| time / s | Volume $O_2$ evolved / $cm^3$ |
|---|---|
| 386 | 15.4 |
| 448 | 17.2 |
| 507 | 18.9 |
| 568 | 20.4 |
| 625 | 21.7 |
| 688 | 22.9 |
| 1805 | 33.1 |
| infinity | 35.1 |

# Analysis of data

$$H_2O_2\ (l) \rightarrow H_2O\ (l) + \tfrac{1}{2}\ O_2\ (g)$$

$$rate = -\frac{d[H_2O_2]}{dt} = k[H_2O_2]^n[I^-]^m$$

But iodide concentration is a constant as it acts as a catalyst

$$-\frac{d[H_2O_2]}{dt} = k_{app}[H_2O_2]^n$$

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# Analysis of data

Determine order by relevant straight line plots

| | | Slope | intercept |
|---|---|---|---|
| Zero order | $[H_2O_2]$ vs time | $-k_o$ | $[A]_o$ |
| First order | $\ln[H_2O_2]$ vs time | $-k_1$ | $\ln[A]_o$ |
| Second order | $1/[H_2O_2]$ vs time | $k_2$ | $1/[A]_o$ |

# Analysis of data

$$H_2O_2\ (l) \rightarrow H_2O\ (l) + \tfrac{1}{2}\ O_2\ (g)$$

$$[H_2O_2]_{reacted} \propto V$$

$$[H_2O_2]_o \propto V_f$$

$$\therefore \quad [H_2O_2] = [H_2O_2]_o - [H_2O_2]_{reacted} \propto V_f - V$$

# Analysis of data

$$[H_2O_2]_o \propto V_f$$

$$\therefore \quad [H_2O_2]_o = c\,V_f$$

$$V_f = 35.1\ cm^3$$

$$[H_2O_2]_o = 0.892\ mol\ dm^{-3}\ after\ dilution\ with\ KI$$

$\therefore$ Plot $c(V_f - V)$, or $\ln\{c(V_f - V)\}$ or $1/\{c(V_f - V)\}$ to obtain order and rate constant

# Determining order

$c = [H_2O_2]_o / V_f$

$c = 0.892 \text{ mol dm}^{-3} / 35.1 \text{ cm}^3$

$= 0.0254 \text{ mol dm}^{-3} \text{ cm}^{-3}$

| time / s | volume / $cm^3$ | concentration $c (V_f - V)$ / mol $dm^{-3}$ |
|---|---|---|
| 0 | 0.0 | 0.892 |
| 85 | 2.8 | 0.821 |
| 147 | 5.9 | 0.742 |
| 207 | 8.8 | 0.670 |
| 273 | 11.2 | 0.607 |
| 327 | 13.4 | 0.551 |
| 386 | 15.4 | 0.501 |
| 448 | 17.2 | 0.455 |
| 507 | 18.9 | 0.413 |
| 568 | 20.4 | 0.375 |
| 625 | 21.7 | 0.340 |
| 688 | 22.9 | 0.309 |
| 1805 | 33.1 | 0.051 |

