# CIE Chemistry IGCSE

## AO3 Practical Skills 4: Interpret and evaluate experimental observations and data

Notes

# Processing data and drawing conclusions

## Data Tables

Tables of data are the most common form of **recording observations** in chemistry. A table should be set up **before** the experiment starts, and should have the correct number of rows so that there is enough space to record all of your observations. A student must therefore have a good idea of how many observations they will make as well as what they will be observing. Tables can contain quantitative or qualitative data or both, they help to organise the data so **conclusions** can more easily be made. **Units** of measurements must be in the headings of the columns and not in each individual box.

The **independent variable** is always in the **first column** of the table and the **dependent variable(s)** is in the **next column(s).**

The table below is an example of a table containing qualitative data.

| | **Solution A** | **Solution B** | **Solution C** |
|---|---|---|---|
| **Test with $AgNO_3$** | No reaction | White precipitate | Yellow precipitate |
| **Test with $Ba(NO_3)_2$** | White precipitate | No reaction | No reaction |
| **Test with $NH_3$** | Blue precipitate | Pink precipitate | Green precipitate |

In the exam you may have to **complete tables**, some of them will require **simple calculations** such as **calculating the mean** - remember to **exclude anomalies**. You may have to fill in a table like the one above using knowledge of how to identify different ions from the results of chemical tests.

## Drawing conclusions

Once all of your data has been collected and you have made your analysis, **conclusions** can be made, these may be drawn from the **shapes of graphs** that may show certain **trends**, or values given by the analysis. From there you can begin to **evaluate** your experiment. Is the experiment **accurate** enough for the conclusion to be supported? Does the experiment need to be **repeated**? It is vitally important that all observations are written down in the experiment as it makes evaluating the method much easier.

When drawing conclusions from an experiment it is important to **reference the data.** In the exam this includes **giving examples of data** collected to illustrate a **trend or pattern** and **averages** such as the **mean and ranges**. You are expected to use a **calculator** when necessary, such as when calculating these averages. An **explanation** of the trends and observations from your experiment should accompany the data you've included in your conclusion. These explanations should draw upon **scientific knowledge** from your entire course.

# Presentation of data

## Introduction

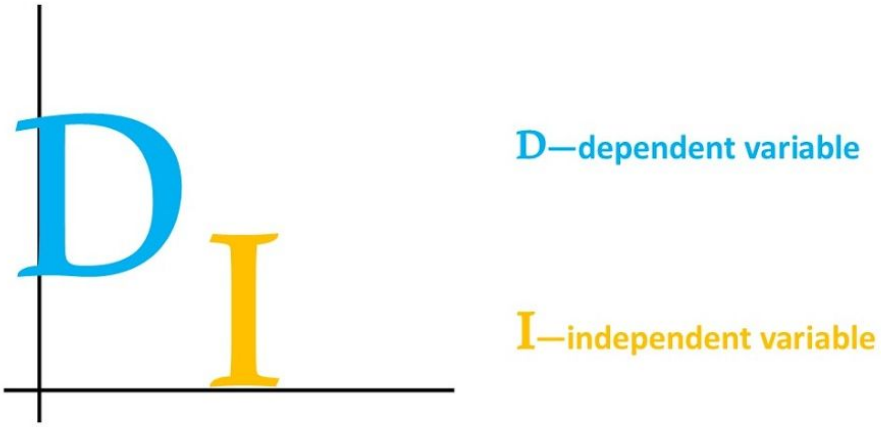
A **table** is a good way of **recording results** and **observations** during the experiment and for **qualitative data** it is also a good way of **presenting** the data. However, for **quantitative data**, a **graph** is generally best used to present the data, as it clearly shows patterns and trends and how the dependent variable varies with the independent variable.

## Drawing graphs

You will not only need to be able to **read and interpret** graphs given to you in the exam, you may also be expected to **draw** a graph from a set of data given. Here are some important tips for drawing graphs:

- Always use a **sharpened pencil** and **ruler** to draw the axis and line of best fit.
- **Label** the **axis** with its variable and its **units.**
- Draw your graph a **sensible size.**
  - Use up at least half of the graph paper given.
- Use a sensible **scale.**
- The **dependent variable** goes on the **vertical y axis.**
- The **independent variable** goes on the **horizontal x axis.**
- Determine the **ranges** of the axis so you can include all the data points collected.
- Give the graph an appropriate **title .**
- Indicate any **anomalies** but identify them as anomalous.
  - Ignore these when drawing your line of best fit.
- Draw a **line of best fit** if possible.
  - The 'line' could be **straight or curved.** If the line of best fit is not a straight line, a freehand continuous curve must be drawn.
  - **Never** just connect the points like a dot-to-dot.
  - Bring a long, **clear** ruler to the exam so you can see the data points when drawing a straight line of best fit.

