CHEMICAL KINETICS

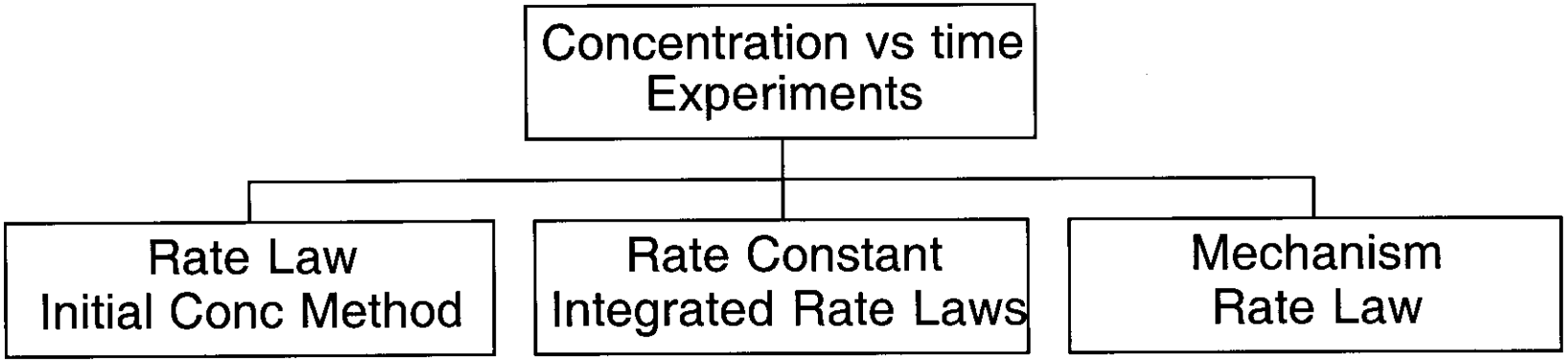
Lecture 30/36

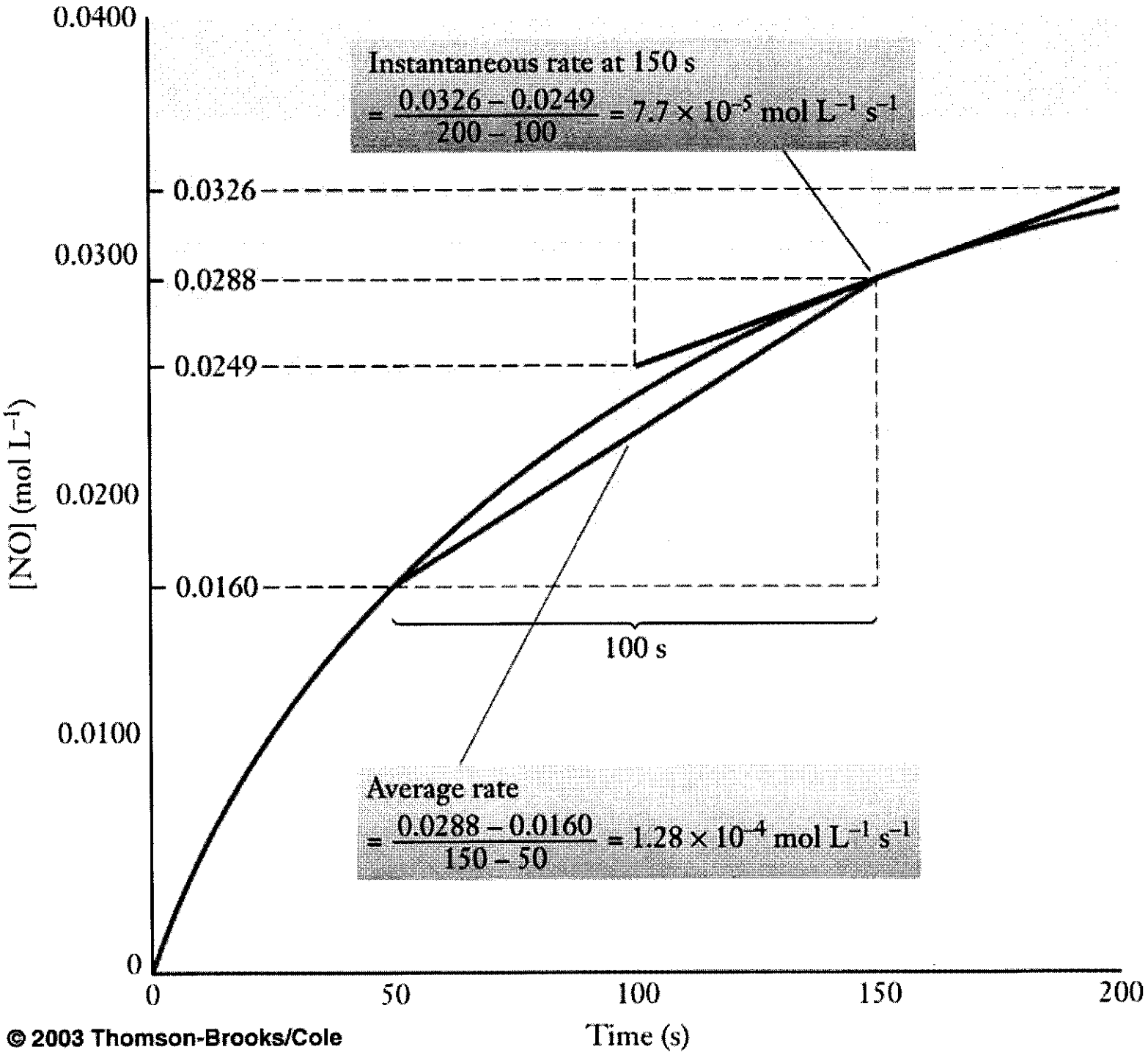
Rate of a reaction

Rate Law

Determination of the Rate Law

Chemical Kinetics





$$a\,A \quad + \quad b\,B \rightarrow x\,X \quad + \quad y\,Y$$

$$J = -\frac{1}{a}\frac{dN_A}{dt} = \frac{1}{y}\frac{dN_Y}{dt}$$

If

Volume = constanant = V

rate of a reaction = $r = \frac{J}{V}$

$$r = -\frac{1}{a}\frac{d[A]}{dt} = \frac{1}{y}\frac{d[Y]}{dt}$$

$$BrO_3^-(aq)+9I^-(aq)+6H^+(aq) \text{ -----> } 3I_3^-(aq)+Br^-(aq)+3H_2O(l)$$

$[I^-]_o$/M	$[BrO_3^-]_o$/M	$[H^+]_o$/M	Rate/Ms^{-1}
0.10	0.10	0.10	x
0.20	0.20	0.10	4 x
0.10	0.20	0.10	2 x
0.20	0.20	0.20	4 x

