

Important Concepts . . .

Preview Review



Science

Grade 9 TEACHER KEY

W2 - Lesson 2: Chemical Reactions

Important Concepts of Grade 9 Science

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W1 - Lesson 2	Electrical Circuits
W1 - Lesson 3A	Energy Consumption
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W3 - Quiz	

Materials Required

Textbook:

Science in Action 9

Science Grade 9

Version 5

Preview/Review W2 - Lesson 2 TEACHER KEY

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Preview/Review Concepts for Grade Nine Science

TEACHER KEY



***W2 - Lesson 2:
Chemical Reactions***

OUTLINE

By the end of this lesson, you should

- give a definition of a chemical reaction
- describe combustion and corrosion
- explain the difference between endothermic and exothermic reactions
- identify conditions that affect rates of reactions

GLOSSARY

combustion - chemical reaction that occurs when oxygen reacts with a substance to form a new substance and give off energy

conservation of mass - principle that matter is not created or destroyed in a chemical reaction; the mass of the products always equals the mass of the reactants

endothermic reaction - a chemical reaction that takes in energy

enzyme - catalyst involved in chemical reactions in living things

exothermic reaction - a chemical reaction that releases energy

reactant - substance that reacts with another substance or substances in a chemical reaction to create new substances with different properties

W2 - Lesson 2: Chemical Reactions



Did you know that you are surrounded by chemical reactions? You want to go for a ride on your bicycle to pick up a movie from the video store. You had better have a snack first! You need food to provide your muscles with energy to ride that bike. A chemical reaction takes place in the cells of your body to allow you to move.

Chemical Reactions

Did you know that the process of baking involves chemical reactions? A **chemical reaction** is a reaction that takes place when two or more substances **react** to form new substances. The example of baking a cake in the previous lesson outlines a chemical reaction. The ingredients of the cake (flour, eggs, oil, cocoa, baking powder) are **reactants**. The finished cake (after heat is applied to the batter) is a **product**. Some of the ways we know that a chemical reaction or chemical change has taken place are a colour change, a smell, the production of a solid or gas, or the release or absorption of heat.

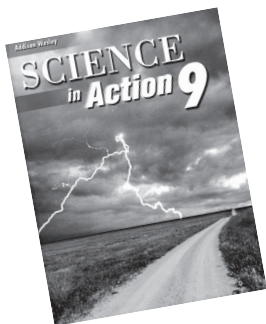
Another chemical reaction occurs when food reacts with oxygen in your cells to produce energy. This process is called **cellular respiration**.

Food (glucose) + oxygen \longrightarrow carbon dioxide + water + energy

The reactants are the food (glucose) and oxygen. The products are the carbon dioxide, water, and energy.

Although the products can look completely different from the reactants, the mass of the products will be equal to the mass of the reactants. This is referred to as the law of **conservation of mass**. An example of a chemical reaction occurs when 50 grams of potassium metal are mixed with 35 grams of aluminum chloride to produce pure solid aluminum and potassium chloride.

Read pages 157, 158, and 163 of *Science in Action 9*.



1. The chemical reaction for an air bag is outlined on page 157 of your textbook. Identify the reactants and products of the reaction.

Reactant – sodium azide ($\text{NaN}_{3(s)}$)

Products – sodium (Na) and nitrogen ($\text{N}_{2(g)}$)

2. Explain how you can identify if a chemical reaction has taken place.

A chemical reaction has taken place if there is a change in colour or odour, the formation of a solid, or the absorption and/or release of heat energy.

3. Based on the law of conservation of mass, how much physical product will be produced in the previously mentioned chemical reaction between potassium metal and aluminum chloride?

There will be 85 grams total of product produced (the sum of the product masses).

Combustion and Corrosion



Anytime you light a fire or a candle, a **combustion reaction** is taking place. Basically, wood reacts with oxygen to produce heat and light, carbon dioxide, and water. Oxygen is needed for a fire to burn. If you take a candle and put a glass jar over it, the candle will stop burning as soon as all the oxygen inside the jar is gone.

We have many uses for combustion reactions. One occurs in vehicles to move us around. Another heats our houses (natural gas), and some allow us to cook!

