Core practical: energy changes on dissolving

Student activity • practical and reasoning

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The question

Can dissolving make the surroundings warmer or colder?

Measure temperature changes when two named salts dissolve in equal water volumes. Classify the energy transfer without assuming that every temperature change proves a new chemical substance.

Equipment

- Eye protection, two insulated cups supported in beakers, lids, measuring cylinder and stirrer
- Thermometer/probe, balance, weighing boats and spatulas
- Staff-issued anhydrous calcium chloride and potassium chloride; room-temperature water

Wear eye protection. Avoid dust, splashes and ingestion; use only named staff-issued salts. Do not seal cups or use flames.

Course coverage: Shared core: 3.1–3.2 and 3.8, salts dissolving in water. Equal-mass comparison is not a molar enthalpy comparison.

Plan, model or apparatus sketch

Draw the insulated cup, supported probe and loose lid; label energy transfer between reaction and surroundings.

Method and reasoning

Read the whole sequence before starting

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1. Wear eye protection. Label separate cups $CaCl_2$ and KCl and support each in a beaker. Measure 25.0 cm^3 water into each.

2. Record the initial water temperature and thermometer resolution. Ensure the probe tip is immersed without forcing it against the cup.

3. Add 2.00 g of the first named salt, replace the loose lid and stir gently. Record temperature at 15-second intervals for three minutes on a separate time table.

4. Record the highest or lowest reading and whether all solid dissolved. Calculate $\Delta T = T(\text{extreme}) - T(\text{initial})$, retaining its sign.

5. Use clean equipment and fresh water for the other salt. Keep water volume, salt mass, starting temperature and stirring as similar as possible.

6. Classify each dissolution, discuss heat exchange with the room and explain why equal salt masses are not equal amounts in moles.

Cleanup

- Staff direct collection/disposal of labelled salt solutions; rinse equipment and wash hands.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Record your own readings. ΔT=T(extreme)−T(initial). A rise indicates energy transferred from dissolution to the surroundings; a fall indicates energy absorbed from the surroundings. The system is the dissolving process, while the measured solution/cup acts as calorimetric surroundings. Do not copy expected temperatures into results.

Salt	Initial / extreme °C	ΔT / interpretation
$CaCl_2$		
KCl		
Repeat / uncertainty		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Calculate ΔT from your actual readings for both salts.

2. Classify each process using evidence.

3. Explain why a temperature change alone does not prove chemical reaction.

4. Identify two controlled variables and one limitation.

5. Why is equal mass not an equal-mole comparison?

6. Suggest a repeat or insulation improvement and explain its purpose.