Differential forms

$$\frac{d[A]}{dt} = k \qquad \frac{d[A]}{dt} = k[A]$$

$$\frac{d[A]}{dt} = k[A]^2 \qquad \frac{d[A]}{dt} = k[A][B]$$

Zeroth Order

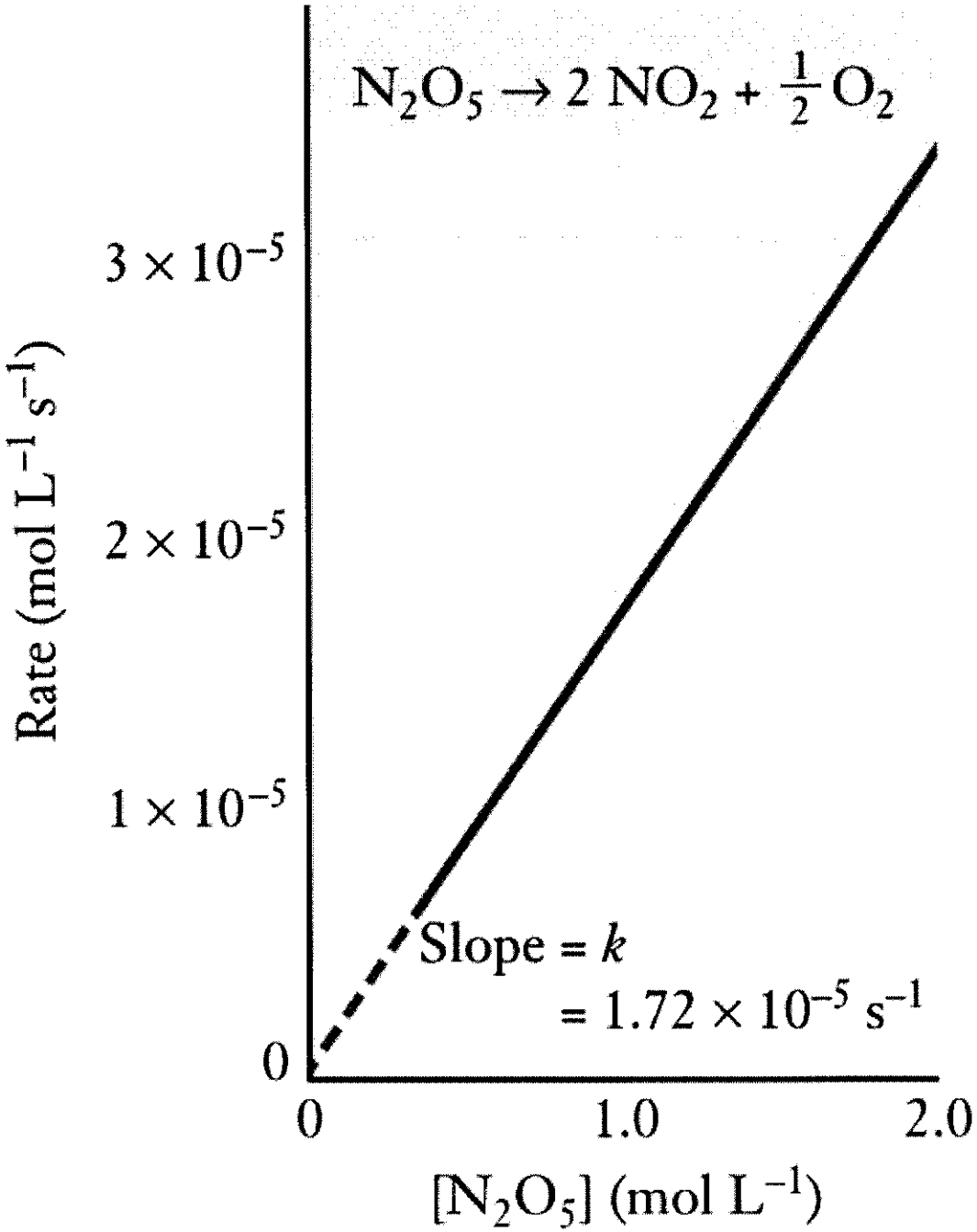
$$\frac{d[A]}{dt} = k \quad [A(t)] = [A_o] + k\,t$$

