

5. Chemical Reactions I



Chemical Reactions I

Series Overview

In this series of nine lessons learners will learn how to represent chemical changes they observe as balanced chemical equations. The chemical reactions shown in these lessons will also give learners a better understanding of the chemistry of metals. We will explore the reactions of Group I, II and the transition metals with oxygen; the reaction of the metal oxides formed and water; and finally the reaction of the alkali metals and the alkaline earth metals with water.

Curriculum Links

This series of lessons is linked to the core knowledge area, Physical and Chemical Change, within the theme, Representing Chemical Change. The context for this series is the reactions of metals. In this series **all three Learning Outcomes** are addressed in the tasks provided at the end of each lesson.

Educational Approach

When examining the policy document for this theme you will notice that the content learners are required to know is balancing chemical equations. We decided that it would be important to contextualise this learning instead of expecting learners to simply do numerous worksheets balancing endless, meaningless equations. We chose the context of the reactions of metals for the following reasons:

- Metals and mining are a very important part of the South Africa economy.
- The reactions of metals will enhance learners' understanding of the periodic table.
- The reactions of the alkali and alkaline earth metals are exciting and spectacular.
- Teachers will be familiar with this context.

The key to a good understanding of the theme, Representing Chemical Change is to link the real chemical change taking place in an experiment with a representation of this change. In this series we represent the chemical change by writing word equations, drawing diagrams and writing balanced chemical equations.

The skill of writing balanced chemical equations is the most important chemistry skill learners will develop in Grade 10. There are numerous chemical calculations required in Grade 11 and Grade 12 that require learners to have mastered this process. For this reason we have identified the key steps required for learners to take. These steps are explained and repeated with each new example. You will find that the lesson notes give learners activities that can be used together with the video lessons. The answers to these in-lesson activities are given with the task answers.

One of the challenges that this particular theme presents is being able to address all the Learning Outcomes. We have designed tasks that include an investigation (LO 1); exercises that require problem solving and application of scientific knowledge (LO 1 and LO 2); and a survey that investigates the impact of the alkali metals on our lives (LO 3). These tasks will assist you in assessing your learners' progress towards achieving the required assessment standards.



Chemical Reactions I

Series at a Glance

Lesson Title	Lesson Outcomes By the end of this lesson, the learner should be able to:
Lesson 1 An Introduction to Reactions	<ul style="list-style-type: none"> • Explain the basic process of extracting metal from metal ore • Explain why a chemical equation needs to be balanced • Balance a chemical equation
Lesson 2 An Introduction to Metals	<ul style="list-style-type: none"> • Identify the physical properties of metals • Explain how the microscopic model of metals can be used to explain these macroscopic properties
Lesson 3 Reactions of the Alkali Metals with Oxygen	<ul style="list-style-type: none"> • Describe the observations of the reactions • Name the products • Write a balanced chemical equation for each of the reactions
Lesson 4 Reaction of Alkali Metal Oxides with Water	<ul style="list-style-type: none"> • Describe the chemical properties of the oxides of alkali metals • Identify common everyday substances containing alkali metals
Lesson 5 Reaction of the Alkaline Earth Metals	<ul style="list-style-type: none"> • Describe the observations of the reactions • Name the products • Write balanced chemical equations for these reactions
Lesson 6 Reactions of the Group II Metal Oxides	<ul style="list-style-type: none"> • Describe the observations of the reactions • Name the products • Write balanced chemical equations for the reactions
Lesson 7 Reaction of the Transition Metals with Oxygen	<ul style="list-style-type: none"> • Represent the chemical changes taking place when transition metals react with oxygen as a balanced chemical equation • Plan and conduct an experiment to show what factors affect the reaction of oxygen and iron
Lesson 8 Reactions of the Alkali Metals with Water	<ul style="list-style-type: none"> • Describe your observations • Write balanced chemical equations
Lesson 9 Reactions of the Alkaline Earth Metals with Water	<ul style="list-style-type: none"> • Describe the observations of the reactions • Write balanced chemical equations



Chemical Reactions I

Teaching Guidelines

Lesson 1: An Introduction to Reactions

In this lesson we introduce the learners to the importance of metals in our world. We show how metals are found in rocks. Rocks that contain valuable minerals, such as metals, are called ores. The ore is dug out of the ground, crushed and then undergoes a number of chemical process in order to extract the metal from the rock. The extracted metal is purified and then used to make a variety of products. In this lesson we examine how iron is extracted from iron ore in a blast furnace.

