**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:

| - | 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. |

Performance Standards for Stage 1 Chemistry