

world war one information and activity answers File PDF

World War One Information and Activity Answers

World War One, often called the Great War, was a global conflict that reshaped the world in profound ways. Understanding its causes, major events, consequences, and key figures is essential for students and history enthusiasts alike. This article provides comprehensive World War One information along with activity answers to help deepen your knowledge of this pivotal period in history.

Introduction to World War One

World War One lasted from July 28, 1914, to November 11, 1918. It involved many of the world's great powers, which were divided into two main alliances: the Allies and the Central Powers. The war was characterized by trench warfare, technological innovations, and immense human loss. Its aftermath led to major political changes, including the fall of empires and the creation of new nations.

Causes of World War One

Understanding the causes of WWI helps clarify why the conflict erupted so suddenly and massively. The main causes include:

Militarism

- Countries built large armies and stockpiled weapons.
- Competition between nations increased fears and tensions.
- Entangling alliances like the Triple Alliance (Germany, Austria-Hungary, Italy) and Triple Entente (France, Russia, Britain).
- These alliances meant that a conflict between two countries could quickly involve others.

Imperialism

- European nations competed for colonies and global dominance.
- This competition created rivalries and distrust.

Nationalism

- Pride in one's nation often turned into hostility towards others.
- Ethnic groups sought independence, causing unrest within empires.

Assassination of Archduke Franz Ferdinand

- The immediate trigger was the assassination in Sarajevo on June 28, 1914.
- A Serbian nationalist, Gavrilo Princip, killed the heir to Austria-Hungary, leading to a chain of events.

Major Events of World War One

The war was marked by significant battles, technological advancements, and political developments.

Beginning of the War

- Austria-Hungary declared war on Serbia.
- Alliances activated, leading to a widespread conflict.

The Western Front

- Characterized by trench warfare.
- Major battles included the Battle of the Marne, Verdun, and the Somme.
- Conditions in trenches were brutal, with soldiers facing mud, rats, and disease.

The Eastern Front

- Larger and more mobile than the Western Front.
- Fought mainly between Germany, Austria-Hungary, and Russia.

Technological Innovations

- Introduction of tanks, airplanes, machine guns, and poison gas.
- These innovations changed warfare tactics and resulted in high casualties.

U.S. Entry into the War

- The United States joined in 1917, providing fresh troops and resources.
- Their entry was crucial in tipping the balance in favor of the Allies.

End of the War

- Germany signed an armistice on November 11, 1918.
- The Treaty of Versailles was signed in 1919, officially ending the war.

Consequences and Impact of World War One

The aftermath of WWI had lasting effects on global politics and society.

Political Changes

- Collapse of empires: Austro-Hungarian, Ottoman, German, and Russian Empires.
- Formation of new nations like Yugoslavia and Czechoslovakia.
- Rise of communist Russia after the Bolshevik Revolution.

Economic Impact

- Economies were devastated and required rebuilding.
- War debts and reparations strained nations.

Social Changes

- Loss of a generation of young men.
- Changes in gender roles, with women entering workforce roles traditionally held by men.

Treaty of Versailles and Its Effects

- Imposed heavy reparations on Germany.
- Created the League of Nations to promote peace, though it was ineffective in preventing future conflicts.

Key Figures of World War One

Understanding the leaders and figures involved provides context to the war's decisions and outcomes.

William II

- Emperor of Germany during WWI.
- His policies and alliances contributed to the war.

Gavrilo Princip

- Serbian nationalist who assassinated Archduke Franz Ferdinand.

Woodrow Wilson

- President of the United States.
- Proposed the Fourteen Points for peace and led the U.S. into the war.

King George V

- Monarch of Britain during WWI.

Ferdinand Foch

- French general and Allied commander.

Activity Questions and Answers

Engaging with activity questions helps reinforce understanding of WWI.

- **Question:** What was the immediate cause of World War One?
- **Answer:** The assassination of Archduke Franz Ferdinand of Austria-Hungary in Sarajevo.
- **Question:** Name three new weapons introduced during WWI.
- **Answer:** Tanks, poison gas, and airplanes.
- **Question:** Which countries were part of the Allies?
- **Answer:** France, Britain, Russia (until 1917), Italy, and later the United States.
- **Question:** What was trench warfare?
- **Answer:** A type of combat where soldiers fought from deep trenches dug into the ground, leading to stalemates and horrible living conditions.
- **Question:** When did World War One end?
- **Answer:** November 11, 1918.
- **Question:** What was the purpose of the League of Nations?
- **Answer:** To promote peace and prevent future wars through international cooperation.