This lesson is the most important in the series as it introduces the steps required to represent chemical change in the form of a balanced chemical equation. We identify and then represent the reactions taking place in the blast furnace in a balanced chemical equation.

Task assesses **LO 1 AS 3**

Learners are asked to balance the reaction of iron (III) oxide and carbon monoxide that results in iron and carbon dioxide forming. Your learners should be able to write a word equation and the formula for each of the substances reacting. They may struggle to balance the equation. We suggest that they draw diagrams or cut out circles to help them. They will also find the hint of reacting three molecules of carbon monoxide useful. It is essential that learners complete this task as the answer is given at the beginning of Lesson 2.

Lesson 2: An Introduction to Metals

When studying the reactions of metals it is useful to know more about these elements. This lesson explores the physical properties of metals by conducting experiments. Learners are required to link these macroscopic properties to the microscopic model used to describe metallic bonding. This lesson is directly related to the core knowledge section, Matter and Materials, and is suitable as a revision or extension lesson for that topic.

Task assesses **LO 2 AS 3**

In this task learners are required to use the metallic bonding model to explain why metals are good electrical and thermal conductors. You could use this task to assess how your learners apply their scientific knowledge.

Lessons 3: Reactions of the Alkali Metals with Oxygen

Your learners will enjoy watching the experiments in this lesson. We show how alkali metals react in air and how they burn in pure oxygen. The product formed in each reaction is a metal oxide. We suggest that your learners draw up a blank table before watching the lesson. After they have seen each experiment, you could pause the video to give them a chance to record their observations.

Task assesses **LO 1 AS 3** and **LO 2 AS 2**

This task will give your learners another opportunity to focus on representing chemical change as balanced chemical equations.

Lesson 4: Reaction of Alkali Metal Oxides with Water

This lesson shows how the alkali metal oxides react with water to form a metal hydroxide. Once learners have seen the reaction of lithium oxide and water, we suggest that you pause the video (pause button will appear on the screen). At this point you can ask your learners to turn to the lesson notes and complete the activities given. After they have attempted the activities in the lesson notes, you can allow them to watch the rest of the video and to check their answers.

Task assesses **LO 1 AS 4** and **LO 3 AS 2**

Before they do this task, we suggest that you first allow your learners to plan how they will carry out the survey and then how they will present the data collected. This could be a group activity. After they have completed the survey get each group to present their data.



Chemical Reactions I

Lesson 5: The Reactions of the Alkaline Earth Metals and Oxygen

Lesson 6: The Reactions of Group II Metal Oxides and Water

In these two lessons we show how Group II metals burn in oxygen and how the metal oxides formed react with water. These lessons will give your learners further opportunities to make observations and to write balanced chemical equations that represent the chemical changes taking place. The lesson notes provide activities for learners to complete during the lessons.

By studying the same reactions of Group I and Group II metals your learners will be encouraged to take note of the similarities and differences between these groups of metals.

Task assesses *LO 1 AS 3* and *LO 2 AS 3*

The tasks from lessons 5 & 6 require learners to solve problems by applying their knowledge of the reactions of metals to reactions that they have not yet observed.

Lesson 7: Reaction of the Transition Metals with Oxygen

The transition metals are less reactive than the metals in Groups I and II but their reactions are important to us. By this stage of the series your learners should be able to independently write balanced chemical equations before being given the answer. If they are struggling, you may want to let them watch Lesson 1 again.

Task assesses *LO 1 AS 1*; *LO 1 AS 2*; *LO 1 AS 3* and *LO 1 AS 4*

The task in this lesson will give your learners the chance to plan and carry out an investigation. This task can be used to assess their progress in achieving the assessment standards for Learning Outcome 1. A simple rubric can help you assess your learners' progress in this task.

Lesson 8: Reactions of the Alkali Metals with Water

Lesson 9: Reactions of the Alkaline Earth Metals with Water

The chemical reactions shown in these two lessons are amazing. Your learners will be fascinated and will definitely want to see the reactions more than once. Make sure that they keep recording their observations and write down an accurate representation of what is happening. The lesson notes provide a useful framework for learners to complete these activities.

Task assesses *LO 1 AS 3* and *LO 2 AS 3*

These tasks will give your learners more practice in writing balanced chemical equations. They are also required to apply their knowledge and skill to unfamiliar reactions.