4.3	R	ate Lav	VS ning Br		Ulaine	the N	latha	d of lait	ial Patas	
		etermi	ning Ka		vUsing	ne n	netho	σοιπι	iai rales	
telicke B.✓ ≋ADY								[TCI] M	[11] 1 M	
•	-	2 ICI +	\cdot H _o = L	+ 2 H	CI		⊢xp		H2 0, M	Initial Rate, Ms ⁻¹
			••2 •2			• •	1	0.309	0.114	7.07e-3
2)		What i	s the o	vorall d	order of	F	2	0.018	0.114	1.41e-2 2.83e-2
a)	4	the reaction?					4	0.618	0.228	5.65e-2
				2			· ·	0.010	3.220	
			PREVIO	1284 14	did this	the &	000 110	u this time	WE WIRD SI	host cut it !
							0	3,		
					1 Contrine	Rate =	k[I	2] ^x [H ₂] ^y		
					Sintime	Rate =	<u>k[](</u>	<u>אן ג(א3 ג(א</u>		
					<u>Contine</u>	Rote =	<u>k [](</u>	<u>2]^x [H₂]^y</u>		
xp 1 \$ 3	¢ 9		held con	istont a	<u>Amilia</u> shife the	<u>Rate =</u>	<u>h[](</u>	<u>צ]* [א₂]^ש</u> ונגגוונ[ו	Ha] is held	constant while the
xp 1 ‡ 3	:	[[0] is [H2] uni	held con Reases l	nstant n my a fact	<u>Anilia</u> Shife the OR of 2	Rate =	<u>k [](</u> Xxp '	<mark>יי [א₂]^ש און געור בעריים ג</mark>	H2] is held ICP] uncrea	a constant while the
xp 1 ‡ 3	•	[][0] is [H2] जाग	held con :Reases l	estant a es a fact	<u>Amilia</u> Shile the or of 2	Rate =	<u>h [](</u> £xp *	<u>ען גען גען גען אין אין אין אין אין אין אין אין אין אי</u>	H2] is held LCP] uncrea	ases by a factor of 2
xp 1 \$ 3	•	[I CJ] is [H2] נתונ	held con :Reases &	estant a es a fact	<u>Amilian</u> Shife the OR of 2	Rote =	<u>h [](</u> £xp -	<u>אן יינאאן אין אין אין אין אין אין אין אין אין </u>	H2] is held [Cf] uncrea	ases by a factor of 2
xp 1 { 3 <u>3 . 2</u>	: 1	[[0] is [H2] with 3 × 10 ⁻²	held con :Reases &	est ant a	Anitian T shife the on of 2		<u>h [](</u> Xxp ' 2.	<mark>יין עַן זיין עַן צַן גַאַן זיין צַעַיין צַעַיין צַעַיין צַעַיין צַעַיין צַעייין צַעייין צַעייין צַעייין צַעייי נ <u>ו . 41 ג</u></mark>	H2] is held ICP] uncrea (10 ⁻²	ases by a factor of 2
$\frac{3}{1}:\frac{2}{3}$: 1 2 8 7.0	[[0] is [H2] with 3×10 ⁻²]×10 ⁻³	held car :Reases & = 4	astant a as fact	<u>Amilia</u> shife the or of 2		<u>k [](</u> &xp · 2 <u>2</u> 1	<u>לן אן ז' (א2) און אין אין אין אין אין אין אין אין אין אי</u>	H2] is held [CP] uncrea (10 ⁻² 10 ⁻³ =	ases by a factor of 2 = 2
xp 1 ‡ 3 3 : 2 1	: 1	[[0] is [H2] on 3 × 10 ⁻²] * 10 ⁻³	hed con :Reases 9 = 4	istant k g a fact	<u>Amilian</u> shife the or of 2		<u>k [](</u> £xp ⁻ <u>2</u> 1	<mark>タ]* [H₂]⁹</mark> まえ : [I [<u> . 4</u>] 7.07	H2] is held [Cf] uncrea (10 ⁻² 10 ⁻³ =	constant while the ases by a factor of 2 = 2
xp 1 { 3 3 <u>2</u>	: 1	[[0] is [H2] und <u>3×10⁻²</u>]7×10 ⁻³ 2, ⁴ = 1	held con :Reases & = 4	nstont n g a facti	$\frac{4\pi i hio}{100}$		<u>k [](</u> <i>k</i> xp · <u>2</u>	<mark>۲]* [H2]^ع (H2]^ع (ا \$ 2 : [[<u>۱ \$ 2 : [</u> [<u>۱ . 41 x</u> 7 . 07</mark>	H2] is held ICP] uncrea (10 ⁻² × 10 ⁻³ = = 2	constant while the ases by a factor of 2 = 2
xp 1 ‡ 3	: ([[0] is [H2] with 3 × 10 ⁻²] × 10 ⁻³ 2, ^y = 0 y =	held con :Reases & = 4 + 2	istant a g a facti	<u>Amilia</u> shife the or of 2		<u>k [](</u> &xp ² 1	<mark>لا [۸] ^۲ [۸] ^۲ [۸] ^۲ [۸] ^۲]</mark>	H2] is held [CP] uncrea (10 ⁻² + 10 ⁻³ = = 2 = 1	constant while the ases by a factor of 2 = 2
xp 1 \$ 3 3 . 2	: 1 2 8 7.0	[[0] is [H2] with 3×10 ⁻² 07×10 ⁻³ 2 ^y = 1 y =	hæd con :Reases 8 = 4 + 2	stant r g a fact	Anitia 1		<u>k [](</u> <u>&xp</u>	<mark>۲]* [۲] * [۲] گ</mark> ۱ ξ ۵ ۲ [۲] ۱ ۱ ξ ۵ ۲ [۲] ۲.07 2 x 2 x	H2] is held ICP] uncrea (10 ⁻² × 10 ⁻³ = = 2 = 1	constant while the ases by a factor of 2 = 2
xp 1 ‡ 3	: 1	[[0] is [H2] with 3×10 ⁻² 3×10 ⁻³ 2 ^y = 1 y =	held con :Reases \$ =4 + 2.	nstont a g a facti	Anition 1		<u>k [](</u> <u>&xp</u> <u>2</u> <u>1</u>	(1.41) (1.41) (1.41) (1.41) (1.41) (2.4	H2] is held ICR] uncrea (10 ⁻² × 10 ⁻³ = = 2 = 1	constant while the ases by a factor of 2 = 2
xp 1 \$ 3	: 1	$\begin{bmatrix} I (0) \end{bmatrix}$ is $\begin{bmatrix} H_2 \end{bmatrix}$ only 3×10^{-2} 3×10^{-3} $2^{4} = 1$ $4^{4} = 1$ $4^{4} = 1$	held con :Reases 9 =4 + 2	nstont a g a facti	Anitian 1		<u>k [Ι(</u> &xρ 2. 1	<u>ک]* [H2] کی</u> ا ف کی : [U [<u>۱.415</u> <u>۲.07</u> 2 ^x x x	H2] is held ICP] uncrea (10 ⁻² × 10 ⁻³ = = 2 = 1 = 1 = 1	constant while the ases by a factor of 2 = 2
	: 1	$\begin{bmatrix} I (0) \end{bmatrix} \text{ is} \\ \begin{bmatrix} H_2 \end{bmatrix} \text{ ord} \\ 3 \times 10^{-2} \\ 3 \times 10^{-2} \\ 7 \times 10^{-3} \\ 2 \text{ y} = 1 \\ 2 \text{ y} = 2 \\ \text{ y}$	held con :Reoses \$ 	stont a g a facti	Anition 1		<u>k [1(</u> <u>8xp</u> <u>2</u> <u>1</u>	$\frac{2 \left[\frac{1}{2} + \frac{1}{2} \right]^{x} \left[\frac{1}{2} + \frac{1}{2} \right]^{x}}{\left[\frac{1}{2} + \frac{1}{2} \right]^{x}}$ $\frac{1}{2} + \frac{1}{2} + $	H2] is held ICP] uncrea (10^{-2}) $\times 10^{-3}$ = 2 = 1 = 1 = 1 + 1	constant while the ases by a factor of 2 = 2