A **corrosion reaction** is a slow chemical change that occurs when oxygen in the air reacts with a metal. Oxygen ($\text{O}_{2(g)}$) is a very reactive substance. Anything that is exposed to oxygen over time will age and change. This even happens to cells in our bodies. The most common corrosion reaction is the formation of rust.

Read page 160 of *Science in Action 9*.

4. Outline the chemical reaction that forms rust. Indicate the reactants and products.

Reactants – Iron (Fe) + oxygen ($O_{2(g)}$) =
Product – iron oxide (rust)

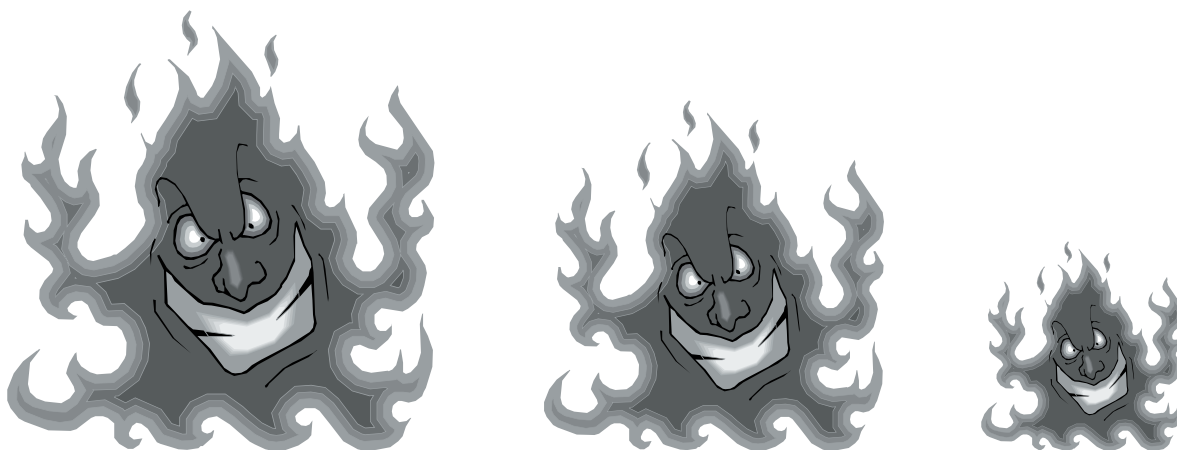
5. Explain what the fire triangle is.

The fire triangle is composed of fuel, air, and heat.

These three factors are necessary for a fire to keep
burning. If one is missing, the fire will stop.

6. What are the end products of a combustion reaction?

carbon dioxide, water, and heat energy



7. Fill in the blanks on the following chemical reaction:

Methane (natural gas) + oxygen \Longrightarrow carbon dioxide + water + heat

This reaction is a combustion reaction.

Endothermic and Exothermic Reactions

When chemical reactions occur, an energy change occurs. Energy can be **absorbed** due to a chemical reaction. This is an **endothermic reaction**. This type of reaction occurs when a person activates a cold pack from a sports first-aid kit. The reaction that occurs involves the dissolving of ammonium nitrate to produce ammonium ions and nitrate ions. Energy is absorbed during this process and the bag feels cold.



Energy can also be **released** during a chemical reaction. This is an **exothermic reaction**. This type of reaction occurs in a hot pack when calcium chloride combines with water. A large amount of heat energy is given off and the bag feels very warm. The heat comes from the energy stored in the chemical bonds of the reactant molecules—which is greater than the energy stored in the chemical bonds of product molecules.

Read page 160 of *Science in Action 9*.

