

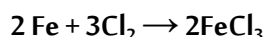
Section 2: Balancing Redox Equations

Balancing Redox Equations Using Half-Reactions

In chemistry, a **species** is any kind of chemical unit involved in a process.

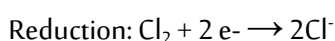
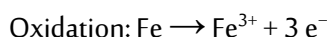
In the equilibrium equation $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{OH}^-$, there are four species: the two molecules and and the two ions and

In this reaction:



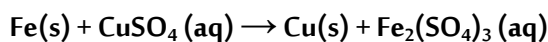
Iron is the reducing agent because

Chlorine is the oxidizing agent because

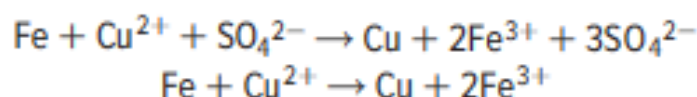


Equations such as these represent half-reactions. A **half-reaction** is one of the two parts of a redox reaction—the oxidation half or the reduction half.

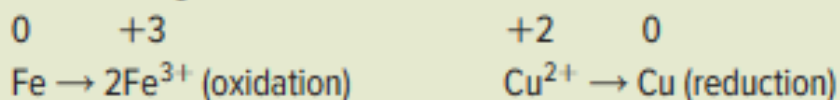
To balance the chemical equation for the reaction between iron and copper sulfate solution, you could use half-reactions.



1. Write the unbalanced, net ionic equation for the reaction, omitting spectator ions.



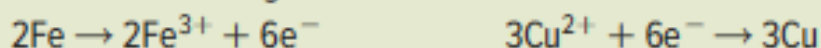
2. Write separate, incomplete equations for the oxidation and reduction half-reactions, including oxidation numbers.



3. Balance the atoms in the half-reactions. Balance the charges in each half-reaction by adding electrons as reactants or products.



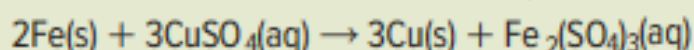
4. Adjust the coefficients so that the number of electrons lost in oxidation equals the number of electrons gained in reduction.



5. Add the half-reactions and cancel or reduce like terms on both sides of the equation.



6. Return spectator ions, if desired. Restore state descriptions.

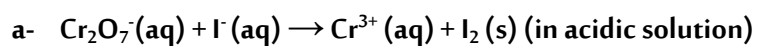


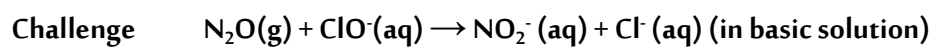
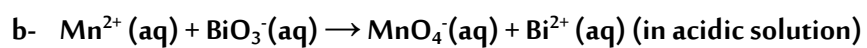
Balance the redox equation for the reaction below using half-reactions.



PRACTICE

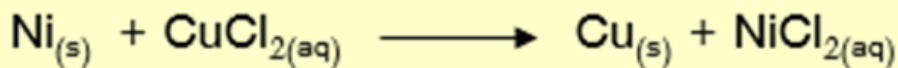
Use the half-reaction method to balance the redox equations. Begin by writing the oxidation and reduction half-reactions. Leave the balanced equation in ionic form.





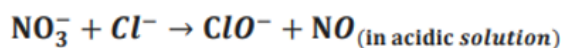
The reaction between nickel and copper (II) chloride shown below. What are the half-reactions for this redox reaction?

التفاعل بين النيكل وكلوريد النحاس (II) الموضح أدناه. ما نصف تفاعلات الأكسدة والاختزال؟

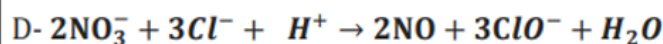
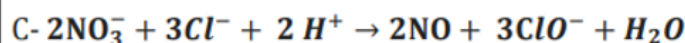
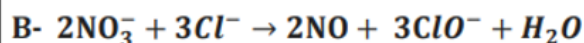
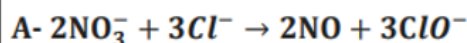
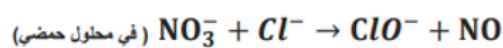


	نصف تفاعل الأكسدة Oxidation Half Reaction	نصف تفاعل الاختزال Reduction Half Reaction
A	$\text{Ni} \longrightarrow \text{Ni}^{2+} + 2\text{e}^{-}$	$\text{Cl}_2 \longrightarrow 2\text{Cl}^{-} + 2\text{e}^{-}$
B	$\text{Ni} \longrightarrow \text{Ni}^{2+} + \text{e}^{-}$	$\text{Cu}^{+} + \text{e}^{-} \longrightarrow \text{Cu}$
C	$\text{Ni} \longrightarrow \text{Ni}^{2+} + 2\text{e}^{-}$	$\text{Cu}^{2+} + 2\text{e}^{-} \longrightarrow \text{Cu}$
D	$\text{Cu}^{+} + \text{e}^{-} \longrightarrow \text{Cu}$	$\text{Ni} \longrightarrow \text{Ni}^{2+} + 2\text{e}^{-}$

Which of the following is the correct balanced redox equation for the following reaction using the half-reaction method ?

