# Reaction of Metals with Air (Oxygen) and Water

## A. Fill in the Blanks

**Complete the sentences with the correct scientific term.**

1. The reaction of a metal with oxygen is a type of _____ reaction.
2. Reactive metals react with water to produce a metal hydroxide and _____ gas.
3. The reactivity series helps us _____ how a metal will react.
4. Gold and platinum are called _____ metals because they are very unreactive.
5. When iron reacts with steam, it forms iron _____ and hydrogen gas.

## B. Match the Following;

**Match the property in Column A with its correct description in Column B.**

| Column A (Metal) | Column B (Description / Reaction) |
|---|---|
| 1. Sodium | A. Rusts to form a reddish-brown, flaky solid. |
| 2. Gold | B. Burns with a dazzling, bright white light. |
| 3. Iron | C. Reacts violently with cold water, zipping on the surface. |
| 4. Copper | D. Highly unreactive; used for high-value coins and jewelry. |
| 5. Magnesium | E. Reacts very slowly with oxygen; forms a black oxide when heated. |

## C. Practice Problems

**Apply your knowledge to answer the following questions.**

1. Write the word equation for the reaction when a strip of magnesium is burned in the air. _____ + _____ → _____
2. A student drops a small piece of calcium into a beaker of water. List two observations they would make.
   a) _____ b) _____

3. What gas is produced when sodium reacts with water? How would you test for this gas in a lab? Gas: _____ Test: _____

4. Why does a shiny copper pipe develop a black, dull coating when heated with a blowtorch?

5. Arrange the following metals in order from most reactive to least reactive: Iron, Gold, Potassium, Magnesium _____ > _____ > _____ > _____

6. Write the word equation for the reaction of potassium with water. _____ + _____ → _____ + _____

7. Why are iron gates and bridges often painted?

8. Some metals, like zinc and iron, do not react with cold water but will react with steam. What are the two products formed when iron reacts with steam? _____ and _____

9. Compare the reactivity of sodium and magnesium with oxygen.

10. Why is it dangerous to store sodium in a place exposed to air and moisture?

## D. Warm-up Questions

**Answer these quick questions to refresh your memory.**

1. What gas present in the air is essential for the reaction of metals like burning or rusting?

2. What is the common name for the reddish-brown flaky substance that forms on iron?

3. Name one metal that is highly unreactive and is often used to make expensive jewelry.

4. When a metal reacts with oxygen, what is the general name for the new substance formed?

5. Which is more reactive: a metal that reacts with cold water or a metal that only reacts with steam?

## E. Challenge Questions

**Think critically to solve these problems.**

1. A science teacher has three unlabeled metal samples: Copper, Calcium, and Zinc. Describe a two-step experiment using only water (in its liquid and gas forms) to correctly identify each metal.

Step 1: _____

Step 2: _____

2. You are given a piece of iron and a piece of magnesium of the same size. If you place both in separate beakers of warm water, which one will produce bubbles of hydrogen gas faster? Explain your answer using the concept of the reactivity series.

3. While both are reactions with oxygen, explain the difference between the rusting of iron and the burning of magnesium. Consider the speed of the reaction and the energy released.

4. Write the balanced chemical equation for the reaction of sodium with water. (Hint: The formula for sodium hydroxide is NaOH).

5. An astronaut finds a shiny metallic rock on a new planet with an oxygen-rich atmosphere. After a year, the rock is still perfectly shiny. What can you infer about the reactivity of this unknown metal? Why would this metal be a poor choice for creating a chemical hand-warmer that works by reacting with air?

## F. Word Problems & Application

**Apply your knowledge to real-world scenarios.**

1. The School Fence: A new school fence is made of iron. To protect it from the rain and air, the school decides to coat it. What is this process called, and why is it necessary?

2. The Camping Trip: While on a camping trip, you use a magnesium fire starter. It creates a very bright spark when scraped. What chemical reaction is happening to create that bright light?

3. The Old Statue: A city has a very old statue made of bronze (an alloy of copper). Over 100 years, it has developed a green coating. An identical statue made of gold was erected on the same day. How would the gold statue look today? Explain why.

4. Kitchen Cookware: Some expensive pots and pans have a layer of copper on the bottom to help them heat evenly. Why is pure sodium or potassium never used to make cookware, despite being metals?

5. Car Exhausts: Car exhaust pipes are often made of steel (mostly iron) but can rust through quickly. Some high-performance cars use stainless steel or titanium for their exhausts. Based on this, what can you conclude about the reactivity of titanium compared to iron?

## G. True or False

1. All metals react with oxygen at the same speed. _____

2. Burning magnesium in the air produces a white powder called magnesium hydroxide. _____

3. The test for hydrogen gas is that it relights a glowing splint. _____

4. Copper is more reactive than iron. _____

5. Painting an iron object prevents rusting by stopping water and carbon dioxide from reaching it. _____