

Why some changes heat up and others cool

Grade 8 science (Year 9 · Class 8) · Lab answers

Model answers use the sample data. Your own values will differ a little, but the signs of the changes should agree. Check your calculations by redoing them with your own numbers.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS1-6

Question 1 Temperature changes

Calcium chloride: $30.0 - 20.5 = +9.5$; ammonium chloride: $15.5 - 21.0 = -5.5$; sodium chloride: $20.0 - 20.5 = -0.5$; potassium nitrate: $13.5 - 20.5 = -7.0$. **+9.5, -5.5, -0.5 and -7.0 °C.**

Question 2 Classify

Calcium chloride is **exothermic**. Ammonium chloride and potassium nitrate are **endothermic**. Sodium chloride changed by only 0.5 °C, so it is hard to classify.

Question 3 Energy transfers

Calcium chloride: $50 \times 4.2 \times 9.5 = 1995$ J released, **about 2.0 kJ**. Ammonium chloride: $50 \times 4.2 \times 5.5 = 1155$ J absorbed, **about 1.2 kJ**.

Question 4 Sodium chloride

The change is -0.5 °C, which equals the smallest division of the thermometer. It could be a reading error, so **it is within the uncertainty**.

Question 5 Heat loss

Polystyrene is a poor conductor and the lid cuts heat exchange with the air. Without them the water would gain or lose energy from the room, so the measured ΔT would be **smaller than the true value**.

Question 6 Choosing solids for packs

Calcium chloride suits a hot pack, as it warms the water by 9.5 °C, and potassium nitrate suits a cold pack, as it cools by 7.0 °C. A concern is that **calcium chloride irritates skin and eyes**.

Question 7 Improving reliability

Repeat each test three times and take the mean. Use the same number of moles, or the same mass, in each test, and use a thermometer with finer divisions. **Repeats and finer scale** improve reliability.