**STAGE 1 CHEMISTRY – ASSESSMENT TYPE 1: Investigations Folio**

**Practical (Design): Enthalpy of Solution**

**Purpose**

Instant hot packs and cold packs can be purchased from pharmacies in order to soothe injuries such as muscle and joint sprains. They consist of a large pouch containing a dry salt plus an inner pouch of water. When the seal on the pouch of water is broken and then the pack is shaken vigorously, the salt mixes with the water and either an exothermic or endothermic reaction occurs.

**Description of the problem**

What salt could be used to cause a temperature change of 20°C in 50 mL of water for either an instant hot pack or an instant cold pack?

Factors that should be considered in your design include:

The ideal hand warmer increases in temperature as quickly as possible, costs as little as possible to make, and uses safe chemicals that can be disposed without harm to the environment.

Salts that could be tested for a hot pack include:

calcium chloride, magnesium sulfate and sodium acetate

Salts that could be tested for a cold pack include:

potassium chloride, ammonium chloride and ammonium nitrate

This assessment provides you with the opportunity to:

* deconstruct a problem in order to design and conduct an investigation
* collect, record and display data
* analyse and interpret data to form a justified conclusion
* evaluate procedures and their effect on the data
* communicate your understanding of concepts relating to enthalpy of solution

**Part A Deconstruct the problem and design an investigation procedure**

You will need to provide evidence of your thinking about the problem, your choice of question and reasons why you are selecting the various parts of your procedure.

Work with a partner to:

* research salts that are used in commercially available packs
* select a range of salts to use as the independent variable
* carry out a preliminary trial to plan your procedure. Make notes on your summary sheet.

Individually:

* write an investigable question or hypothesis that can be tested in the laboratory
* identify factors that can be controlled and those that cannot be controlled
* design and write a procedure to test your question. Include a list materials required and a detailed list of steps in dot points. Justify your choice of equipment and the various steps in the procedure.

Evidence of deconstruction should outline the deconstruction process, the method designed as most appropriate, and a justification of the plan of action, to a maximum of 4 sides of an A4 page. This evidence must be attached to the practical report.

Suggested formats for this evidence include flow charts, concept maps, tables, or notes.

* Your evidence of deconstruction, including your list of requirements, must be completed and handed in for assessment one week before the practical investigation.

**Part B Practical investigation**

* Carry out your approved investigation with your partner.

**Part C Investigation Report**

Individually write a practical report that includes:

* introduction with relevant chemistry concepts, and either a hypothesis and variables, or an investigable question
* materials/apparatus
* the method that was implemented
* identification and management of safety and/or ethical risks
* results, including table(s) and/or graph(s)
* analysis of results, including identifying trends and linking results to concepts
* evaluation of procedures and their effect on data, and identifying sources of uncertainty
* conclusion, with justification.

The report should be a maximum of 1000 words if written, or a maximum of 6 minutes for an oral presentation, or the equivalent in multimodal form.

Only the following sections of the report are included in the word count:

* introduction
* analysis of results
* evaluation of procedures
* conclusion and justification.

**Assessment conditions**

**Part A**

Plan the investigation in the laboratory under teacher supervision.

**Part B**

The practical is completed in the laboratory during a ninety-minute lesson.

**Part C**

An individual practical report is completed and submitted for assessment no later than seven days after completion of Part B.

In the report the specific features IAE1, IAE2, IAE3, IAE4 and KA2 are assessed:

**Performance Standards for Stage 1 Chemistry**

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|  | | **A** | **B** | **C** | **D** | **E** |
| **Investigation, Analysis and Evaluation** | **1**  **2**  **3**  **4** | **Critically** deconstructs a problem and **designs** a **logical, coherent**, and **detailed** chemistry investigation.  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 their effects on data. | **Logically** deconstructs a problem and d**esigns** a **well-considered** and **clear** chemistry investigation.  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 effects on data. | Deconstructs a problem and **designs** a **considered** and **generally clear** chemistry investigation.  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 effects on data. | **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 a **basic** conclusion.  **Attempts** to evaluate procedures **or** suggest **an** **effect** on data. | **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. |
| **Knowledge and Application** | **1**  **2**  **3**  **4** | 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. | 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. | Demonstrates knowledge and understanding of a **general** range of chemical concepts.  Applies chemical concepts **generally effectively** in **new o**r 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. | 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. | Demonstrates some **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. |