Conclusion

World War One was a devastating conflict that reshaped the world politically, socially, and economically. Its causes were complex, rooted in militarism, alliances, imperialism, and nationalism, and its effects are still felt today. By exploring the major events, key figures, and consequences, students and history enthusiasts can better understand this critical chapter in human history. The activity questions provide an engaging way to test knowledge and deepen understanding. Remembering the lessons of WWI is essential to appreciating the importance of peace and diplomacy in our world.

If you're studying for exams or simply want to learn more about WWI, continually review these key points, and explore additional resources to expand your knowledge about this significant historical event.

World War One Information and Activity Answers: An In-Depth Expert Review

Understanding the complexities of World War One (WWI) is essential for students, educators, history enthusiasts, and anyone interested in the pivotal events that shaped the 20th century. This comprehensive guide explores key facts, themes, and educational activities related to WWI, providing detailed insights and expert recommendations to enhance learning and comprehension.

Introduction to World War One: An Overview

World War One, also known as the Great War, was a global conflict that lasted from July 28, 1914,

to November 11, 1918. It involved many of the world's most powerful nations, primarily divided into two alliances: the Allies and the Central Powers. The war's unprecedented scale, brutal trench warfare, technological innovations, and profound political consequences make it a critical subject of study.

The Origins of WWI

The causes of WWI are multifaceted, often summarized through the acronym MAIN:

- Militarism: An arms race and the buildup of military forces heightened tensions among nations.
- Alliances: Complex treaties and agreements created a web of obligations, turning regional conflicts into a global war.
- Imperialism: Competition for colonies and global dominance fueled rivalries.
- Nationalism: Intense pride and ethnic tensions, particularly in the Balkans, contributed to destabilization.

The immediate catalyst was the assassination of Archduke Franz Ferdinand of Austria-Hungary in Sarajevo on June 28, 1914, which set off a chain reaction among allied nations.

Major Participants and Alliances

Understanding the key players provides context for the war's scope and impact.

The Allies

- Main Countries: France, the United Kingdom, Russia (until 1917), Italy (joined 1915), and later the United States (joined 1917).
- Goals: Defense of sovereignty, protection of colonies, and the promotion of democratic ideals.

The Central Powers

- Main Countries: Germany, Austria-Hungary, the Ottoman Empire, and Bulgaria.
- Goals: Territorial expansion, preservation of empires, and regional dominance.

Additional Participants

- Countries like Japan, Greece, and Romania joined later, each with specific strategic interests.

Key Battles and Campaigns

WWI was characterized by intense battles with significant strategic and technological developments.

Major Battles

- Battle of the Marne (1914): Marked the end of the German advance into France and the beginning of trench warfare.
- Battle of Verdun (1916): One of the longest and bloodiest battles, symbolizing French resilience.
- Battle of the Somme (1916): Notorious for high casualties, illustrating the brutal nature of trench warfare.
- Gallipoli Campaign (1915-1916): A failed attempt by the Allies to open a new front in the Ottoman Empire.

Trench Warfare

A defining feature of WWI, trench warfare led to stalemates, terrible living conditions, and massive casualties.

Technological Innovations

- Machine guns
- Tanks
- Poison gas
- Aircraft
- Submarines (U-boats)

These innovations increased the destructive power of armies and introduced new tactics.

Consequences and Impact of WWI

The war reshaped the world politically, socially, and economically.

Political Changes

- Collapse of Empires: Austro-Hungarian, Ottoman, German, and Russian empires dissolved.
- Treaty of Versailles (1919): Imposed harsh penalties on Germany, redrew borders, and established the League of Nations.

Social Impact

- Loss of Life: Estimated 17 million deaths and 20 million wounded.
- Women in the Workforce: Increased participation in workplaces due to men fighting.
- Psychological Effects: Rise of shell shock and recognition of psychological trauma.

Economic Consequences

- War debts and reparations strained economies.
- Disruption of trade and agriculture.

Educational Activities and Answers for WWI Learning

Understanding WWI is enhanced through engaging activities that reinforce knowledge and critical thinking. Below are some common activity questions with in-depth answers, designed to serve as comprehensive guides.

