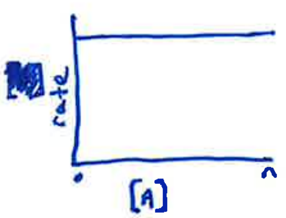
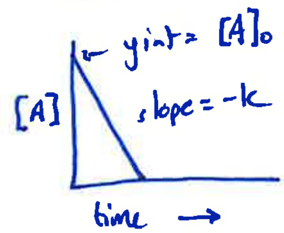
HW 12

C Exam: INT RATE LAWS

(Elementary) Rxn	Order	Rate Law	Int. Rate Law ($y = mx + b$)	Half-life	k
$A \rightarrow \cdots$	0th	rate = k	$[A]_t = -kt + [A]_0$	$t_{1/2} = \frac{[A]_0}{2k}$	$M s^{-1}$
$A \rightarrow \cdots$	1st	rate = k[A]	$\ln[A]_t = -kt + \ln[A]_0$	$t_{1/2} = \frac{\ln 2}{k}$	s^{-1}
$2A \rightarrow \cdots$	2nd	rate = $k[A]^2$	$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$	$t_{1/2} = \frac{1}{k[A]_0}$	$M^{-1}s^{-1}$
$A + B \rightarrow \cdots$	2nd	rate = k[A][B]	(complex)	...	$M^{-1}s^{-1}$

0th Order RL





already Linear!

IRL

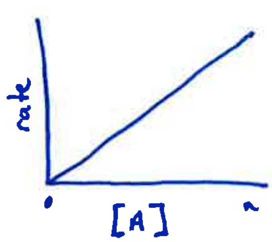
$[A]_t = -kt + [A]_0$

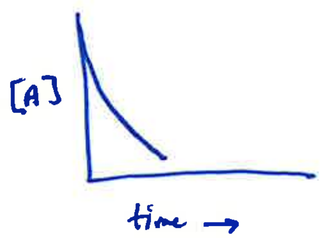
$M = \frac{M}{s}(s) + M$

$t_{1/2}$ decreases

$[A]\downarrow$

1st Order RL





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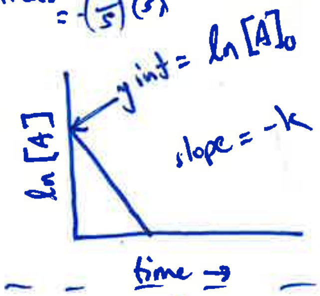
$\underset{\text{unitless}}{\ln[A]_t} = -kt + \underset{\text{unitless}}{\ln[A]_0}$

$= -\left(\frac{1}{s}\right)(s)$

$t_{1/2}$ const

$[A]\downarrow$



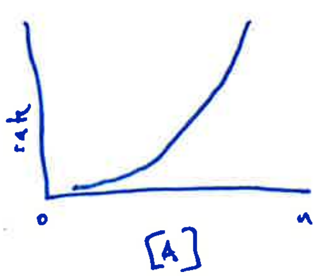
2nd Order RL

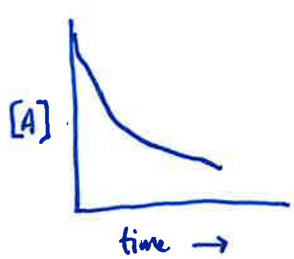
$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$

$M^{-1} = \left(\frac{1}{Ms}\right)s + M^{-1}$

$t_{1/2}$ grows

$[A]\downarrow$





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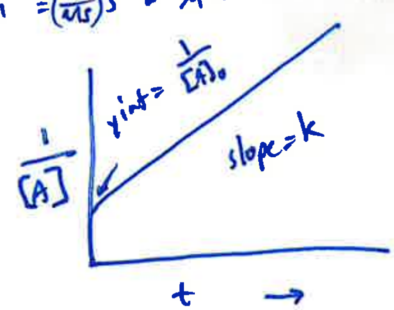

Zeroth order Half-life

$$[A]_t = -kt + [A]_0$$

$$\frac{1}{2}[A]_0 = -kt_{1/2} + [A]_0$$

$$kt_{1/2} = [A]_0 - \frac{1}{2}[A]_0$$

$$kt_{1/2} = \frac{1}{2}[A]_0$$

$$t_{1/2} = \frac{[A]_0}{2k}$$

RULES

$t \rightarrow t_{1/2}$

$[A]_t \rightarrow \frac{1}{2}[A]_0$

solve for $t_{1/2}$

Molecularity

If elementary Rxn... # of particles

$A \rightarrow P$	unimolecular
$2A \rightarrow P$	bimolecular
$A + B \rightarrow P$	bi
$3A \rightarrow P$	termolecular
$2A + B \rightarrow P$	ter
$A + B + C \rightarrow P$	ter