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6. Consider the reaction represented above.

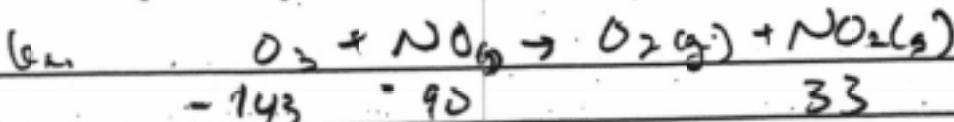
- (a) Referring to the data in the table below, calculate the standard enthalpy change, ΔH° , for the reaction at 25°C. Be sure to show your work.

	$\text{O}_3(g)$	$\text{NO}(g)$	$\text{NO}_2(g)$
Standard enthalpy of formation, ΔH_f° , at 25°C (kJ mol ⁻¹)	143	90.	33

- (b) Make a qualitative prediction about the magnitude of the standard entropy change, ΔS° , for the reaction at 25°C. Justify your answer.
- (c) On the basis of your answers to parts (a) and (b), predict the sign of the standard free-energy change, ΔG° for the reaction at 25°C. Explain your reasoning.
- (d) Use the information in the table below to write the rate-law expression for the reaction, and explain how you obtained your answer.

Experiment Number	Initial [O ₃] (mol L ⁻¹)	Initial [NO] (mol L ⁻¹)	Initial Rate of Formation of NO ₂ (mol L ⁻¹ s ⁻¹)
1	0.0010	0.0010	x
2	0.0010	0.0020	2x
3	0.0020	0.0010	2x
4	0.0020	0.0020	4x

- (e) The following three-step mechanism is proposed for the reaction. Identify the step that must be the slowest in order for this mechanism to be consistent with the rate-law expression derived in part (d). Explain.



$$\begin{aligned}\Delta H^\circ &= \sum \Delta H_{\text{prod}}^\circ - \sum \Delta H_{\text{reactant}}^\circ \\ &= -133 - (-143 + 90) \\ &= -200 \text{ kJ}\end{aligned}$$

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