

Reaction rates 2: Investigating reaction rates

Components

NAME	DESCRIPTION	AUDIENCE
	<i>Investigating reaction rates</i> teacher guide	The guide shows how this resource may be used to explore the concept of reaction rates. It outlines an introductory activity and investigation, that students perform in the laboratory, about how changing conditions can affect the rate of a chemical reaction.
	<i>Investigation scaffold</i> worksheet	This worksheet prompts students to examine their investigation findings in respect of their scientific knowledge of reaction rates.

Purpose

To **Explore** factors that affect the rate of a chemical reaction, through student investigation.

Outcomes

Students:

- describe the rate of a reaction in terms of change of a measureable quantity, with time;
- identify and apply factors affecting rates of reaction (including nature of reactants, concentration, catalysts, temperature and state of subdivision); and
- investigate a real-world problem in a laboratory setting.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
Students brainstorm reactions that are happening around them, and discuss how the rate of these reactions could be increased or decreased.	as a class
Students research and develop an investigation into reaction rates, as outlined below. They use the worksheet, <i>Investigation scaffold</i> , to plan and research their chosen reaction.	in pairs or lab groups for investigation
Students write a report about their investigation and complete the worksheet, <i>Investigation scaffold</i> .	individuals

Investigating reaction rates in the real world

Students design and perform an experiment to investigate factors that may influence the rate of a chemical reaction. Students choose a chemical reaction that is controlled in a domestic or industrial process (eg cooking, food preservation, pharmaceuticals, manufacturing or environment). One or more factors students think may affect the rate of the reaction, may be investigated.

This activity may be extended by using multimedia information gained from experiments, and knowledge from learning objects, to produce a presentation. Students need to be aware if this activity is planned, so they can collect multimedia evidence from their experiment, including pictures, video and detailed diagrams of their investigation.

Technical requirements

The guide and worksheet require Adobe Reader (version 5 or later), which is a free download from adobe.com. Internet access or chemistry books will be needed to help students with their research.

Some reactions that students might investigate include:

food preservation	<ul style="list-style-type: none">• Apple oxidises (it turns brown) when it reacts with oxygen in air.• Prolonged contact with air causes cheese to develop mould.
pharmaceuticals	<ul style="list-style-type: none">• Antacid tablets contain a base that reacts with hydrochloric acid in the stomach.• Alka-Seltzer tablets contain aspirin, citric acid and baking soda, which react when dissolved in water.• Dyes involve complex chemical reactions, but many of the factors that affect reaction rate are relevant when dyeing material. They include: temperature, concentration of dye, and surface area.
manufacturing	<ul style="list-style-type: none">• Rusting or corrosion involves reaction between iron (or another reactive metal) and water.• Drain cleaner involves reaction between Al and NaOH to produce H_2 (eg in Drano). Students will need to be reminded of safe handling of NaOH.
environment	<ul style="list-style-type: none">• Acid rain and limestone can be modelled by a reaction between calcium carbonate and sulphuric acid or vinegar.
just for fun	<ul style="list-style-type: none">• Light sticks that use chemiluminescent reactions to glow in the dark are affected by temperature changes.

Teachers with time constraints may consider choosing one of the above investigations for the whole class, in groups, to complete (eg antacid and hydrochloric acid reaction). Alternatively, they may allocate, to each group, a different variable to investigate (eg effect of changing temperature), followed by a class discussion of results.

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Associated SPICE resources

Reaction rates 2: Investigating reaction rates may be used with related SPICE resources to address the broader topic of reaction rates.

DESCRIPTION	LEARNING PURPOSE
<i>Reaction rates (overview)</i> This learning pathway shows how a number of SPICE resources can be combined to teach the topic of reaction rates.	
<i>Reaction rates 1: Photochemical smog</i> A video shows how environmental factors can increase chemical reactions that occur in the atmosphere, to produce photochemical smog.	Engage
<i>Reaction rates 2: Investigating reaction rates</i> Students investigate how they can change the rate of a real-life chemical reaction in the laboratory.	Explore
<i>Reaction rates 3: Controlling reactions</i> An interactive learning object explains relationships between reaction rates, collision theory, energy profile diagrams and kinetic energy distribution graphs.	Explain
<i>Reaction rates 4: Enzymes</i> Students extend their knowledge of catalysts by studying how enzymes work.	Elaborate