$$A(g) + B(g) \rightarrow C(g) + D(g)$$

2. For the gas-phase reaction represented above, the following experimental data were obtained.

Experiment	Initial [A] (mol L^{-1})	Initial [B] (mol L^{-1})	Initial Reaction Rate (mol L^{-1} s^{-1})
1	0.033	0.034	6.67×10^{-4}
2	0.034	0.137	1.08×10^{-2}
3	0.136	0.136	1.07×10^{-2}
4	0.202	0.233	?

(a) Determine the order of the reaction with respect to reactant A. Justify your answer.

(b) Determine the order of the reaction with respect to reactant B. Justify your answer.

(c) Write the rate law for the overall reaction.

(d) Determine the value of the rate constant, k, for the reaction. Include units with your answer.

(e) Calculate the initial reaction rate for experiment 4.

(f) The following mechanism has been proposed for the reaction.

Step 1: $B + B \rightarrow E + D$ *slow*

Step 2: $E + A \rightleftarrows B + C$ *fast equilibrium*

Provide two reasons why the mechanism is acceptable.

(g) In the mechanism in part (f), is species E a catalyst, or is it an intermediate? Justify your answer.