

UGANDA NATIONAL EXAMINATIONS BOARD
UGANDA CERTIFICATE OF EDUCATION
OCTOBER - NOVEMBER, 2023

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In a sports academy, there are so many complaints of recent, about post-exercise muscle injuries. The sports doctor aims at utilizing the enthalpies of solutions of one of the two salts, Salt M and Salt G, to make efficient Cold Packs for post-exercise recovery but needs to know which of the compounds is more suitable. You are provided with

Salt M

Salt G

Thermometer

Plastic beaker

Any other apparatus that can be found in the laboratory

Task

Design and carry out an experiment that can help the sports doctor to make the right decision.

Response

- a) Aim: An experiment to determine the temperature changes ^{DV} enthalpies of solutions of two salts when dissolved in water at different ^{IV} time intervals. 02 scores
- Aim with both key words (DV and IV)

b) Variables

DV — Temperature of the solution (mixture)

IV — Time taken to record the temperature change 03 score

CV — Amount of salt used and volume of water used

Incl. (DV, IV and CV) 03

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(c) Hypothesis: Heat is given out (Released) or absorbed when a salt is dissolved in water. (02 scores)

(d) Procedures and materials:

- Thermometer
 - Beakers (plastic)
 - measuring cylinder
 - Stop clock.
- Materials
x Relevant materials (01 score)

Procedures
- material - relevant
- Procedures - relevant
- coherent procedures (03)

- 10cm³ (any volume) of ~~dist~~ distilled water is measured and transferred into a plastic beaker ✓ P

- Its initial temperature is noted and recorded in the table below.

- A measured mass of salt M (any mass b/w (4-5g) or that provided) is added to the volume of P water in a plastic beaker, at the same time a stop clock is started. (03 scores)

- The mixture is stirred using a thermometer and the temperature change of the solution is noted and recorded at an interval of 30 seconds for 3 minutes. The results are recorded in the table.

- The solution is poured and the beaker is rinsed with distilled water.

- The same (above) procedures are repeated using another salt G ✓ P



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(e) Risk and Mitigation (only one)

- Solution spills on the Question paper - Be careful while stirring the solution

- Fumes from the solution - Use protective gear like gloves mask (2 scores)

Any Risk Identified and mitigated

(f) Data Presentation and Recording

Time (seconds)	0	30	60	90	120	150	180
Temperature of solution with salt M. (°C)	25.5	39.5	47.5	51.5	54.5	52.5	50.5
Temperature of solution with salt G. (°C)	26.0	24.5	23.0	21.5	20.5	20.0	20.0

Note - $\frac{2}{3}$ of required sets of data appropriately presented (10)

- Appropriate recording of data with in the error margin (8)

- Required number of decimals (4)

0.8 score

(g) Data Analysis

- See the graph.