- What were the main causes of World War One?

Answer: The main causes include militarism, which led to arms races; alliances that created a web of obligations; imperialism fueling competition for colonies; and nationalism fostering ethnic tensions and desire for independence. The assassination of Archduke Franz Ferdinand acted as the immediate trigger, inflaming existing tensions.

- How did trench warfare affect soldiers' lives?

Answer: Trench warfare created long, stagnant front lines with soldiers living in muddy, rats-infested trenches under constant threat of enemy fire and poison gas. Conditions led to illnesses like trench foot, psychological trauma, and high casualty rates. The stalemate resulted in little territorial gain despite massive losses.

- Why did the United States enter WWI, and what was its impact?

Answer: The U.S. joined in 1917 primarily due to unrestricted German submarine warfare (notably the sinking of Lusitania) and the Zimmermann Telegram, which revealed Germany's attempt to ally with Mexico against the U.S. Entry provided fresh troops and resources, tipping the balance.

toward the Allies and helping to end the war.

- What were the key technological advancements used during WWI?

Answer: Innovations included machine guns, which increased firepower; tanks, which broke through trench lines; poison gas, causing horrific injuries; aircraft for reconnaissance and combat; and submarines, which threatened maritime supply routes. These changes transformed warfare tactics and increased casualties.

- How did WWI influence the political map of Europe?

Answer: The war led to the dismantling of empires (Austro-Hungarian, Ottoman, Russian, and German), replaced monarchies with republics or new governments, and redrew borders, creating new nations like Yugoslavia and Czechoslovakia. It also sowed seeds for future conflicts by imposing harsh terms on Germany.

Additional Resources and Activities for Deepening Understanding

To further explore WWI, consider engaging in activities such as:

- Creating a WWI timeline: Mapping major events from assassination to armistice.
- Analyzing primary sources: Letters, photographs, and propaganda posters.
- Debate activities: Discussing the fairness of the Treaty of Versailles.
- Role-play simulations: Reenacting key battles or diplomatic negotiations.
- Research projects: Investigating the life of soldiers or technological innovations.

These activities foster critical thinking, empathy, and a nuanced understanding of the war's multifaceted nature.

Conclusion: The Lasting Significance of WWI

World War One remains one of the most transformative events in modern history. Its causes, battles, innovations, and consequences continue to influence global politics and society today. Educators and learners benefit from comprehensive understanding and engaging activities that decode the complexities of this monumental conflict.

By integrating detailed information with interactive approaches, students can develop a well-rounded perspective on WWI, appreciating its profound impact and lessons for the future.

Final Notes: When approaching WWI in educational settings, always encourage critical analysis of sources, discussion of differing perspectives, and reflection on the war's broader implications. This comprehensive guide aims to serve as a reliable resource for educators, students, and history buffs seeking expert-level insight into the Great War.

Question What were the main causes of World War I? The main causes of World War I included militarism, alliances, imperialism, and nationalism, often summarized as the 'eighteen-year crisis' that escalated tensions among European powers. Which countries were the major Allied and Central Powers in WWI? The major Allied Powers included France, the United Kingdom, Russia, and later the United States. The Central Powers mainly consisted of Germany, Austria-Hungary, the Ottoman Empire, and Bulgaria. What was the significance of the Battle of the Somme? The Battle of the Somme was one of the bloodiest battles in WWI, symbolizing the brutal trench warfare and causing over a million casualties. It marked a significant point in the Western Front and highlighted the horrors of modern warfare. How did World War I impact women's roles in society? WWI led to increased opportunities for women in the workforce, as many took on jobs traditionally held by men, contributing to the women's suffrage movement and societal changes regarding gender roles. What was the purpose of the League of Nations? The League of Nations was established after WWI to promote peace, prevent future conflicts, and facilitate diplomatic resolution of disputes, although it ultimately failed to prevent WWII. How did technological advancements influence warfare during WWI? Technological innovations like machine guns, tanks, airplanes, and chemical weapons made WWI more deadly and destructive, leading to trench warfare and unprecedented casualties. What were the terms of the Treaty of Versailles? The Treaty of Versailles imposed heavy reparations and territorial losses on Germany, demilitarized the Rhineland, and established the League of Nations, aiming to prevent future conflicts but also sowed resentment that contributed to WWII. What are some key activity ideas to learn about WWI history? Activities include creating timelines of major battles, analyzing primary source documents, role-playing negotiations like the Treaty of Versailles, and engaging in virtual tours of war museums or trenches to better understand WWI history.

