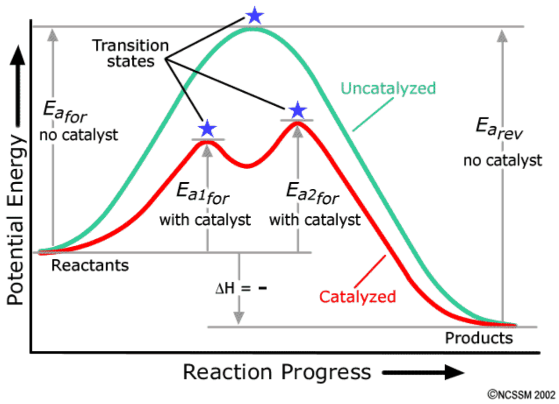
Kinetic Molecular Theory-continued

4. Temperature - higher temp. ⇒ faster reaction
   - higher temp → faster particles
   - greater chance of collision
   - more particles achieve activation E

   → Reaction is faster.

5. Catalyst - speeds up reaction by lowering E_{act}
   - it is not consumed

The uncatalyzed reaction still goes on



Questions - Text
P. 476 #1
P. 484 # 1, 2, 4

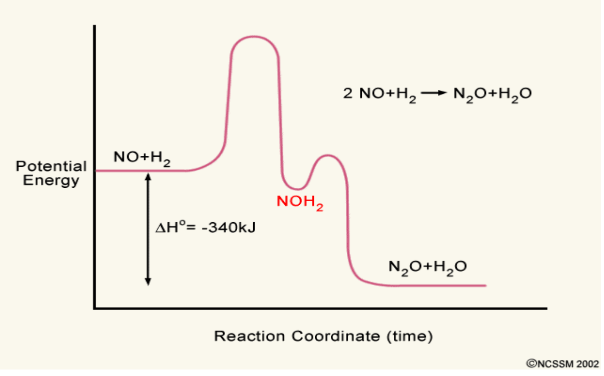
Reaction Mechanism and Rate-Determining Step

Example- $2NO + O_2 \rightarrow 2NO_2$ overall

Reaction is made up of several steps called elementary reactions

1. $NO + O_2 \rightarrow NO_3$ Intermediate
2. $NO_3 + NO \rightarrow 2NO_2$

NO_3 is produced in step 1 & used in step 2



- Step one is slower due to high Eact
- Step 1 is rate determining

Example- Write the overall reaction, given

1. $NO_2 + NO_2 \rightarrow NO_3 + NO$ slow

2. $NO_3 + CO \rightarrow NO_2 + CO_2$ fast

overall- $NO_2 + CO \rightarrow NO + CO_2$

Step 1 is rate-determining

Text questions p. 478 #5-8

p. 486 #10-11

Read p. 479 →

Experimental Rate Law

Rate Law - communicates how the initial concentration of each reactant affects the rate.

order

e.g. $Rate = k [A]^n [B]^m + \ldots\ldots$

↑ initial (Rate) ↑ constant (k)

Overall order = $n + m + \ldots$

Rate Law Examples

See handout, table 17-3

A. Compare trials 1+2 ([B] is same)

Trial	[A]	[B]	Rate
1	0.100	0.100	2×10^{-3}
2	0.200	0.100	4×10^{-3}

Δ[A]	Rate
$\frac{0.200}{0.100} = 2$ times	$\frac{4 \times 10^{-3}}{2 \times 10^{-3}} = 2$ times

$$\Delta[A]^n = \Delta \text{rate}$$

$$2^n = 2$$

$$2^1 = 2$$

$$n = 1$$

B. Use trials 2+3

Trial	[B]	Rate
2	0.100	4×10^{-3}
3	0.200	16×10^{-3}

[B]	Rate
$\frac{0.200}{0.100} = 2$ times	$\frac{16 \times 10^{-3}}{4 \times 10^{-3}} = 4$ times

$$2^m = 4$$

$$m = 2$$

second order for B

So $\text{Rate} = k[A][B]^2$