Unit 4, Lesson 06: Evaluating Reaction Mechanisms, Answers to Homework

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17. For the reaction: $2\ NO_2\ (g) + F_2\ (g) \rightarrow 2\ NO_2F\ (g)$ *remember to balance it

The following reaction mechanism has been proposed:

(i)	$NO_2\ (g) + F_{2(g)} \rightarrow NO_2F_{(g)} + F_{(g)}$	(slow)
(ii)	$NO_2\ (g) + F_{(g)} \rightarrow NO_2F_{(g)}$	(fast)
Sum:	$2\ NO_2\ (g) + F_{2(g)} \rightarrow 2\ NO_2F_{(g)}$	

The Rate Law for this reaction was determined experimentally to be: rate = $k\ [NO_2]^1\ [F_2]^1$.

Is the proposed reaction mechanism plausible?
- the rate law for the RDS (slow step) is rate = $[NO_2]\ [F_2]$
- the sum of the steps in the reaction mechanism add to give the overall equation
- all steps are uni- or bi-molecular
- therefore, the reaction mechanism is plausible for this reaction

18. For the overall reaction: $2\ C + D \rightarrow E$, a researcher claims the rate law is rate = $k\ [C]^1\ [D]^1$.

a) Is the rate law equation possible for this reaction? Yes

b) A possible mechanism could be:

$C + D \rightarrow CD$	(slow)
$CD + C \rightarrow E$	(fast)

As long as the coefficients of the slow step agree with the rate law, and the reaction mechanism adds to give the overall reaction, then the mechanism is possible, which it is.

19. For the proposed reaction mechanism:

$A + B \rightarrow C$	(slow)
$C + A \rightarrow E + F$	(fast)

a) Sum: $2\ A + B \rightarrow E + F$

b) The stoichiometry of the RDS (the slow step) indicates the rate law, so it is Rate = $r\ [A]^1\ [B]^1$.

20. The suggested mechanism is reasonable because:
- it adds to give the overall equation,
- the RDS (the slow step) shows the unimolecular breakdown of $(CH_3)_3CBr$ (aq). This is in agreement with the rate law that showed that the rate is first order with regard to $(CH_3)_3CBr$ or Rate = $k\ [\ (CH_3)_3CBr\ ]$
- the mechanism is zero order in water, which means that water does not affect the reaction rate. This is also in agreement with the proposed mechanism because the RDS does not include water.