

## Prior Knowledge Review: Reactions of Metals

Answer the questions below.

1. Define 'the reactivity series'.

**The reactivity series is a list of metals arranged in order of reactivity (from most reactive at the top to least reactive at the bottom)**

2. Where does gold appear on the reactivity series?

**Gold appears at the bottom of the reactivity series.**

3. Define 'oxidation'.

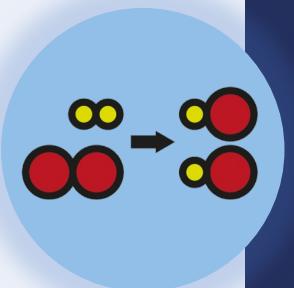
**Oxidation is the addition of oxygen.**

4. Define 'reduction'.

**Reduction is the loss of oxygen.**

5. What name is given to minerals that contain enough metal to be extracted economically?

**Ore**



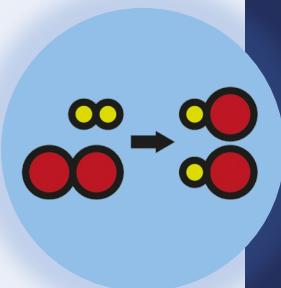
## Prior Knowledge Review: Reactions of Metals

### **Do Now:**

1. Define 'the reactivity series'.
2. Where does gold appear on the reactivity series?
3. Define 'oxidation'.
4. Define 'reduction'.
5. What name is given to minerals that contain enough metal to be extracted economically?

### **Drill:**

1. Put potassium, copper and carbon in order of reactivity.
2. Why does copper oxide react with carbon?
3. Name the two products of this reaction.



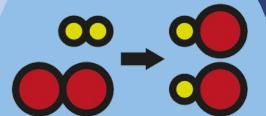
## Prior Knowledge Review: Reactions of Metals

### Read Now:

Nikolai Beketov was a Russian scientist, born in 1827. He was a chemist and metallurgist. Beketov determined the reactivity series of metals. He discovered the displacement of metals from solutions of their salts, using hydrogen. He also established that magnesium and zinc displaced other metals from their salts. In 1864, Beketov organised the department of physical chemistry at Kharkiv University, and taught the first course in physical chemistry as an independent subject.

Kharkiv University is located in the North-East of Ukraine. In March 2022, many of the University buildings were heavily damaged due to the Russian invasion into Ukraine.

1. Where was Nikolai Beketov from?
2. What subjects did Beketov study?
3. What did Beketov discover?
4. In which University did Beketov work?
5. Which topic did Beketov teach as an independent subject for the first time?



# Prior Knowledge Review: Reactions of Metals

C4.2.1

Science  
**Mastery**

➤ **C4.2.1 PKR: Reactions of Metals**

C4.2.2 Extracting Less Reactive Metals

C4.2.3 PKR: Ions, Ionic Bonding and Deducing Ionic Formulae

C4.2.4 (HT) Ionic Equations and Displacement Reactions

C4.2.5 (HT) Writing Half Equations

C4.2.6 (HT) Ionic Equations for the Reactions of Acids and Metals

C4.2.7 Introduction to Electrolysis

C4.2.8 Extracting Metals by Electrolysis

C4.2.9 Electrolysis of Molten Ionic Compounds

C4.2.10 Electrolysis in Solutions

C4.2.11 RP: Electrolysis of Aqueous Solutions 1

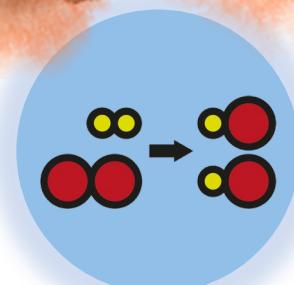
C4.2.12 RP: Electrolysis of Aqueous Solutions 2

C4.2.13 TIF: Corrosion and its Prevention

C4.2.14 (HT) Obtaining Raw Materials

C4.2.15 Recycling Metals

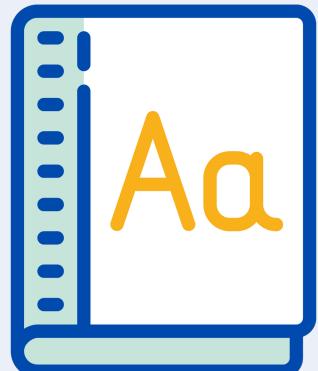
C4.2.16 Feedback Lesson



## Following this lesson, students will be able to:

- List metals in order of reactivity
- Describe the reactions of acids and metals
- Predict the salts formed in neutralisation reactions

### Key Words:



reactivity

neutralisation

salt

# Reactions of metals

Some metals are more reactive than others.

**The reactivity series** is a list of metals from most reactive to least reactive.

Which is the most reactive metal in each pair?

- Lead
- Aluminium

- Gold
- Silver

- Magnesium
- Zinc

- Sodium
- Calcium

most reactive

least reactive



Potassium
Sodium
Calcium
Magnesium
Aluminium
Carbon
Zinc
Iron
Tin
Lead
Hydrogen
Copper
Silver
Gold
Platinum

# How can we use observations to place metals in order of reactivity?

When a **metal** reacts with an **acid**, a **salt** and **hydrogen** are made.



**How do we know that a chemical reaction is occurring?**

Bubbles observed in the solution show that a **gas** is being made in the chemical reaction.



# Using the Reactivity Series

The reactivity series can be used to make predictions about the reactions of metals.