Related keywords: World War I, WWI facts, trench warfare, causes of WWI, WWI battles, war propaganda, soldier activities, WWI timeline, weapons of WWI, war history

Pogil the activity series answers

pogil the activity series answers are an essential resource for students and educators seeking to understand the reactivity of metals and the principles behind chemical reactions. The POGIL (Process Oriented Guided Inquiry Learning) activity series is designed to foster active learning through guided inquiry, helping learners grasp complex concepts related to the activity series of metals. This article provides a comprehensive overview of the activity series, offers detailed answers

to typical POGIL activities, and explains how understanding these answers can enhance your grasp of chemical reactivity and metal displacement reactions.

Understanding the Activity Series of Metals

What Is the Activity Series?

The activity series of metals is a ranked list that arranges metals based on their reactivity with other substances, especially acids and water. Metals higher in the series are more reactive and can displace metals lower in the series from their compounds. This concept is fundamental in predicting the outcomes of various chemical reactions involving metals.

Purpose of the Activity Series

- To predict whether a metal will react with acids or water.
- To determine the feasibility of displacement reactions.
- To understand the relative reactivity of different metals.
- To assist in identifying safe handling and storage of metals.

Commonly Used Reactivity Series

The activity series typically includes metals such as:

- Potassium (K)
- Sodium (Na)
- Calcium (Ca)
- Magnesium (Mg)
- Aluminum (Al)
- Zinc (Zn)
- Iron (Fe)
- Lead (Pb)
- Copper (Cu)
- Mercury (Hg)
- Silver (Ag)
- Gold (Au)

Key Concepts in POGIL Activities on the Activity Series

Displacement Reactions

Displacement reactions occur when a more reactive metal displaces a less reactive metal from its compound. For example:

- Zinc reacting with copper sulfate: $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

Reactions with Water and Acids

Metals react differently depending on their position in the activity series:

- Highly reactive metals (e.g., potassium, sodium) react vigorously with water.
- Moderately reactive metals (e.g., zinc, iron) react slowly or not at all with water but react with acids.
- Less reactive metals (e.g., copper, silver) usually do not react with acids or water.

Corrosion and Protection

Understanding the activity series helps in preventing corrosion:

- Sacrificial protection involves placing a more reactive metal (like zinc) to protect less reactive metals (like iron).

Common POGIL Activity Series Questions and Answers

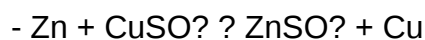
Question 1: Rank the following metals from most reactive to least reactive: magnesium, copper, zinc, and silver.

- Most reactive: Magnesium
- Zinc
- Copper
- Least reactive: Silver

Answer Explanation: Magnesium is higher in the activity series, meaning it reacts more readily with acids and water. Zinc is below magnesium but above copper and silver, which are much less reactive.

Question 2: Will zinc displace copper from copper sulfate? Explain your answer.

Answer: Yes, zinc will displace copper from copper sulfate because zinc is more reactive than copper according to the activity series. The reaction is:

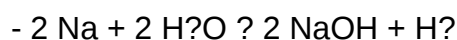


Question 3: Which metals will react with water? Provide examples from the activity series.

Answer: Metals above hydrogen in the activity series react with water:

- Potassium (K)
- Sodium (Na)
- Calcium (Ca)
- Magnesium (Mg)

Example: Sodium reacts vigorously with water:



Question 4: Why does gold not react with acids or water? Use the activity series to support your answer.

Answer: Gold is at the bottom of the activity series, indicating it has very low reactivity. Therefore, it does not react with acids or water because it is less reactive than hydrogen and cannot displace other elements from their compounds.

How to Use the Activity Series in Chemistry

Predicting Reactions

To predict if a displacement reaction will occur:

- Check the positions of the metals involved.
- If the metal you are adding is higher in the series than the metal in the compound, a reaction will likely occur.

Designing Experiments

- Select metals based on their position in the activity series.
- Observe reactions with acids, water, or other metal compounds.
- Record and analyze results to reinforce understanding.

