Unit 6

On completion of the unit you should be able to:

1. balance chemical equations.
2. interpret balanced equations in terms of moles, mass units and number of particles.
3. given the number of moles (or mass or number of particles) of one substance calculate the number of moles (or mass or number of particles) of another substance in the balanced equation.
4. define limiting and excess reactants.
5. identify the following types of reactions:
   - synthesis
   - decomposition
   - combustion
   - single-replacement
   - double-replacement
   - neutralization
6. define endothermic and exothermic reactions.
7. define acids and bases.

Today's focus.

6.5 Types of Reactions

Single-replacement reactions

- **PREDICT by using the table of activity series of metals**
- **PREDICT single replacement reactions involving non-metals (halogens)**
- **Examples: Penny reactions | Explanations using the activity series of metals**
- **Two single replacement reactions**

  - What happens when aluminum is dipped in a copper (II) chloride?
  - What happens when magnesium is dipped in a copper (II) chloride?

$$2\ Al\ (s) + 3\ CuCl_2\ (aq) \longrightarrow 2\ AlCl_3\ (aq) + 3\ Cu\ (s)$$

$$Mg\ (s) + CuCl_2\ (aq) \longrightarrow MgCl_2\ (aq) + Cu\ (s)$$

Single-replacement reactions

- synthesis
- decomposition
- combustion
- single-replacement
- double-replacement
- neutralization

1. Learn to *predict* Single-replacement reaction
   If and when a reaction occurs, what are the products?

2. Learn to *write* Single-replacement reaction:
   (i) Balanced chemical reaction
   (ii) Net ionic reaction
   (iii) Identify which species is oxidized, and which species is reduced
   (iv) Identify spectator ions in the reaction

- synthesis
- decomposition
- combustion
- single-replacement
- double-replacement
- neutralization

Single-replacement reactions

Single-replacement reactions include reactions of the general form: A + BC ⟶ AC + B

There are two types of single-replacement reactions:

1. Single-replacement reactions of metals ⟵ Using Activity Series of Metals
2. Single-replacement reactions of nonmetals ⟵ Involving the halogens

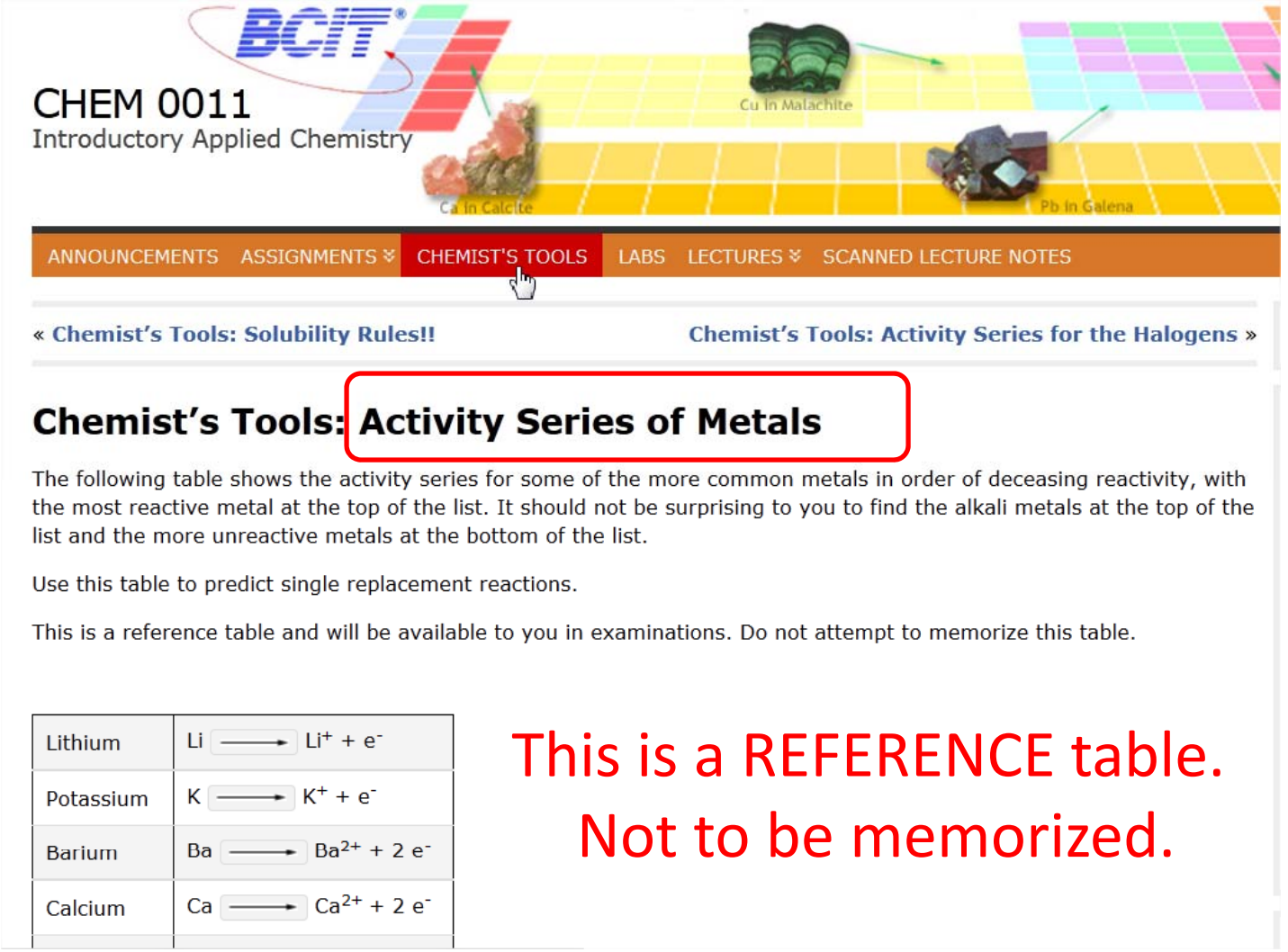
Today we will focus on single-replacement reactions of metals.

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

Lithium	$Li \longrightarrow Li^+ + e^-$
Potassium	$K \longrightarrow K^+ + e^-$
Barium	$Ba \longrightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \longrightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \longrightarrow Na^+ + e^-$
Magnesium	$Mg \longrightarrow Mg^{2+} + 2\ e^-$
Aluminum	$Al \longrightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \longrightarrow Mn^{2+} + 2\ e^-$
Zinc	$Zn \longrightarrow Zn^{2+} + 2\ e^-$
Chromium	$Cr \longrightarrow Cr^{3+} + 3\ e^-$
Iron	$Fe \longrightarrow Fe^{2+} + 2\ e^-$
Cobalt	$Co \longrightarrow Co^{2+} + 2\ e^-$
Nickel	$Ni \longrightarrow Ni^{2+} + 2\ e^-$
Tin	$Sn \longrightarrow Sn^{2+} + 2\ e^-$
Lead	$Pb \longrightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \longrightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \longrightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$



This is a REFERENCE table.
Not to be memorized.

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

The more reactive metals at the top of the table.

This is a REFERENCE table. Not to be memorized.

You are responsible to know how to use it.

Lithium	$Li \rightarrow Li^+ + e^-$
Potassium	$K \rightarrow K^+ + e^-$
Barium	$Ba \rightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \rightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \rightarrow Na^+ + e^-$
Magnesium	$Mg \rightarrow Mg^{2+} + 2\ e^-$
Aluminum	$Al \rightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \rightarrow Mn^{2+} + 2\ e^-$
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Lead	$Pb \rightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \rightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \rightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \rightarrow Ag^+ + e^-$
Mercury	$Hg \rightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \rightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \rightarrow Au^{3+} + 3\ e^-$

The less reactive metals at the bottom of the table.

