1) rate (M/s) $= K[S_2O_8^{2-}]^m[I^-]^n$

a)

$$\text{rate}(M/s) = K\ [S_2O_8^{2-}]^m (M) [I^-]^n (M)$$

unit for K

$$K = \frac{\text{rate}\ (M/s)}{(M)[S_2O_8^{2-}][I^-](M)} = \frac{M}{s \cdot M \cdot M} = \frac{1}{s \cdot M}$$

for S_2O_8:

$$\frac{\text{exp 1}}{\text{exp 2}} : \frac{K(0.018)^m(0.036)^n}{K(0.027)^m(0.036)^n} = \frac{2.6\times10^{-6}}{3.9\times10^{-6}}$$

$$(0.667)^m = 0.667$$

$$m = 1 \quad s^{-1} \cdot M^{-1}$$

for $[I^-]$

$$\frac{\text{exp 2}}{\text{exp 3}} : \frac{K(0.027)(0.036)^n}{K(0.036)(0.054)^n} = \frac{3.9\times10^{-6}}{7.8\times10^{-6}}$$

$$(0.667)^n = 0.667$$

$$n = 1 \quad s^{-1} \cdot M^{-1}$$

$$\text{rate} = K[S_2O_8^{2-}]^1[I^-]^1 \ M/s$$

b) $$K = \frac{\sum_{n=1}^{4} \frac{\text{rate}_n}{[I^-]_n[S_2O_8^{2-}]_n}}{4}$$

for K:

$n=1$, $K = 0.004$

$n=2$, $K = 0.004$

$n=3$, $K = 0.004$

$n=4$, $K = 0.0039$

$$k = \frac{(0.004)3 + 0.0039}{4}$$

$$k = 0.003975 \ s^{-1} M^{-1}$$

c) $S_2O_8^{2-} + 3I^- \rightarrow 2SO_4^{2-} + I_3^-$

$$-\frac{d}{dt}[S_2O_8^{2-}] = -\frac{d}{dt}\frac{1}{3}[I^-] = \frac{d}{dt}\frac{+1}{2}[SO_4^{2-}] = \frac{d}{dt}[I_3]$$

$\therefore$ SO_4^{2-} formation is twice as fast as disappearance of S_2O_8

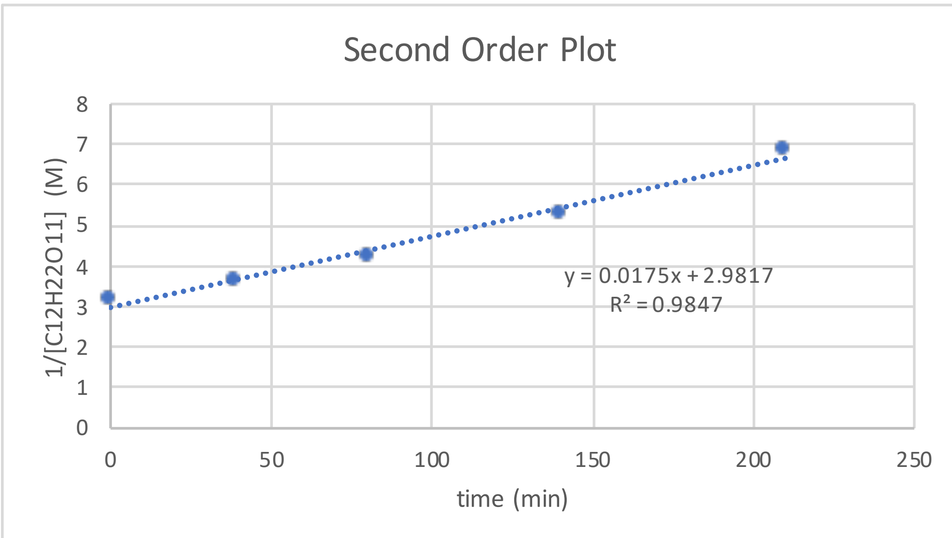
$$2\,\frac{-d}{dt}[S_2O_8^{2-}] = \frac{d}{dt}[SO_4^{2-}]$$