Safety Considerations

- Highly reactive metals like potassium and sodium should be handled with care.
- Reactions involving these metals should be performed under supervision and with proper safety equipment.

Summary of Key Points for POGIL Activity Series Answers

- The activity series ranks metals based on reactivity.
- More reactive metals can displace less reactive metals from their compounds.
- Metals react differently with water and acids depending on their position.
- Gold and platinum are least reactive, often unreactive with acids and water.
- Understanding the activity series aids in predicting reactions, preventing corrosion, and designing chemical experiments.

Additional Tips for Mastering the Activity Series

Memorization Strategies

- Use mnemonic devices to remember the order of metals.
- Create flashcards with metal names and their positions.
- Practice predicting reactions regularly.

Real-World Applications

- Corrosion prevention in infrastructure.
- Metal extraction and refining processes.
- Designing batteries and electrochemical cells.
- Understanding environmental impacts of metal waste.

Practice Questions for Reinforcement

- Which metals can react with acids but not with water?
- How does the activity series explain the corrosion of iron?
- What is the significance of the activity series in recycling metals?

Conclusion

Understanding the **pogil the activity series answers** is fundamental to mastering concepts in chemistry related to metal reactivity. By exploring the principles behind the activity series, students can predict chemical reactions, understand displacement reactions, and appreciate the importance of metal reactivity in industrial processes and everyday life. Whether you're preparing for exams, conducting experiments, or simply seeking to deepen your understanding of chemistry, mastering the activity series through guided inquiry activities like POGIL can significantly enhance your knowledge and analytical skills.

Keywords: pogil activity series answers, metal reactivity, displacement reactions, activity series of metals, chemical reactivity, corrosion prevention, metal reactions with water, metal reactions with acids, POGIL activities, chemistry education

Pogil the Activity Series Answers: A Comprehensive Guide to Understanding and Using the Activity Series in Chemistry

Understanding the Pogil the Activity Series Answers is essential for students and educators who aim to master the concepts of reactivity in chemistry. The activity series, often presented in Pogil (Process Oriented Guided Inquiry Learning) activities, provides a systematic way to predict the outcomes of single replacement reactions and to understand the relative reactivity of metals and non-metals. This guide aims to demystify the activity series, explain how to interpret Pogil activities related to it, and provide strategies for mastering the answers effectively.

What is the Activity Series?

The activity series is a ranked list of elements (mainly metals) based on their ability to displace other elements from compounds, particularly in aqueous solutions. It helps chemists predict whether a certain single displacement reaction will proceed spontaneously.

Key Features of the Activity Series:

- Reactivity ranking: Elements are ordered from most reactive to least reactive.
- Displacement capability: More reactive metals can displace less reactive metals from their compounds.
- Standard reduction potentials: The series correlates with the elements' tendencies to gain

electrons (be reduced).

The Role of Pogil Activities in Learning the Activity Series

Pogil activities are designed to facilitate inquiry-based learning. When applied to the activity series, these activities encourage students to analyze data, interpret trends, and develop reasoning skills related to chemical reactivity.

Typical Pogil Activity Structure:

- Initial exploration: Students observe and analyze experimental data or reaction patterns.
- Guided questions: Foster critical thinking about the relationships between element reactivity and their positions in the series.
- Application exercises: Students predict the outcomes of reactions based on the series and verify their reasoning.

How to Approach Pogil the Activity Series Activities

Mastering Pogil activities related to the activity series involves a strategic approach:

Step 1: Review the Activity Series Chart

Familiarize yourself with the standard activity series chart. Recognize the order of metals and how it relates to their reactivity.

Step 2: Understand Key Concepts

- Displacement reactions: Metal A displaces metal B if A is above B in the series.
- Reaction spontaneity: Reactions proceed spontaneously if the element doing the displacing is more reactive.

Step 3: Analyze Experimental Data

Look at the data provided in the activity:

- Which reactions occurred?
- Which did not?
- What patterns emerge?

Step 4: Answer Guided Questions Carefully

Reflect on the reasoning behind each answer:

- Why does a particular reaction happen or not?
- How does the position of an element in the series influence its reactivity?

Step 5: Practice with Variations

Try predicting the outcomes of reactions not explicitly covered in the activity to reinforce understanding.

Common Questions and Answer Strategies for Pogil the Activity Series

Below are typical questions encountered in Pogil activities and strategies for answering them effectively.

