2025 Ch H1 Q17

Section: Chemistry in Society

Topic: Equilibrium / Reaction Pathways

Question summary

The reaction pathway diagram shows the following sequence:

$2NO + O_2 \rightarrow 2NO_2$ (step a)

$2NO_2 \rightarrow N_2O_4$ (step b)

Overall: $2NO + 2O_2 \rightarrow N_2O_4$ (step c)

The question asks for the relationship between a, b, and c.

Worked solution

Each arrow in the energy diagram represents an enthalpy change.

The total enthalpy change for the overall reaction (c) equals the sum of the enthalpy changes for the individual steps (a and b).

Therefore, $c = a + b$.

Final answer

A. $c = a + b$

Revision tips

- When a reaction occurs in several steps, the total enthalpy change is the sum of the enthalpy changes for the steps (Hess's Law).

- Hess's Law applies because enthalpy depends only on the initial and final states, not on the reaction pathway.

- If a step is reversed, change the sign of its enthalpy before adding it to the others.