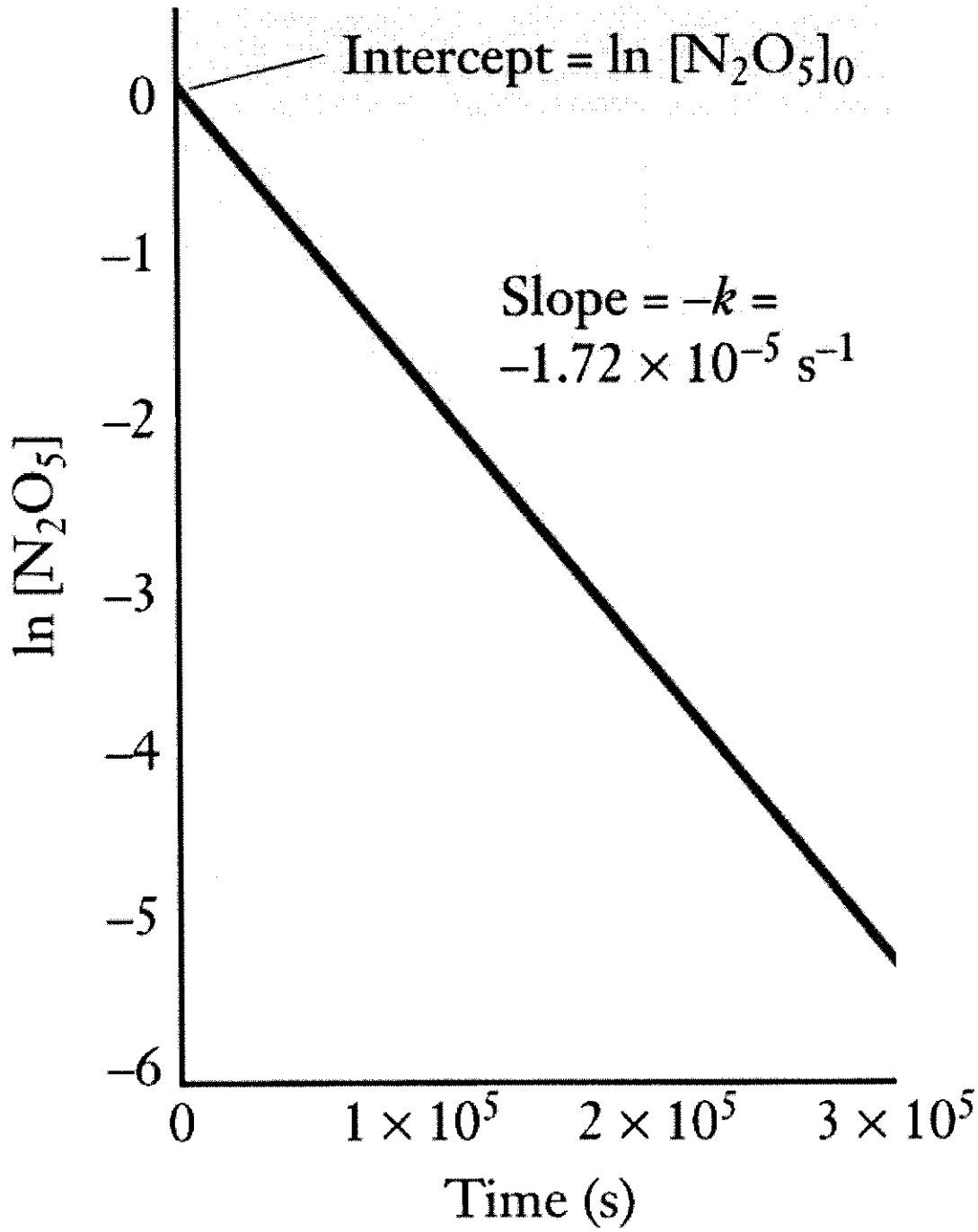
- Plotting [A] vs t yields a straight line with slope equal to the rate constant k.

First Order

$$\frac{d[A]}{dt} = k[A] \qquad [A(t)] = [A_o]\, e^{k t}$$

- Plotting ln[A] vs t yields a straight line with slope equal to the rate constant k.

