2024 Higher Chemistry Paper 1 – Q18

Section: Chemistry in Society
Topic: Chemical Energy (Hess's Law)

Question summary (Q18):
Using the enthalpies given, apply Hess's law to calculate the enthalpy change for reaction X.

Worked Solution:
• Given data (ΔH, kJ mol^{-1}):
$C(g) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$
$CO(g) + ½O_2(g) \rightarrow CO_2(g)$ $\Delta H = -283.0$

• We need enthalpy for: $C(g) + ½O_2(g) \rightarrow CO(g)$.
This can be obtained by: $[C + O_2 \rightarrow CO_2] - [CO + ½O_2 \rightarrow CO_2]$.
$\Delta H = (-393.5) - (-283.0) = -393.5 + 283.0 = -110.5$ kJ mol^{-1}.

Final Answer: B — -110.5 kJ mol^{-1}

Revision Tips:
• Hess's Law: enthalpy change is independent of the pathway.
• Use $\Delta H_{target} = \Delta H_1 - \Delta H_2$ when subtracting two related reactions.
• Always align arrows so intermediates cancel properly.