

## 2024 Higher Chemistry Paper 1 - Q21

Section: Chemistry in Society

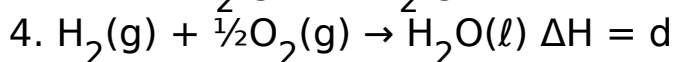
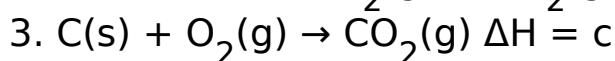
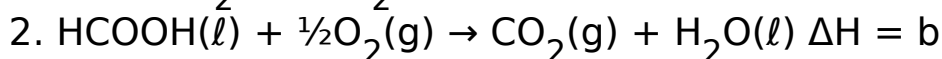
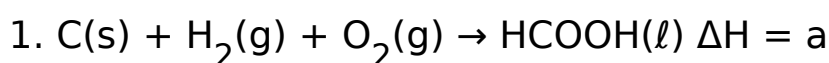
Topic: Chemical Energy (Hess's Law)

Question summary (Q21):

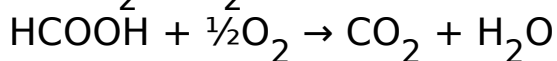
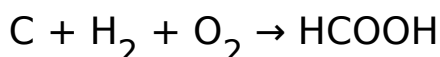
Four reactions with enthalpy changes a, b, c, d are given. The task is to find the correct relationship between them using Hess's law.

Worked Solution:

• Reactions:

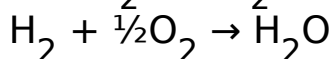
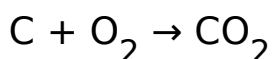


• Adding (1) and (2):



Gives overall:  $\text{C} + \text{H}_2 + 1.5\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ , with  $\Delta H = a + b$ .

• Compare with (3) + (4):



Gives:  $\text{C} + \text{H}_2 + 1.5\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ , with  $\Delta H = c + d$ .

• Therefore:  $a + b = c + d \rightarrow a = c + d - b$ .

Final Answer: A —  $a = c + d - b$

Revision Tips:

• Hess's Law: overall enthalpy change = sum of enthalpy changes for steps leading to same reaction.

• Write out reactions clearly and cancel intermediates.

• Always check that the overall equations match before comparing  $\Delta H$  values.