CAIE Chemistry A-Level

4.2.2 - Practical Skills for Paper 3

Analysis, Conclusions and Evaluation

Flashcards

Why is analysis completed after an experiment?

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To allow conclusions to be drawn from the experimental data.

What are anomalies?

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Anomalies are pieces of data which lie out of the trend of data.

Why does repeating an experiment increase the accuracy?

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Gaining more data for the experiment allows easy identification of anomalous data which can be removed from the data set, making the results more accurate.

How should the mean be calculated from data?

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The mean should be calculated after concordant results have been acquired (if relevant). This means when the results are within 0.1 units. Any anomalous results should not be included in the mean calculation.

The mean is calculated for each measurement by adding the concordant results and dividing by the number of values that were added.

Calculate the mean titre for the table below:

Titre	Volume of acid added (cm^3)
Rough titre	26.45
1	25.60
2	25.45
3	25.40
Mean	?

Calculate the mean titre for the table below:

The rough titre should not be included in the calculation because it usually goes beyond the endpoint of the reaction and is an outlier.

Titre 2 and titre 3 have concordant results so the mean should be calculated from these two values:

Mean = (25.45+25.40)/2 = 25.425 cm^3

Titre	Volume of acid added (cm^3)
Rough titre	26.45
1	25.60
2	25.45
3	25.40
Mean	?

How can the percentage gain/loss of a mass be calculated?

How can the percentage gain/loss of a mass be calculated?

Percentage gain/loss =

(Change in mass/original mass) x 100

How can percentage error be calculated?

How can percentage error be calculated?

$$\% \text{ error} = \frac{\text{absolute uncertainty}}{\text{calculated value}} \times 100$$

A titre volume is recorded as 11.30 cm^3. The accuracy of the burette is $\pm 0.05 cm^3$. Calculate the maximum percentage error.

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$$\% \text{ error} = \frac{\text{absolute uncertainty}}{\text{calculated value}} \times 100$$

$$(0.05 \div 11.30) \times 100 = 0.442\%$$

A burette has a resolution of 0.1 cm^3. What is the uncertainty of measurements taken using this burette?

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$\pm 0.05\ cm^3$

How can percentage yield be calculated?

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$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

Theoretical yield is the largest possible mass of product that could be formed. Actual yield is the mass of product obtained.

How can atom economy be calculated?

How can atom economy be calculated?

Atom economy =

$$\frac{\text{relative formula mass of desired product}}{\text{total relative formula masses of reactants}} \times 100$$

How can the gradient of a straight line graph be calculated?

How can the gradient of a straight line graph be calculated?

Gradient = change in y ÷ change in x

How could the gradient of a curve at a particular point be calculated?

How could the gradient of a curve at a particular point be calculated?

- Draw a tangent to the curve at that point
- Gradient = change in y ÷ change in x

How can percentage purity be calculated?

How can percentage purity be calculated?

$$\% \text{ purity} = \frac{\text{mass of desired substance}}{\text{mass of impure substance}} \times 100$$

How can percentage purity be increased?

How can percentage purity be increased?

- Recrystallisation
- Filtration
- Reduce the number of times the mixture is transferred between apparatus
- Use a different method to produce the compound

When writing a conclusion, what information should be included?

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The hypothesis should be reasserted and the conclusion must state whether the data supports the original hypothesis. Scientific knowledge must be used to explain the shape/trends of graphs and data. The results should also be evaluated by suggesting relevant improvements.

What are the different ways in which an experiment can be evaluated?

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- How the proposed method can be improved
- How the apparatus can be improved
- How the control variables can be better controlled
- Identify any erroneous steps

How many significant figures should calculated results be given to?

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The same number of significant figures as the least accurate measured quantity.

If a thermometer is calibrated at 1°C intervals, how accurately should temperature be recorded?

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To the nearest 0.5°C

How could the percentage uncertainty be reduced when measuring the volume of a liquid?

How could the percentage uncertainty be reduce when measuring the volume of a liquid?

Use a larger volume of liquid

What is the difference between random and systematic errors?

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Random error - reading fluctuates around the true value due to problems when taking measurements

Systematic error - consistent variation from the true value due to incorrect calibration of equipment

Suggest ways in which random and systematic errors are caused

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Random - variability of a material, fluctuation in the temperature of the surroundings

Systematic - a thermometer that reads 0.5°C above the actual temperature, reading the volume incorrectly from the meniscus

A glass beaker is used to contain a reaction mixture during an enthalpy change investigation. Suggest ways in which this experiment could be improved.

A glass beaker is used to contain a reaction mixture during an enthalpy change investigation. Suggest ways in which this experiment could be improved.

- Use a polystyrene cup and pleace in a beaker of cotton wool to further insulate the cup.
- Use a lid.
- Repeat the experiment and calculate an average.
- Use more accurate apparatus to measure volumes (e.g. volumetric pipette rather than a measuring cylinder).