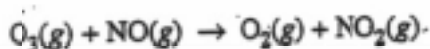


B B B B B B B B B B B B B B

6 D



6. Consider the reaction represented above.

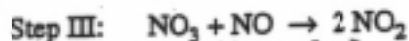
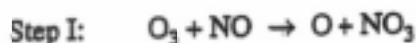
- (a) Referring to the data in the table below, calculate the standard enthalpy change, ΔH° , for the reaction at 25°C. Be sure to show your work.

	$\text{O}_3(\text{g})$	$\text{NO}(\text{g})$	$\text{NO}_2(\text{g})$
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 $[\text{O}_3]$ (mol L ⁻¹)	Initial $[\text{NO}]$ (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.



② $\Delta H^\circ = \text{prod} - \text{react}$
 $\Delta H^\circ = (33) - (90 + 143) =$
 $33 - 233$
 $\Delta H^\circ = -200$