

## Evaluating experiments

### Learning objectives

- 1 Understand what is required when evaluating an experiment or investigation.
- 2 Identify the aspects of a named investigation that are relevant to its evaluation.
- 3 Evaluate the aspects identified and use them to write an overall evaluation, if required.

### Introduction

Practical skills are an important part of most chemistry courses. They include being able to evaluate the methods used, data collected and the conclusion. This student sheet will help you evaluate your experiment as you are doing it. You can use the glossary at the end of the sheet to help with any words you are unsure of.

### General guidance

Complete the table at suitable intervals during your experiment. You must decide when this is appropriate. Complete the 'Evaluating the planning stage' and 'Evaluating the apparatus' sections before you carry out your experiment. Answer the 'Evaluating the method' questions either as you carry out the experiment or soon after. If you are completing this section as you are carrying out the experiment, take care that it is safe to leave the experiment and that you are not introducing additional errors. Write your answers in the 'Evaluating the conclusion' and 'Improvements' sections after you have processed the data.

Your course may require you to write an overall evaluation. Your teacher will tell you if you need to do this.

Experiment:	
Evaluating the planning stage	Answer
What is the independent variable?	
What is the dependent variable?	
Which variables are you controlling?	
Are there any variables you cannot control? If so, name them.	
Will your method provide valid data relevant to your hypothesis? Explain your answer.	

<b>Evaluating the apparatus</b>	
Which pieces of apparatus that you are using have uncertainties? (errors)  Hint: look at the apparatus. Uncertainties are usually printed on them.	
What are you doing to limit errors from apparatus?	
<b>Evaluating the method</b>	
List any errors due to the method you are using.	
List any errors due to the way you carried out the investigation.	
What is your biggest source of error?	

<b>Evaluating the conclusion</b>	
Have you identified and dismissed any anomalous results?	
Have you used a suitable range of values for the independent variable?	
Have you done enough repeats? Have you taken an average of repeat values, excluding any anomalous results?	
What are the limitations of your investigation and conclusion?	
Is your conclusion reproducible?	
<b>You have now completed your evaluation. How could you improve the experiment?</b>	
What changes can be made to the apparatus and method to improve the validity of the results?	

## Glossary

**Anomalous result** – a result that does not fit the pattern of other results. This may be in the pattern of the overall results or in a number of repeats under the same conditions.

**Control variable** – a variable which you keep constant so that it does not affect the results. For example, keeping a constant temperature or concentration of a solution.

**Dependent variable** – the variable for which the values change when the independent variable is changed. This is the variable you measure. For example, if you are changing the temperature of a reaction and timing how long it takes, time is the dependent variable.

**Errors** – things that are inaccurate in an experiment. They can be due to the method, the apparatus or human error. Errors can make your results less accurate.

**Hypothesis** – a statement of what you think will happen in your investigation.

**Independent variable** – the variable for which you select the values. This is the variable you change in an investigation. For example, if you are changing the temperature of a reaction and timing how long it takes, temperature is the independent variable.

**Limitations** – how far you can apply your conclusion. For example, if you conclude that an increase in temperature increases the rate of reaction of a certain reaction, does this apply to all reactions?

**Range** – the maximum and minimum values of the independent and dependent variables. For example, if temperature is the independent variable, the range of values investigated maybe from 10°C to 50°C.

**Reproducible** – measurements are reproducible if different learners obtain the same results using the same apparatus and method.

**Uncertainty** – the range you'd expect a measurement to be between. For example, a burette has an uncertainty of  $\pm 0.05 \text{ cm}^3$ , so a reading of  $25.00 \text{ cm}^3$  may be between  $24.95 \text{ cm}^3$  and  $25.05 \text{ cm}^3$ .

**Validity** – the suitability of the procedure to test the hypothesis. This includes the suitability of the method and apparatus used to test the hypothesis.

**Variable** – something that can change in an investigation.