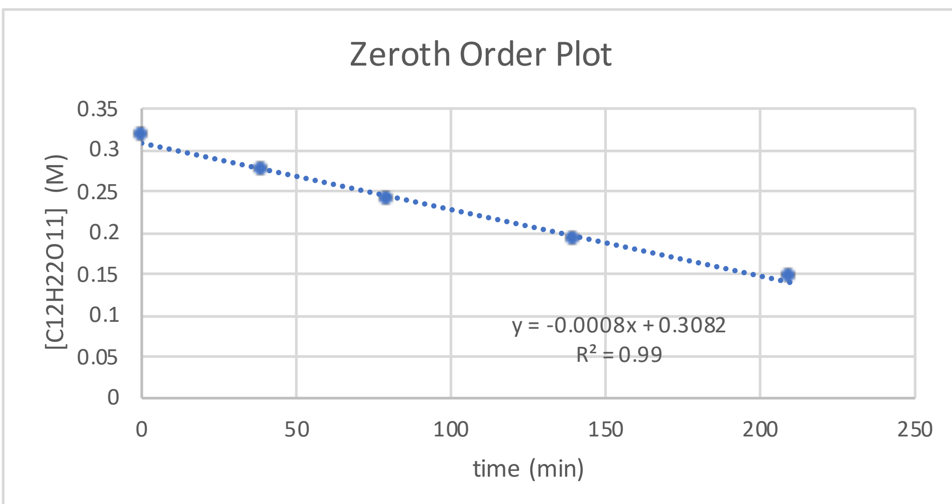
d)

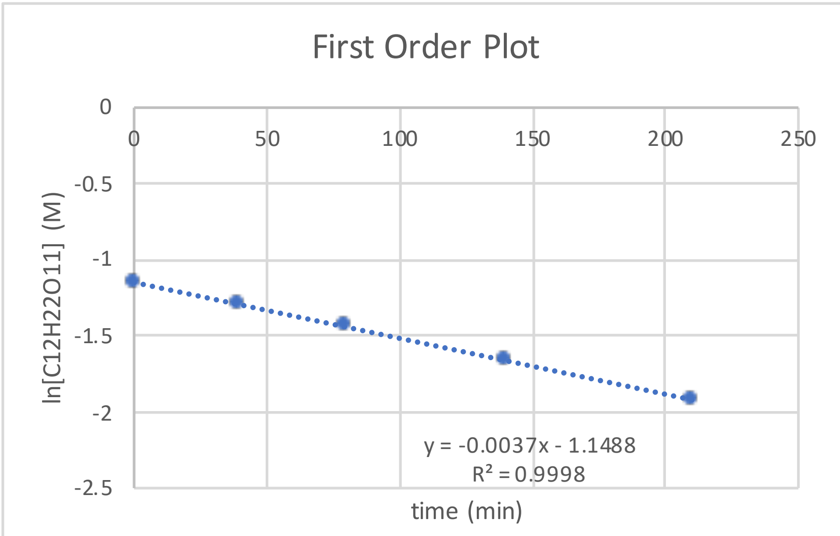
$\therefore$ formation of I_3^- is $1/3$ as fast as the disappearance of I^-

$$\frac{d}{dt}[I_3] = -\frac{1}{3}\frac{d}{dt}[I^-]$$

Time (min)	[C12H22O11]	ln[C12H22O11]	1/[C12H22O11]
0	0.316	-1.152013065	3.164556962
39	0.274	-1.294627173	3.649635036
80	0.238	-1.435484605	4.201680672
140	0.19	-1.660731207	5.263157895
210	0.146	-1.924148657	6.849315068







a. What is the order of the reaction?
--> The plot with the most linear approximation is the first order plot, with a correlation coefficient of 0.9998.
--> The reaction is thus order 1

b. What is the rate constant for the reaction?
--> The rate constant is equal to the slope of the linear regression polynomial.
k = 0.0037 M / min or
k = 0.222 M / s