

Metal Displacement Reactions

Spoken Tutorial Project

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



Learning Objectives

- ▶ Carry out displacement reactions of,



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- ▶ Carry out displacement reactions of,
 - ▶ Magnesium



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- ▶ Carry out displacement reactions of,
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 - ▶ Zinc



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 - ▶ Lead



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 - ▶ Copper



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 - ▶ Silver



Learning Objectives

- ▶ Carry out displacement reactions of,
 - ▶ Magnesium
 - ▶ Zinc
 - ▶ Lead
 - ▶ Copper
 - ▶ Silver
- ▶ Arrange metals in decreasing order of reactivity



Pre-requisites



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- ▶ **ChemCollective Vlabs interface**



Pre-requisites

- ▶ **ChemCollective Vlabs interface**
- ▶ **If not for relevant tutorials please visit our website**
www.spoken-tutorial.org



System Requirement



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- ▶ Mac OS v 10.10.5



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- ▶ **Mac OS v 10.10.5**
- ▶ **ChemCollective Vlabs v 2.1.0**



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- ▶ **Mac OS v 10.10.5**
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- ▶ **Java v 8**



Redox Reactions



Redox Reactions

- ▶ **An oxidation-reduction (redox) reaction, involves transfer of electrons between two species**



Redox Reactions

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- ▶ **Oxidation is loss of electrons by any species**



Redox Reactions

- ▶ **An oxidation-reduction (redox) reaction, involves transfer of electrons between two species**
- ▶ **Oxidation is loss of electrons by any species**
- ▶ **Reduction is gain of electrons by any species**



Displacement Reactions



Displacement Reactions

- ▶ **Metal displacement reactions are a type of Redox reactions**



Displacement Reactions

- ▶ **Metal displacement reactions are a type of Redox reactions**
- ▶ **In metal displacement reactions,**



Displacement Reactions

- ▶ Metal displacement reactions are a type of Redox reactions
- ▶ In metal displacement reactions,
- ▶ a more reactive metal displaces a less reactive metal in a metal salt solution



Reactivity Series



Reactivity Series

Metal	Oxidation Reaction	E°/V
Lithium	$\text{Li} \rightarrow \text{Li}^{+} + \text{e}^{-}$	3.05
Calcium	$\text{Ca} \rightarrow \text{Ca}^{2+} + 2\text{e}^{-}$	2.87
Sodium	$\text{Na} \rightarrow \text{Na}^{+} + \text{e}^{-}$	2.71
Magnesium	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^{-}$	2.36
Zinc	$\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^{-}$	0.76
Iron	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^{-}$	0.44
Cobalt	$\text{Co} \rightarrow \text{Co}^{2+} + 2\text{e}^{-}$	0.28
Lead	$\text{Pb} \rightarrow \text{Pb}^{2+} + 2\text{e}^{-}$	0.13
Hydrogen	$\text{H}_2 \rightarrow 2\text{H}^{+} + 2\text{e}^{-}$	0.00
Copper	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$	-0.34
Silver	$\text{Ag} \rightarrow \text{Ag}^{+} + \text{e}^{-}$	-0.80
Platinum	$\text{Pt} \rightarrow \text{Pt}^{2+} + 2\text{e}^{-}$	-1.2
Gold	$\text{Au} \rightarrow \text{Au}^{3+} + 3\text{e}^{-}$	-1.50



Increase in Ease of Oxidation



Metal Displacement Reactions



Metal Displacement Reactions

- ▶ $AB(aq) + C \rightarrow CB(aq) + A$
- ▶ $2AgNO_3(aq) + Cu(s) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$
- ▶ $Cu(NO_3)_2(aq) + 2Ag(s) \rightarrow \text{no reaction}$



Metal Displacement Reactions



Metal Displacement Reactions

Metal Displacement Reactions:

Displaced : +, Not Displaced : - , Solution not used in the experiment : X

S.No	Metal (Oxidation Potential)	$\text{Mg}(\text{NO}_3)_2$	$\text{Zn}(\text{NO}_3)_2$	$\text{Pb}(\text{NO}_3)_2$	$\text{Cu}(\text{NO}_3)_2$	$\text{Ag}(\text{NO}_3)_2$
1	Mg (2.375 V)	X	+	+	+	+
2	Zn (0.7628 V)	-	X	+	+	+
3	Pb (0.13 V)	-	-	X	+	+
4	Cu (-0.34 V)	-	-	-	X	+
5	Ag (-0.80 V)	-	-	-	-	X



Order of reactivity



Order of reactivity

Order of reactivity from strongest to weakest reducing agent is as follows



Summary



Summary

- ▶ **Determined the order of reactivity for the following metals,**
 - ▶ **Magnesium**
 - ▶ **Zinc**
 - ▶ **Lead**
 - ▶ **Copper**
 - ▶ **Silver**



Assignment



Assignment

As an assignment,

- 1. Perform displacement reactions using solutions of metal halides**



Assignment

As an assignment,

- 1. Perform displacement reactions using solutions of metal halides**
- 2. Establish the order of reactivity of halogens**



Assignment

As an assignment,

- 1. Perform displacement reactions using solutions of metal halides**
- 2. Establish the order of reactivity of halogens**
- 3. The required chemicals are available in the Stockroom Explorer**



About the Spoken Tutorial Project

- ▶ Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project
- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- ▶ Do you have questions in **THIS Spoken Tutorial?**
- ▶ Please visit <http://forums.spoken-tutorial.org>
- ▶ Choose the minute and second where you have the question
- ▶ Explain your question briefly
- ▶ Someone from our team will answer them



Acknowledgements

- ▶ **Spoken Tutorial Project is a part of the Talk to a Teacher project**
- ▶ **It is supported by the National Mission on Education through ICT, MHRD, Government of India**
- ▶ **More information on this Mission is available at**

<http://spoken-tutorial.org /NMEICT-Intro>