8. Explain the difference between endothermic and exothermic reactions.

*An endothermic reaction absorbs heat energy whereas
an exothermic reaction gives off heat energy.*

9. Identify where the heat energy comes from in an exothermic reaction.

*Heat comes from the chemical bonds between the
elements of the compound.*

10. Outline the reactants and products of the reaction that occurs in a cold pack.

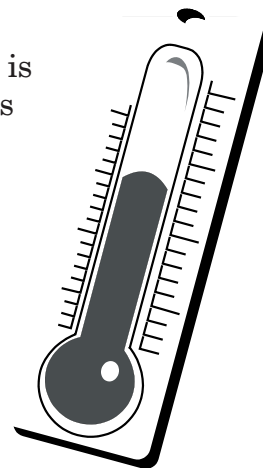
Reactant – ammonium nitrate,

Products – ammonium ions & nitrate ions

Factors Affecting the Rate of a Chemical Reaction

The speed of a chemical reaction is affected by a variety of factors. Certain things can speed up or slow down the reaction. The speed of the reaction is referred to as the rate of the reaction. Four factors affect the rate of reaction:

- the presence of a catalyst
- the concentration of reactants
- the temperature of the reactants
- the surface area of the reactants



A **catalyst** is a substance that participates in a chemical reaction to speed it up. The catalyst is not used up in the process. One type of catalyst in the human body is an **enzyme**. An enzyme allows a chemical reaction to occur at low temperatures so that the body is not harmed in the process. The enzyme **lactase** helps break down the milk sugar lactose from the milk you drink into glucose units that your cells use to produce energy.

The **concentration of reactants** affects the rate of a chemical reaction. The higher the concentration of reactants, the faster the chemical reaction. There are more atoms available to react.

The **temperature of the reactants** affects the rate of a chemical reaction. The higher the temperature, the faster the reaction. The warmer the molecules are, the faster they move and the more they collide with other particles. Therefore, the reaction will proceed at a faster rate.

The **surface area of the reactants** also affects the rate of a chemical reaction. The greater the surface area of the reactants, the faster the reaction is. There is more area that is able to react.

Read pages 166-169 of *Science in Action 9*.

11. Give an example of an enzyme not already noted that occurs in the human body and explain what it does.

The enzyme catalase breaks down poisonous hydrogen peroxide in the body into harmless byproducts

12. How does the concentration of a reactant affect the rate of a chemical reaction?

The greater the concentration of the reactants, the faster the reaction will take place.

13. A chemical reaction takes place when copper metal reacts with silver nitrate to produce silver metal and copper nitrate. What two things could you do to increase the rate of this reaction?

Heating the solution causes the molecules to move faster and, therefore, increase the rate of the reaction.

Stirring the solution helps increase the rate of the reaction as well.

14. Why should you chew an antacid before you swallow it?

Chewing an antacid will increase the surface area of the pill so that the effectiveness of the reaction in the stomach will be increased.

Websites

The addresses for the websites below were valid at the time of printing.

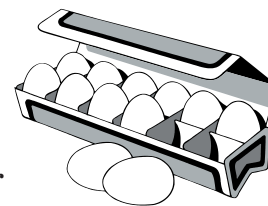
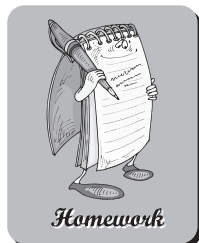
<http://www.geocities.com/chemdemo>

<http://pbskids.org/zoom/kitchenchemistry/virtual-start.html>

<http://www.StrangeMatterExhibit.com>



Homework



15. Here is a simple chemical reaction you can carry out at home. Pour two-thirds of a cup of vinegar into an empty margarine container or bowl. Place a whole egg including the shell in the vinegar solution. Leave it overnight and record your observations the next day.

The shell of the egg (which is made of calcium

carbonate) will dissolve due to being exposed to

vinegar which is an acid leaving the egg surrounded

by a membrane. The egg will increase in size as some of the vinegar will move into the egg.

16. Here is another chemical reaction to try. Take a dull penny and put a thin layer of salt on it. Find an eye dropper or a medicine dropper and put a few drops of vinegar on top of the salt. Record your observations. Leave the pennies overnight and record your observations. Explain.

The penny will turn shiny initially. The salt combines

with the vinegar to form hydrochloric acid which

removes the dull coating. Over time the penny will turn

black as it is being oxidized while exposed to air.

17. Cut an apple in half. Leave one piece of it for about an hour but eat the rest of it now. Record your observations of the piece left exposed in the air. Explain.

The apple turns brown in the air (oxidation reaction.)