- Proper title

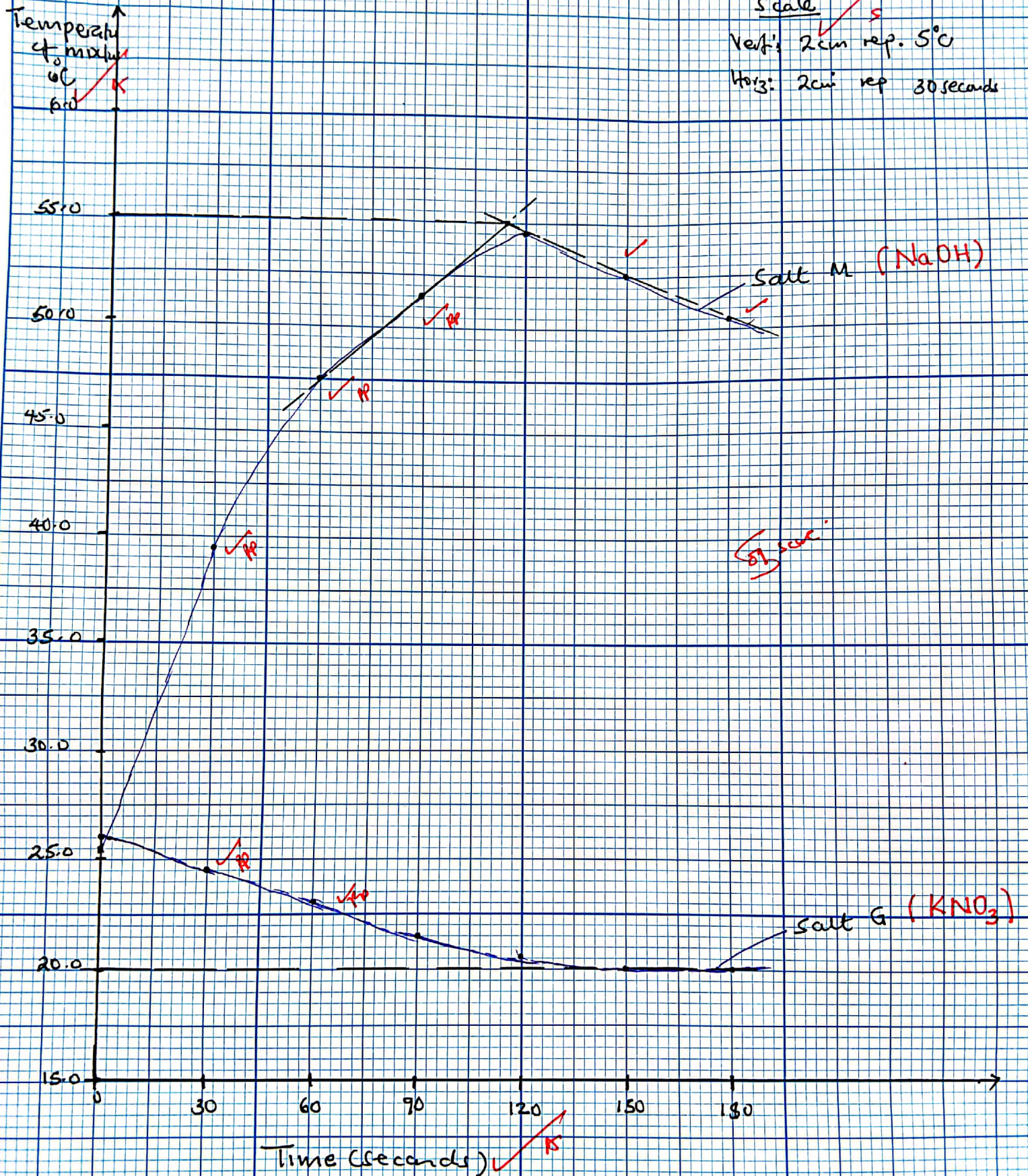
Appropriate and accurate

- Proper scale

- Proper labelling of axes

- Proper plotting of points

A graph of Temperature of solution against Time



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✓ For salt M:

$$\text{mass of solution} = (25 \times 1) = 70\text{g} = m, \quad \theta = 55.0 - 25.5$$

$$\text{Heat evolved} = m c \theta = 29.5^\circ\text{C}$$

$$\text{Heat evolved} = (70 \times 4.2 \times 29.5)$$

$$= - 8,673 \text{ Joules}$$

✓ For salt G

$$\text{mass of solution} = (100\text{cm}^3 \times 1\text{g/cm}^3) = 100\text{g}$$

$$\text{Temperature change} = 26.0 - 20.0 = 6.0^\circ\text{C}$$

$$\text{From heat absorbed} = m c \theta$$

$$= 100 \times 4.2 \times 6$$

$$= + 1,764 \text{ Joules of heat}$$

Accurate
and

Appropriate

by Conclusion:

✓ Salt M dissolves with release of heat $(- 8,673)$ Joules,
 or It dissolves exothermically with the heat change of
 $- 8,673$ Joules of heat.

✓ Salt G dissolves with absorption of heat $(+ 1,764)$ Joules
 or It dissolves endothermically with a heat change of
 $- 1,764$ Joules of heat, Therefore Salt G is a
 suitable compound to make cold packs.

Conclusion based on the data
 Interpretation