

# Chemical Reactions II

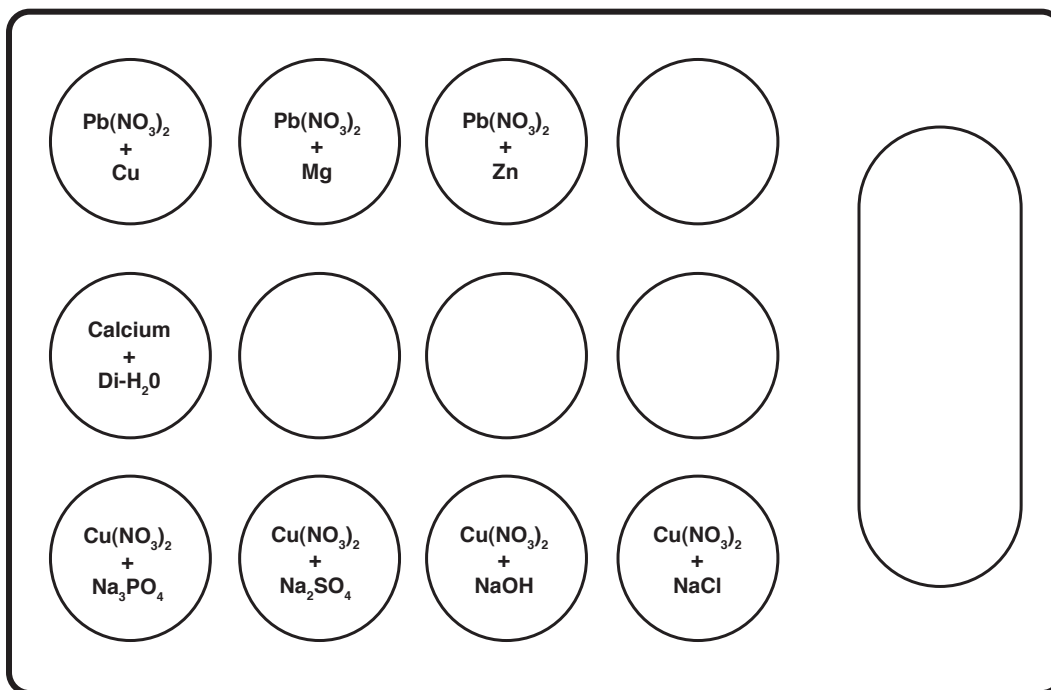
## Objective:

During this lab, you will observe several different types of chemical reactions. Based on these observations, you will write complete, balanced chemical equations (including states of matter) for each reaction. You may use an activity series and a solubility chart.

## Procedure:


- 1) Obtain a clean, dry spot plate then **\*\*Refer to Figure 1: Spot Plate Set-Up\*\***
- 2) For the first series of reactions: place 5-10 drops of lead (II) nitrate solution in wells 1, 2, and 3 in the first horizontal row. Place a small piece of Copper in well 1. Place a small piece of Magnesium in well 2. Place a small piece of Zinc in well 3.
- 3) Observe each well for 5 minutes. Record observations in Chart 1 (record NR if no reaction). Write the complete, balanced equations, including states of matter, for each reaction.
- 4) Place a small piece of calcium metal into well 1 in the second horizontal row. Add 15 drops of distilled water. Record results in Chart 2. Write the complete, balanced equation, including states of matter, for the reaction.
- 5) For the final series of reactions: place 5 drops of copper (II) nitrate solution in wells 1-4 in the third horizontal row. Add 5 drops of sodium phosphate to well 1, 5 drops of sodium sulfate to well 2, five drops of sodium hydroxide to well 3, and 5 drops of sodium chloride to well 4. Record results in Chart 3. Write the complete, balanced equations, including states of matter, for the reactions.
- 6) For clean-up: Decant all liquids into sink and flush with tap water. ALL Solid material should be deposited in the waste bin on the front table.