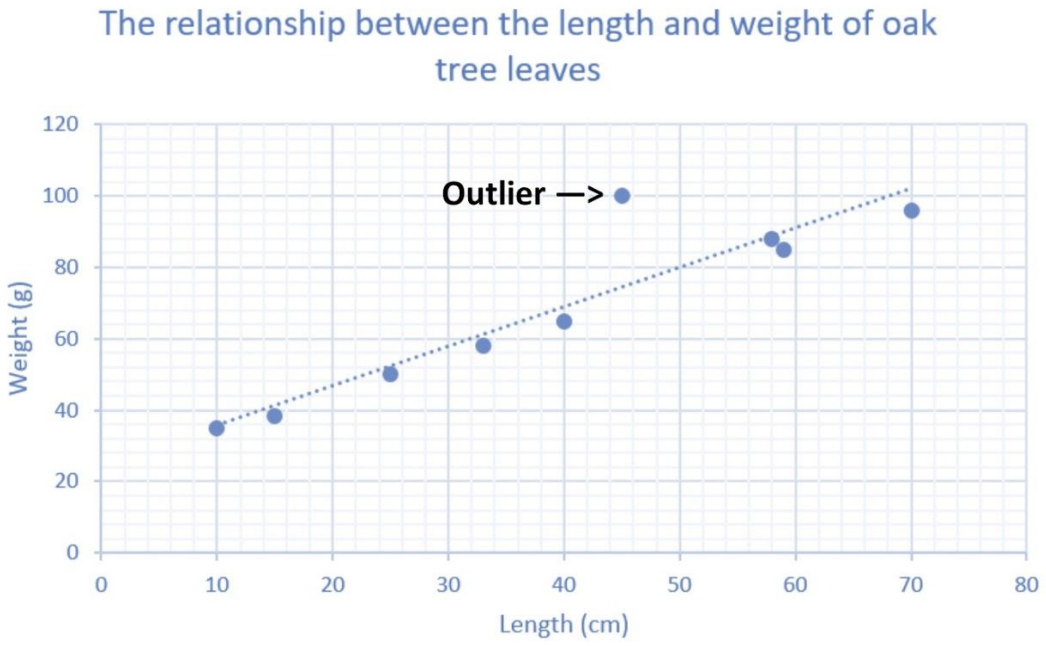
A helpful way to remember which axis the independent and dependent variables go on is to imagine the letters 'I' and 'D' sat on their respective axis as shown:



**Shown below is an example graph drawn for the following table of results:**
Notice that the **units** of measurements are only included in the title of each column. Each measurement of the same type must be given to the same **degree of accuracy** - e.g. in the table below, each weight value is given to three significant figures.

| Length (cm) | Weight (g) |
|---|---|
| 10 | 35.0 |
| 15 | 38.5 |
| 25 | 50.0 |
| 33 | 58.0 |
| 40 | 65.0 |
| 45 | 100 |
| 58 | 88.0 |
| 59 | 85.0 |
| 70 | 96.0 |

The **graph** to represent this data:




**An example conclusion:**
The data collected shows that as the length of oak leaves increases, the weight of them also increases linearly. For instance, a leaf which measured 10 cm weighed only 35.0 g whereas a leaf

which measured 59 cm weighed 85.0 g. The explanation for this is that longer leaves have a larger surface area and, therefore, a greater mass. If I were to repeat this experiment I would measure longer leaves to investigate whether the trend remains the same and if it remains linear for lengths past 80 cm.

**This conclusion includes:**

- The **pattern/trend**
- **Data points** to illustrate the trend
- A **scientific explanation** for the trend
- A short **evaluation**

**Exam questions**

As well as drawing graphs you will need to be able to **interpret and read graphs** given to you in the exam. Possible skills you could be tested on include:

- **Reading data points** off a graph
- **Drawing** an appropriate **line of best fit**
    - Remember it may not be straight!
- Suggesting the **type of graph** you would use for a given set of data
    - General rule of thumb - if **quantitative** use a **scatter graph**, if **qualitative** use a **bar chart.**
- Identifying **patterns** and **trends**
- **Drawing conclusions** from the graph which must include **referencing data points**
- **Comparing** 2 similar graphs
    - For instance, comparing 2 graphs which have the same dependent and independent variables but a different subject of study (e.g. for the example above, comparing that graph to another graph which shows the lengths and weights for a different species of leaf).