sup>-</sup>, H<sup>+</sup>, I<sup>-</sup>, Br<sup>-</sup>) and a row for 'Oxidation number' with input boxes. A 'CHECK' button is located below the table. On the left side of the question area, there is a sidebar with 'Question 3', 'Tries remaining: 2', and options to 'Flag question', 'Edit question', and 'v2 (latest)'. Navigation buttons for 'BACK', 'PREVIOUS PAGE', and 'NEXT PAGE' are also visible.

Ion	K <sup>+</sup>	Na <sup>+</sup>	Cl <sup>-</sup>	H <sup>+</sup>	I <sup>-</sup>	Br <sup>-</sup>
Oxidation number	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

# Unit 4:

## Activity 4.9(a) Oxidation Numbers

This page provides examples to guide students in finding oxidation numbers for elements in a compound.

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**Rule 3**

**Always**

- The usual oxidation state for group 1 elements is **always +1**
- Group 2 elements is **always +2**
- Fluorine is **always -1**

**Oxidation number chart**

Periodic table : Oxidation Numbers

+1		+2										+3		+4		-3		-2	
1	-1																		
H																			
1	2											3	4	-2	3	-5	-2		
Li	Be											B	C	N	O				
1	2											3	4	5	-3	6	-2	1	
Na	Mg	3	4	3	-5	4	-2	6	1										
1	2	3	4	3	4	3	-5	4	-2	6	1								

**Concept check**

Write the oxidation number for the following elements. Write the sign first (+ or -) then the magnitude.

Formula	Element	Oxidation number
LiO	Li	+1
CaO	Ca	<input type="text"/>
MgO	Mg	<input type="text"/>
NaCl	Na	<input type="text"/>
BeO	Be	<input type="text"/>
HF	F	<input type="text"/>

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# Unit 4:

## Acitivity 4.9(a) Oxidation Numbers

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This page shows students how to determine **hydrogen's oxidation number**, whether it combines with metals or non-metals,

The screenshot displays the VIZ!SCIENCE interface for an interactive module on Oxidation Numbers. It includes a navigation bar, a video player for 'Rule 4', a list of oxidation rules for Hydrogen, an 'Oxidation chart' showing oxidation states for various elements, and a 'Concept check' section with a table of compounds and oxidation numbers.

**Rule 4**

Hydrogen

- Hydrogen is **-1** when combined with a metal.
- Hydrogen is **+1** when combined with a non-metal.

**Oxidation chart**

Periodic table - Oxidation Numbers

Element	Oxidation Number
H	1, -1
Li	1
Be	2
B	3
C	4, -4
N	3, -3
O	2, -2
Na	1
Mg	2
Al	3
Si	4, -4
P	3, -3
S	4, -2
Cl	1, -1
F	-1

**Concept check**

Write the oxidation number for the elements in the following compounds. The sum of the oxidation numbers in a neutral compound is zero.

Compounds	Other element	H element	Sum of oxidation numbers
CH <sub>4</sub>	(-) x 1	(+) x 4	0
NaH	( ) x 1	( ) x 1	0
NH <sub>3</sub>	( ) x 1	( ) x 3	0
H <sub>2</sub> O	( ) x 1	( ) x 2	0
LiH	( ) x 1	( ) x 1	0



# Unit 4:

## Activity 4.9(a) Oxidation Numbers

The screenshot shows the VIZ!SCIENCE AP Interactive Modules interface. The page title is "AP INTERACTIVE MODULES" and the breadcrumb trail is "Dashboard > My courses > AP INTERACTIVE MODULES > UNIT 4 > 4.9(a) | Oxidation Number > Preview". The page is titled "Rule 4" and features a video player with a red play button. Below the video, the text "Video courtesy of Dr. Wayne Brown" is displayed. The "Hydrogen" section lists two rules: "Hydrogen is  $-1$  when combined with a metal." and "Hydrogen is  $+1$  when combined with a non-metal." The "Oxidation chart" section shows a periodic table with oxidation numbers for each element, ranging from  $+1$  and  $+2$  on the left to  $+3$ ,  $+4$ ,  $-3$ , and  $-2$  on the right. The "Concept check" section asks students to write the oxidation number for elements in various compounds, with a table provided for input.

**Hydrogen**

- Hydrogen is  $-1$  when combined with a metal.
- Hydrogen is  $+1$  when combined with a non-metal.

**Oxidation chart**

Periodic table: Oxidation Numbers

		+1 +2				+3 +4		-3 -2							
1, -1	H														
1	2					3	4	4-2	3-5	-2					
Li	Be					B	C	N	O						
1	2					3	4	5,3,3	6,2,2	1					
Na	Mg					Al	Si	P	S						
1	2	3	4,3	5,4,3	3,-2,6	2,3,4	2,3	2,3	2,1	2	3	4	3,-3,5	4,-2,6	1

**Concept check**

Write the oxidation number for the elements in the following compounds. The sum of the oxidation numbers in a neutral compound is zero.

Compounds	Other element	H element	Sum of oxidation numbers
$\text{CH}_4$	$(-4) \times 1$	$(+1) \times 4$	0
$\text{NaH}$	$(\quad) \times 1$	$(\quad) \times 1$	0
$\text{NH}_3$	$(\quad) \times 1$	$(\quad) \times 3$	0
$\text{H}_2\text{O}$	$(\quad) \times 1$	$(\quad) \times 2$	0
$\text{LH}$	$(\quad) \times 1$	$(\quad) \times 1$	0

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This page shows students how to determine hydrogen's oxidation number, whether it combines with metals or non-metals,

# Unit 4:

## Activity 4.9(a) Oxidation Numbers

(Not shown in this demo) Students will also delve into oxidation rules involving electronegativity, polyatomic ions, and elements with multiple oxidation states, gaining a deeper understanding of how to apply these concepts accurately.

- Electronegativity
- Polyatomic ions
- Multiple oxidation states

# End of Demo

This comprehensive exercise is designed to be completed in about 45 minutes at an average pace.

By fully leveraging this unit and carefully working through each step, students can use the answer feedback in the concept check questions to solidify their understanding and eliminate misconceptions. For additional practice, students can access our dedicated quizzes section, offering ample opportunities to refine their skills with immediate feedback.

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