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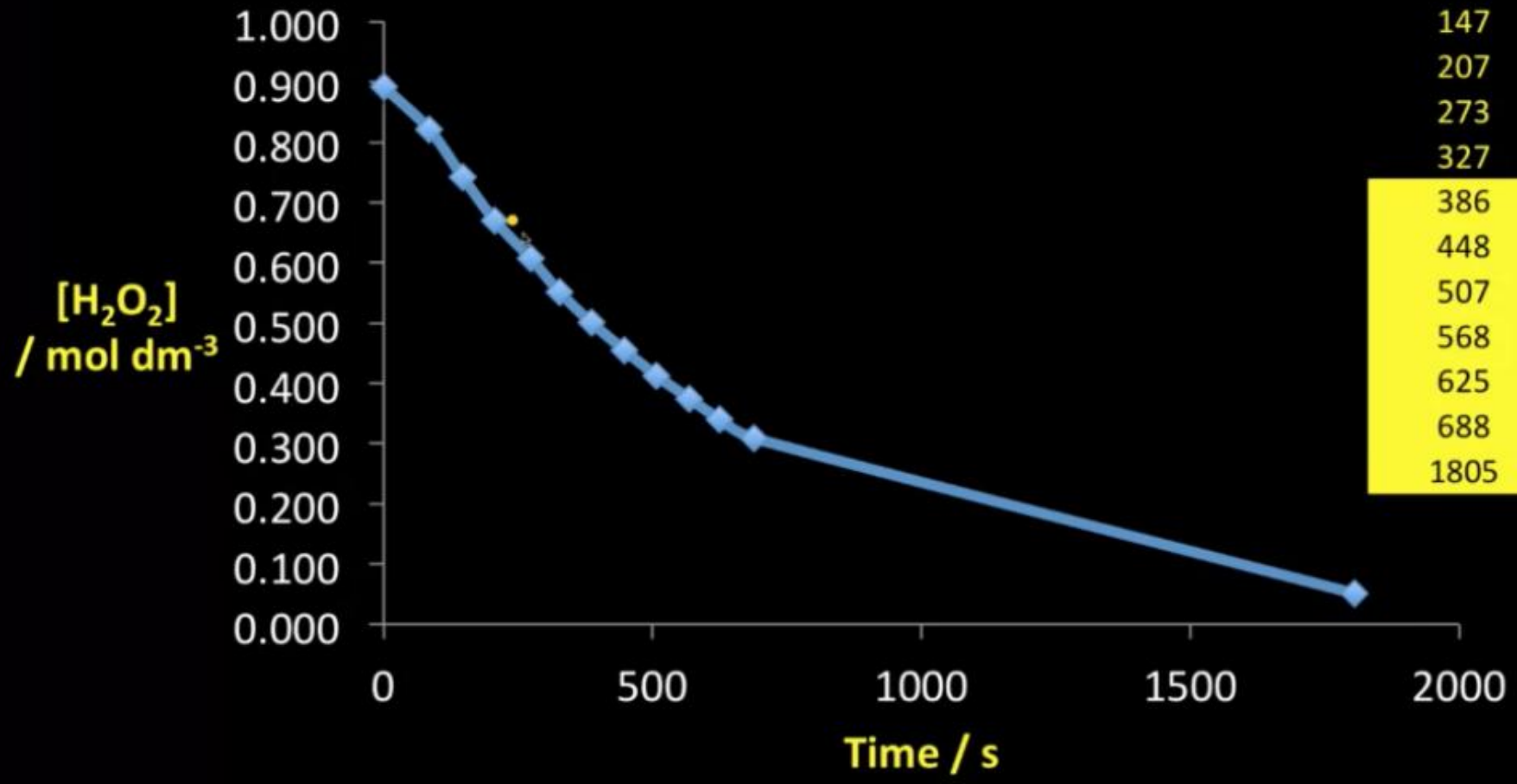
# Zero order plot

| time / s | $[H_2O_2]$ |
|---|---|
| 0 | 0.892 |
| 85 | 0.821 |
| 147 | 0.742 |
| 207 | 0.670 |
| 273 | 0.607 |
| 327 | 0.551 |
| 386 | 0.501 |
| 448 | 0.455 |
| 507 | 0.413 |
| 568 | 0.375 |
| 625 | 0.340 |
| 688 | 0.309 |
| 1805 | 0.051 |