Table shows oxidation reactions: Metals at the top of the table are active metals and they *lose* their electron(s) easily (i.e. They are easily oxidized.)

E.g. $Li\ (s) \rightarrow Li^+\ (aq) + e^-$

(Electrons written on the RHS)

Lithium *metal* is oxidized.

The opposite process of oxidation is **Reduction**, where the metal ions *gain* electron(s).

E.g. $Li^+\ (aq) + e^- \rightarrow Li\ (s)$

(Electrons written on the LHS)

Lithium ion is reduced.

Single-replacement reactions involving metals

ACTIVITY SERIES OF METALS

(Most active)

Lithium	$Li \longrightarrow Li^+ + e^-$
Potassium	$K \longrightarrow K^+ + e^-$
Barium	$Ba \longrightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \longrightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \longrightarrow Na^+ + e^-$
Magnesium	$Mg \longrightarrow Mg^{2+} + 2\ e^-$
Aluminum	$Al \longrightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \longrightarrow Mn^{2+} + 2\ e^-$
Zinc	$Zn \longrightarrow Zn^{2+} + 2\ e^-$
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Copper	$Cu \longrightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$

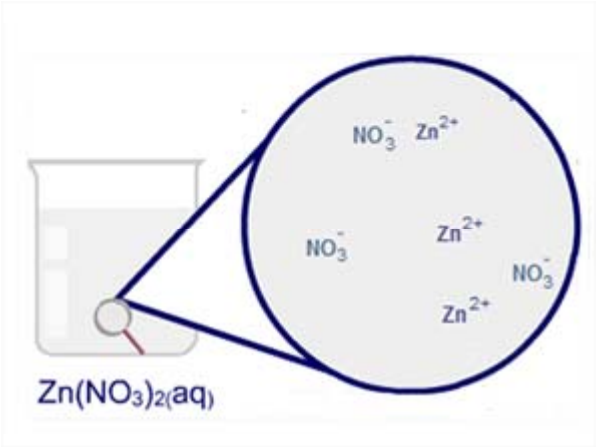
(Least active)

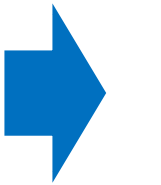
Q: Compare the positions of Magnesium and Zinc.
Which is higher on the Activity Series of Metals?

A: Mg is higher on the table. Mg is a more active metal than Zn.

What does this mean?

Consider an experiment: What happens if you dip Mg metal into a Zn^{2+} (aq) solution?

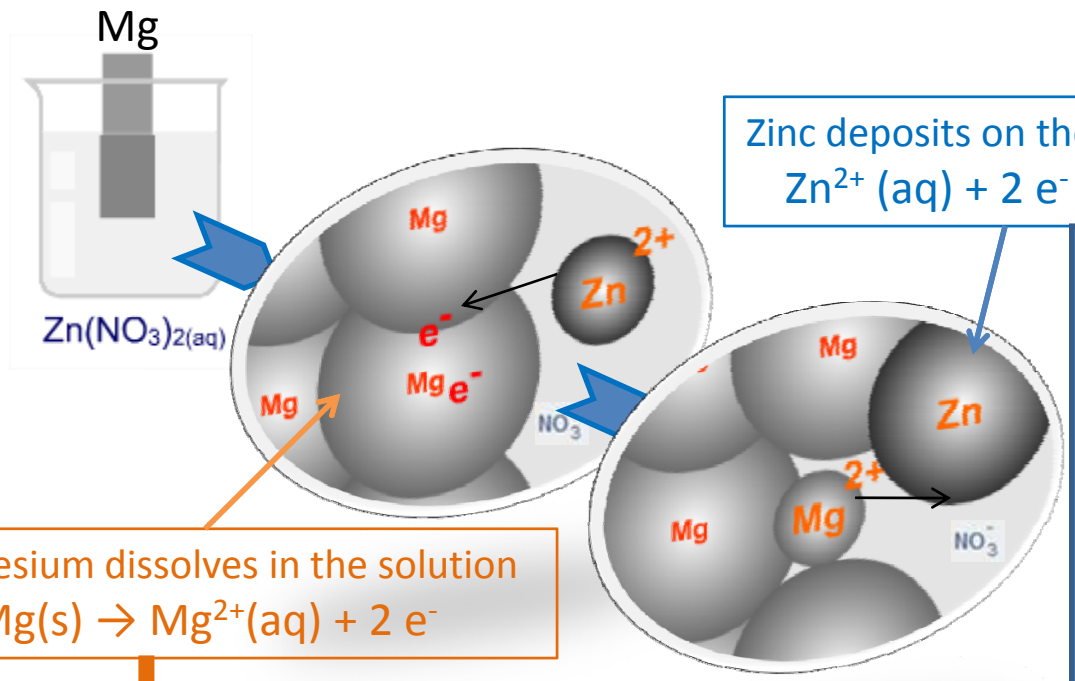




What is happening in the beaker of $Zn(NO_3)_2$ solution?

Single-replacement reactions involving metals

Starting Materials:
1. Mg(s)
2. $Zn(NO_3)_2$ (aq)



Zinc deposits on the Mg metal
Zn^{2+} (aq) + 2 e^- → Zn(s)

Magnesium dissolves in the solution
Mg(s) → Mg^{2+}(aq) + 2 e^-

A + BC → AC + B

Balanced chemical reaction:

Mg (s) + $Zn(NO_3)_2$ (aq) → $Mg(NO_3)_2$ (aq) + Zn (s)

A + BC → AC + B

Two processes happening:

Oxidation: Mg(s) → Mg^{2+}(aq) + 2 e^-

Reduction: Zn^{2+} (aq) + 2 e^- → Zn(s)

Net ionic reaction: Mg(s) + Zn^{2+} (aq) → Zn(s) + Mg^{2+} (aq)

Mg metal dissolves and displaces Zn^{2+} ions from solution because Mg is higher on the Activity Series of Metals than Zn.

Mg (s) is oxidized.
Zn^{2+} (aq) is reduced.

Q: What happened to the NO_3^- (aq) ions?

A: NO_3^- ions remain in solution. They did not participate in the reaction.

NO_3^- are spectator ions.

Single-replacement reactions involving metals

ACTIVITY SERIES OF METALS

(Most active)

Lithium	$Li \longrightarrow Li^+ + e^-$
Potassium	$K \longrightarrow K^+ + e^-$
Barium	$Ba \longrightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \longrightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \longrightarrow Na^+ + e^-$
Magnesium	$Mg \longrightarrow Mg^{2+} + 2\ e^-$
Aluminum	$Al \longrightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \longrightarrow Mn^{2+} + 2\ e^-$
Zinc	$Zn \longrightarrow Zn^{2+} + 2\ e^-$
Chromium	$Cr \longrightarrow Cr^{3+} + 3\ e^-$
Iron	$Fe \longrightarrow Fe^{2+} + 2\ e^-$
Cobalt	$Co \longrightarrow Co^{2+} + 2\ e^-$
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Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$

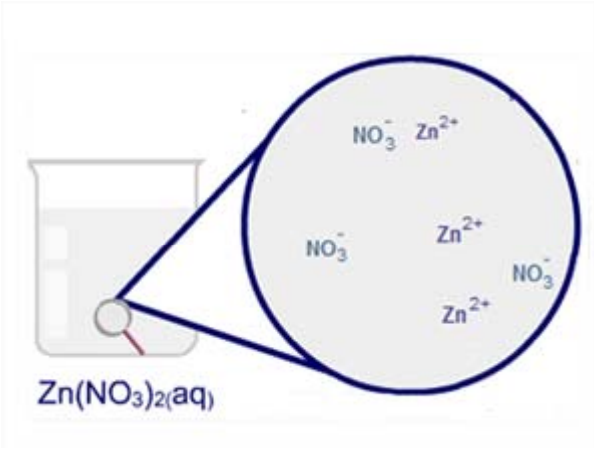
(Least active)

Q: Compare the positions of Copper and Zinc.
Which is higher on the Activity Series of Metals?

