Stage 2 Chemistry

Assessment Type 1: Investigations Folio

Practical Investigation: Analysis of Antacids

Chemists are often tasked with monitoring, assessing and evaluating consumer products to ensure their safety or to verify product claims.

In December 2015, the Federal Court of Australia ordered a popular pain relief brand to pay a fine and compensation after it found that its line of ‘specific pain’ products were misleading for consumers. Four pain relief products suggested that they were formulated to target a specific pain type, however it was found that they had the same formula and active ingredient. It was found that none of the products were any more or less effective in treating a specific type of pain, and the products themselves were also more expensive as general pain products and products of competitors.

Over-the-counter pain remedies are sold directly to a consumer without prescription from a health care professional. Another over-the-counter remedy sold alongside pain relieving products are *antacids.* An *antacid* is a substance which contains alkaline ions that can chemically neutralise stomach acid (a mixture of hydrochloric acid, potassium chloride and sodium chloride). These are designed to combat excessive amounts of stomach acid being produced in the stomach, which damages the natural mucous barrier that protects the lining of the stomach (resulting in ulceration) as well as the oesophagus (due to acid-reflux).

Research popular brands of antacids and collect information in a table, such as one below for the purposes of carrying out comparisons. Select brands that produce a variety of different antacid products (e.g. original, double-strength, dual action). You are also encouraged to also consider other antacid products that are available at a range of prices.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Antacid** | **RRP** | **Quantity** | **Adult Dose** | **Active Ingredients** |
| Brand A Original | \_\_\_\_ | \_\_\_ tablets | \_\_ tablets | \_\_\_ mg sodium alginate  \_\_\_ mg sodium bicarbonate  \_\_\_ mg calcium carbonate |
| Brand A Double Strength | \_\_\_\_ | \_\_\_ tablets | \_\_ tablet | \_\_\_ mg sodium alginate  \_\_\_ mg sodium bicarbonate  \_\_\_ mg calcium carbonate |
| Brand A Dual Action | \_\_\_\_ | \_\_\_ tablets | \_\_ tablets | \_\_\_ mg sodium alginate  \_\_\_ mg sodium bicarbonate  \_\_\_ mg calcium carbonate |
| Brand B Original | \_\_\_\_ | \_\_\_ tablets | \_\_ tablets | \_\_\_ mg aluminium hydroxide \_\_\_ mg magnesium hydroxide \_\_\_ mg simethicone |
| Brand B Double Strength (Tablet) | \_\_\_\_ | \_\_\_ tablets | \_\_ tablet | \_\_\_ mg aluminium hydroxide \_\_\_ mg magnesium hydroxide \_\_\_ mg simethicone |

# Part A: Selecting an Investigable Question

You could choose one of the following investigable questions to form the basis of your investigation, or develop your own:

* Do double strength antacids neutralize *double* the number of moles of acid compared with standard strength antacids?
* Do more expensively branded antacid tablets neutralize more acid than those available at a cheaper price?

**Part B: Undertaking a Back Titration (Collaborative)**

The procedure below can be used to determine the number of moles of acid neutralised by an antacid tablet. Use this procedure, with modifications as required, to collect data that can be used to answer your investigable question.

**Basic Procedure for Analysis of an Antacid Tablet**

1. Prepare a standard solution of sodium hydroxide of approximately 1.0 mol.L1 in a

250.0 mL volumetric flask.

1. Weigh an antacid tablet using an electronic balance and record its mass
2. Transfer the antacid tablet to a mortar and pestle and grind to a powder
3. Transfer the ground antacid tablet to a conical flask, rinsing the mortar and pestle into the conical flask using distilled water.
4. Using a 25.0 mL volumetric pipette, transfer 25.0 mL of 1.20 mol.L1 hydrochloric acid solution to the conical flask, and leave for 2 minutes.
5. Add 3 drops of bromothymol blue indicator to the conical flask
6. Using a funnel, fill a 50.0 mL burette with the sodium hydroxide standard solution
7. Titrate with the sodium hydroxide standard solution, using a 50.0 mL burette.

# Part C: Practical Report Individual)

You will need to submit a practical report that addresses the following report format requirements:

* *Introduction (KA4)*

Introduce the focus of your investigation (investigable question) and any relevant chemistry concepts.

* *Investigation Outline (IAE2)\**

Communicate, in an appropriate format, the materials and apparatus used and the procedure that was undertaken*.*

* *Results (IAE2)\**

Display the raw data obtained in the investigation using appropriate formats

* *Analysis (IAE3)*

Use the data collected in the investigation to determine an answer to the investigable question, with reference to relevant chemistry concepts where necessary.

* *Evaluation (IAE4)*

Evaluate the data obtained in the investigation for its reliability, accuracy and validity, with reference to sources of uncertainty where appropriate.

* *Conclusion (IAE3)*

Formulate and justify a suitable conclusion, acknowledging limitations where appropriate.

Your practical report should be a maximum of 1500 words (sections marked with asterisk (\*) above are excluded from this word count).

Performance Standards for Stage 2 Chemistry

| - | Investigation, Analysis, and Evaluation | Knowledge and Application |
| --- | --- | --- |
| A | Critically deconstructs a problem and designs a logical and coherent chemistry investigation with detailed justification.  Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.  Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.  Critically and logically evaluates procedures and discusses their effect on data. | Demonstrates deep and broad knowledge and understanding of a range of chemical concepts.  Applies chemical concepts highly effectively in new and familiar contexts.  Critically explores and understands in depth the interaction between science and society.  Communicates knowledge and understanding of chemistry coherently, with highly effective use of appropriate terms, conventions, and representations. |
| B | Logically deconstructs a problem and designs a well-considered and clear chemistry investigation with reasonable justification.  Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.  Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.  Logically evaluates procedures and their effect on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of chemical concepts.  Applies chemical concepts mostly effectively in new and familiar contexts.  Logically explores and understands in some depth the interaction between science and society.  Communicates knowledge and understanding of chemistry mostly coherently, with effective use of appropriate terms, conventions, and representations. |
| C | Deconstructs a problem and designs a considered and generally clear chemistry investigation with some justification.  Obtains, records, and represents data, using generally appropriate conventions and formats, with some errors but generally accurately and effectively.  Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.  Evaluates procedures and some of their effect on data. | Demonstrates knowledge and understanding of a general range of chemical concepts.  Applies chemical concepts generally effectively in new or familiar contexts.  Explores and understands aspects of the interaction between science and society.  Communicates knowledge and understanding of chemistry generally effectively, using some appropriate terms, conventions, and representations. |
| D | Prepares a basic deconstruction of a problem and an outline of a chemistry investigation.  Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.  Describes data and undertakes some basic interpretation to formulate a basic conclusion.  Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of chemical concepts.  Applies some chemical concepts in familiar contexts.  Partially explores and recognises aspects of the interaction between science and society.  Communicates basic chemical information, using some appropriate terms, conventions, and/or representations. |
| E | Attempts a simple deconstruction of a problem and a procedure for a chemistry investigation.  Attempts to record and represent some data, with limited accuracy or effectiveness.  Attempts to describe results and/or interpret data to formulate a basic conclusion.  Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of chemical concepts.  Attempts to apply chemical concepts in familiar contexts.  Attempts to explore and identify an aspect of the interaction between science and society.  Attempts to communicate information about chemistry. |