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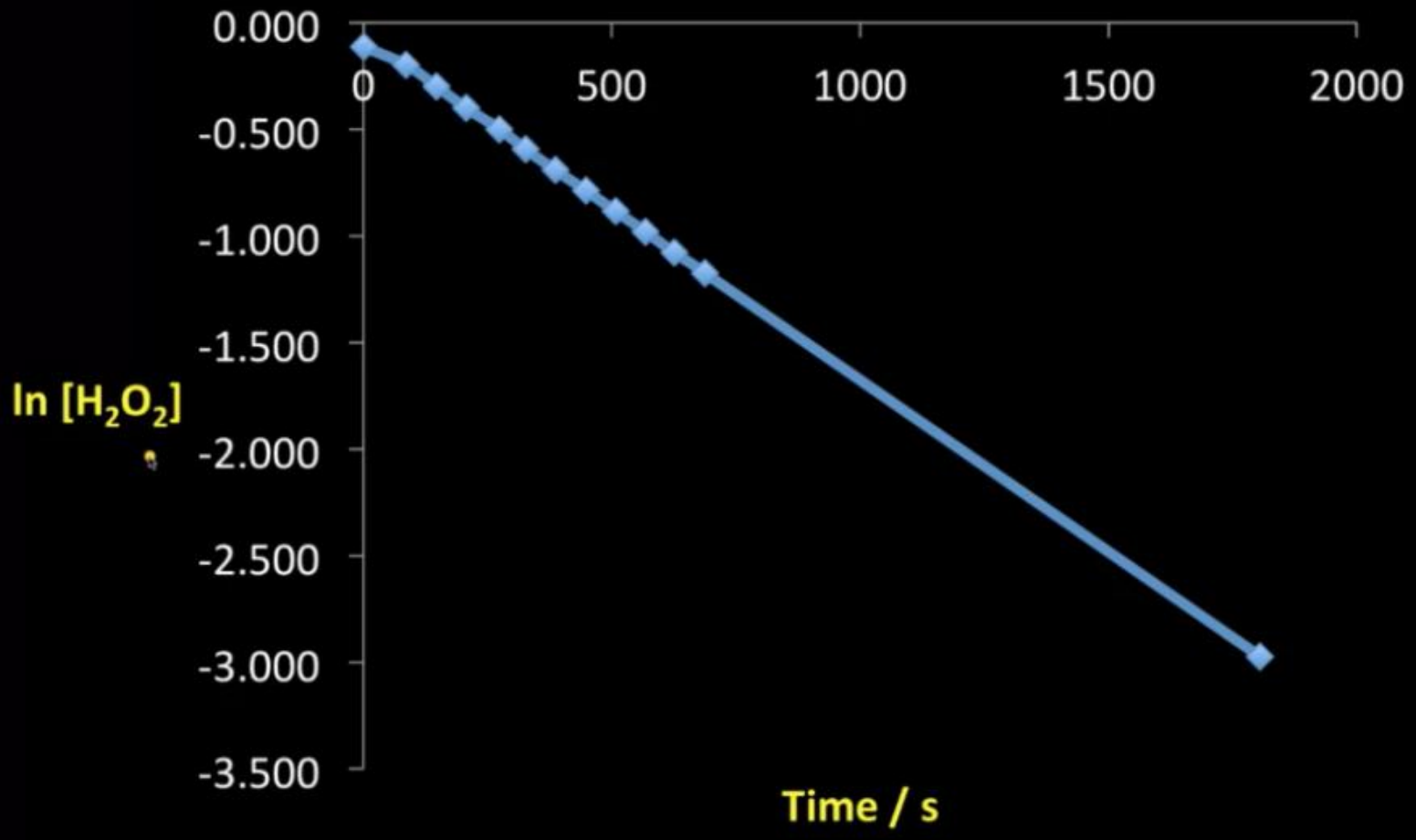