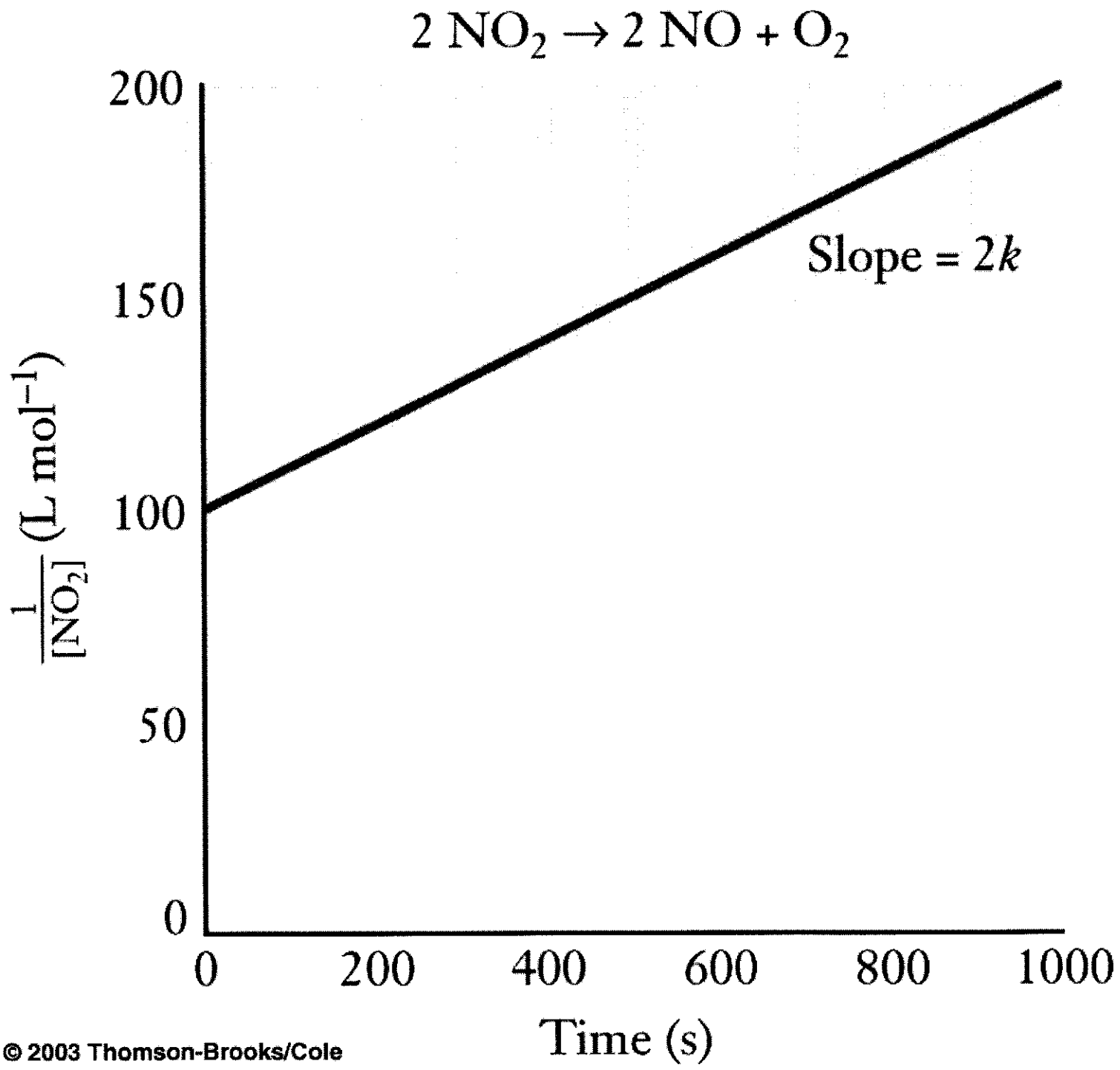


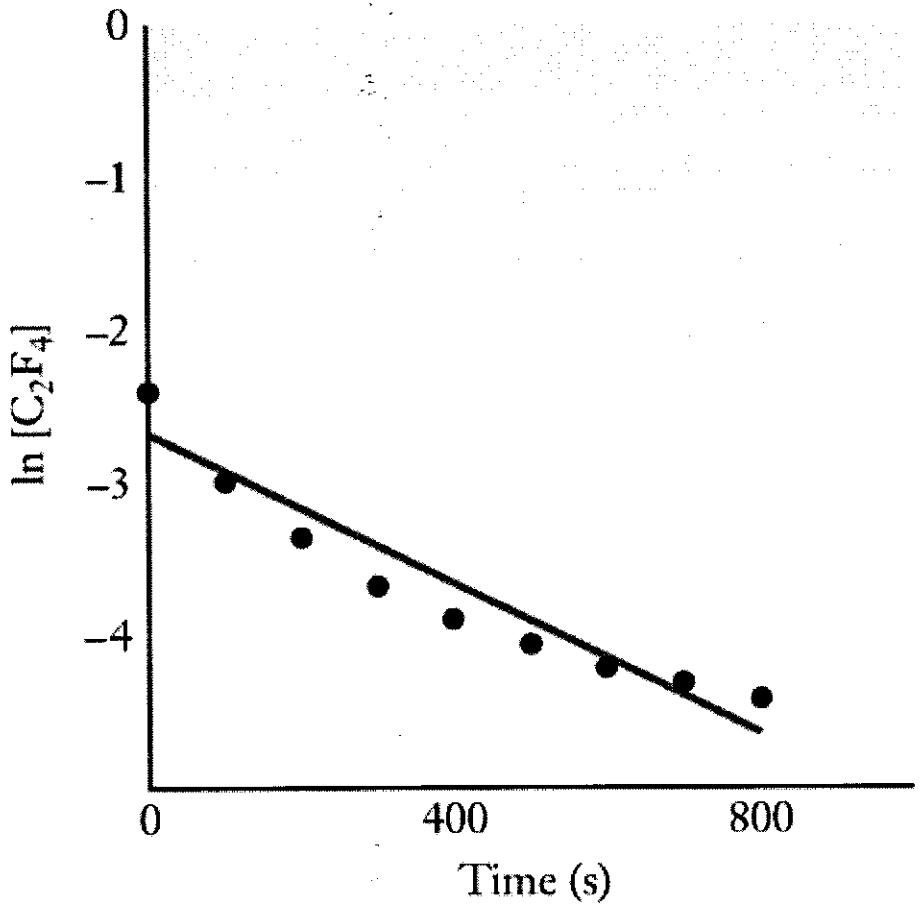


Second Order

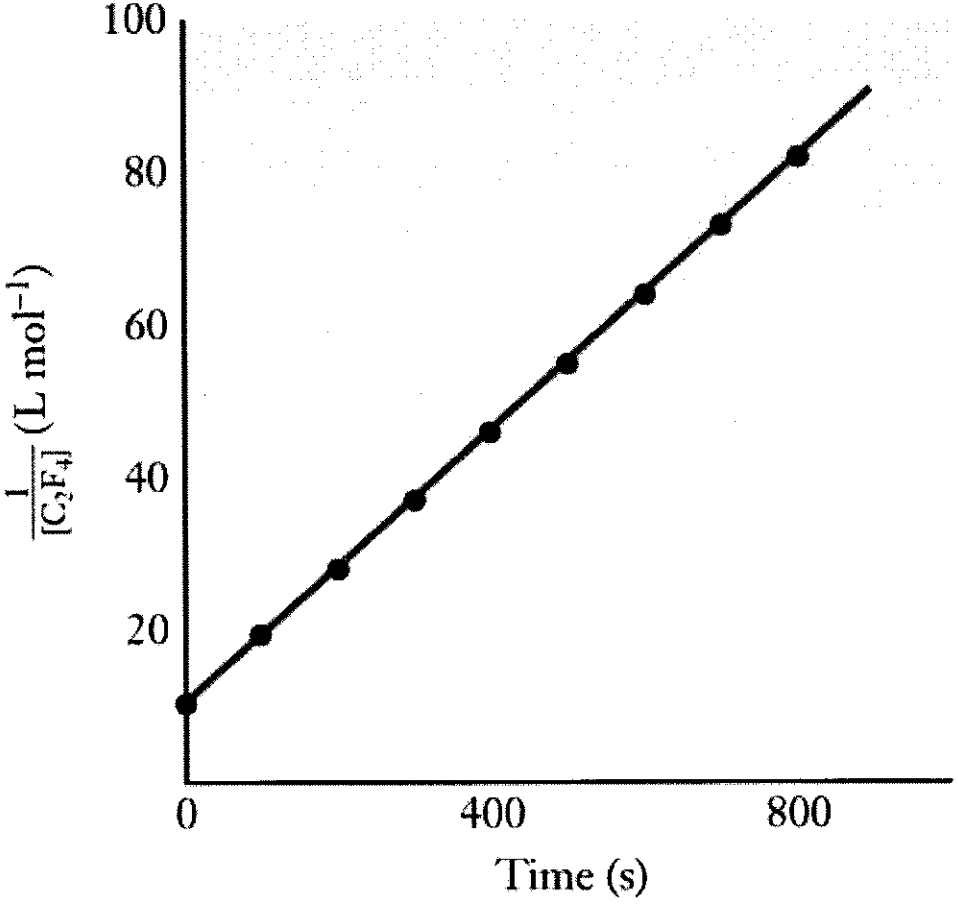
$$\frac{d[A]}{dt} = k[A]^2 \quad \frac{1}{[A(t)]} = \frac{1}{[A_o]} + k\,t$$

- Plotting 1/[A] vs t yields a straigth line with slope equal to k





(a)



(b)