Question 1: Which metals can displace hydrogen from acids?

Answer approach:

- Refer to the activity series to identify metals above hydrogen.
- Metals like zinc, magnesium, and iron are above hydrogen and can displace it from acids.
- Metals below hydrogen (e.g., copper, silver) cannot.

Question 2: Why does a reaction occur between zinc and copper sulfate but not between copper and zinc sulfate?

Answer approach:

- Look at the position of zinc and copper in the activity series.
- Zinc is above copper, so zinc can displace copper from its sulfate.
- Copper is below zinc, so it cannot displace zinc from its sulfate.

Question 3: Predict whether a given reaction will occur.

Answer approach:

- Check the relative reactivity of the metals involved.
- Confirm whether the metal attempting to displace is higher in the activity series.

Tips for Mastering the Activity Series and Pogil Answers

- Memorize the basic activity series: While not always necessary to memorize the entire series, knowing the general order helps in quick reasoning.
- Understand the underlying principles: Recognize that the activity series is based on oxidation-reduction tendencies.
- Practice with real examples: Use textbook problems, online quizzes, and lab experiments to reinforce your understanding.
- Use visual aids: Create flashcards or charts to visualize the series.
- Discuss with peers or instructors: Clarify doubts and explore different reasoning approaches.

Real-World Applications of the Activity Series

Understanding the activity series extends beyond academic exercises and into practical applications:

- Corrosion prevention: Selecting appropriate metals for construction to prevent rust.
- Electrochemical cells: Designing batteries based on the reactivity of metals.
- Metal extraction: Choosing suitable metals for reduction processes.

Conclusion

Mastering Pogil the Activity Series Answers is a fundamental step toward understanding chemical reactivity and predicting reaction outcomes. By familiarizing yourself with the structure of the activity series, practicing interpretation of Pogil activities, and applying critical reasoning strategies, you will enhance your comprehension of oxidation-reduction processes. Remember, the activity series is more than just a list—it's a powerful tool that unlocks the predictive power of chemistry in both academic and real-world contexts.

Empower your chemistry learning journey by engaging deeply with Pogil activities and the activity series. With practice and understanding, you'll develop the confidence to analyze reactions critically and apply your knowledge effectively.

Question What is the purpose of the POGIL activity series activity? The purpose is to help students understand the reactivity of metals by arranging them in a activity series based on their ability to displace or react with other substances. How do I determine the position of a metal in

the activity series using POGIL activities? You determine the position by analyzing experimental results from displacement reactions and comparing how easily metals react with acids, water, or other solutions, as guided by the POGIL activity instructions. Are the answers to the POGIL activity series activity available online? Yes, various educational resources and teacher websites provide answer keys to POGIL activity series activities, but it's best to use them to understand concepts rather than just copying answers. What are common mistakes students make when completing the POGIL activity series activity? Common mistakes include misinterpreting experimental data, confusing the reactivity order of similar metals, or not following the experimental procedure carefully as outlined in the activity guide. How can I use the POGIL activity series to predict chemical reactions? By understanding the activity series, you can predict whether a metal will displace another from a compound or react with acids, based on their positions in the series. Is the POGIL activity series activity suitable for beginner chemistry students? Yes, it is designed to introduce students to the concept of reactivity and series of metals in a collaborative and inquiry-based manner suitable for beginners. Where can I find detailed answers or explanations for the POGIL activity series? You can find detailed explanations in teacher guides, educational websites, or textbooks that accompany the POGIL curriculum, and some online forums or study groups discuss these activities. How does understanding the activity series help in real-world applications? Understanding the activity series helps predict corrosion, metal extraction, and reactivity in industrial processes, making it essential for chemistry-related industries. Can I complete the POGIL activity series activity without prior knowledge of reactivity series? While prior knowledge helps, the activity is designed to guide students through the process of discovering the reactivity series through experimentation and guided inquiry. What should I do if I get stuck on the POGIL activity series question? Review the experimental data, revisit the activity instructions, collaborate with classmates, or consult your teacher for hints to help clarify the concepts and move forward.

Related keywords: activity series, pogil worksheet, reactivity series, metal reactivity, pogil activities, activity series chart, metal reactivity order, chemistry pogil, activity series answers, metal displacement reactions

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