Logo, company name

Description automatically generated**Year 11 ATAR Chemistry**

Task 8: Designing a cold pack Investigation

Reference: Exploring Chemistry Year 11 ATAR pg 87

Weighting 7.5% of Year Total

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

WORKED WITH: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Background:**

Endothermic and exothermic reactions impact our energy needs, both biological and commercial and they have applications in the health industry. Cold packs are applied to sporting and other injuries to decrease the blood supply to the injured area by cooling the area. They reduce bruising and swelling that may result from an injury. Some commercially available cold packs depend on an endothermic solution process. The manufacturers claim that the temperature of the resulting solution can be lowered to about 1°C for around 20 minutes.

The energy change of an endothermic or exothermic reaction can be calculated using the mathematical formula:

**Q = mcΔT**

Where:

* Q = energy change in joules
* m = total mass = mass (solute) + mass (water) 
  + (1ml water = 1g) (must covert to kg)
* C = specific heat capacity of water = 4184 J/kg·K
* ΔT = change in temperature (final temperature – initial temperature)

**TASK:**

1. To determine the most suitable solute for use in a cold pack.
2. To determine the optimum ratio of solute to solvent that will produce the maximum cooling effect.

1. Read through the investigation in your STAWA book.

2. List the names and the formulae of the four solutes tested.

Task 1: To determine the most suitable solute for use in a cold pack.

1. Identify the independent variable. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Identify the dependant variable. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. List four variables that are important to control.

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| --- | --- |
| Variable 1 |  |
| Variable 2 |  |
| Variable 3 |  |
| Variable 4 |  |

4. Write a hypothesis for this investigation.

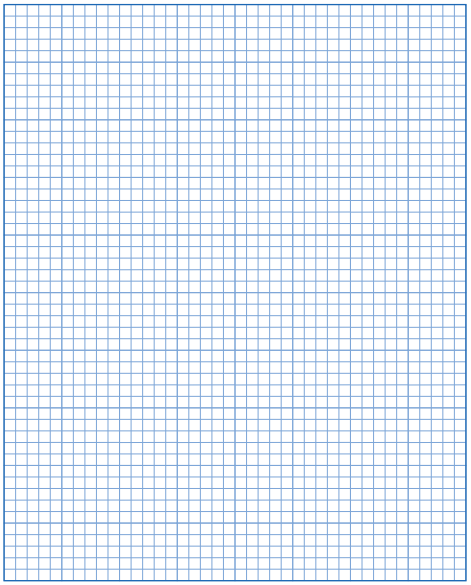
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5. Write a method for your investigation.

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6. Prepare a table and collect your results. You must test all four solids with a minimum of two trials for each one. Use your table to calculate the energy change of each experiment.

7. Draw a graph that shows the results for Task 1.



8. What do your results show about the most suitable solute to use? Refer to your results table. This solute will be used in task 2.

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9. Do your results agree with your hypothesis? Why/Why not?

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Task 2: To determine the optimum ratio of solute to solvent that will produce the maximum cooling effect.

1. Identify the independent variable. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Identify the dependant variable. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. List four variables that are important to control.

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| --- | --- |
| Variable 1 |  |
| Variable 2 |  |
| Variable 3 |  |
| Variable 4 |  |

4. List all of the equipment you plan on using.

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5. Write a brief method for your investigation.

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6. Prepare a table and collect your results. You must do at least 4 tests with a minimum of two trials for each one.

7. From your results, what is the optimum ratio of solvent to solute? Refer to your results table.

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8. Engineering: draw a design for your cold pack and write a description for how it would work.

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**END OF INVESTIGATION**