**Figure 1: Spot Plate Set-Up**



## Activity Series of Metals in Aqueous Solution

Metal	Oxidation Reaction
Lithium	$\text{Li} \rightarrow \text{Li}^+ + \text{e}^-$
Potassium	$\text{K} \rightarrow \text{K}^+ + \text{e}^-$
Barium	$\text{Ba} \rightarrow \text{Ba}^{2+} + 2\text{e}^-$
Calcium	$\text{Ca} \rightarrow \text{Ca}^{2+} + 2\text{e}^-$
Sodium	$\text{Na} \rightarrow \text{Na}^+ + \text{e}^-$
Magnesium	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$
Aluminum	$\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$
Manganese	$\text{Mn} \rightarrow \text{Mn}^{2+} + 2\text{e}^-$
Zinc	$\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$
Chromium	$\text{Cr} \rightarrow \text{Cr}^{3+} + 3\text{e}^-$
Iron	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$
Cobalt	$\text{Co} \rightarrow \text{Co}^{2+} + 2\text{e}^-$
Nickel	$\text{Ni} \rightarrow \text{Ni}^{2+} + 2\text{e}^-$
Tin	$\text{Sn} \rightarrow \text{Sn}^{2+} + 2\text{e}^-$
Lead	$\text{Pb} \rightarrow \text{Pb}^{2+} + 2\text{e}^-$
Hydrogen	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
Copper	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
Silver	$\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$
Mercury	$\text{Hg} \rightarrow \text{Hg}^{2+} + 2\text{e}^-$
Platinum	$\text{Pt} \rightarrow \text{Pt}^{2+} + 2\text{e}^-$
Gold	$\text{Au} \rightarrow \text{Au}^{3+} + 3\text{e}^-$


  
**Reactivity Increases**

Solubility Rules

General Chemistry I

### Solubility of Ionic Compounds

#### *Classes of soluble compounds*

- compounds of the alkali metals (1A)
- ammonium ( $\text{NH}_4^+$ ) compounds
- nitrates ( $\text{NO}_3^-$ ), chlorates ( $\text{ClO}_3^-$ ), perchlorates ( $\text{ClO}_4^-$ ), acetates ( $\text{CH}_3\text{CO}_2^-$ )
- chlorides ( $\text{Cl}^-$ ), bromides ( $\text{Br}^-$ ), iodides ( $\text{I}^-$ ), **except:**  $\text{Pb}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Hg}_2^{2+}$
- sulfates ( $\text{SO}_4^{2-}$ ), **except:**  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Ag}^+$  (the last three are slightly soluble)

#### *Classes of insoluble compounds*

- carbonates ( $\text{CO}_3^{2-}$ ), phosphates ( $\text{PO}_4^{3-}$ ), oxalates ( $\text{C}_2\text{O}_4^{2-}$ ), chromates ( $\text{CrO}_4^{2-}$ ), **except:** alkali metals,  $\text{NH}_4^+$
- sulfides ( $\text{S}^{2-}$ ), **except:** alkali metals,  $\text{NH}_4^+$ , alkaline earth metals (2A) ( $\text{CaS}$ ,  $\text{SrS}$ , and  $\text{BaS}$  are slightly to moderately soluble),
- hydroxides ( $\text{OH}^-$ ), oxides ( $\text{O}^{2-}$ ), **except:** alkali metals, alkaline earth metals ( $\text{Ca}(\text{OH})_2$  and  $\text{Sr}(\text{OH})_2$  are only slightly soluble;  $\text{Mg}(\text{OH})_2$  is only very slightly soluble)

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## Chemical Reactions II Data Sheet

Chart 1: (R or NR)

	<b>Cu</b>	<b>Mg</b>	<b>Zn</b>
<b>Lead (II) nitrate</b>			

Balanced equations from Chart 1:

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Chart 2: (R or NR)

	<b>Calcium</b>
<b>Di-H<sub>2</sub>O</b>	

Balanced equation from Chart 2:

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Chart 3: (R or NR)

	<b>Sodium phosphate</b>	<b>Sodium sulfate</b>	<b>Sodium hydroxide</b>	<b>Sodium chloride</b>
<b>Copper (II) nitrate</b>				

(over)

Balanced equations from Chart 3:

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Write complete, balanced equations for the following:

A. Combustion of octane ( $C_8H_{18}$ )

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B. Decomposition of Fructose ( $C_6H_{12}O_6$ )

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C. Magnesium oxide reacts with  $H_2O$

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