CIE Chemistry A-Level

4.2.2 - Practical Skills for Paper 3

Manipulation, Measurement and Observation

Flashcards

Name the two types of data found in chemistry and explain the types of data they refer to

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Qualitative - non-numerical data that is collected by observation

Quantitative - data that can be measured

Give examples of qualitative data

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- Colour of a solution
- Observations of precipitates
- pH when using an acid-alkali indicator

Give examples of quantitative data

Give examples of quantitative data

- Height
- Temperature
- Mass
- Age

What is meant by the term precision?

What is meant by the term precision?

How close two measurements are to one another.

How can precision be increased?

How can precision be increased?

Use equipment with a higher resolution.

E.g. use a mass balance with more decimal places or use a ruler with smaller divisions.

What is meant by the term accuracy?

What is meant by the term accuracy?

How close the value is to the true value.

How can accuracy be increased?

How can accuracy be increased?

Repeat measurements

How should the reading on a burette be taken?

How should the reading on a burette be taken?

The measurement should be read at eye level to the burette. It is easier to read if a piece of paper is placed behind the burette.

The measurement should be read from the bottom of the meniscus.

Describe the method used to weigh out a solid

Describe the method used to weigh out a solid

Weighing-by-difference method:

Measure the mass of a weighing boat on a balance. Add the solid to the weighing boat and remeasure the mass. The difference between the two masses is the mass of solid.

Describe how the volume of gas could be measured during an experiment

Describe how the volume of gas could be measured during an experiment

Use a bung and delivery tube to connect a conical flask to either:

- A gas syringe
- An upturned measuring cylinder in a water trough

How can pH be measured?

How can pH be measured?

Using a pH probe

Using an indicator and a colour chart

What tool can be used to measure pH to ensure precise and accurate measurements are being recorded?

What tool can be used to measure pH to ensure precise and accurate measurements are being recorded?

pH probe:

- Precise: The pH probe will give results to 2 decimal places.
- Accurate: It gives an accurate answer which overcomes the subjectiveness of using universal indicator.

How can the colour of a solution be quantified? How can this be used to work out the concentration of a solution?

How can the colour of a solution be quantified? How can this be used to work out the concentration of a solution?

A colorimeter can be used to measure the amount of light absorbed by a solution. This can be compared to a calibration curve. A calibration curve is created by using a colorimeter to measure the absorbance of known concentrations of the solution.

What is an anomaly?

What is an anomaly?

Data that does not fit the expected trend

What should be done if an anomalous result is obtained during an experiment?

What should be done if an anomalous result is obtained during an experiment?

Repeat the reading until concordant results.

Omit the anomaly from mean calculations and line of best fit on graphs.

Why might an experiment be repeated?

Why might an experiment be repeated?

To allow easy identification of anomalous results.

Means can be calculated so the results are more accurate.

Which values should be used to calculate the mean titre after a titration?

Which values should be used to calculate the mean titre after a titration?

Two titres that are within 0.10 cm^3 of each other (concordant). The rough titre should be ignored.

Describe the test for gaseous ammonia

Describe the test for gaseous ammonia

Damp red litmus paper will turn blue in the presence of ammonia.

Ammonia has a characteristic strong choking smell.

Describe the test for carbon dioxide

Describe the test for carbon dioxide

A white precipitate is formed when bubbled through limewater.

Describe the test for chlorine gas

Describe the test for chlorine gas

Damp blue litmus paper turns red then bleaches white in the presence of chlorine.

Describe the test for hydrogen gas

Describe the test for hydrogen gas

Insert a lit splint into the test tube of gas. If hydrogen is present, a squeaky pop will be sound.

Describe the test for oxygen gas

Describe the test for oxygen gas

Insert a glowing splint into a test tube of gas. If oxygen is present, the splint will relight.

If bubbles are produced during a reaction, what does this mean?

If bubbles are produced during a reaction, what does this mean?

A gas is produced

How can NH_4^+ be identified?

How can NH_4^+ be identified?

Add a few drops of sodium hydroxide to the sample and warm. Test the gas produced using damp red litmus paper. If ammonium ions were present, the litmus will turn blue.

Describe the reactions of $Al^{3+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Al^{3+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - white precipitate, soluble in excess

NH_3 - white precipitate, insoluble in excess

Describe the reactions of $Ba^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Ba^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - faint white precipitate observed unless reagents are pure

NH_3 - no precipitate

Describe the reactions of $Ca^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Ca^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - white precipitate with concentrated Ca^{2+}

NH_3 - no precipitate

Describe the reactions of $Cr^{3+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Cr^{3+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - grey-green precipitate, soluble in excess

NH_3 - grey-green precipitate, insoluble in excess

Describe the reactions of $Cu^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Cu^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - pale blue precipitate, insoluble in excess.

NH_3 - pale blue precipitate, soluble in excess producing a dark blue solution.

Describe the reactions of $Fe^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Fe^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - green precipitate (turns brown in air), insoluble in excess

NH_3 - green precipitate (turns brown in air), insoluble in excess

Describe the reactions of $Fe^{3+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Fe^{3+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - red-brown precipitate, insoluble in excess

NH_3 - red-brown precipitate, insoluble in excess

Describe the reactions of $Mg^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Mg^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - white precipitate, insoluble in excess

NH_3 - white precipitate, insoluble in excess

Describe the reactions of $Mn^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Mn^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - off-white precipitate (rapidly turns brown in air), insoluble in excess

NH_3 - off-white precipitate (rapidly turns brown in air), insoluble in excess

Describe the reactions of $Zn^{2+}(aq)$ with $NaOH(aq)$ and $NH_3(aq)$

Describe the reactions of $Zn^{2+}(aq)$ with NaOH(aq) and $NH_3(aq)$

NaOH - white precipitate, soluble in excess

NH_3 - white precipitate, soluble in excess

How can CO_3^{2-} ions be identified?

How can CO_3^{2-} ions be identified?

Add acid to the sample and use a bung and delivery tube to connect the reaction vessel to a test tube of limewater. If carbonate ions are present, CO_2 will be produced which turns limewater cloudy.

How can NO_3^- ions be identified?

How can NO_3^- ions be identified?

Heat with aqueous sodium hydroxide and aluminium foil. Nitrate ions will be reduced to ammonia (test using red litmus paper).

How can NO_2^- ions be identified?

How can NO_2^- ions be identified?

Heat with aqueous sodium hydroxide and aluminium foil. Ammonia will form (test using red litmus paper).

How can SO_4^{2-} ions be identified?

How can SO_4^{2-} ions be identified?

Add aqueous barium nitrate. A white precipitate ($BaSO_4$) will form if sulfate ions are present. This precipitate is insoluble in excess dilute strong acids.

How can SO_3^{2-} ions be identified?

How can SO_3^{2-} ions be identified?

Add aqueous barium nitrate. A white precipitate ($BaSO_3$) will form if sulfite ions are present. This precipitate is soluble in excess dilute strong acids.

How can halide ions be identified?

How can halide ions be identified?

Add dilute nitric acid to react with carbonate ions so no Ag_2CO_3 forms (white solid).

Add silver nitrate. Precipitate forms:

- White: AgCl (soluble in dilute ammonia)
- Cream: AgBr (soluble in concentrated ammonia)
- Yellow: AgI (insoluble in ammonia)