A: Zn is higher on the table. Zn is more active than Cu.

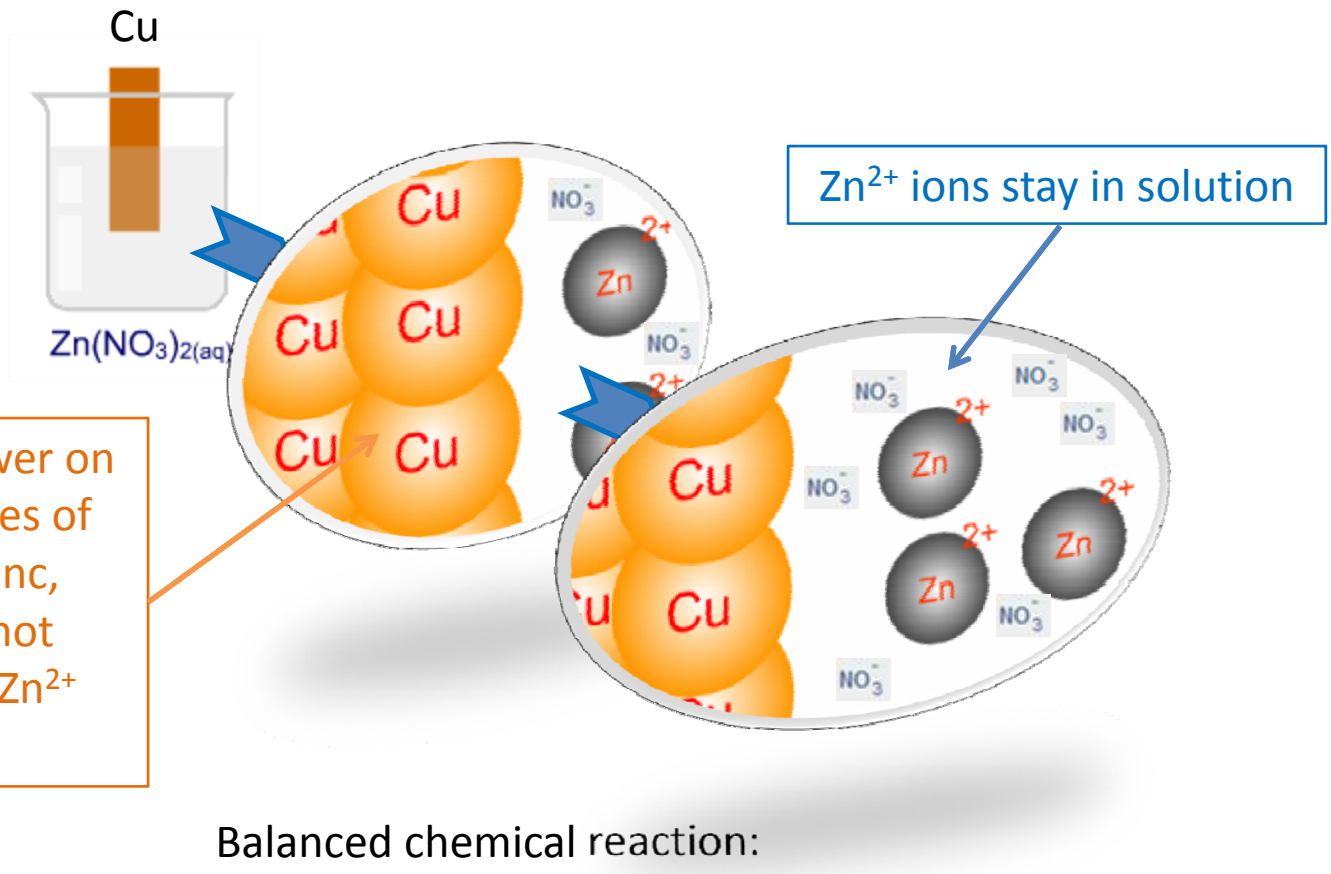
What does that mean?

Consider an experiment: What happens if you dip Cu metal into a Zn^{2+} (aq) solution?



What is happening in the beaker of $Zn(NO_3)_2$ solution?

Single-replacement reactions involving metals



Balanced chemical reaction:

No reaction. Since Cu is lower on the Activity Series of Metals than Zinc, Cu metal cannot displace Zn^{2+} ions from the solution.

Single-replacement reactions involving metals - SUMMARY

$A + BC \rightarrow AC + B$

ACTIVITY SERIES OF METALS

(Most active)

Lithium	$Li \rightarrow Li^+ + e^-$
Potassium	$K \rightarrow K^+ + e^-$
Barium	$Ba \rightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \rightarrow Ca^{2+} + 2\ e^-$
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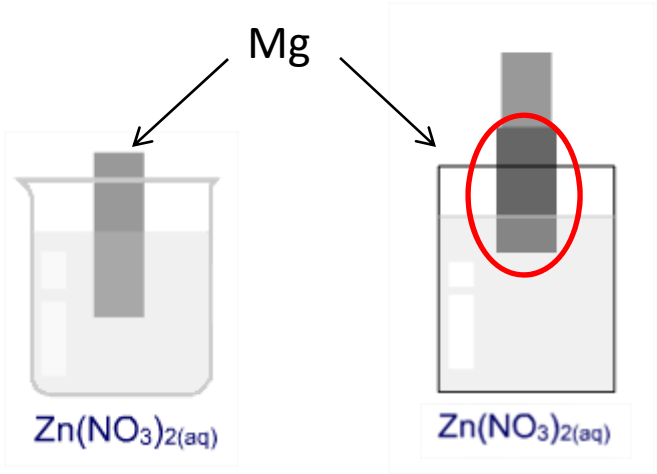
Silver	$Ag \rightarrow Ag^+ + e^-$
Mercury	$Hg \rightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \rightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \rightarrow Au^{3+} + 3\ e^-$

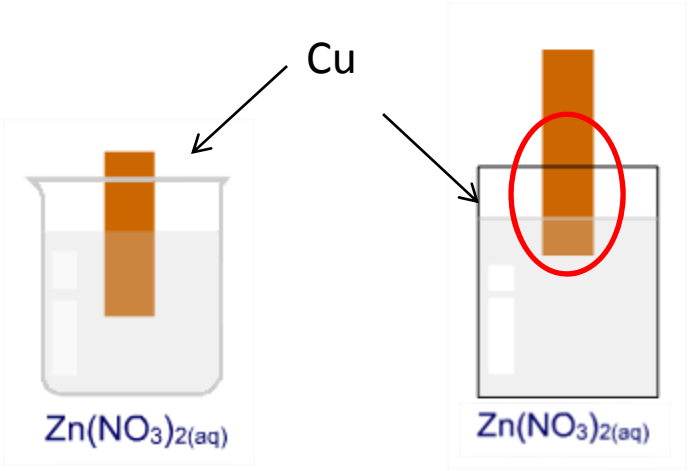
(Least active)



Mg (s) is oxidized.
Zn^{2+} (aq) is reduced.
NO_3^- are the spectator ions.

