# 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.

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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)

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

$$Reaction rate= \frac{amount of gas (mL)}{total time taken (min)}$$

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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?

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

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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?

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

 How could you improve on your technique?

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**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?

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

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Now arrange them from fastest to slowest.

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# 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.

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| **Concentration of thiosulfate** | **Reaction time** |
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## 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.

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2. What variables were kept constant in the experiment?

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3. What were the independent and dependent variables?

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

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5. Write a conclusion for this experiment.

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## 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**

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**Results**

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**Conclusions**

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## Notebook: Effective collisions

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

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2. Explain how the following can affect reaction rate:

a. temperature

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 b. concentration of the reactants.

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

 What are the reactants and products in these reactions?

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4. b. Explain two ways that you could:

 (i) speed the reaction up

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 (ii) slow the reactions down.

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# 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?

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2. Write an equation to represent this reaction.

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## 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?)

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## Discussion

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

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2. Is there any evidence that the copper dissolved?

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

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## 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.

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

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# 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**

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**Results**

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**Conclusion**

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# 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.

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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?

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

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

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**Lesson Outcomes Checklist Part 3**

**NAME:**

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| --- | --- | --- |
| **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
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| * collect valid and reliable data
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| * apply mathematical concepts to interpret experimental data
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| * draw graphs to analyse trends in data collected.
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| **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
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