Worksheet: Reactivity Series & Metal Extraction

ChemistrySheets

Specification: GCSE Chemistry (AQA 5.4.1 / Edexcel SC11 / OCR Gateway C4.1)

Core Concepts: The reactivity series orders metals by their reactivity. More reactive metals displace less reactive metals from their compounds. Metals above carbon in the reactivity series are extracted by electrolysis; those below carbon are extracted by reduction with carbon. Oxidation is loss of electrons; reduction is gain of electrons.

Section A: Key Concepts & Terminology

A1. Complete the following sentences using the most appropriate terms.

(i) The _____ is a list of metals arranged in order of their decreasing reactivity.

(ii) A more reactive metal can _____ a less reactive metal from its compound.

(iii) The extraction of metals from their ores often involves _____, which is the _____ of electrons.

(iv) Metals that are more reactive than carbon are typically extracted by _____.

A2. Consider the reaction between magnesium metal and copper(II) sulfate solution.

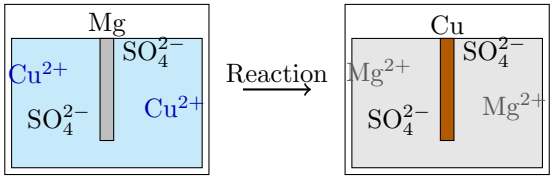

Figure 1: Displacement reaction between magnesium and copper(II) sulfate.

(i) Write a word equation for this reaction.

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(ii) Explain why this reaction occurs in terms of reactivity.

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(iii) Identify which species is oxidised and which is reduced in this reaction.

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Section B: Core Concepts & Explanations

B1. Explain what is meant by a 'displacement reaction' in the context of the reactivity series.

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B2. Describe how the position of a metal in the reactivity series relates to its tendency to form positive ions.

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B3. Explain why metals above carbon in the reactivity series must be extracted by electrolysis, while those below carbon can be extracted by reduction with carbon.

B4. Describe the general process of extracting a metal from its oxide using carbon, including a general word equation.

Section C: Exam Application & Extended Writing

C1. A student investigated the reactivity of four unknown metals (P, Q, R, S) by reacting them with dilute hydrochloric acid and observing the rate of hydrogen gas production. The results are shown in the table below:

Metal	Observation with dilute HCl
P	Very slow bubbles
Q	Vigorous bubbling, metal disappears quickly
R	No visible reaction
S	Moderate bubbling, metal slowly disappears

Table 1: Reactivity of metals with dilute hydrochloric acid.

(i) Based on the observations, arrange the metals in order of decreasing reactivity (most reactive first).

C2. Aluminium is a metal that is widely used in industry. Explain why aluminium is extracted by electrolysis and describe the key features of this process, including the role of cryolite and the reactions at the electrodes. (6 marks)