14.4 Concentration Changes over Time Integrated Rate Laws

Reaction Order	Rate Law	Integrated Rate Law	En La Antipartentin at 1 - 0
Zero order	rate = $k [A]^0 = k$	$[A]_t = [A]_0 - \kappa t$	[A]. (membertin at t
First order	∦ rate = <i>k</i> [A]	$\ln \frac{[A]_t}{[A]_0} = -kt$	
Second order	rate = $k[A]^2$	$\frac{1}{\left[\mathbf{A}\right]_t} = \frac{1}{\left[\mathbf{A}\right]_0} + kt$	
		trt	,t:t
A :	= Products	(1/[A])	d[A] = ·k dt
A C A 7		tió	t : Ō
	= k[A]	Sn [A]]e - \$m [A]o = - ht
d[A]	= - h[A] if A 15 ve	Ry snalln	$\frac{J_{E}}{AJ_{e}} = -kL$
$\left(\frac{1}{1}\right)$	J[A] = -kdt		
([A]/			

14.4 Concentration Changes over Time Integrated Rate Laws

The decomposition of nitrous oxide $N_2O(g) = N_2(g) + \frac{1}{2}O_2(g)$ is second order in N_2O with a rate constant of $1.20 \times 10^{-3} \text{ M}^{-1} \text{s}^{-1}$. If the initial concentration of N_2O is 1.79 M, the concentration of N_2O will be 0.187 M after how many seconds.