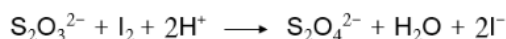
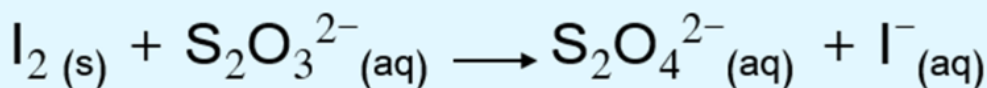


أي مما يلي هي المعادلة الموزونة الصحيحة لتفاعل الأكسدة والاختزال التالي باستخدام طريقة نصف التفاعل؟



Using the half-reaction method to balance the oxidation-reduction reactions, what is the correct balanced equation for the following reaction in acidic solution?

بإستخدام طريقة نصف التفاعل لوزن تفاعلات الأكسدة والاختزال، ما المعادلة الموزونة الصحيحة للتفاعل التالي في المحلول الحمضي؟



If given the following two redox half-reactions.

إذا أعطيت نصفي تفاعل الأكسدة والاختزال التاليين. ما هو الحد الأدنى

What is the minimum numbers of Pb^{2+} and Fe^{3+} would

لأيونات Pb^{2+} وأيونات Fe^{3+} التي يمكنها التفاعل لكيلا يبقى إلكترونات؟

have to react in order to have zero electrons left over?

$\text{Pb}^{2+} \longrightarrow \text{Pb}^{4+} + 2\text{e}^-$	نصف تفاعل الأكسدة Oxidation Half-Reaction
$\text{Fe}^{3+} + 3\text{e}^- \longrightarrow \text{Fe}$	نصف تفاعل الاختزال Reduction Half-Reaction

Fe^{3+}	Pb^{2+}	
2	3	A
3	2	B
2	1	C
1	2	D

Using the half-reaction method.

مستخدمًا طريقة نصف التفاعل.

Which of the following is the balanced equation for the

أي مما يأتي هي المعادلة الموزونة للتفاعل أدناه في محلول حمضي؟

reaction below in an acidic solution?



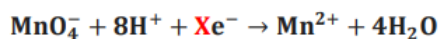
To balance the redox equations that take place in **acidic medium**, you must add

- A- H_2O and OH^-
- B- H_2O and H^+
- C- OH^- only
- D- H_2O only

لوزن معادلات الأكسدة والاختزال التي تحدث في وسط **حمضي** يجب إضافة

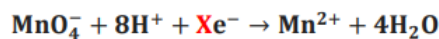
- A- H_2O و OH^-
- B- H^+ و H_2O
- C- فقط OH^-
- D- فقط H_2O

What is the value of **X** in the following half reaction equation to be balanced?



- A. 1
- B. 2
- C. 10
- D. 5

ما قيمة **X** في معادلة نصف التفاعل التالي حتى تصبح موزونة؟



- 1 -A
- 2 -B
- 10 -C
- 5 -D

If given the following two redox half-reactions. What minimum numbers of Ce^{4+} ions and Sn^{2+} ions would have to react in order to have zero electrons left over?

إذا أعطيت نصفي تفاعل الأكسدة والاختزال التاليين. ما هو الحد الأدنى

لأيونات Ce^{4+} وأيونات Sn^{2+} التي يمكنها التفاعل لكيلا يبقى

إلكترونات؟

$\text{Ce}^{4+} + \text{e}^- \longrightarrow \text{Ce}^{3+}$	نصف تفاعل الاختزال Reduction Half-Reaction
$\text{Sn}^{2+} \longrightarrow \text{Sn}^{4+} + 2\text{e}^-$	نصف تفاعل الأكسدة Oxidation Half-Reaction

Sn^{2+}	Ce^{4+}	
3	2	A
1	2	B
2	1	C
2	3	D

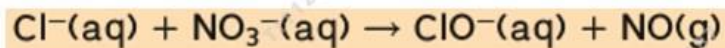
Using the half-reaction method. Which of the following

باستخدام طريقة نصف التفاعل. أي مما يأتي هي المعادلة الموزونة

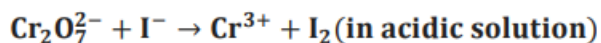
is the balanced equation for the reaction below

للتفاعل أدناه في محلول حمضي؟

in an **acidic** solution?



Which of the following is the correct balanced redox equation for the following reaction using the half-reaction method?



أي مما يلي هي المعادلة الموزونة الصحيحة لتفاعل الأكسدة-الاختزال التالي باستخدام طريقة نصف التفاعل؟