Balanced chemical reaction $Mg\ (s) + Zn(NO_3)_2\ (aq) \rightarrow Mg(NO_3)_2\ (aq) + Zn\ (s)$

Net ionic reaction $Mg(s) + Zn^{2+}\ (aq) \rightarrow Zn(s) + Mg^{2+}\ (aq)$



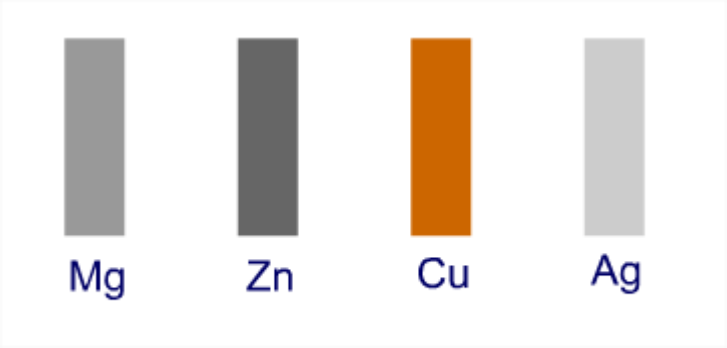
No reaction

RULE: The metal (Mg) has to be more active than the metal ions in solution (Zn^{2+}) in order to displace the ions from the solution. Otherwise, no reaction occurs.

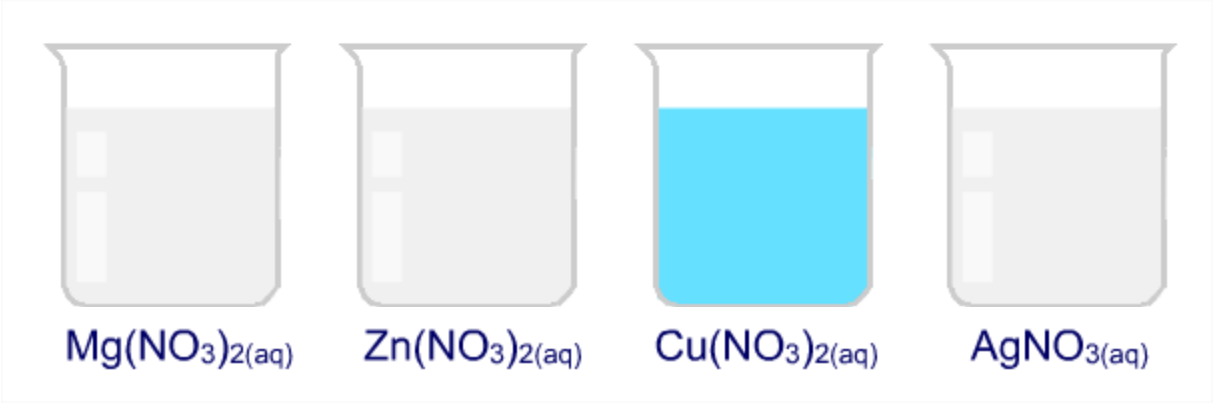
Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

Consider these metals:



What happens when they are dipped into different solutions?

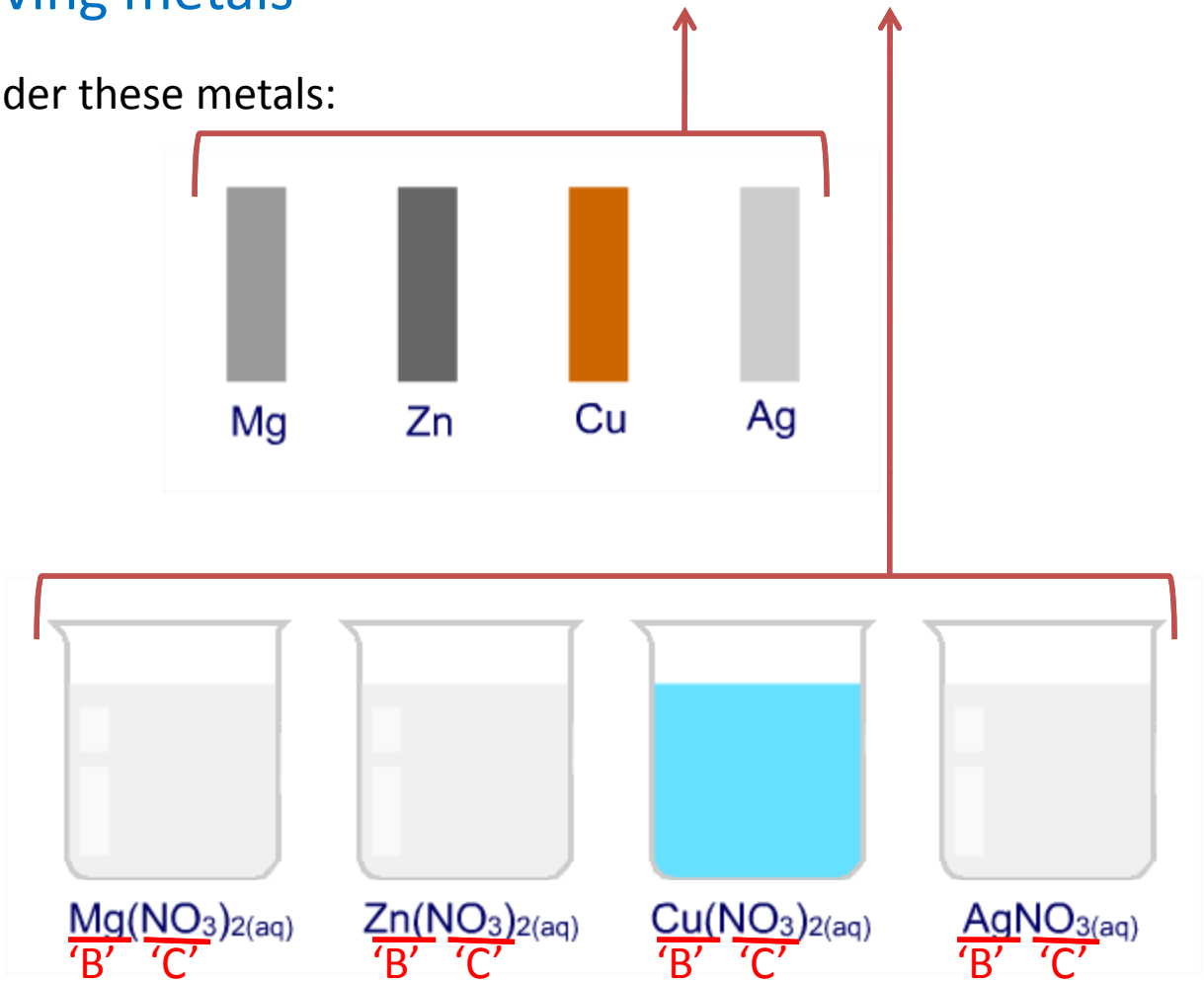


Can we predict if there is a reaction?