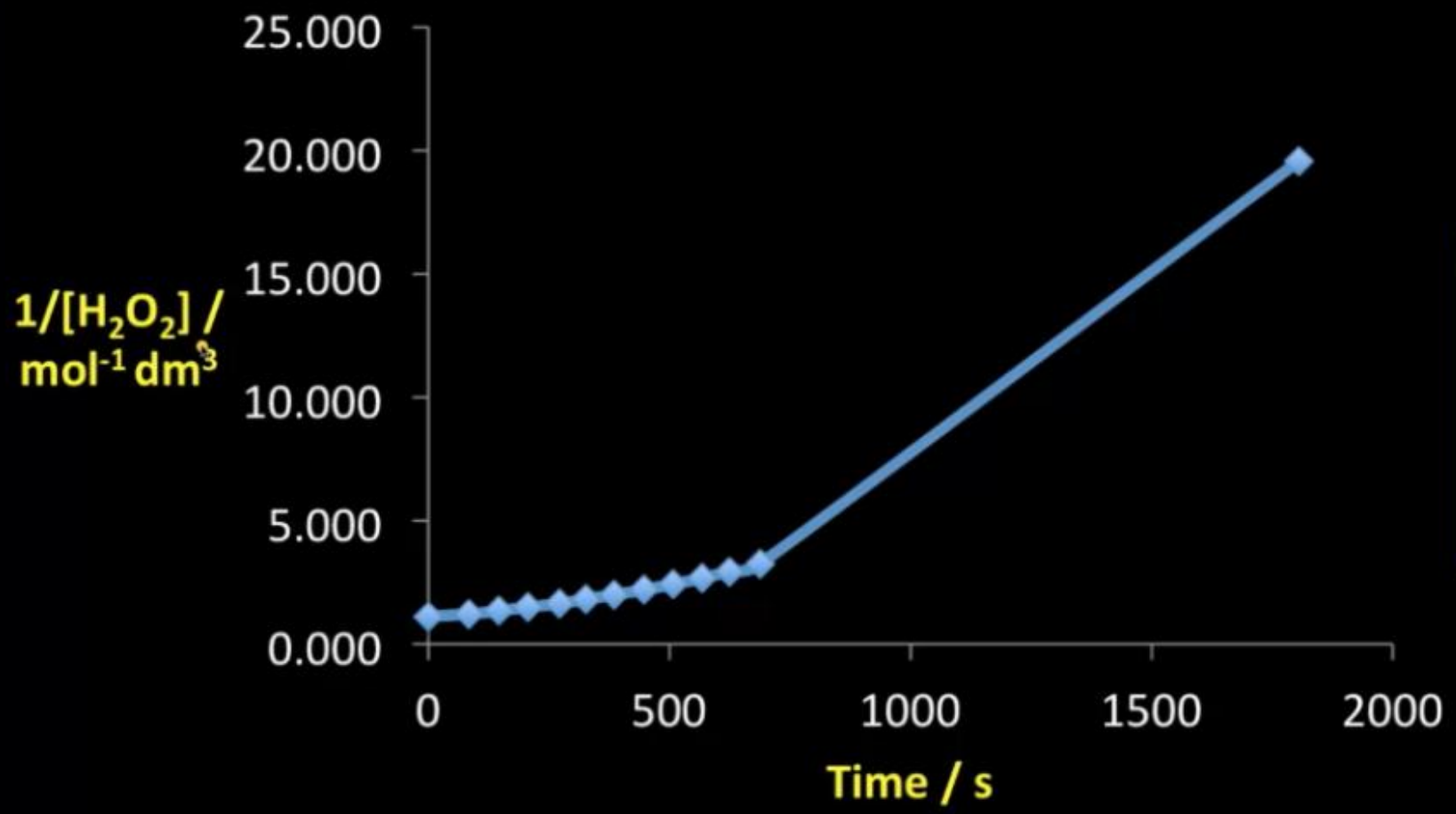
# First order plot

