

Why some changes heat up and others cool

Grade 8 science (Year 9 · Class 8) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to classify changes as exothermic or endothermic, calculate temperature changes, and use $Q = m \times c \times \Delta T$ to find energy transferred. You also read graphs and energy diagrams, and think about everyday products such as hand warmers.

They suit Grade 8, Year 9 and Class 8 students and follow NGSS MS-PS1-6 and KS3 and IGCSE foundations.

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

Problem 1 Key words (easy)

1. Define an exothermic reaction.
2. Define an endothermic reaction.
3. State what happens to the temperature of the surroundings in each case.

Problem 2 Sort the changes (easy)

Chiamaka in Lagos lists five changes: burning charcoal, an instant cold pack, photosynthesis, a hand warmer and melting ice.

1. Sort them into exothermic and endothermic.

Problem 3 Calculate the change (easy)

Two reactions are carried out in cups. Reaction A goes from 20.0 °C to 26.5 °C. Reaction B goes from 22.0 °C to 17.5 °C.

1. Calculate ΔT for each reaction.
2. State whether each is exothermic or endothermic.

Problem 4 Hot or cold sachet? (easy)

Aarav in Pune presses two sachets. Sachet X warms up in his hand and sachet Y feels cold.

1. State which sachet is exothermic.
2. State which direction the energy moves for sachet Y.

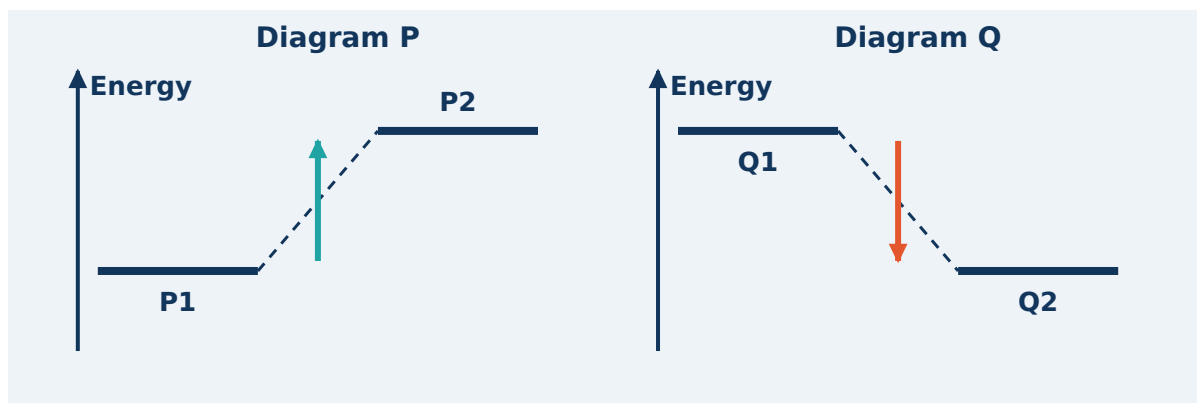
Problem 5 Where is the energy? (easy)

1. State what happens to the total amount of energy in a reaction.

2. Complete: in an exothermic reaction energy moves from the ____ to the ____.

Problem 6 Energy diagrams (easy)

Mei in Singapore draws two energy diagrams. In each, the lower line is shorter on the left.



Diagrams P and Q.

1. State which diagram shows an exothermic change.
2. State what the arrow in diagram Q represents.

Problem 7 Energy in the water (medium)

Kofi in Accra dissolves a solid in 100 g of water and the temperature rises by 8.0 °C. Use $c = 4.2 \text{ J/(g °C)}$.

1. Calculate the energy gained by the water.
2. Convert your answer to kJ.

Problem 8 A cooling solution (medium)

A cold-pack solid is dissolved in 200 g of water, and the water falls by 5.0 °C.

1. Calculate the energy lost by the water.
2. State where that energy goes.

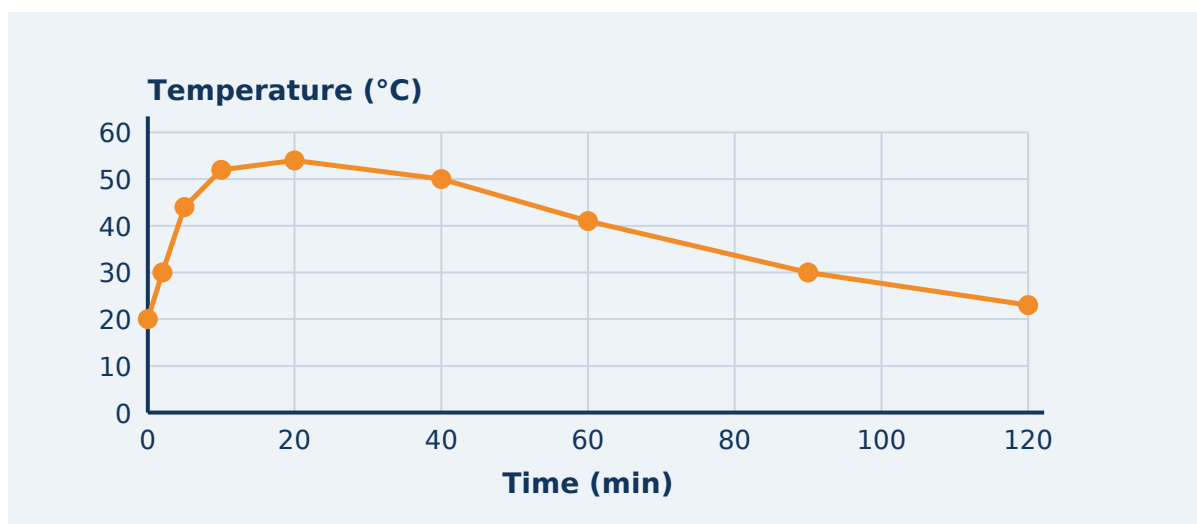
Problem 9 Finding the temperature change (medium)

A reaction transfers 2520 J of energy to 150 g of water.