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

Consider these metals:

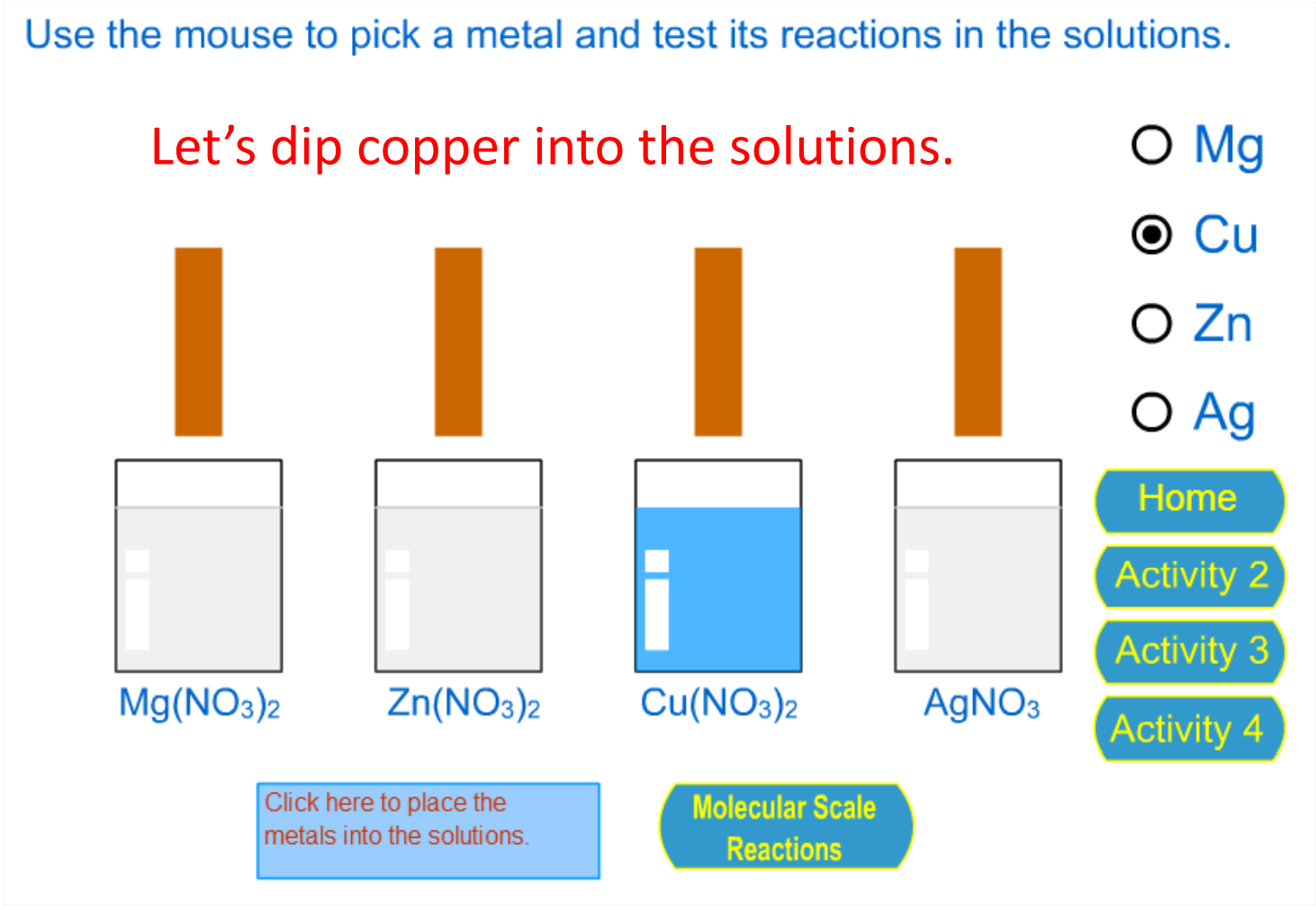


What happens when the metals are dipped into the different solutions?

A reaction may or may not occur. But ***if*** there is a reaction, it will follow the Single Replacement reaction format to form the products, AC + B.

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$



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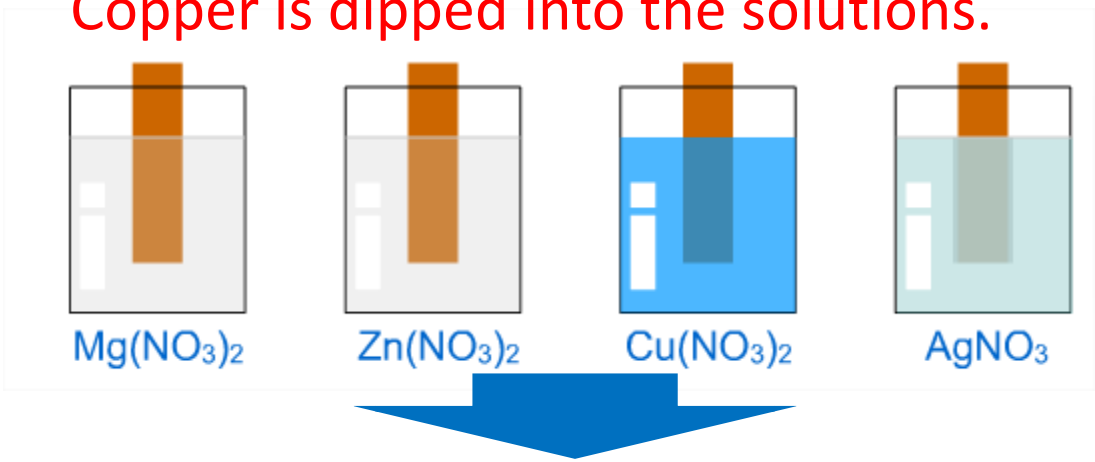
Single-replacement reactions involving metals

