Energy Clue Lab

Use temperature and bond energy data to classify reactions.

CHE.3.c "Analyze and interpret temperature and bond energy data to classify a reaction as endothermic or exothermic."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two sentences that explain what a temperature change reveals about energy flow, then circle the sentence that tells you how to calculate the net bond energy change.

What Happened in the Cup?

1. A foam cup lets a class watch energy move during a chemical reaction. A thermometer records the mixture's temperature before and after the reactants combine. If the mixture warms without an outside heater, the reaction releases energy to its surroundings and is exothermic. If the mixture cools, the reaction absorbs energy from its surroundings and is endothermic.

2. Temperature is one clue, but bonds offer another. Separating bonds in reactants takes energy; making bonds in products releases energy. Subtract the energy released when bonds form from the energy required to break bonds. A positive result means a net energy input, while a negative result means a net energy release. The table reports modeled bond energies per mole of reaction.

TEMPERATURE AND BOND ENERGY DATA

Trial	Start (°C)	End (°C)	Bonds broken (kJ/mol)	Bonds formed (kJ/mol)
A	20	26	180	240
B	20	16	240	190
C	20	23	150	195
D	20	18	220	180

3. For each trial, students stirred liquids in identical covered cups, with no heater or ice. The thermometer readings show each mixture's change; the bond energies let you check whether the change fits the calculation. A larger temperature change does not always mean a larger bond energy change because a mixture's amount and heat capacity also matter.

2 ANSWER WITH EVIDENCE

Use the passage

1. Classify trial A. Use its temperature change and calculated bond energy change to support your answer.

2. Classify trial B. Use its temperature change and calculated bond energy change to support your answer.

3. Compare trials A and C. Which releases more energy per mole according to the bond data, and how do their temperature changes compare?

4. Compare trials B and D. Which absorbs more energy per mole according to the bond data, and how do their temperature changes compare?

3 YOUR TURN

Your own words

Create a new trial with a starting temperature, an ending temperature, and bond energy values for bonds broken and formed. Classify your reaction, then explain how both the temperature change and your bond energy calculation support that classification.

Energy Clue Lab

PART 1 · READ AND MARK

Underline the two sentences that explain what a temperature change reveals about energy flow, then circle the sentence that tells you how to calculate the net bond energy change. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Classify trial A. Use its temperature change and calculated bond energy change to support your answer.	**A is exothermic. The temperature rises by 6 °C, and 180 − 240 = −60 kJ/mol, a net energy release.**
2	Classify trial B. Use its temperature change and calculated bond energy change to support your answer.	**B is endothermic. The temperature falls by 4 °C, and 240 − 190 = +50 kJ/mol, a net energy input.**
3	Compare trials A and C. Which releases more energy per mole according to the bond data, and how do their temperature changes compare?	**A releases more energy per mole: 60 kJ/mol versus C's 45 kJ/mol. A warms by 6 °C; C warms by 3 °C.**
4	Compare trials B and D. Which absorbs more energy per mole according to the bond data, and how do their temperature changes compare?	**B absorbs more energy per mole: 50 kJ/mol versus D's 40 kJ/mol. B cools by 4 °C; D cools by 2 °C.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Trial E starts at 21 °C and ends at 17 °C. Breaking bonds requires 210 kJ/mol, and forming bonds releases 170 kJ/mol. The mixture cools by 4 °C, and 210 − 170 = +40 kJ/mol, so the reaction is endothermic.

For the open task, accept any invented values with consistent units, a correctly calculated bond energy change, and a classification supported by both that change and the temperature direction. Temperature changes need not be proportional to bond energy changes.