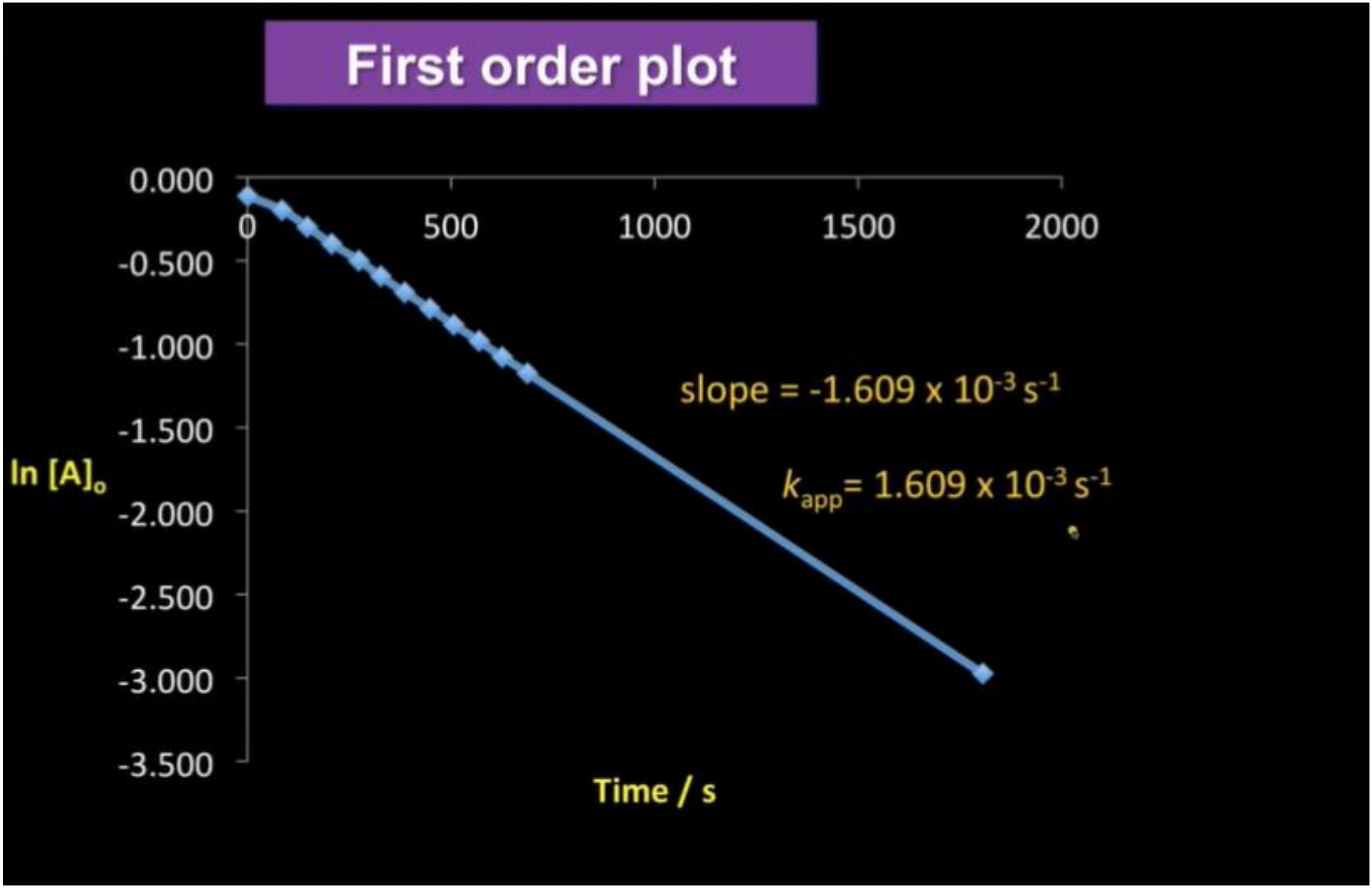



| time / s | ln [$H_2O_2$] |
|---|---|
| 0 | -0.114 |
| 85 | -0.197 |
| 147 | -0.298 |
| 207 | -0.401 |
| 273 | -0.499 |
| 327 | -0.595 |
| 386 | -0.692 |
| 448 | -0.788 |
| 507 | -0.885 |
| 568 | -0.981 |
| 625 | -1.078 |
| 688 | -1.175 |
| 1805 | -2.974 |

# Second order plot




| time / s | 1 / [$H_2O_2$] / $mol^{-1}$ $dm^3$ |
|---|---|
| 0 | 1.121 |
| 85 | 1.218 |
| 147 | 1.348 |
| 207 | 1.493 |
| 273 | 1.646 |
| 327 | 1.813 |
| 386 | 1.997 |
| 448 | 2.200 |
| 507 | 2.423 |
| 568 | 2.668 |
| 625 | 2.939 |
| 688 | 3.237 |
| 1805 | 19.569 |


First order plot
0.000
-0.500
-1.000
-1.500
-2.000
-2.500
-3.000
-3.500
0
500
1000
1500
2000
ln [A]o
slope = -1.609 x 10-3 s-1
kapp= 1.609 x 10-3 s-1
Time / s