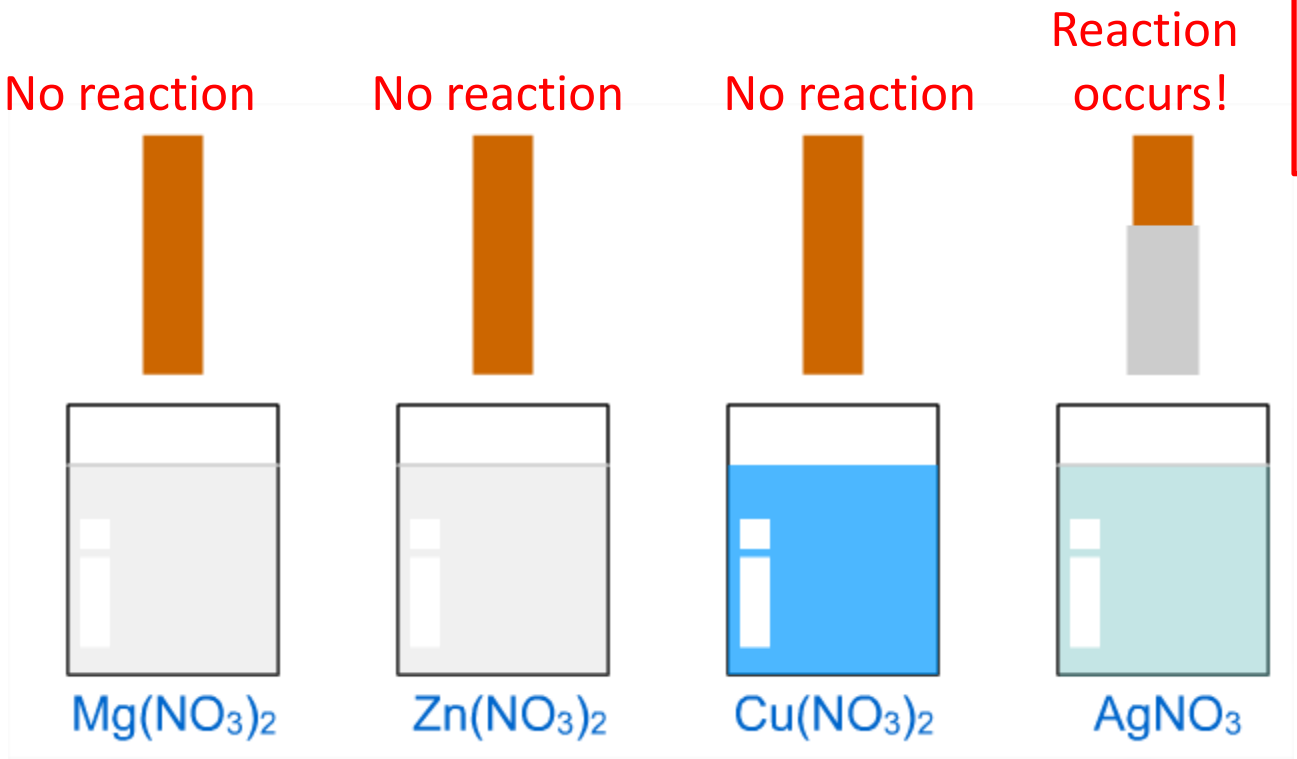
$A + BC \rightarrow AC + B$

Copper is dipped into the solutions.



Let's remove the copper from the solutions.

Let's record observations on the worksheet.



Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

Lithium	$Li \rightarrow Li^+ + e^-$
Potassium	$K \rightarrow K^+ + e^-$
Barium	$Ba \rightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \rightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \rightarrow Na^+ + e^-$
Magnesium	$Mg \rightarrow Mg^{2+} + 2\ e^-$
Aluminium	$Al \rightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \rightarrow Mn^{2+} + 2\ e^-$
Zinc	$Zn \rightarrow Zn^{2+} + 2\ e^-$
Chromium	$Cr \rightarrow Cr^{3+} + 3\ e^-$
Iron	$Fe \rightarrow Fe^{2+} + 2\ e^-$
Cobalt	$Co \rightarrow Co^{2+} + 2\ e^-$
Nickel	$Ni \rightarrow Ni^{2+} + 2\ e^-$
Tin	$Sn \rightarrow Sn^{2+} + 2\ e^-$
Lead	$Pb \rightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \rightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \rightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \rightarrow Ag^+ + e^-$
Mercury	$Hg \rightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \rightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \rightarrow Au^{3+} + 3\ e^-$

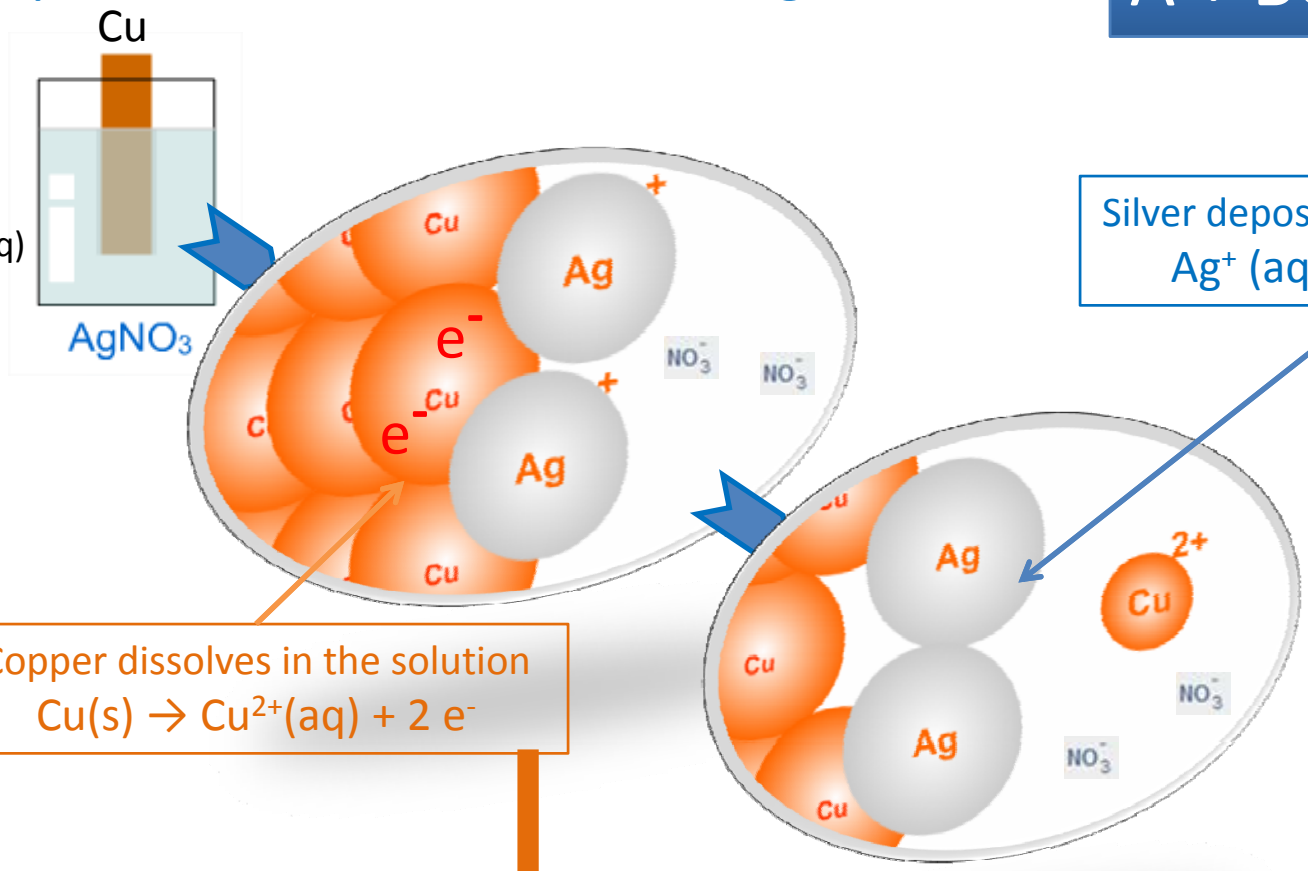
Let's write the reaction for Cu (s) in $AgNO_3$(aq).

SOLID METALS	(NR = no reaction) SOLUTIONS							
	$Mg(NO_3)_2$ (aq)		$Zn(NO_3)_2$ (aq)		$Cu(NO_3)_2$ (aq)		$AgNO_3$ (aq)	
Mg (s)	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Cu (s)	Is there a reaction? NR	Is the solid metal more active? No	Is there a reaction? NR	Is the solid metal more active? No	NR		Is there a reaction? Yes	Is the solid metal more active? Yes
Zn (s)	Is there a reaction?	Is the solid metal more active?	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Ag (s)	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	NR	

Single-replacement reactions involving metals

$A + BC \rightarrow AC + B$

Starting Materials:
1. Cu(s)
2. $AgNO_3$ (aq)



Silver deposits on the Cu metal

$Ag^+ (aq) + e^- \rightarrow Ag(s)$

Copper dissolves in the solution

$Cu(s) \rightarrow Cu^{2+}(aq) + 2\ e^-$

Balanced chemical reaction:

$Cu\ (s) + 2\ AgNO_3\ (aq) \rightarrow Cu(NO_3)_2\ (aq) + 2\ Ag\ (s)$

Two processes happening:

Oxidation: $Cu(s) \rightarrow Cu^{2+}(aq) + 2\ e^-$

Reduction: $2\ Ag^+ (aq) + 2\ e^- \rightarrow 2\ Ag(s)$

NO_3^- are spectator ions.