**Use the reactivity series to predict whether a reaction will take place and how intense the reaction will be.**

Metal	Reacting with	Prediction
Silver	Acid	no reaction
Sodium	Water	reacts vigorously
Gold	Oxygen	no reaction
Potassium	Oxygen	reacts vigorously

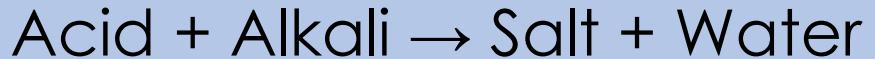
Potassium  
Sodium  
Calcium  
Magnesium  
Aluminium  
Carbon  
Zinc  
Iron  
Tin  
Lead  
Hydrogen  
Copper  
Silver  
Gold  
Platinum

# How many ways can neutralisation happen?

## Alkalies/Bases

They react with acids to produce **salt** and **water**.

These can be metal oxides or metal hydroxides.



## Metal Carbonates

A metal carbonate is a compound containing a **metal**, **carbon** and **oxygen**. They react with acids to produce a **salt**, **water** and **carbon dioxide**.



## Did you know?

Calcium carbonate can be found in rocks as a mineral.

# How many different ways can neutralisation happen?

A **base** is a substance that can react with acids and neutralise them. Most are **insoluble**.

Examples of **bases**: copper oxide (CuO), zinc oxide (ZnO)

**Alkalis** are **soluble bases**.

Examples of **alkalis**: sodium hydroxide (NaOH), potassium hydroxide (KOH)

**Carbonates** are **bases**, they are insoluble and neutralise acids to make salt, water and carbon dioxide.

Examples of **carbonates**: copper carbonate (CuCO3), calcium carbonate (CaCO3)

# Neutralisation reactions

Acid + Alkali/Base → Salt + Water

**Acronym:** **A** + **A/B** → **S** + **W**

Acids + metal carbonates → salt + water + carbon dioxide

**Acronym:** **A** + **C** → **S** + **W** + **C**

**How might your observations be different for the two reactions above?**

When acid reacts with metal carbonates, carbon dioxide is released. There will be bubbles/fizzing formed. This will not happen when an acid reacts with an alkali or base.

## Copy and complete the equations below

1. Acids + alkali/base → **Salt + water**
2. Acids + metal carbonates → **Salt + water + carbon dioxide**
3. Hydrochloric acid + lithium oxide → **Lithium chloride + water**
4. Nitric acid + magnesium hydroxide → **Magnesium nitrate + water**
5. Sulfuric acid + copper carbonate → **Copper sulfate + water + carbon dioxide**
6. Hydrochloric acid + calcium carbonate → **Calcium chloride + water + carbon dioxide**

## Which statements do you agree with?

**Sam:** Reaction between acid and metal carbonates forms bubbles due to oxygen being released

**Jo:** Alkali is not a base

**Houria:** Carbonate salts are formed when acid reacts with metal carbonates

**Maysa:** Neutralisation reaction does not always form neutral salts

# Place these metals in order of reactivity

Gold  
Sodium  
Silver  
Potassium  
Aluminium  
Iron  
Lithium

**Hold up 1, 2 or 3 fingers to answer**

**Which of the following is a characteristic of chemical reactions?**

1. The change is irreversible ✓
2. The change is reversible
3. A new product is not made

**Which of the following gases is made in the reaction between a metal and an acid?**

1. Carbon dioxide
2. Oxygen
3. Hydrogen ✓

**Which symbol is used to separate the reactants and products in a word or symbol equation?**

1. =
2. +
3. → ✓

## Drill

1. What is the reactivity series?
2. Where are the most reactive metals in the reactivity series?
3. Where are the least reactive metals in the reactivity series?
4. What is produced when an acid reacts with a metal?
5. What is produced when an acid reacts with a metal carbonate?
6. Give an example of a base.
7. What will be observed with an acid reacts with a metal carbonate
8. What is the chemical formula for hydrochloric acid?
9. What is the chemical formula for sulphuric acid?
10. Write a word equation for the reaction between nitric acid and magnesium.

## Drill answers

1. The reactivity series is a list of metals in order of reactivity.
2. The most reactive metals are at the top of the reactivity series.
3. The least reactive metals are at the bottom of the reactivity series.
4. a salt and water
5. salt, water and carbon dioxide
6. Copper oxide, zinc oxide
7. Bubbles of carbon dioxide will be observed
8. HCl
9.  $\text{H}_2\text{SO}_4$
10. Magnesium + nitric acid → magnesium nitrate + hydrogen

## Answer the questions below.

1. What do all acids have in common?

- A. They are all corrosive
- B. They all have a pH of greater than 7
- C. They all release hydrogen ions ( $H^+$ ) into solutions
- D. They all release hydroxide ions ( $OH^-$ ) ions into solutions

2. In a reaction between a metal and an acid, what will always be produced?

- A. a salt and carbon dioxide
- B. a salt and water
- C. a salt and hydrogen gas
- D. a salt, water and carbon dioxide

## **Answer the question below.**

3. What is the reactivity series?

- A. It is a list of metals ordered from most reactive at the top to least reactive at the bottom
- B. It is a list of metals ordered from least reactive at the top to most reactive at the bottom
- C. It is a list of metals with different reactivities (some are more reactive than others)

## Lesson C4.2.1

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)  
or by emailing [sciencemastery@arkonline.org](mailto:sciencemastery@arkonline.org)  
Thank you!