

# Activity series of metals essay sample



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### Introduction:

The chemical activity of a metal is directly related to its practical use. In this investigation you will investigate the chemical activity of metals with oxygen, water, acid and alkali, to rank metals in order of their activity. Aim: To observe the reactivity of metals in order to determine the activity series of metals.

### Risk Assessment:

In this investigation, hydrochloric acid solution is used which is toxic by all routes of exposure and is also a lung irritant. To avoid harm and ensure safety, eye protection and skin protection must be used. Equipment:

- \* Metal tongs
- \* Bunsen Burner
- \* Zinc
- \* Lead
- \* Magnesium
- \* Iron
- \* Tin
- \* Aluminium
- \* Copper
- \* Splint
- \* 50 ml Hydrochloric acid solution
- \* 8 Test tubes
- \* Measuring Cylinder

\* Beaker

Method:

#### Part A: Reaction of Metals with Oxygen

1. Hold each metal under a Bunsen flame and wait until the metal becomes very hot or melts. 2. If apparent changes are not visible, allow the metal to be left on a gauze mat until it cools and examine again. 3. Repeat the above procedure for each metal.

#### Part B: Reaction of Metals with Water

1. Clean each piece of metal with emery paper (sand paper) until it is shiny. 2. Drop a piece of each metal into a test-tube containing about 5 ml cold distilled water. If a reaction is not visible, heat the water until it boils. 3. If bubbles of gas are produced, test the gas with a lighted splint. If a 'pop' sound is heard, the gas, hydrogen, is present. Part C: Reaction of Metals with

#### Acids

1. Pour 5 ml of hydrochloric acid into each of the eight test tubes. (Make sure to wear eye protection and skin protection in order to prevent harm or contact with the Hydrochloric Acid). 2. Clean each piece of metal with emery paper (sand paper) until it is shiny/polished. 3. Carefully slide into each test-tube a piece of each polished metal. 4. Simultaneously observe the reaction of each metal in the test-tubes and record all observations. Results:

Metal Tested | Part A | Part B | Part C | Hydrogen Present | Zinc | White Powder formed | Few bubbles formed after long standing | Stream of small bubbles were observed | × | Lead | Melts and forms white powder | No reaction | Few

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bubbles formed| Hydrogen gas present| Magnesium| Burns with a bright light and white powder is formed| Slow reaction in hot water| Bubbles formed| ×| Iron| Black solid is formed| Bubbles formed| Slow release of bubbles on the surface| Hydrogen gas present| Tin| Melts| No reaction| No reaction| ×| Aluminium| No reaction| No reaction | Few bubbles formed| ×| Copper| Becomes darker in colour| No reaction | No reaction| ×|

#### Discussion:

1. Suggest a reason why calcium was not tested with acid and oxygen.

Calcium is a very reactive metal with water and therefore reacting with acid may be too dangerous. Calcium was not tested with oxygen because it may explode upon heating with the oxygen. 2. Using your observations, list the metals in decreasing order of their chemical activity. Calcium Magnesium Zinc Aluminium Iron Lead Tin Copper 3. What were your criteria to establish the above activity series of metals? The criteria used to establish the above activity series of metals was the reactivity of the metals with water and the rate at which the bubbles formed.

4. What is the product of a reaction between metal and oxygen? The product of a reaction between a metal and oxygen is a metal oxide. 5. Contrast the formation of oxide layers on aluminium and iron. Aluminium oxide is a thin, invisible film on the surface of the metal that prevents it from reacting with the environment. This is why aluminium is used extensively in construction industries particularly in areas of high salinity. Iron rusts very quickly with oxygen and water. The prevention of oxide formation is an expensive battle. Iron oxide flakes off, exposing the underlying layer of iron to attack by the

environment. 6. Write a balanced chemical equation for the reaction of calcium with water.



7. Acids corrode some metals, while other metals are resistant to corrosion.

a) What are the general products of corrosion? The general products of corrosion are a metal oxide/hydroxide. However, the general products of corrosion in acids are salt and Hydrogen gas is evolved. b) The reaction with acids can be viewed as 'ionisation requiring the transfer of electrons'. Write appropriate half-equations to illustrate this concept. Use the reaction of zinc with hydrochloric acid to illustrate this.  $\text{Zn}(\text{s}) + \text{HCl}(\text{l}) \rightarrow \text{ZnCl}_2(\text{s}) + \text{H}_2(\text{g})$