Cu (s) is oxidized.
Ag^+ (aq) is reduced.

$Cu(s) + 2\ Ag^+ (aq) \rightarrow 2\ Ag(s) + Cu^{2+}\ (aq)$

Net ionic reaction

Single-replacement reactions involving metals

$A + BC \rightarrow AC + B$

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Activity 1

SOLID METALS	SOLUTIONS							
	$Mg(NO_3)_2$ (aq)		$Zn(NO_3)_2$ (aq)		$Cu(NO_3)_2$ (aq)		$AgNO_3$ (aq)	
Mg (s)	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Cu (s)	Is there a reaction? NR	Is the solid metal more active? No	Is there a reaction? NR	Is the solid metal more active? No	NR		Is there a reaction? Yes	Is the solid metal more active? Yes
Zn (s)	Is there a reaction?	Is the solid metal more active?	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Ag (s)	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	NR	

Continue with Activity 1, 2, and 3.

For every reaction,

1. Write the balanced overall chemical reaction.
2. Write the balanced net ionic reaction.
3. Determine the species oxidized.
4. Determine the species reduced.
5. Identify the spectator ion(s).

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

(Most active)

Lithium	$Li \longrightarrow Li^+ + e^-$
Potassium	$K \longrightarrow K^+ + e^-$
Barium	$Ba \longrightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \longrightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \longrightarrow Na^+ + e^-$
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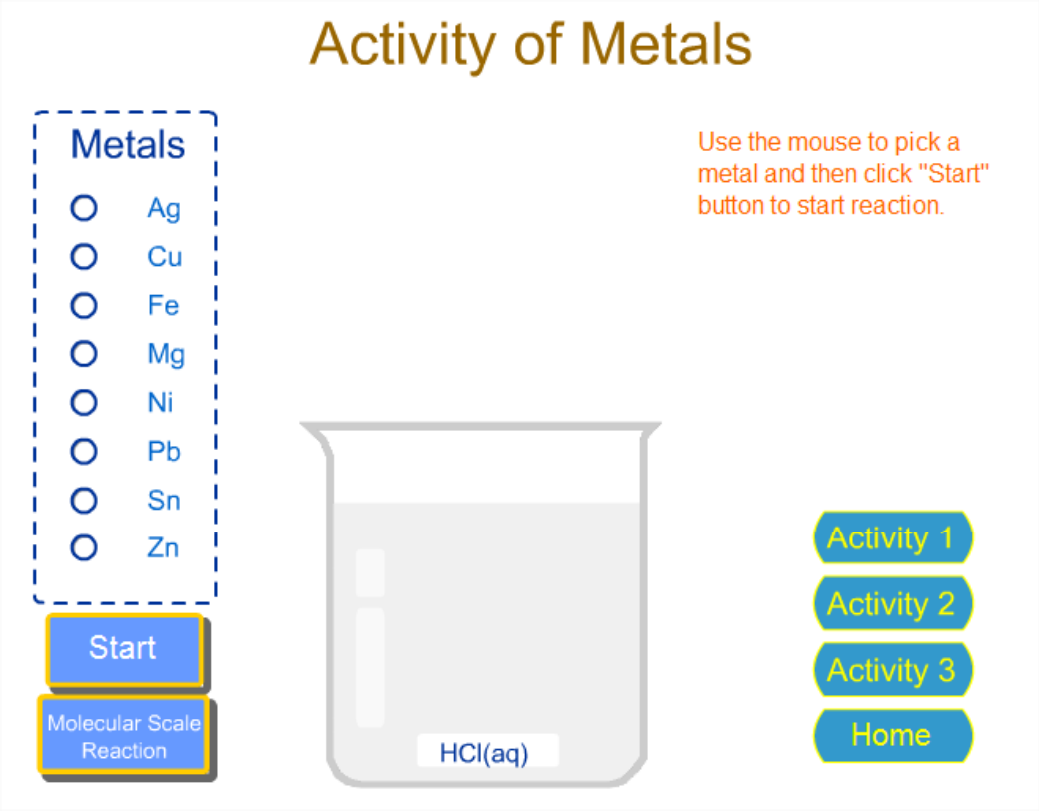
Lead	$Pb \longrightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \longrightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \longrightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$

(Least active)

Activity 4

Compare the positions of the Metal and Hydrogen.

Q: Will the metal under consideration react with hydrogen ions in solution to displace H_2 from the solution?



Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

(Most active)

Lithium	$Li \longrightarrow Li^+ + e^-$
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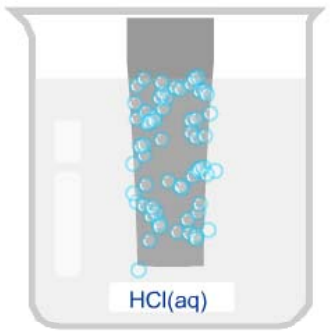
Lead	$Pb \longrightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \longrightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \longrightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$

(Least active)

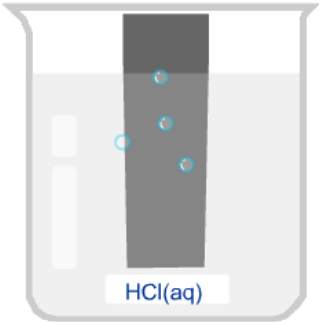
Activity 4

Q: Will the Mg (s), Pb (s), and Ag (s) react with hydrogen ions in an HCl solution to displace H_2 from the solution?

Reaction occurs!
Mg (s)



Reaction occurs!
Pb (s)



No Reaction
Ag (s)

Bubbles shows the formation of H_2 (g) as H^+ (aq) is displaced from the solution. The more bubbles, the faster the reaction.

RULE: The metal (Mg and Pb) has to be more active than H^+ ions in solution in order to displace H_2 (g) from the solution.

