# Activity 3.1 How fast can it go?

## Measuring reaction rate

**What to do:**

Carry out the reaction rate experiment of magnesium reacting with hydrochloric acid.

|  |
| --- |
|  |

Construct a table to record your results. You could set up an Excel spreadsheet and then use the graphing function to produce a graph of your data.

## Discussion

1. Draw a line graph of volume of gas against time. (Or insert a graph from your Excel data sheet)

|  |
| --- |
|  |

2. Calculate the rate of the reaction over the whole period of the experiment using the formula:

|  |
| --- |
|  |

3. Describe the trend in reaction rate shown by the gas. At what times was the reaction rate the fastest and slowest? How do you explain this?

|  |
| --- |
|  |

4. What gas was produced by the reaction of the magnesium with the acid? Write an equation for this reaction.

|  |
| --- |
|  |

5. The acid sinks to the bottom and reacts with the magnesium ribbon.

Why does it sink? Why doesn’t the water produce the same reaction?

|  |
| --- |
|  |

6. Consider the equipment used in this experiment. Why has each been selected for this experiment?

How could you improve on your technique?

|  |
| --- |
|  |

**Work with a group**

Many chemical reactions occur naturally (e.g. digestion and rusting) or are triggered by us (e.g. fireworks, adding fertiliser to plants).

When you light a Bunsen burner you are observing a rapid chemical reaction.

Can you name a reaction which takes a long time?

|  |
| --- |
|  |

List as many fast and slow chemical reactions as you can.

|  |
| --- |
|  |

Now arrange them from fastest to slowest.

|  |
| --- |
|  |

# Activity 3.2 Changing reaction rate

## The effect of concentration on reaction rate

**What to do:**

Complete the experiment investigating the reaction rate of hydrochloric acid and sodium thiosulfate. Record your results in the table.

|  |  |
| --- | --- |
| **Concentration of thiosulfate** | **Reaction time** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## Discussion

1. Draw a graph to show how the time taken for the reaction varied with the concentration of the sodium thiosulfate. Write a sentence to describe the trend in the results.

|  |
| --- |
|  |

2. What variables were kept constant in the experiment?

|  |
| --- |
|  |

3. What were the independent and dependent variables?

|  |
| --- |
|  |

4. How could you make your group’s results more reliable?

|  |
| --- |
|  |

5. Write a conclusion for this experiment.

|  |
| --- |
|  |

## Temperature and reaction rate

**What to do:**

Design a controlled experiment using the same reaction to investigate the relationship between temperature and reaction rate.

**Experiment Design**

|  |
| --- |
|  |

**Results**

|  |
| --- |
|  |

**Conclusions**

|  |
| --- |
|  |

## Notebook: Effective collisions

1. What is meant by an effective collision? Explain why they are needed to make a reaction happen.

|  |
| --- |
|  |

2. Explain how the following can affect reaction rate:

a. temperature

|  |
| --- |
|  |

b. concentration of the reactants.

|  |
| --- |
|  |

3. a. Describe two chemical reactions that happen in your everyday life.

What are the reactants and products in these reactions?

|  |
| --- |
|  |

4. b. Explain two ways that you could:

(i) speed the reaction up

|  |
| --- |
|  |

(ii) slow the reactions down.

|  |
| --- |
|  |

# Activity 3.3 Catalysts

## Decomposition of hydrogen peroxide

**What to do:**

Carry out the decomposition reaction as described in the **Student Guide**.

## Discussion

1. What evidence is there that manganese dioxide is a catalyst in this reaction? How could you prove that it is not used up in the reaction?

|  |
| --- |
|  |

2. Write an equation to represent this reaction.

|  |
| --- |
|  |

## Zinc and hydrochloric acid

**What to do:**

Carry out the experiment as described in the **Student Guide**.

**Results:** (how does the rate of gas bubble production compare between the two test tubes?)

|  |
| --- |
|  |

## Discussion

1. What gas is produced in this reaction? Write an equation to represent the process.

|  |
| --- |
|  |

2. Is there any evidence that the copper dissolved?

|  |
| --- |
|  |

3. Is the copper acting as a catalyst? Explain.

|  |
| --- |
|  |

## Notebook: How catalysts work

1. The simulation in the **Student Digital** gives one idea of how catalysts might work. Explain what idea you think it is trying to get across.

|  |
| --- |
|  |

2. Do you think a catalyst could work in another way?

|  |
| --- |
|  |

# Activity 3.4 Controlled experiment

**What to do:**

Your task is to design and carry out an experiment to investigate the effect of particle size on reaction rate.

**Experiment design**

|  |
| --- |
|  |

**Results**

|  |
| --- |
|  |

**Conclusion**

|  |
| --- |
|  |

# Activity 3.5 Sulfuric acid – king of chemicals

## Notebook: Industrial questions

Your task is to design and carry out an experiment to investigate the effect of particle size on reaction rate.

1. Draw a flow chart outlining the contact process for the production of sulfuric acid.

|  |
| --- |
|  |

2. Reaction rate is particularly important in industrial chemical processes. What catalyst is used in the production of sulfuric acid and how does it affect reaction rate?

|  |
| --- |
|  |

3. What potential environmental problems arise from the production of sulfuric acid?

|  |
| --- |
|  |

4. Describe two important uses of sulfuric acid in Australia.

|  |
| --- |
|  |

**Lesson Outcomes Checklist Part 3**

**NAME:**

|  |  |  |
| --- | --- | --- |
| **ACTIVITY** | **LESSON OUTCOMES**  **At the end of these activities I can:** | **Please indicate if you achieved each learning outcome:**  **✓ = Yes**  **? = Partly**  **X = No** |
| **Activity 3.1 How fast can it go?** | * identify that chemical reactions can occur at different rates |  |
| * collect valid and reliable data |  |
| * apply mathematical concepts to interpret experimental data |  |
| * draw graphs to analyse trends in data collected. |  |
| **Activity 3.2 Changing reaction rate** | * describe the effects of temperature and concentration on reaction rate |  |
| * specify dependent and independent variables for controlled experiments |  |
| * assess the reliability and validity of first-hand data |  |
| * design controlled experiments to collect valid data. |  |
| **Activity 3.3** **Catalysts** | * describe the role of a catalyst in a chemical reaction |  |
| * make inferences from observations in first-hand activities. |  |
| **Activity 3.4 Controlled experiment** | * justify why variables need to be kept constant if reliable first-hand data is to be collected |  |
| * select equipment to collect and record data |  |
| * analyse patterns and trends in data, including identifying inconsistencies |  |
| * write a scientific report of a first-hand investigation. |  |
| **Activity 3.5 Sulfuric acid – king of chemicals** | * discuss how chemistry can be used in industry to produce a range of useful substances |  |
| * construct a flow chart to clearly demonstrate a chemical process |  |