1. Rearrange $Q = m \times c \times \Delta T$ to find ΔT .
2. Calculate ΔT .

Problem 10 Hand warmer graph (medium)

Bilal in Lahore records the temperature of a hand warmer for two hours.



A hand warmer over two hours.

1. State the peak temperature and the time it occurs.
2. Calculate the rise from the start to the peak.
3. State the temperature at 60 minutes.
4. Explain why the temperature falls after the peak.

Problem 11 Inside a hand warmer (medium)

A hand warmer contains iron powder, salt, water and carbon, sealed in a bag that blocks air.

1. Write the word equation for the main reaction.
2. Explain why the pack starts to warm only when opened.
3. Explain why it eventually goes cold.

Problem 12 Changes of state (medium)

Imani in Kampala studies state changes.

1. State whether melting, freezing, evaporating and condensing are exothermic or endothermic.
2. Explain why sweating cools the body.

Problem 13 Spot the errors (medium)

Emma writes: (a) An exothermic reaction makes energy from nothing. (b) In an endothermic reaction the temperature of the mixture goes up. (c) A cold pack gives cold to an injury.

1. Correct each statement.

Problem 14 Three processes (medium)

Respiration releases energy from food, photosynthesis stores light energy in sugar and combustion of gas heats a kitchen.

1. Classify each as exothermic or endothermic.

2. Suggest why respiration keeps our bodies warm.

Problem 15 Neutralising acid (medium)

Wanjiru mixes 25.0 cm³ of acid at 21.0 °C with 25.0 cm³ of alkali at 21.0 °C and the mixture reaches 27.0 °C.

1. Calculate ΔT .
2. Classify the reaction.
3. Estimate the energy gained by 50 g of solution, using $c = 4.2 \text{ J/(g } ^\circ\text{C)}$.

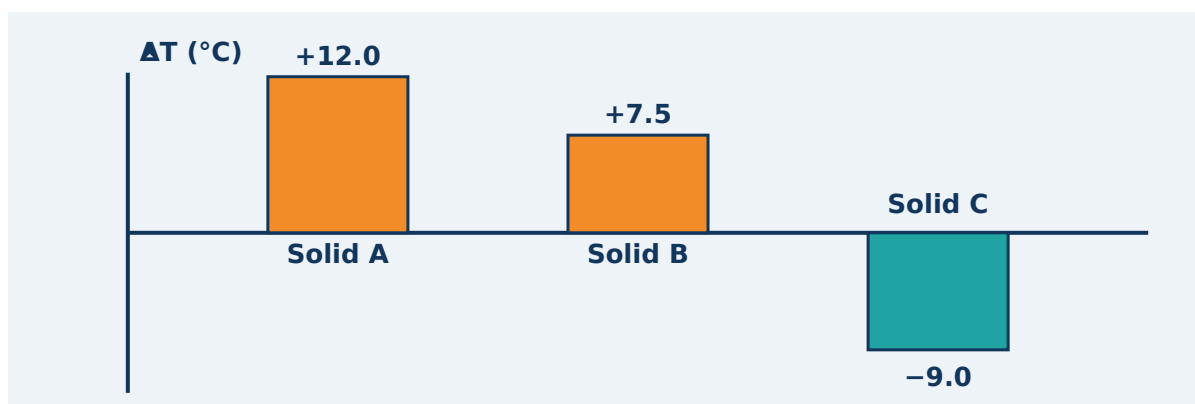
Problem 16 Energy per gram (hard)

Diego dissolves 5.0 g of calcium chloride in 60 g of water. The temperature rises by 11.0 °C.

1. Calculate the energy released into the water.
2. Calculate the energy per gram of solid.
3. State whether the dissolving is exothermic or endothermic.

Problem 17 Best solid for each pack (hard)

Three solids are each dissolved in 50 g of water. Solid A: 4.0 g, $\Delta T = +12.0 \text{ } ^\circ\text{C}$. Solid B: 5.0 g, $\Delta T = +7.5 \text{ } ^\circ\text{C}$. Solid C: 6.0 g, $\Delta T = -9.0 \text{ } ^\circ\text{C}$. Use $c = 4.2 \text{ J/(g } ^\circ\text{C)}$.



Temperature change for each solid.

1. Calculate the energy transferred for each solid.
2. Calculate the energy per gram for each.
3. Choose the best solid for a hand warmer and for a cold pack.

Problem 18 Comparing hand warmer brands (hard)

Chiamaka wants to test three brands of hand warmer.

1. State the independent variable, the dependent variable and two control variables.
2. Describe how to take the readings.
3. Describe how to decide which brand is best.

Problem 19 Reaction energy diagram (hard)

A reaction has reactants at an energy of 120 kJ and products at 85 kJ.

1. Sketch the energy diagram in words and state the type.
2. Calculate the energy transferred.
3. State the energy transferred in the reverse reaction.

Problem 20 Instant pack or ice? (hard)

A coach in Leeds compares an instant cold pack and a bag of ice. The ice stays below 10 °C for 25 minutes. The instant pack reaches a lowest temperature of 4 °C and stays below 10 °C for 12 minutes.

1. Calculate how many minutes longer the ice stays below 10 °C.
2. Calculate how many times longer the ice lasts.
3. Evaluate which is the better choice for a match.