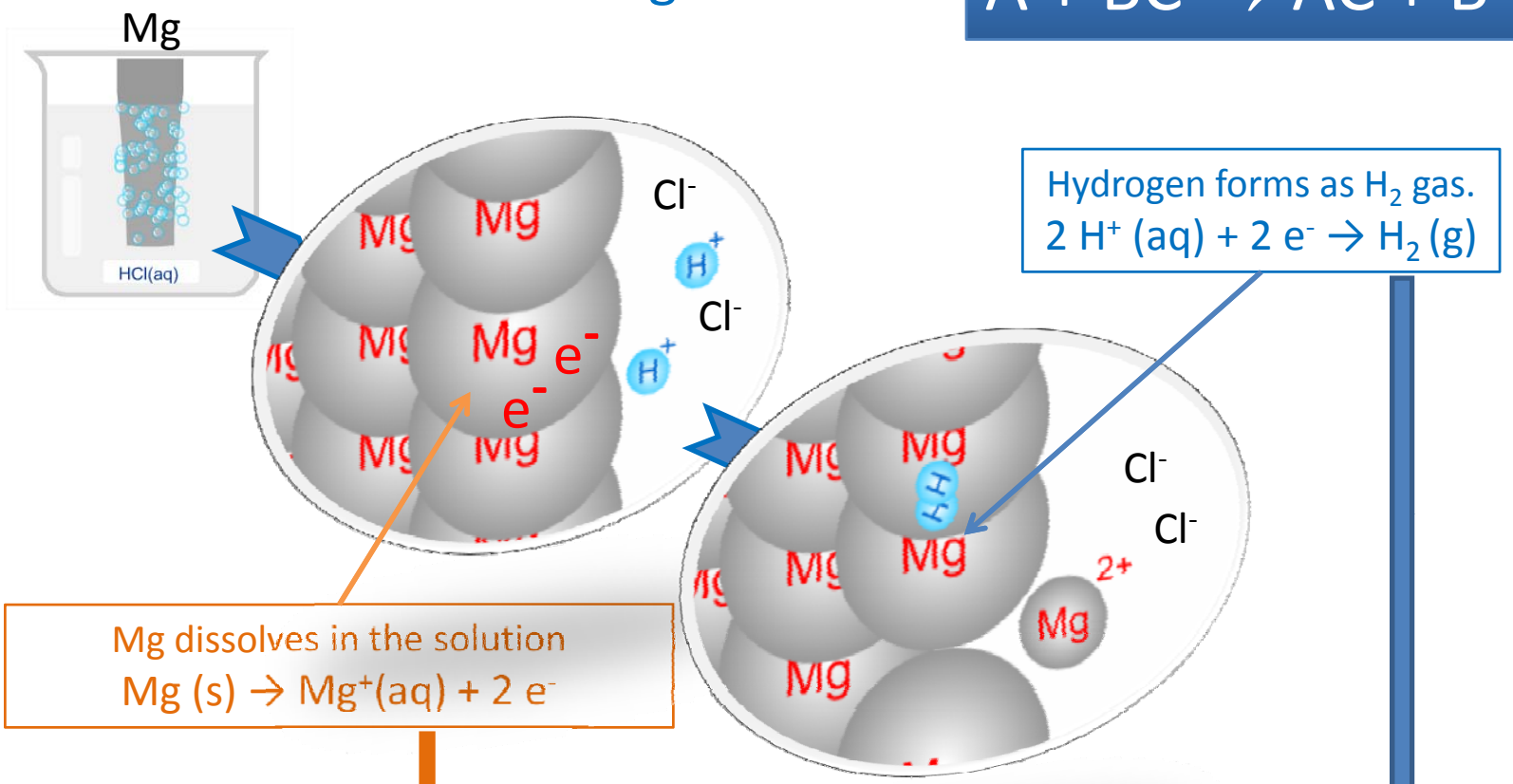
Let's write the reaction involving Mg (s) in HCl solution.

Single-replacement reactions involving metals

$A + BC \rightarrow AC + B$

Starting Materials:

1. Mg(s)
2. HCl (aq)



Balanced chemical reaction:

$Mg\,(s) + 2\,HCl\,(aq) \rightarrow MgCl_2\,(aq) + H_2\,(g)$

Two processes happening:

Oxidation: $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

Reduction: $2\,H^+\,(aq) + 2e^- \rightarrow H_2\,(g)$

$Mg(s) + 2\,H^+\,(aq) \rightarrow H_2\,(g) + Mg^{2+}\,(aq)$

Net ionic reaction

Cl^- are spectator ions.

Mg (s) is oxidized.
H^+ (aq) is reduced.

Single-replacement reactions involving metals

$$A + BC \rightarrow AC + B$$

ACTIVITY SERIES OF METALS

Lithium	$Li \longrightarrow Li^+ + e^-$
Potassium	$K \longrightarrow K^+ + e^-$
Barium	$Ba \longrightarrow Ba^{2+} + 2\ e^-$
Calcium	$Ca \longrightarrow Ca^{2+} + 2\ e^-$
Sodium	$Na \longrightarrow Na^+ + e^-$
Magnesium	$Mg \longrightarrow Mg^{2+} + 2\ e^-$
Aluminum	$Al \longrightarrow Al^{3+} + 3\ e^-$
Manganese	$Mn \longrightarrow Mn^{2+} + 2\ e^-$
Zinc	$Zn \longrightarrow Zn^{2+} + 2\ e^-$
Chromium	$Cr \longrightarrow Cr^{3+} + 3\ e^-$
Iron	$Fe \longrightarrow Fe^{2+} + 2\ e^-$
Cobalt	$Co \longrightarrow Co^{2+} + 2\ e^-$
Nickel	$Ni \longrightarrow Ni^{2+} + 2\ e^-$
Tin	$Sn \longrightarrow Sn^{2+} + 2\ e^-$
Lead	$Pb \longrightarrow Pb^{2+} + 2\ e^-$
Hydrogen	$H_2 \longrightarrow 2\ H^+ + 2\ e^-$
Copper	$Cu \longrightarrow Cu^{2+} + 2\ e^-$
Silver	$Ag \longrightarrow Ag^+ + e^-$
Mercury	$Hg \longrightarrow Hg^{2+} + 2\ e^-$
Platinum	$Pt \longrightarrow Pt^{2+} + 2\ e^-$
Gold	$Au \longrightarrow Au^{3+} + 3\ e^-$

Activity 4

	HCl (aq)	If a reaction occurs, rank the speed of the reaction. (1) for the fastest reaction, (2) for the 2nd fastest reaction, etc.
Ag (s)	No	3
Cu (s)		
Fe (s)		
Mg (s)	Yes	1
Pb (s)	Yes	2

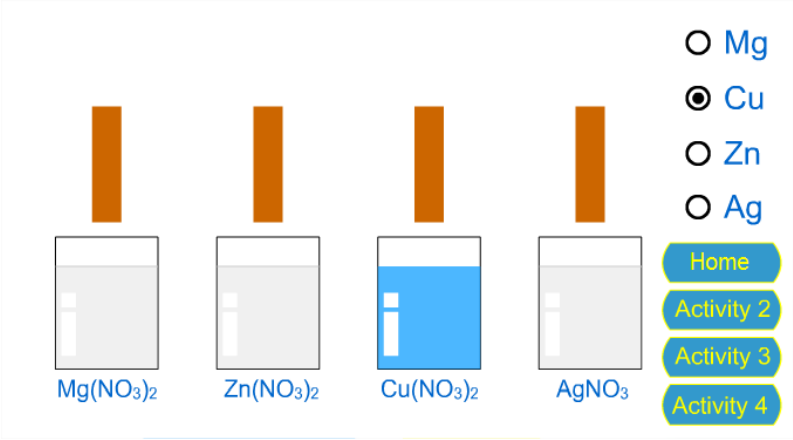
Continue with Activity 4.

For every reaction,

1. Write the balanced overall chemical reaction.
2. Write the balanced net ionic reaction.
3. Determine the species oxidized.
4. Determine the species reduced.
5. Identify the spectator ion(s).

Finish the worksheet: Activity 1, 2, 3, 4

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/redox/home.html



Single Replacement Reactions

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/redox/home.html

Activity 1

SOLID METALS	SOLUTIONS							
	$Mg(NO_3)_2$ (aq)		$Zn(NO_3)_2$ (aq)		$Cu(NO_3)_2$ (aq)		$AgNO_3$ (aq)	
Mg (s)	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Cu (s)	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	NR		Is there a reaction?	Is the solid metal more active?
Zn (s)	Is there a reaction?	Is the solid metal more active?	NR		Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?
Ag (s)	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	Is there a reaction?	Is the solid metal more active?	NR	

Look up the solid metals on the Activity Series of metals. Arrange the solid metals in order of activities (From most active to least active).

Try some practice problems in Maple TA.

Use Dimensional Analysis in ALL your calculations!!