14.4 Concentration Changes over Time Graphical Determination of Reaction Order

Determining the Rate Equation: Graphical Method

Description

The rate law for reactions involving a single reactant can be determined using the graphical method. This method involves constructing a series of plots of concentration vs. time data and analyzing the plots to extract the reaction order and the rate constant.

The general reaction used for this tutor is: $A \longrightarrow C$

The concentration vs. time data at right were collected by running the reaction at a constant temperature. These are data taken for a single trial of the reaction.



Submit

tim	e, min	[A], mol/L	time, n	nin [A], mol/L
	0	0.7245	5	0.4046
	1	0.6605	6	0.3406
	2	0.5965	7	0.2766
	3	0.5325	8	0.2126
	4	0.4686		
Γ				● [A] vs. Time
				○ In[A] vs. Time
	~	0	- A-	○ 1/[A] vs. Time
	500	IVASE LIOVE	719	
[A]] 66	Class Ner	2116	Least Squares
[A]	266	Crass Ner 3	שופ	Least Squares
[A]	266	Time	2116	Least Squares
[A]	266	Time	2116	Least Squares
[A]	⊇ee	Time	2116	Least Squares
[A]	⊇ee	Time	⊃ יינפ	Least Squares

14.4 Concentration Changes over Time Graphical Determination of Reaction Order

Reaction Order	Integrated Rate Law	Rearranged Rate Law	Straight-Line Plot	
Zero order	$[A]_t = [A]_0 - \kappa t$	$\begin{bmatrix} \mathbf{A} \end{bmatrix}_t = -kt + \begin{bmatrix} \mathbf{A} \end{bmatrix}_0$ y = mx + b	$y = [A]_t$ x = t slope = $-k$	
First order	$\ln \frac{[\mathbf{A}]_t}{[\mathbf{A}]_0} = -kt$	$\ln[A]_t = -kt + \ln[A]_0$ y = mx + b	$y = \ln[A]_t$ x = t slope = $-k$	
Second order	$\frac{1}{\left[\mathbf{A}\right]_t} = \frac{1}{\left[\mathbf{A}\right]_0} + kt$	$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$ $y = mx + b$	$y = 1/[A]_t$ x = t slope = k	



14.4 Concentration Changes over Time Reaction Half-Life

Γ	Zero Order	First Order	Second Order	
	$t_{1/2} = \frac{[A]_o}{2k}$	$t_{1/2} = \frac{\ln 2}{k}$	$t_{1/2} = \frac{1}{k[A]_0}$	
	Directly proportional to [A]。	Constant	Inversely proportional to [A]。	

In	۲A']t	=	-	h 1	t +	Ĵm	F A	1].	:	0	しりつ	[A]t	:	1/21	[A]	0
													,				

Sm (½[A]₀) = - kt½ +	Ĵm [A]o
$-kty_2 = ln(4)$	[A].) - Sm [A].
= Sn 1/2	+ \$m [A]o - \$m [A]o
። ያመ ½	
= 1	- Sm 2
= 0	Sm 2.
- ht/2 : - S	n 2.
ht/2 : S	n 2,
t1/2 *	<u>In 2</u> B

Nitrogen-13 positron emi	is used in tracers injected ssion tomography (PET).	l into the bloodstream for The <mark>half-life of nitrogen-13</mark> uired for the mass of
a sample of decompositi	nitrogen-13 to fall to 6.25 on is a radioactive decay	percent of its original value? Since the reaction, it is first order.
	$\int_{n} \frac{[A]_{t}}{[A]_{o}} = -ht ;$	$t/2 = 10 m m$; $\frac{[A]_{1}}{[A]_{0}} = 0.0625$
t'/2 = -	<u>Sm 2</u> R	$\int m \frac{[A]_{t}}{[A]_{0}} = -ht$
10 =	<u>Sm 2.</u>	$Sm(0.0625) = -6.930 \times 10^{-2} t$
10 k =	n Sm 2	$t = \frac{Jm (0.0625)}{-6.930 \times 10^{-2}}$
h =	$\frac{3m 2}{2} = 6.930 \times 10^{2} \text{min}^{1}$	= 40 minutes
• •	10	