

## Reactions of Metals Lab Activity 2 - Student Edition

# Making Metal Hydroxides

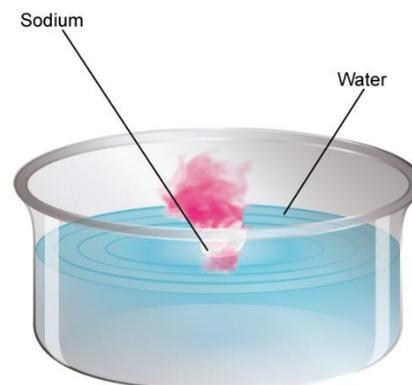
### Background Information:

Some metals are more reactive than others and can react violently with water. These metals are usually found in group 1 of the periodic table and are usually kept under oil to stop them from reacting.

## Metal + Water → Metal Hydroxide + Hydrogen Gas

This lab demonstrates and explores some of the more reactive metals on the periodic table including the some of the group 1 metals such as lithium and sodium, group 2 metals calcium and magnesium and several other metals which are much less reactive.

When metal atoms react with water, they lose their outer electrons and form positive metal ions. This means that they have more protons than electrons. The oxygen atoms gain the electrons lost by the metal, forming negatively charged ions, since they have more electrons than protons. The oxide ions react with the hydrogen ions in the water to form a negative hydroxide ion ( $\text{OH}^-$ ) which is attracted to the positive metal ion. This forms the metal hydroxide component of the product. The leftover hydrogen ions from hydrogen gas ( $\text{H}_2$ ) which in some cases will combust causing the metal to catch alight.



In less violent reactions, the hydrogen gas can be collected and tested with a lit splint to confirm its presence. Metal hydroxides are basic, therefore if the leftover solution is tested with phenolphthalein indicator it will change from colorless to bright pink.

This lab will have two parts:

1. Teacher demonstration of sodium in water.
2. Student activity in pairs or groups of three.

### Learning Objectives:

- Predict the reaction of metals with water
- Examine how different metals react with water.

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### Pre-Lab Questions:

1. Name the main product formed when a metal reacts with water.

\_\_\_\_\_

2. Which metals on the periodic table are generally the MOST reactive with water?

\_\_\_\_\_

3. Which metals on the periodic table are generally the LEAST reactive with water?

\_\_\_\_\_

### Equipment Needed:

- Samples of metals:
  - Magnesium ribbon
  - Calcium pellets
  - Zinc pieces
  - Copper strips
  - Aluminum strips
- Safety glasses
- Test tubes and rack
- 600ml glass Beaker
- Cold water
- Phenolphthalein indicator
- Marker pen

### Safety Notes:

- Wear safety glasses for the entire lab.

### *Before starting this lab:*

1. Complete the column in the results table to order the metals from most to least reactive using the scale 1-5, 1 being the most reactive.
2. Your teacher will demonstrate the reaction of sodium in water. Observe the reaction and record any observations in the results table below.

### Method:

1. Arrange the test tubes in a test tube rack with a different metal sample inside each test tube. Use a marker pen to write the chemical symbol for each metal on the test tube.
2. Pour 300ml of cold water into the beaker and add 10 drops of phenolphthalein indicator to the beaker.
3. Carefully half-fill each test tube with the water and indicator solution.

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4. Observe and record any changes to each metal.



### Results:

Metal	Order of reactivity (1-5)	Observations <i>Before and after the reaction</i>
Magnesium		
Zinc		
Sodium		
Copper		
Aluminum		
Calcium		

### Analysis:

Based on your observations, order the six metals from most to least reactive.

\_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_

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### Post-Lab Questions:

1. Which metal is the most reactive?

\_\_\_\_\_

- a) Complete the word equation for this reaction

\_\_\_\_\_

- b) Explain color change in the water when it was added to the metal named in question 1.

\_\_\_\_\_

\_\_\_\_\_

- c) How does the reactivity of this metal relate to its position on the periodic table?

\_\_\_\_\_

\_\_\_\_\_

2. Both calcium and magnesium move to the surface of the water and float during the experiment. Explain why this occurs.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Which metals were unreactive in cold water?

\_\_\_\_\_

4. Explain how you could differentiate the reactivity of the three metals mentioned in question 3.

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